City of Aumsville
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WASTEWATER SYSTEM FACILITIES PLAN

Final Draft June 2022

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WASTEWATER SYSTEM FACILITIES PLAN

CITY OF AUMSVILLE, OREGON

Final Draft June 2022

Prepared for
City of Aumsville
595 Main Street
Aumsville, Oregon 97325

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May 26, 2022

Ron Hardin, City Administrator
City of Aumsville
595 Main Street
Aumsville, OR 97325

RE: WQ-City of Aumsville Collection/Treatment System
File No. 4475, NPDES Permit No. 101984
Marion County
Facilities Plan Comments

Dear Mr. Hardin:

DEQ has completed review of the January 2022 Facilities Plan for the proposed improvements to the City of Aumsville's sewage collection and treatment facilities. Comments were provided to your engineer, Westech Engineering, and all of DEQ's questions and comments have been addressed. The plan is hereby approved.

There was an outstanding question about the mass loads that will be in the next permit renewal. DEQ uses the secondary treatment standard concentrations for BOD and TSS and the maximum monthly average design flows for the applicable season to calculate mass loads. If the calculated mass loads are greater than the permittee's current allowable loads, DEQ will need to ensure the increase is consistent with the state's Antidegration Policy and can be allowed. If the permittee does not need the increase, DEQ will continue with the loading previously allowed by permit.

This concludes my review of the facilities plan for the City of Aumsville. If you have any questions please contact me at (503) 378-4995.

Sincerely,

Timothy C. McFetridge, P.E.
Senior Environmental Engineer
DEQ, Salem Office

cc: Alexis Cooley, DEQ, Eugene
Chris Brugato, P.E. Vice President
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FOREWORD

Using this Report

This report will be used by many people whose needs for information will differ widely. Accordingly, an Executive Summary appears at the beginning of this report. The summary provides an overview of the report and presents the main conclusions. Readers may gain a good general understanding of the report and its contents by reading the summary. Additional detailed information is presented in the body of the report.

LIST OF ABBREVIATIONS

AAF	average annual flow
AC	asbestos cement
ADWF	average dry weather flow
ATS	automatic transfer switch
AWWA	American Water Works Association
AWWF	average wet weather flow
BGS	below ground surface
BOD	biochemical oxygen demand
BSF	base sewage flow
CFS	cubic feet per second
CIP	capital improvement plan
CMU	concrete masonry units
DAF	dissolved air flotation
DEQ	Oregon Department of Environmental Quality
DHS	Oregon Department of Human Services
DO	dissolved oxygen
EPA	US Environmental Protection Agency
FEMA	Federal Emergency Management Agency
FM	force main
FPS	feet per second
FRP	fiber reinforced plastic
GPD	gallons per day
HDPE	high density polyethylene
HP	horsepower
IGA	intergovernmental agreement
KW	kilowatt
MAO	mutual agreement and order
MBR	membrane bioreactor
MBBR	moving bed bioreactor
MH	manhole
MMDWF	maximum month dry weather flow
MMWWF	maximum month wet weather flow
MG	million gallons
MGD	million gallons per day
NPDES	National Pollutant Discharge Elimination System
OAR	Oregon Administrative Rule
ODOT	Oregon Department of Transportation

OPSC	Oregon Plumbing Specialty Code
ORS	Oregon Revised Statutes
PDF	peak day flow
PHF	peak hour flow
PIF	peak instantaneous flow
PSI	pounds per square inch
PVC	Polyvinyl chloride
RPM	revolutions per minute
SBR	sequencing batch reactor
SCADA	Refers to a Supervisory Control and Data Acquisition (telemetry) system
SDC	system development charge
SF	square feet
SRT	solids retention time
TDH	total dynamic head
TSS	total suspended solids
TV	television
UGB	urban growth boundary
USGS	United States Geological Survey
UV	ultraviolet light
VFD	variable frequency drive
WEF	Water Environment Federation
WWTP	wastewater treatment plant

EXECUTIVE SUMMARY

Summary Outline

Introduction

Project Objectives

Background Information and Need for Plan

Study Area and Planning Considerations

Basis for Facilities Planning

Overview of Existing Facilities

Wastewater Flows and Loads

Collection System Deficiencies and Recommended Improvements

Treatment System Deficiencies and Recommended Improvements

Recommended Capital Improvement Plan

EXECUTIVE SUMMARY

INTRODUCTION

The purpose of this study is to provide a comprehensive evaluation of the City's wastewater system with respect to its existing and future needs, identify improvements and associated costs necessary to meet those needs, and provide the City with a framework for the provision of sanitary sewer service through the year 2045.

This executive summary has been prepared to provide a concise overview of the evaluations and analyses performed in each chapter of the study. A summary of the recommended capital improvement program costs appears at the end of this summary.

PROJECT OBJECTIVES

This Wastewater Facilities Plan was completed to achieve the following objectives;

- *Evaluate Current and Future Needs*

Evaluate the City's sanitary sewerage facilities with respect to existing and future needs, identify improvements and associated costs necessary to meet those needs, and provide the City with a guide for future development of the City's sanitary sewerage system.

- *Satisfy Funding Agency Requirements*

As with most small cities, Aumsville may have some difficulty accumulating sufficient resources to construct the required improvements. Therefore, outside funding may be desired. The federal and state funding agencies that distribute funds for public wastewater projects have published guidelines for the preparation of Facilities Plans. This plan is intended to conform to those guidelines.

BACKGROUND INFORMATION AND NEED FOR PLAN

The City of Aumsville is located approximately 10 miles southeast of downtown Salem in Marion County. The urban growth boundary encompasses approximately 820 acres. Of this area, approximately 700 acres are located within the City Limits. The current population of Aumsville is approximately 4,000.

The City currently operates its wastewater utility under a NPDES permit issued by the Oregon Department of Environmental Quality (DEQ). The City's wastewater utility consists of a conventional gravity collection system and an aerated lagoon treatment plant. The treatment plant includes an influent pump station, a headworks, two aerated lagoon cells, two facultative lagoon cells, a chlorine disinfection system, and irrigation pump station. During the winter months treated effluent is discharged to Beaver Creek. During the summer months, treated effluent is pumped to a field south of the City where it is used for irrigating cropland. The City owns the field. Other than the influent pump station at the treatment plant, there are no other pump stations in the City's collection system.

The City has been unable to comply with the effluent ammonia concentration limits in the NPDES permit for at least the last decade. The City's treatment plant is simply not designed to reduce effluent ammonia concentrations to levels below the limits listed in the NPDES permit. Therefore, the City will need to make major improvements to the system in order to comply with the ammonia limits. The DEQ recognizes that it is going to take some time for the City to make the needed improvements and the City's NDPES permit includes a compliance schedule with milestones dates that requires the City to make the needed improvements in a series of steps over the next several years (Table ES-1). The preparation of this facilities planning document is the second milestone in Table ES-1. The proposed improvements to address the ammonia issue are substantial and the City will likely have to work with the state and federal funding assistance programs (see Section 8.5) to assemble a funding package. Based on the compliance schedule listed in ES-1, the funding work will need to occur during the 2022/2023 fiscal year.

This new facilities plan is being prepared for a few basic reasons. The previous facilities plan was prepared in 1999 plan is more than 20 years old, does not include the improvements needed to address the ammonia problem, and is generally out of date. Also, a new plan is required as part of the compliance schedule in the permit. For these reasons, it is appropriate to prepare a new plan at this time.

Additional background and introductory information is presented in Chapter 1 of the plan.

Table ES-1 | NPDES Permit Compliance Schedule for Ammonia

Compliance Date:	Requirement:
Within 12 months of permit effective date and annually thereafter (10/01/2022)	Submit to DEQ a written Progress Report outlining the progress made towards achieving the final effluent limitations.
Within 6 months of permit effective date (04/01/2022)	Submit to DEQ a draft Facility Plan that evaluates several alternatives and identifies the permittee's preferred alternative to comply with the ammonia final effluent limits. Permittee must revise documents in accordance with DEQ comments within 60 days of receiving DEQ comments.
Within 2 years of permit effective date (10/01/2023)	Submit a draft Preliminary Design Report for projects identified in the Facility Plan to DEQ for review and approval. City will request permit modification if needed for chosen alternative in facility plan. Permittee must revise documents in accordance with DEQ comments within 60 days of receiving DEQ comments.
Within 4 years of permit effective date (10/01/2025)	Submit a draft Final Design for projects identified in the Facility Plan to DEQ for review and approval. Permittee must revise documents in accordance with DEQ comments within 60 days of receiving DEQ comments.
Within 6 years of permit effective date (10/01/2027)	Complete construction of projects identified in the Facility Plan to comply with the final effluent limits for ammonia.
Within 7 years of permit effective date (10/01/2028)	Complete start up and process optimization for the projects. If permit limits are being achieved, submit a written notice of compliance with the ammonia final effluent limits in Schedule A. If limits are not being achieved submit a corrective action plan. Implement the corrective actions.
Within 8 years of permit effective date (10/01/2029)	Achieve the final limits for ammonia.

STUDY AREA AND PLANNING CONSIDERATIONS

The City's Comprehensive Plan established an urban growth boundary (UGB) encompassing approximately 820 acres, of which about 120 acres are outside the present City limits. Eventually all areas inside the UGB will be part of the City and will be served by the City's utility systems. The Oregon Department of Land Conservation and Development (DLCD) mandates that the planning area for facilities planning be limited to the land within the present UGB of the City. Therefore, the improvements recommended in this plan are based on development of land within the UGB in its present location, as well as the existing land use zoning for these areas. It is assumed that no significant development will occur within the study area that will require major changes to the existing zoning, and that there will be no significant expansions of the UGB within the study period. Changes in any of these assumptions could change the recommendations contained in this facilities plan. Should significant changes in any of the above occur, the facilities plan should be updated accordingly. Additional information regarding the study area and planning considerations is presented in Chapter 2.

The DEQ recommends a minimum 20-year planning period for wastewater facilities planning. Based on this recommendation, the planning year used in this study is 2045. In order to assess the City's needs over this time, population growth projections must be made to determine future wastewater flows and loads. The State of Oregon (ORS 195.036 and EO 97-22) mandates the use of county coordinated growth rates and population projections. These are prepared by the Portland State University Population Research Center. Based on these projections, the population of Aumsville in the year 2045 is expected to be approximately 6,768 (see Section 5).

Wastewater flow and load projections are detailed in Chapter 5. It is important to note that the flow and loading projections are based on several assumptions including the assumption that no large "wet" industries will be sited in Aumsville. The recommended improvements do not include capacity for an industrial user that discharges a significant amount of process water to the City's sewer system. It has been assumed that all industrial use will produce about the same wastewater volume and strength as a similarly-sized residential user. This is actually a fairly conservative assumption for dry industries that do not discharge process water to the City's system.

BASIS FOR FACILITIES PLANNING

During the coming years, improvements to the City's existing wastewater collection and treatment facilities will be required to ensure reliable operation and compliance with regulatory standards. Haphazard improvements that do not adequately consider all of the issues that impact the system may end up costing the City more in the long run than well thought-out, carefully applied solutions. For example, if a particular sewer pipe cannot convey the volume of wastewater that flows into it, a logical solution is to replace the pipe with a larger pipe. However, if the larger pipe is sized only to accommodate the existing flow volumes and future growth upstream of the pipe occurs, the pipe size may need to be increased a second time to accommodate the flow increases. Instead of replacing the pipe twice, a more cost-effective solution is to replace the pipe once with a pipe sized to accommodate the existing flows plus the anticipated future growth. As this simple example illustrates, most wastewater facilities are not well suited for incremental expansion to accommodate growth. More often than not, the most cost-effective solution is to initially size the facilities to accommodate anticipated growth within the planning period. Therefore, this Facilities Plan not only considers the existing deficiencies, but also considers what improvements are likely to be required during the planning period as the City grows and develops. The intent of the recommendations proposed in the plan is to provide the City with reliable wastewater facilities that not only meet current demands, but will also adequately serve the City well into the future. The recommended improvements will also bring the City back into compliance with the NPDES permit.

The City currently operates the wastewater facility an NPDES permit issued by DEQ. All future facilities must be developed and maintained to ensure that the City can remain in compliance with the NPDES permit. NPDES permits are typically renewed every 5 years. The City's existing permit was renewed in October of 2021 and expires in 2026. This plan is based on the assumption that there will be no major changes to the City's permit when it is renewed in 2026.

The NDPES permit identifies the requirements under which the City must collect, treat, and dispose of wastewater and the associated byproducts. The treatment plant produces treated effluent that is discharged to Beaver Creek and sludge that is stored in the lagoons. The NPDES permit lists effluent limits for organic content (BOD), the solids content (TSS), ammonia concentrations, the pH, and pathogenic indicator organisms (fecal coliform and E. coli). As noted above, the existing treatment facilities are currently able to comply with the limits for BOD, TSS, pH, and pathogenic indicator organisms, but not the ammonia limit. Therefore, improvements will be needed early in the planning period to achieve compliance with the ammonia limit.

Detailed descriptions of the regulatory requirements relevant to the City's wastewater utility are presented in Chapter 3.

OVERVIEW OF EXISTING FACILITIES

Chapter 4 provides a detailed description of existing wastewater collection and treatment facilities serving the City. The City currently serves approximately 1,370 user accounts. The City's wastewater facilities consist of a conventional gravity collection system that conveys wastewater to an influent pump station at the treatment plant. The gravity collection piping is divided into several distinct sewer basins a shown in Figure 4-1 in Chapter 4. The collection system consists of approximately 65,500 feet of gravity mainline piping. Of this amount, approximately 9,600 feet is privately owned and the remaining mainline piping is owned and maintained by the City. Pipe sizes range from 6-inch to 24-inch diameter. Most of the piping is 8-inch diameter. The collection system does not include any large pump stations other than the influent pump station at the treatment plant which is classified as part of the treatment plant in this document. There are two small grinder pump stations that serve two homes in the City. The original sewer system was installed in the 1960s. Prior to that time, the residents in the City had individual septic systems with drain fields. The original system extended from a pump station located at the treatment plant south to Olney Street, then east to 9th and 4th Streets. The line on 9th Street extended south to Dell Mar Drive, then west to 11th Street, then south along 11th Street to serve the downtown area. The line on 4th Street extended south to Clover Street and generally served the older parts of the City between Clover Street and Washington Street east of 8th Street. All of these sewer lines remain in place today, but some upgrades have occurred. Since the 1960s, sewer extensions have been made to serve new developments around the City. A more detailed history of the system is presented in Chapter 4.

Like most municipalities in Western Oregon, the infiltration of groundwater and inflow of stormwater (collectively known as “I/I”) is a problem that requires ongoing maintenance. I/I enters the collection system and must be conveyed and treated in the same manner as wastewater. Therefore, I/I consumes conveyance capacity, consumes treatment capacity, increases power consumption costs, and increases wear and tear on the system. As such, I/I is a financial burden to the City and it makes economical sense to control it. That said, it is not practical to eliminate I/I altogether but it is reasonable to assume that management activities can keep I/I amounts from increasing over time. The City currently has a good, but somewhat informal, I/I control program. This plan recommends formalizing the I/I control program with dedicated funding on an annual basis. This funding can be used to inspect the system in order to identify problem areas and make repairs as needed.

At the treatment plant, the influent pump station lifts the water into the headworks where it passes through a mechanical screen and a flow measurement flume. On the downstream end of the headworks, the flow is split. Some of the flow is routed to lagoon cell 1 and the rest is routed to lagoon cell 2. The water flows through lagoon cell 1 and into cell 2. Cell 1 and Cell 2 are equipped with floating mechanical aerators that supply oxygen for the oxidation of the organic matter in the wastewater. From cell 2, the water flows sequentially through cells 3 and 4. Cells 3 and 4 are not equipped with aeration equipment and operate as facultative lagoons. During the wet weather months of November-April, treated effluent is disinfected using chlorine in a chlorine contact chamber. At the end of the contact chamber a chemical is added to remove the chlorine prior to the effluent being discharged to Beaver Creek. During the summer months, treated effluent is disinfected and used for irrigation at a City-owned irrigation site located south of Mill Creek.

The original treatment plant was constructed in the 1960s. The original system included a lift station, a headworks, two facultative lagoons, a chlorine contact chamber, and a discharge to Beaver Creek. The two lagoon cells that were constructed in the 1960’s remain in service and are now known as cells 1 and 2. All of the other facilities from the 1960’s project have been replaced. In the late 1970’s, the treatment plant was improved by adding lagoon cells 3 and 4 and the current chlorine contact chamber and outfall to Beaver Creek. In the early 2000’s, the floating mechanical aerators were added to cells 1 and 2. In 2007, the influent pump station was replaced with the current station and the current headworks was also constructed. In 2011, the irrigation pump station was constructed along with the pipeline to the current irrigation site. The center pivot sprinkler was installed in 2011. No major improvements to the treatment plant have been made since 2011.

As noted above, the treatment plant is unable to consistently meet the effluent limits for ammonia in the City’s NPDES permit. In addition to this problem, the influent pump station and headworks will require some mechanical upgrades during the planning period, the lagoon transfer structures that were constructed in the 1970s are in poor condition and need to either be abandoned or replaced, and sludge accumulation in the lagoons is becoming significant and the City will need to remove the sludge during the planning period. Sludge has never been removed from the lagoons since they were constructed in the 1960s and 1970s. The sludge removal costs are a significant portion (about 10%) of the overall cost of the recommended treatment plant improvement project discussed below.

WASTEWATER FLOWS AND LOADS

Chapter 5 of the plan includes an analysis of the existing wastewater flow rates, organic loading rates, and solids loading rates to the treatment plant. Population projections are used to estimate future flows and loads. The design flows and loads are used to analyze the existing systems. The design flows and loads consist of the existing and future flows and loads due to population growth. As noted above, the flow and loading projections in Chapter 5 are based on the assumption that there will be no “wet” industries in the City that discharge a significant amount of process water to the wastewater system. The reader is referred to Chapter 5 for a description of the flow projection methodology and the results.

COLLECTION SYSTEM DEFICIENCIES AND RECOMMENDED IMPROVEMENTS

Chapter 6 presents an analysis of the wastewater collection system. Current operation and maintenance practices are first reviewed and one change is recommended. This is to establish a formal collection system maintenance program (Program-1). The City’s original collection system was constructed in 1960 and collects large amount of I/I. Therefore, it is important that the City dedicate funds on an annual basis to adequately maintain the system. The City should plan to inspect and clean about 20% of the system each year. At this rate, the City can inspect the entire system about once every 5 years. The City should also plan to rehabilitate manholes and perform spot repairs of mainlines and service laterals. Over the planning period, the collection system will continue to age and deteriorate and it will become increasingly important for the City to make annual repairs in order to keep the system in good condition and control I/I. Therefore, the City should formalize the annual maintenance program at a funding rate of at least $30,000 per year and not divert these funds for other needs.

In addition to operation and maintenance practices, the ability of the existing collection system to convey the anticipated wastewater flows is analyzed in Chapter 6. This analysis shows that the existing system lacks the capacity to adequately convey existing and projected wastewater flows. A hydraulic model was used to simulate flow through the collection system. At design flows, the model predicts widespread surcharging and raw sewage overflows. These modelling results were verified in the field by observing widespread surcharging in the system during a large winter storm event. To date, there have been no known raw sewage overflows from the collection system. However, as the system continues to age and the City grows, wastewater flows will increase as will the potential for raw sewage overflows. As such, improvements to the collection system will be needed during the planning period. These improvements largely consist of replacing undersized sewer pipes. A listing of the recommended collection system projects is included in Chapter 6. These improvements are later prioritized in Chapter 8 to develop the recommended Capital Improvement Plan (see discussion below).

TREATMENT SYSTEM DEFICIENCIES AND RECOMMENDED IMPROVEMENTS

Chapter 7 includes an analysis of the City’s treatment system. The existing treatment facilities do not have the ability to comply with the existing NPDES permit with respect to ammonia. The treatment facilities also lack the organic and hydraulic capacity to adequately treat and handle the increased flows and loads due to the anticipated growth during the planning period. As such, the City will need to make improvements to the treatment plant during the planning period. The treatment plant improvement project is the most significant project recommended in this plan.

Three alternatives to correct the treatment system deficiencies are evaluated. These include the following:

- Alternative 1: Sequencing Batch Reactors (SBRs)
- Alternative 2: Aerated Lagoons with a Fixed Film Process
- Alternative 3: Pump Wastewater to Salem

The first two alternatives (alternatives 1 & 2) include constructing new treatment facilities to produce a higher quality effluent that would comply with the NPDES permit conditions required to discharge into Beaver Creek. The third alternative includes constructing a pump station and pipeline to convey raw wastewater to the City of Salem for treatment and disposal. Under this alternative, the treatment facilities would largely be abandoned, and the City of Aumsville would pay the City of Salem to treat and dispose of the wastewater. Conceptual designs for each of the three alternatives were developed along with cost estimates.

The "Pump to Salem" option (alternative 3) is attractive because it eliminates the need to discharge to Beaver Creek. Most of the challenges with wastewater treatment in Aumsville are the result of the relatively size of Beaver Creek. Beaver Creek is a relatively small stream. As such, it is more susceptible to water quality degradation than a larger stream. Due to the small size of Beaver Creek, there will always be the potential for future regulatory changes that will require the City to provide a higher level of treatment (i.e., construct more treatment facilities). For example, the DEQ may eventually add a total nitrogen or phosphorus limit the City's permit. If so, additional treatment facilities will be needed. This will always be an issue in the City as long as effluent is discharged to Beaver Creek. Unfortunately, there are no larger streams within a reasonable proximity to the City. The only alternative that eliminates the Beaver Creek outfall is the "pump to Salem" option (i.e., alternative 3). Unfortunately, the costs to construct the required infrastructure, along with the user charges from the City of Salem, render this alternative significantly more expensive than the other two alternatives.

The two remaining treatment alternatives include "Alternative 1 - Sequencing Batch Reactors (SBRs)" and "Alternative 2 - Aerated Lagoons with a Fixed Film Process." Of these options, Alternative 2 is the lowest cost alternative. However, it will not produce the same quality of effluent as Alternative 1. The SBR alternative (i.e., Alternative 1) is a modification of the activated sludge process which offers the operators more control and flexibility. Alternative 1 provides a higher overall level of treatment. For example, it will be possible to denitrify the wastewater during the spring, summer, and fall months when flows are lower. This will reduce the overall amount of nitrogen available in the system. This is not possible with Alternative 2. It is expected that Alternative 1 will also produce effluent with lower BOD and TSS concentrations. Also, Alternative 2 is somewhat of an unproven technology in Oregon. There are no similar installations in the state. The proposed fixed film process that is part of Alternative 2 also lacks a clarification or filtration step on the discharge side. This is somewhat risky as the biofilm can slough off of the growth media and degrade the effluent quality. For this reason, it is common to install a clarifier or filter after the fixed film process. Based on discussions with a reputable manufacturer, the system proposed in Aumsville is a very lightly loaded fixed film process. Therefore, the biofilms are expected to be thin and not overly susceptible to sloughing. Nonetheless, there is some risk with Alternative 2 that really does not exist for Alternative 1. Looking beyond the current planning period, the Alternative 1 will likely be able to serve the City longer before there will be a need to add additional treatment processes. This is because the SBR should be able to produce a higher quality effluent. Therefore, looking out over a longer planning horizon than 20 years, Alternative 1 has the potential to be the lowest cost option over the long-run. Alternative 1 also has less risk than Alternative 2. SBRs are common in Oregon and are a well-established treatment technology. That said, the future is difficult to predict, and implementing Alternative 2 at this time would be reasonable choice to reduce the overall cost of the project.

Based on discussions with City staff, Alternative 1 (SBR) has been selected at the preferred alternative. This decision is based on the idea that the SBR is a more proven technology with less overall risk. As such, the slightly higher cost is worth the benefit. The total recommended budget for this project is $21,675,000. The reader is referred to subsection 7.5.1 for a detailed description of the proposed improvements.

RECOMMENDED CAPITAL IMPROVEMENT PLAN

The Facilities Plan identifies a number of deficiencies and includes several recommended improvement projects. Some of these projects are more critical than others. Some projects should be constructed early in the planning period. Other projects are not needed immediately, but will be needed as the City expands and the existing system continues to age.

A prioritizing process was developed to rank the improvement projects. Factors utilized in the prioritizing process included several measures of criticality, as well as a qualitative evaluation of the cost/benefit ratio of each project. This process identified essential, high benefit to cost projects for early implementation, and the deferral of less critical, lower value projects. Each of the projects identified in the plan were examined and assigned a priority for implementation and appear in Table ES-2 below.

The most urgent project is the treatment plant project (Project T-1) which is assigned a Priority 1A ranking. The next most urgent projects are collection system projects that are assigned a Priority 1B ranking. All of the Priority 1 projects have been developed to resolve existing or near-term system deficiencies. Upon adoption of this facilities plan, the City will need to begin implementing the treatment plant project (Project T-1) in accordance with the compliance schedule in the NPDES permit (see above). The remaining Priority 1B projects can be implemented after the completion of Project T-1.

Priority 2 projects will be needed beyond the near term of the Priority 1 projects to improve the quality of service throughout town. Although not critical at this time, they will likely be required at some point during the planning period. Priority 3 projects are long-term improvements designed to provide sanitary sewer service to areas that develop in response to population growth. While important, they are not considered to be critical at the present time and should not be included in the City's list of proposed improvements for the next 20-year planning period.

At a minimum, all of the Priority 1 and Priority 2 improvements should be included in the CIP. The Priority 3 improvements are largely growth driven. It is envisioned that the Priority 3 improvements will be constructed as part of future development and that individual developers will construct and pay for the improvements on an incremental basis.

Several potential funding programs are available to assist communities with the funding of major infrastructure improvements. A number of these programs are identified and discussed in Chapter 8. Even with funding assistance, increases in user rates and SDC fees are likely to be needed.

Table ES-2 | Recommended Capital Improvement Priorities

Project Code [1]	Project	Priority	Total Estimated Project Cost [2]
T-1	WWTP Improvements – Sequencing Batch Reactors	1A	$21,675,000
G-1	Olney Street Sewer (9th Street to 4th Street)	1B	$438,000
G-2	4th Street Sewer (Olney Street to Del Mar Drive)	1B	$414,000
G-3	9th Street Sewer (Olney Street to Del Mar Drive)	1B	$328,000
G-4	Del Mar Drive Sewer (9th Street to 11th Street)	1B	$268,000
G-5	5th Street Sewer (4th/Clover Intersection to 5th/Cleveland Intersection)	1B	$355,000
		Subtotal Priority 1….	**$ 23,478,000**
G-6	11th Street Sewer (Del Mar Drive to Lincoln Street)	2	$216,000
G-7	Del Mar Drive Sewer (4th/Delmar Intersection to Gordon/1st Intersection)	2	$356,000
		Subtotal Priority 2….	**$ 572,000**
E-1	West Olney Basin Pump Station and Forcemain	3	$1,582,000
E-2	Gordon Lane Basin Gravity Sewers	3	Note 3
E-3	West UGB Basin Pump Station and Forcemain	3	$1,365,000
E-4	Mill Creek Basin Pump Station and Forcemain	3	$1,330,000
		Subtotal Priority 3….	**$ 4,277,000**
		TOTAL….	**$ 28,327,000**
Recurring Annual Programs			
Pgm-1	Annual Sewer Collection System Rehabilitation Program (Program – 1)		$30,000
		Subtotal Recurring Annual Programs….	**$ 30,000**

(1) Project Code Legend:
G = Gravity Sewer T = Treatment E = Sewer System Extension Pgm = Improvement Program
(2) See Section 8.3 for basis of project cost estimates. Costs in 2021 dollars ENR = 12,200
(3) Cost estimates not prepared for Gordon Lane Basin gravity sewers because these will likely be constructed by private developers

CHAPTER 1

INTRODUCTION

Chapter Outline

1.1 General Overview
1.2 Authorization
1.3 Purpose
1.4 Scope of Study
1.5 Previous Studies and Reports
1.6 Wastewater Terms and Definitions

INTRODUCTION

CHAPTER 1

1.1 GENERAL OVERVIEW

The City of Aumsville is located in Marion County approximately 10 miles southeast of downtown Salem. The City was incorporated in 1911 and has grown to a population of approximately 3,950 in 2020. The Urban Growth Boundary (UGB) encompasses approximately 820 acres and the City Limits encompasses approximately 700 acres.

The City is served by a publicly owned and operated wastewater utility. This system consists of conventional gravity sewers, a single pump station, and a wastewater treatment plant (WWTP) that is located on the north end of the city. The plant uses aerated lagoons to provide treatment. Treated effluent is disinfected using chlorine and a chlorine contact chamber. At the end of the contact chamber a chemical is added to remove the chlorine prior to the effluent being discharged to Beaver Creek. During the winter months, treated water is discharged from the plant into Beaver Creek near the treatment plant. During the summer months, treated water is pumped from the plant to a land application site located south of the city.

The City's facilities are permitted under a National Pollutant Discharge Elimination System (NPDES) permit issued by the Oregon Department of Environmental Quality (DEQ). The City's permit was most recently renewed in 2021. The permit includes an effluent ammonia concentration limit. The City's existing treatment plant is not able to consistently comply with the ammonia limit without significant capital improvements. Recognizing that it will take some time for the City to make the needed improvements to achieve compliance with the ammonia limit, the DEQ included a compliance schedule in the City's NPDES permit. The compliance schedule includes a series of milestones with deadlines for the City to implement the needed improvements. One of the key early milestones is the completion of a new Wastewater Facilities Plan that evaluates alternatives and provides recommendations for the needed improvements. This plan was prepared to meet the requirements of the compliance schedule.

In addition to addressing the ammonia issue, this plan also includes an evaluation of the entire wastewater collection and treatment system for a 20-year planning period. Each element of the system is evaluated and a recommended capital improvement plan is presented. The City's last wastewater planning document was completed in 1999 and is largely outdated. Therefore, this document is also being prepared to replace the 1999 Facilities Plan.

1.2 AUTHORIZATION

The City authorized Westech Engineering to proceed with the preparation of this Wastewater Facilities Plan in May of 2020. The plan has been prepared to meet the current requirements of the regulatory and funding agencies.

1.3 PURPOSE

The purpose of this plan is to provide a comprehensive evaluation of the City's wastewater system with respect to its existing and future needs, identify improvements and associated costs necessary to meet those needs, and provide the City with a framework for the provision of wastewater service through the year 2045.

This plan will assist the City in the planning and implementation of capital improvements and will assist the development community as the wastewater system is expanded for future growth. The plan will benefit the current and future residents of the City by enhancing the quality of life through improved water quality, planned growth, scheduled improvements, and an equitable distribution of improvement costs.

1.4 SCOPE OF STUDY

The scope of the Wastewater Facilities Plan is intended to comply with the applicable requirements of DEQ and the City. Study area characteristics are identified and include both physical and socioeconomic conditions. Existing population and land use are examined and projected into the future.

The existing wastewater system is investigated and evaluated. Data was collected on the existing wastewater collection and treatment systems from operating records, conversations with City staff, on-site investigations, maps, as-built records, and other pertinent documentation. Existing facilities are evaluated in terms of location, sizing, capacity, condition, limitations, and performance. Consideration is given to the manner in which existing and proposed facilities could be used in the future as the study area develops to City zone densities.

Typical wastewater characteristics are identified in terms of loads, flows, strength and I/I allowances throughout the year. Future characteristics are projected to establish capacity requirements. Wastewater flows are analyzed for both dry period and wet period conditions, and unit design values are established. Future wastewater characteristics are projected.

The basis for planning is established. Applicable regulatory requirements are identified and addressed, including current and future treatment criteria and discharge standards. The design capacity of the City's collection piping, pump stations, and treatment facilities are examined to determine impacts to present and future operation of wastewater facilities. Alternatives are identified for collection, treatment, and effluent disposal/reuse.

Nonviable options are screened out, and a limited number of selected alternatives are established and evaluated in detail. Finally, a recommended capital improvement plan is identified that will enable the City to provide wastewater collection and treatment within the study area. This plan includes preliminary design data, capital improvement and operational costs, and a description of potential financing options.

1.5 PREVIOUS STUDIES AND REPORTS

The following studies and reports were referenced in the preparation of this study:

- *Wastewater System Facilities Plan – City of Aumsville,* Balfour Consulting, Inc., March 1999
- *Marion County Coordinated Population Forecast 2017 through 2067,* Portland State University Population Research Center, June 2017
- *Construction Drawings for Aumsville Wastewater Facility Upgrading,* Kraus and Dalke Consulting Engineers, January 1978
- *Construction Drawings for WWTP Pump Station and Headworks Improvements, Westech Engineering, Inc., April 2007*
- *Construction Drawings for Reclaimed Water – Irrigation*, JMS Engineering, September 2010

- *City of Aumsville, OR WWTP ODEQ IMD Level 2 Mixing Zone Study,* Mixzon Inc., July 2020

1.6 WASTEWATER TERMS AND DEFINITIONS

An understanding of key wastewater terms and definitions is necessary for an understanding of the discussions in this and subsequent sections. The following does not include all terms used in this report, but will provide a useful glossary for those readers not familiar with wastewater terminology. The different sewage flow classifications are defined in Chapter 5.

- Aerobic - Microorganisms living in the presence of free oxygen, or biological treatment processes that occur in the presence of oxygen.
- Anaerobic - Microorganisms capable of living without the presence of free oxygen, or biological treatment processes that occur in the absence of oxygen.
- Anoxic Denitrification - The process by which nitrate nitrogen is converted biologically to nitrogen gas in the absence of oxygen.
- Attached Growth Process - A biological treatment process in which the microorganisms responsible for the conversion of the organic matter or other constituents in the wastewater to gases and cell tissue are attached to some inert medium such as rocks, slag, ceramic or plastic materials. Attached growth treatment processes are also known as fixed film processes.
- Biological Treatment Processes - Treatment processes by which the stabilization and decomposition of organic material in sewage is accomplished by living microorganisms. The organic matter is used as a food source for microorganisms, and converted to forms which can either be removed from the waste stream (soluble organics) or are sufficiently stabilized to allow disposal without negatively affecting the environment (insoluble organics).
- Biological Nutrient Removal - The removal of nitrogen and/or phosphorus with biological treatment processes.
- Biosolids – Processed or treated sludge that is removed from a treatment facility for disposal.
- BOD (Biochemical Oxygen Demand) - The amount of oxygen required to biologically stabilize the organic material in sewage by aerobic treatment processes. All references to BOD in this report are to 5-day BOD at 20°C (BOD5).
- Chlorine Residual - The measured residual of chlorine used in disinfecting wastewater. Chlorine residual can exist in two forms; combined or free. The specific form is dependent on the rate of formation, which is controlled by the pH and temperature. A free chlorine residual is the most effective in achieving disinfection.
- Denitrification - The biological process by which nitrate is converted to nitrogen and other gaseous end products.
- DEQ – Oregon Department of Environmental Quality
- Facultative Processes - Biological treatment processes in which the organisms can function in the presence or absence of molecular oxygen.
- Fecal Coliform - Bacteria which are used as an indicator of fecal pollution.
- Industrial Wastes - Wastes produced as a result of manufacturing or processing operations.
- Infiltration/Inflow (I/I) - Groundwater and stormwater which enters the sanitary sewer system.

- Excessive I/I - Portion of infiltration or inflow which can be removed from the sewerage system through rehabilitation at less cost than continuing to transport or treat that portion of I/I.
- Infiltration - Water that enters the sewage system from the surrounding soil. Common points of entry include broken pipe and defective joints in pipe and manhole walls. Although generally limited to sewers laid below the normal groundwater level, infiltration also occurs as a result of rain or irrigation water soaking into the ground and entering mains, manholes, or shallow house sewer laterals with defective joints or other faults.
- Base Infiltration - Water that enters the sanitary sewer system from the surrounding soil during periods of low groundwater levels.
- Rainfall Induced Infiltration - Additional infiltration which enters the sewerage system during and for several days after a period of rainfall. Rainfall often percolates into sewer ditches, especially ditches with granular backfill, and establishes a perched water table. This water then infiltrates into faulty sewers and manholes.
- Sludge - Solid and semisolid residuals resulting from wastewater treatment operations.
- Inflow - Stormwater runoff which enters the sewerage system only during or immediately after rainfall. Points of entry may include connections with roof and area drains, storm drain connections, holes in manhole covers in flooded streets, and manhole cones located in ditch lines and that do not have watertight joints.
- Lagoon (Stabilization Pond) - A shallow basin constructed by excavating the ground and diking, for the purpose of treating raw sewage by storage under conditions that favor natural biological treatment and accompanying bacterial reduction.
- Sequencing batch reactor (SBR) – A modification of the activated sludge process that uses aeration, mixing, settling, and solids removal in batches to treat wastewater.
- MAO – Mutual Agreement and Order
- Nitrification - The biological process by which ammonia nitrogen is converted first to nitrite, then to nitrate.
- NPDES - National Pollutant Discharge Elimination System.
- pH - The degree of acidity or alkalinity of waste water, 7.0 being neutral, a lower number being acidic, and a higher number being basic.
- Sanitary Sewage - Waterborne wastes principally derived from the sanitary conveniences of residences, business establishments, and institutions.
- Suspended Growth Process - A biological treatment process in which the microorganisms responsible for the conversion of the organic matter or other constituents in the wastewater to gases and cell tissue are maintained in suspension within the liquid.
- TSS (Total Suspended Solids) - All of the solids in sewage that can be removed by settling or filtration. The quantity of TSS removed during treatment impacts the sizing of sludge handling and disposal processes, as well as the effectiveness of disinfection.
- Wastewater - The total fluid flow in a sewerage system. Wastewater may include sanitary sewage, industrial wastes, and infiltration and inflow (I&I).

CHAPTER 2

STUDY AREA AND PLANNING CONSIDERATIONS

Chapter Outline

2.1 Introduction
2.2 Study Area
2.3 Study Period
2.4 Physical Environment
    2.4.1 Climate and Rainfall Patterns
    2.4.2 Topography
    2.4.3 Soils
    2.4.4 Geologic Hazards
    2.4.5 Public Health Hazards
    2.4.6 Energy Production and Consumption
    2.4.7 Flora and Fauna
    2.4.8 Environmentally Sensitive Areas
2.5 Socioeconomic Environment
    2.5.1 Economic Conditions and Trends
    2.5.2 Population and Growth Projections
    2.5.3 Land Use

STUDY AREA AND PLANNING CONSIDERATIONS
CHAPTER 2

2.1 INTRODUCTION

The City of Aumsville is located in Marion County in the central Willamette Valley. The City is located approximately 10 miles southeast of downtown Salem. The City is generally located on a relatively flat area that is bounded by Mill Creek and Highway 22 on the north. Major road transportation is provided to the City by Highway 22 and Aumsville Highway. Figure 2-2 presented at the end of this chapter for formatting reasons, is a vicinity map depicting these features.

2.2 STUDY AREA

The City's Comprehensive Plan was adopted in 1999 and established an Urban Growth Boundary (UGB) that encompasses approximately 820 acres. The current city limits encompass approximately 700 acres. The location of the UGB, City limits, and land use zoning designations for Aumsville are shown in Figure 2-2 and Figure 2-3 presented at the end of this chapter.

The study area of this report is the entire area within the Aumsville UGB. The improvements recommended in this plan are based on the development of land within the UGB in its present location, as well as the existing land use zoning for these areas. It is assumed that no significant development will occur within the study area that will require major changes to the existing zoning, and that there will be no significant expansions of the UGB within the study period. Changes in any of these assumptions could change the recommendations contained in this plan. Should significant changes in any of the above occur, this plan should be updated accordingly.

2.3 STUDY PERIOD

Choosing a "reasonable" design period for which a utility system should be designed is a somewhat arbitrary decision. If the design period is too short the public faces the prospect of continual upgrades and replacements as demands exceed capacity. On the other hand, choosing a design period that is too long can lead to facilities with excess capacity that may never be needed if population growth does not occur at the projected rates. Such facilities can place an economic burden on the present population and may become obsolete before being fully utilized.

The Oregon Department of Environmental Quality (ODEQ) has established 20 years as a proper planning period for sanitary sewer system improvements. This report will evaluate the anticipated sewage collection, pumping, treatment, and disposal needs for the 20 year planning period. The collection system piping will be planned for the ultimate development of land within the planning area based on current land use designations. Although this may result in capacities greater than those needed during the 20-year planning period, sewage collection lines are, by their very nature, unsuited for incremental expansion without extensive capital outlays. The planning period used in this report is approximately 20 years from the completion of the initial treatment plant upgrades and ends in the year 2045. It should be recognized that projections into the future are subject to many variables and assumptions, some of which may prove inaccurate. Accordingly, it is recommended that the City review its wastewater system at five-year intervals and update this report as appropriate.

2.4 PHYSICAL ENVIRONMENT

2.4.1 Climate and Rainfall Patterns

Since there is no National Weather Service recording station in Aumsville rainfall and temperature data were examined from Salem. The Salem weather station is located at the Salem Airport which is only about seven miles from Aumsville. Therefore, the data from the Salem weather station is generally considered to be representative of conditions in Aumsville.

The climate in Aumsville is relatively mild throughout the year, characterized by cool, wet winters and warm, dry summers. Irrigation in the summer months is common due to low precipitation.

Extreme temperatures in the study area are rare. Days with maximum temperature above 90°F occur only 5-15 times per year on average, and temperatures below 0°F occur only about once every 25 years. Mean high temperatures range from the low 80s in the summer to about 40°F in the coldest months, while average lows are generally in the low 50s in summer and low 30s in winter.

Although snow falls nearly every year, amounts are generally quite low. Willamette Valley floor locations average less than 10 inches per year, mostly during December through February. High winds occur several times per year in association with major weather systems.

Relative humidity is highest during early morning hours, and is generally 80-100 percent throughout the year. During the afternoon, relative humidity is generally lowest, ranging from 70-80 percent during January to 30-50 percent during summer. Annual evaporation is about 35 inches, mostly occurring during the period April through October.

Winters are likely to be cloudy. Average cloud cover during the coldest months exceeds 80 percent, with an average of about 26 cloudy days in January. During summer, however, sunshine is much more abundant, with average cloud cover less than 40 percent. More than half of the days in July are clear.

The study area receives an average of approximately 40 inches of precipitation annually, with the majority of the rainfall occurring during the winter months. The wettest year on record was 1996 when approximately 67 inches of rainfall was measured. Approximately 79% percent of the annual precipitation occurs between November 1 and April 30.

2.4.2 Topography

Aumsville is located on a relatively flat terrace between Mill Creek and Beaver Creek. Elevations range from about 350 to 365 feet above sea level. The ground generally slopes from the southeast to the northwest. The existing wastewater treatment plant is located within and adjacent to the Beaver Creek floodplain.

2.4.3 Soils

Soil surveys for the study are available from the U.S. Department of Agriculture Soil Conservation Service. The reader is referred to the soil survey for Marion County for more detailed information.

Several different soil types exist within the study area. Most of the soils are derived from alluvial deposits and primarily consist of gravelly silts and loams with some silty or loamy clay soils along lower lying areas.

None of the soil types outright preclude the construction of typical wastewater facilities from a foundation stability point of view. The construction of significant structures (e.g., buildings, pump stations, treatment plant tankage, etc.) recommended in this report will require detailed geotechnical investigations during the design phase of each project.

2.4.4 Geologic Hazards

Known geologic hazards within the study area primarily include earthquakes and flooding.

2.4.4.1 Earthquakes

The 2008 U.S. Geological Survey (USGS) National Seismic Hazard Maps display earthquake ground motions for various probability levels across the United States. These factors are applied in the seismic provisions of building codes, insurance rate structures, risk assessments, and other public policy. A review of these maps identifies Oregon as having a relatively high seismic risk. The Oregon Structural Specialty Code shares this assessment and has adopted similar ground motion data as the USGS. Seismic risk factors for structures are typically influenced by a combination of factors including the geographical location, specific building and structural configurations, and local soil types. The construction and rehabilitation of significant structures recommended by this report (buildings and hydraulic structures) will require detailed geotechnical reports and site specific seismic evaluations.

2.4.4.2 Flooding

Mill Creek and Beaver Creek are the primary streams within the study area. The Federal Emergency Management Agency (FEMA) has established a 100-year floodplain designation and insurance ratings for the study area. While sometimes referred to as the “100 year flood”, it is more accurate to consider it the flood having a 1 percent chance of occurrence in any year, or a 10 percent chance of occurrence during any 10 year period. The 100-year floodplain has been defined for both Mill Creek and Beaver Creek. Flood profiles and maps for Mill Creek and Beaver Creek are included in the Flood Insurance Study prepared for Marion County and appear on Flood Insurance Rate Maps (FIRMs). It should be noted that the FEMA flood boundaries are based on flood elevations. Therefore, the actual inundation boundaries may vary due to localized topographical variations. Final determinations of whether a specific property is affected must be determined based on a topographic survey of the property in question.

During a FEMA defined 100-year flood, Mill Creek and Beaver Creek will rise out of their normal channel into the floodplain. The floodplain for Mill Creek generally extends to the south of the study area and does not impact the City. The floodplain for Beaver Creek does include some of the northern areas of the City. Most notably for this report, the existing wastewater treatment plant is located within, and adjacent to, the Beaver Creek Floodplain. The 100 year flood plain elevations vary across the treatment plant site from about 346 feet in the east to about 342 feet in the west. The top of the lagoon dikes are all located above the floodplain elevations as are the public works buildings located north of lagoon cells 1 and 2. Therefore, flooding is not a major concern for the existing treatment facilities. Any new facilities should be located well above the 100 year floodplain elevations.

2.4.5 Public Health Hazards

There are no known public health hazards within the City of Aumsville.

2.4.6 Energy Production and Consumption

Electricity is provided to the community by the Pacific Power. There are no known power generation facilities with the City. Natural gas service is provided by Northwest Natural Gas.

The major energy demand in a wastewater treatment and collection system is from the electric motors that drive pumps and other equipment. It is recommended that these components be specified as having high efficiency motors and variable speed controls, which will reduce the energy costs over the life of the project. Depending on the current programs in place with the electric utility, there may be rebates available if high efficiency electrical motors and variable speed controls are specified, which will tend to offset the slightly higher capital construction cost.

The power supply system in the City can be somewhat unreliable. City staff reports multiple power bumps per month which tend to create nuisance alarms and add to the City's overall workload.

2.4.7 Flora and Fauna

The study area encompasses upland areas as well as riparian areas associated with Mill Creek and Beaver Creek. Therefore, there is a wide variety of plant and animal life within the study area. Common plants include Douglas Fir, hardwood trees such as Oregon White Oak, Ash, Alder, Maple, Oregon Grape, Dogwood, Wild Rose, Sycamore, and Poplar. Common wildlife species include Muskrat, Beaver, Opossum, Raccoon, Skunk, Coyote, and Deer. Mill Creek and Beaver Creek provide habitat for rainbow trout, coastal cutthroat trout, dace, sculpin, salmon, and steelhead.

2.4.8 Environmentally Sensitive Areas

Mill Creek, Beaver Creek, and the riparian areas and wetlands adjacent to these natural waterways are considered to be environmentally sensitive. Wetland delineations should be prepared for work near these areas. There are also likely to be other isolated wetland areas within the study area. Therefore, wetland issues will need to considered early in the design phase for each of the recommended projects.

2.5 SOCIOECONOMIC ENVIRONMENT

Growth within the study area will depend on socioeconomic conditions. The following section contains a general discussion of economic conditions, trends, population, land use, and public facilities relating to the both the study area and the City.

2.5.1 Economic Conditions and Trends

Regional economic trends will heavily influent the population growth in Aumsville. State forecasts call for continued growth in the Willamette Valley over the next 50 years. The area around Aumsville supports a diverse economy. Therefore, residents can easily settle in Aumsville and commute to other area for employment. Aumsville is an attractive community due to the rural character and centralized location. Aumsville is located only a few minutes to Salem and has good access to Highway 22 and the I-5 corridor. As shown in Chapter 5, population growth in Aumsville has been steady for many years and this trend is expected to continue through the planning period.

2.5.2 Population and Growth Projections

The population in Aumsville in 2021 is about 4,000[1]. Based on United States census data, the population was 1,673 in 1990, 3,025 in 2000, and 3,574 in 2010. Therefore, the historic data shows a steady population increase over the last 30 years. This trend is expected to continue during the planning period. In June of 2017, population projections for Marion County were prepared by the Portland State University Population Research Center[2]. These projections estimate the 2045 population of Aumsville to be 6,768. These projections will be used for planning purposes in order to conform to state-wide planning goals.

A more detailed discussion of future population growth is presented in Chapter 5 -Wastewater Flows and Loads.

2.5.3 Land Use

The City's Comprehensive Plan was adopted in 1999 and established an urban growth boundary (UGB) encompassing approximately 820 acres. The current City Limits encompasses approximately 700 acres.

A majority of land use zoning in the City is comprised of residential uses with some areas designated for commercial uses and Industrial uses. The location of the UGB and City limits are shown in Figure 2-3. This figure also shows the land use zoning designations within the City. The total areas contained under each zoning designation are listed in Table 2-1 and illustrated in Figure 2-1.

Table 2-1 | Aumsville Land Use by Area

Zoning Designation	(Acres)	(%)
I - Industrial	119	15.4%
P - Public	100	13.0%
RM - Residential Multi-Family	175	22.7%
RS - Residential Single-Family	255	33.1%
CL - Commercial	11.3	1.5%
CL - Commercial/Business District	28.7	3.7%
ID - Interchange Development	82	10.6%
Total (Acres)	771(1)	100.0%

Notes:
(1) Total does not include road right of ways and other similar non-zoned areas.

[1] Portland State University, Population Research Center
[2] Portland State University, Population Research Center, Coordinated Population Forecast Marion County Oregon 2017-2067

Figure 2-1| Ranked Land Uses

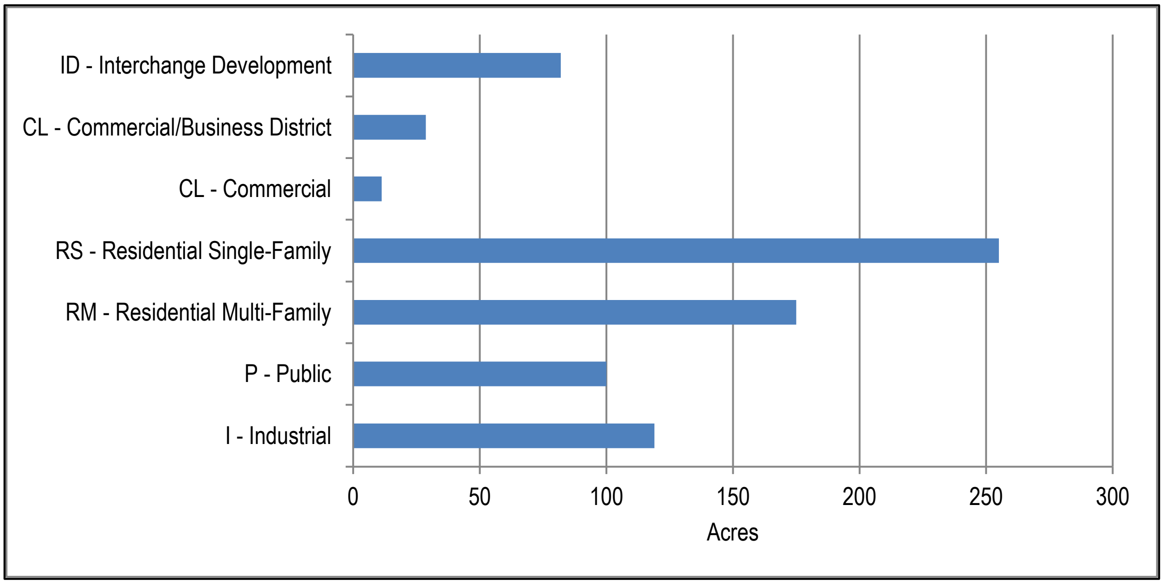


Figure 2-2 | Study Area and Vicinity Map

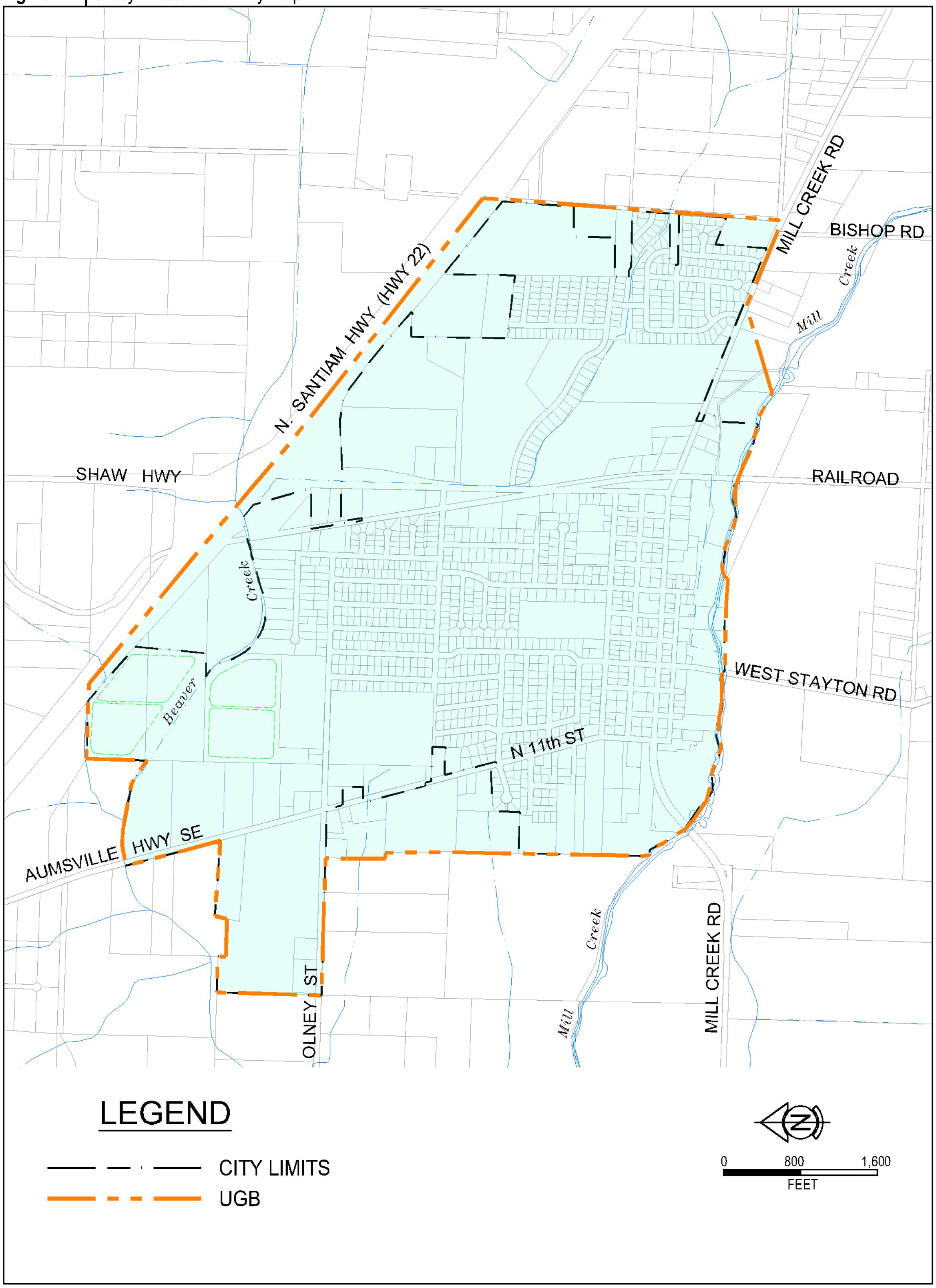
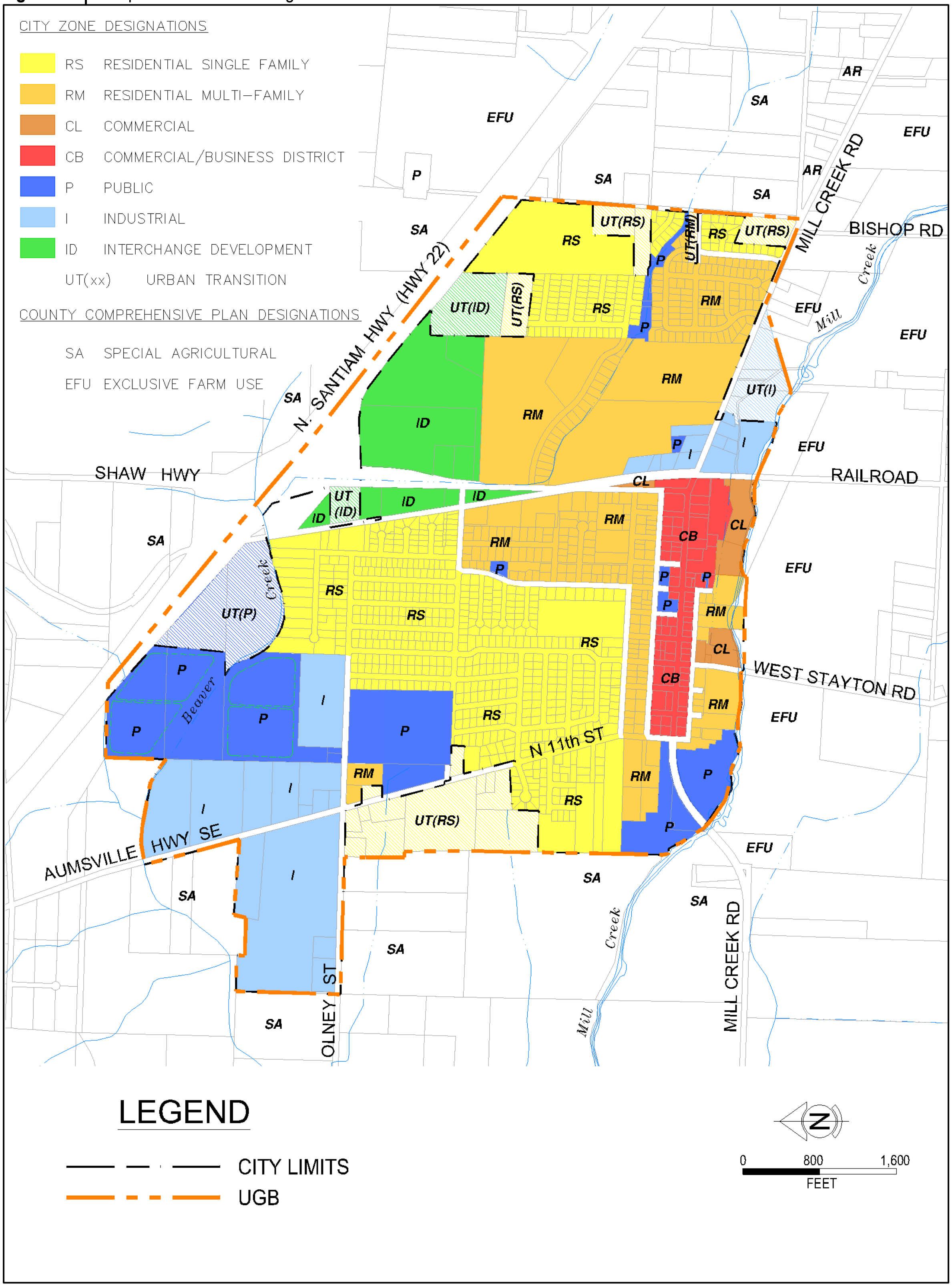


Figure 2-3 | Comprehensive Plan Designations



CHAPTER 3

BASIS OF PLANNING

Chapter Outline

3.1 Introduction
3.2 Regulating Agencies
3.3 Existing Permit Requirements
3.4 Receiving Stream Background Information
3.5 Groundwater Protection
3.6 Wastewater Recycling
3.7 Sludge Stabilization Requirements
 3.7.1 Biosolids Quality
 3.7.2 Pathogen Requirements
 3.7.3 Vector Attraction Requirements
 3.7.4 Trace Elements
 3.7.5 Biosolids Use
 3.7.6 Biosolids Land Application Site Criteria
3.8 Reliability and Redundancy Requirements
3.9 Collection System Design Criteria
3.10 Pump Station and Forcemain Design Criteria

BASIS OF PLANNING

3.1 INTRODUCTION

The purpose of this chapter is to present an overview of the regulatory requirements as well as the basic design criteria used to develop and evaluate the various alternatives. This chapter presents the common baseline used to evaluate each of the recommended improvements. All of the recommended improvements must meet all applicable regulatory requirements and provide reliable service for a reasonable cost.

3.2 REGULATING AGENCIES

The U.S. Environmental Protection Agency (EPA) regulates disposal and/or reuse of sewage sludge and septage, as well as the discharge of wastewater effluent to surface waters. Subsurface disposal of treated effluent is regulated by the Oregon Department of Environmental Quality (DEQ). The basis of the regulations imposed or overseen by the EPA is the Federal Water Pollution Control Act of 1972 (Public Law 92-500) often referred to as the Clean Water Act (CWA). The scope of the Clean Water Act has been revised and expanded over the subsequent years. The EPA promulgates regulations to implement the requirements of the CWA and subsequent legislation, and is required to coordinate its requirements with other federal agencies such as the National Oceanic and Atmospheric Administration, the U.S. Army Corps of Engineers, the U.S. Fish and Wildlife Service, and with state agencies such as the Department of Environmental Quality (DEQ), the Department of Fisheries, and the Department of Health.

In Oregon, the Oregon Department of Environmental Quality (DEQ) is the EPA's delegated agency to implement the Clean Water Act.

3.3 EXISTING PERMIT REQUIREMENTS

The City's existing treatment plant is regulated under a National Pollutant Discharge Elimination System (NPDES) permit issued by DEQ (Appendix A). The existing permit was issued in 2021 and expires in 2026. The City is currently permitted to discharge treated effluent to Beaver Creek from November 1 through April 30 of each year. No discharge to surface waters is allowed from May 1 through October 31. In addition to seasonal limitations, the NPDES permit includes several other limitations with respect to effluent quality and quantity (Table 3-1).

The NPDES permit also establishes a mixing zone in the receiving stream. The mixing zone is defined as that portion of Beaver Creek that is 10 feet out from the outfall pipe and extends from 10 feet upstream of the outfall to 100 feet downstream from the outfall.

Table 3-1 | Current NPDES Permit Discharge Limitations

NPDES Permit Schedule A, Treated Effluent, Outfall 001(Beaver Creek)
Discharge Permitted November 1 – April 30

Constituent	Max. Concentration (mg/L)		Max. Mass Load (lb/day)		
	Avg. Monthly	Avg. Weekly	Avg. Monthly	Avg. Weekly	Daily
BOD5	30	45	170	250	340
TSS	50	80	280	420	560
pH		Range		6.5 – 8.9	
E. coli Bacteria		Monthly Geometric Mean		126 cts/100 ml	
		Maximum Single Sample		406 cts/100 ml	
BOD5 Removal Efficiency		Min. Monthly Average Removal		85%	
TSS Removal Efficiency		Min. Monthly Average Removal		65%	
Total Chlorine Residual		Maximum Monthly Average		0.01 mg/L	
Ammonia-N		Maximum Monthly Average		3.3 mg/L	
		Daily Maximum		6.8 mg/L	

In addition to the surface water discharge, the City is also permitted to use recycled water for crop irrigation during the dry weather months. Under the NPDES permit for outfall 002, no discharge to the waters of the state is allowed. All discharge must be land applied in accordance with a recycled water use plan approved by the DEQ subject to the following additional requirements.

- The water must be used and applied at a rate that does not have the potential to adversely impact groundwater quality.
- The water must be applied at a rate in accordance with site management practices that ensure continued agricultural, horticultural, or silvicultural production and does not reduce the productivity of the site.
- The water must be irrigated using sound irrigation practices to prevent:
    - Offsite surface runoff or subsurface drainage through drainage tile
    - Creation of odors, fly and mosquito breeding or other nuisance conditions
    - Overloading of land with nutrients, organics, or other pollutant parameters

At the present time, the NPDES permit and the City' recycled water use plan calls for the production of Class C recycled water. Class C recycled water must be disinfected to reduce total coliform to 240 organisms per 100 mL in two consecutive samples, and a 7-day median of 23 organisms per 100 mL. The City currently uses recycled water for irrigation at a site located south of the City.

At the present time, the City is unable to meet the effluent quality criteria listed in the NPDES permit. Specifically, the City cannot meet the ammonia limits in the existing permit. The existing treatment facilities do not have the ability to reduce effluent ammonia limits to levels that comply with the permit. Significant capital improvements must be made in order for the City to achieve compliance with the permit. Recognizing that time is needed to implement the improvements, the NPDES permit includes a compliance schedule that lists the milestones and deadlines (Table 3-2) under which the City must make the improvements needed to achieve compliance with the effluent ammonia limits. The preparation of this facilities planning document is the second milestone in Table 3-2. The proposed improvements to address the ammonia issue are substantial and the City will likely have to work with the state and federal funding assistance programs (see Section 8.5) to assemble a funding package. Based on the compliance schedule listed in Table 3-2, the funding work will need to occur during the 2022/2023 fiscal year.

Table 3-2 | NPDES Permit Compliance Schedule for Ammonia

Compliance Date:	Requirement:
Within 12 months of permit effective date and annually thereafter (10/01/2022)	Submit to DEQ a written Progress Report outlining the progress made towards achieving the final effluent limitations.
Within 6 months of permit effective date (04/01/2022)	Submit to DEQ a draft Facility Plan that evaluates several alternatives and identifies the permittee's preferred alternative to comply with the ammonia final effluent limits. Permittee must revise documents in accordance with DEQ comments within 60 days of receiving DEQ comments.
Within 2 years of permit effective date (10/01/2023)	Submit a draft Preliminary Design Report for projects identified in the Facility Plan to DEQ for review and approval. City will request permit modification if needed for chosen alternative in facility plan. Permittee must revise documents in accordance with DEQ comments within 60 days of receiving DEQ comments.
Within 4 years of permit effective date (10/01/2025)	Submit a draft Final Design for projects identified in the Facility Plan to DEQ for review and approval. Permittee must revise documents in accordance with DEQ comments within 60 days of receiving DEQ comments.
Within 6 years of permit effective date (10/01/2027)	Complete construction of projects identified in the Facility Plan to comply with the final effluent limits for ammonia.
Within 7 years of permit effective date (10/01/2028)	Complete start up and process optimization for the projects. If permit limits are being achieved, submit a written notice of compliance with the ammonia final effluent limits in Schedule A. If limits are not being achieved submit a corrective action plan. Implement the corrective actions.
Within 8 years of permit effective date (10/01/2029)	Achieve the final limits for ammonia.

3.4 RECEIVING STREAM BACKGROUND INFORMATION

During the winter months, the City discharges treated effluent to Beaver Creek at river mile 2.9. Beaver Creek is a tributary of Mill Creek which is tributary of the Willamette River. The discharge is located in the Middle Willamette Subbasin. The Oregon DEQ maintains a list of waterbodies that do not meet state water quality standards. This list is known as the 303d list. There are no entries on the 303d list for Beaver Creek, but there are several for Mill Creek (Table 3-3) which is only 2.9 miles downstream of the City's discharge into Beaver Creek. The 303d listing means that the water quality does not meet the water quality standards for specific parameters. In these cases, the DEQ is required to establish Total Maximum Daily Loads (TMDLs) of pollutants that are affecting a beneficial use. The TMDL may assign waste load allocations (WLA) to pollution sources such as the City's effluent discharge.

Table 3-3 | 303d Listed Waterbodies Near Aumsville

Waterbody Name	Listed River Mile	Parameter	Season	TMDL Completed
Mill Creek	0 to 19	Dissolved Oxygen	October 15 - May 15	No
Mill Creek	0 to 25.7	E. coli	Year Around	Yes
Mill Creek	0 to 19	Temperature (spawning 13 C)	October 15 – May 15	Yes
Mill Creek	0 to 25.7	Temperature (migration 18 C)	Year Around	Yes

3.5 GROUNDWATER PROTECTION

Groundwater is a critical natural resource providing domestic, industrial, and agricultural water supply as well as other beneficial uses. Groundwater also provides base flow for rivers, lakes, streams, and wetlands. The state has adopted rules with the goal of protecting all groundwater from pollution. Oregon's groundwater protection rules are described in OAR 340-040. Groundwater resources in the Aumsville area are good and the City obtains all its drinking water from ground water sources. As such, groundwater protection is a relevant issue in Aumsville.

3.6 WASTEWATER RECYCLING

An alternative to direct discharge to surface water is to recycle the treated effluent for other uses such as irrigation or industrial process water. The City currently disposes of recycled water at a 55 acre farmed field located south of the City.

Reuse of effluent by land application is governed by OAR 340-055, Recycled Water Use, and groundwater quality is governed by OAR 340-040, Groundwater Quality Protection. Per OAR 340-055 recycled wastewater is characterized in five classes including Class A through D and Non-disinfected water. These classes range in quality from Class A being the most treated to Non-disinfected water being the least treated. Each wastewater class has different treatment and testing requirements and beneficial purposes. The treatment requirements and possible beneficial uses described in the rules are summarized in Table 3-4 and Table 3-5.

Table 3-4 | Treatment & Monitoring Requirements for use of Recycled Water

Reuse Class	A	B	C	D	Non-Disinfected
Minimum Treatment Required	Oxidation, filtration & disinfection	Oxidation & disinfection	Oxidation & disinfection	Oxidation and disinfection	Oxidized
Parameter - Total Coliform (number/100 mL)					
7 day median	2.2	2.2	23	No Limit	No limit
Maximum single sample	23	23	240	No limit	No limit
Parameter – E. coli (number /100 mL)					
30 day LOG mean	Not Required	Not Required	Not Required	126/100ML	No limit
Maximum Single Sample	Not Required	Not Required	Not Required	406/100ML	No limit
Parameter – Turbidity Prior to Disinfection (NTU)					
24 hour mean	2	No limit	No limit	No limit	No limit
5% of the time during any 24 hour period	5	No limit	No limit	No limit	No limit
Maximum any sample	10	No limit	No limit	No limit	No limit
Minimum Monitoring Requirements					
Total Coliform	Daily	3/week	1/week	Not Required	As in NPDES or WPCF Permit
Turbidity	Hourly	Not Required	Not Required	Not Required	Not Required
E. Coli	Not Required	Not Required	Not Required	1/week	Not Required
Public Access					
	Controlled: Same as Class D for some uses and unrestricted for others	Controlled: Same as Class D	Controlled: Same as Class D plus direct contact restrictions for some uses	Controlled: Notification of staff and signs posted around the perimeter of use area	Prevented: fences, gates, locks
Set-Back Requirements					
From property line where irrigation is applied directly to the soil	None	10 feet	10 feet	10 feet	Site specific
From property line where sprinkler irrigation is used	None	50 feet	70 feet	100 feet	Site specific
From food preparation or serving area or drinking fountain to edge of sprinkler irrigation	Cannot be sprayed directly on to use area	10 feet	70 feet	70 feet	Site specific
From edge of irrigation to water supply source for human consumption	None	None	100 feet	100 feet	150 feet

Table 3-5 | Allowable Uses for Recycled Water

Beneficial Purpose	Class A	Class B	Class C	Class D	Non-disinfected
Irrigation					
Fodder, fiber, seed crops not intended for human ingestion, commercial timber	Yes	Yes	Yes	Yes	Yes
Firewood	Yes	Yes	Yes	Yes	No
Sod	Yes	Yes	Yes	Yes	No
Pasture for animals	Yes	Yes	Yes	Yes	No
Processed food crops	Yes	Yes	Yes	No	No
Orchards or vineyards if an irrigation method is used to apply recycled water directly to the soil	Yes	Yes	Yes	No	No
Golf Courses, cemeteries, highway medians, industrial or business campuses	Yes	Yes	Yes	No	No
Any agricultural or horticultural use	Yes	No	No	No	No
Parks, playgrounds, school yards, residential landscapes, other landscapes accessible to the public	Yes	No	No	No	No
Industrial, Commercial, or Construction					
Industrial cooling	Yes	Yes	Yes	No	No
Rock crushing, aggregate washing, mixing concrete	Yes	Yes	Yes	No	No
Dust control	Yes	Yes	Yes	No	No
Nonstructural fire fighting using aircraft	Yes	Yes	Yes	No	No
Street sweeping or sanitary sewer flushing	Yes	Yes	Yes	No	No
Stand alone fire suppression systems in commercial and residential buildings	Yes	Yes	No	No	No
Non-residential toilet or urinal flushing, floor drain trap priming	Yes	Yes	No	No	No
Commercial car washing	Yes	No	No	No	No
Fountains when the water is not intended for human consumption	Yes	No	No	No	No
Impoundments or Artificial Groundwater Recharge					
Water supply for landscape impoundments including, but not limited to, golf course water ponds and non-residential landscape ponds	Yes	Yes	Yes	No	No
Restricted recreational impoundment	Yes	Yes	No	No	No
Nonrestricted recreational impoundments including, but not limited to, recreational lakes, water features accessible to the public, and public fishing ponds	Yes	No	No	No	No
Artificial groundwater recharge	Yes	No	No	No	No

3.7 SLUDGE STABILIZATION REQUIREMENTS

As discussed in Chapter 7, the sludge that accumulates in the lagoons must be periodically removed and disposed of. As such, the regulations regarding sludge stabilization and disposal are summarized in this subsection.

The term “sludge” refers to the solids that settle and are removed when a liquid with suspended solids passes through a settling basin or tank. Sludge may originate from several sources in a wastewater treatment plant, but can typically be classified as either raw or primary sludge (primary settling of untreated sewage) or secondary sludge (excess biological sludge from secondary treatment processes). All sludge must be stabilized prior to reuse or disposal. Stabilized sludge is a mixture of solids and liquids that is one of the end products of the wastewater treatment process. Adequately processed sludge is classified in regulations as “biosolids.” It is commonly disposed of by applying it to agricultural or forest land after adequate processing.

3.7.1 Biosolids Quality

Wastewater biosolids are subject to differing regulations and restrictions based on quality. The Code of Federal Regulations (40 CFR 503) defines standards for three measures of biosolids quality:

- Pathogens
- Vector attraction (the tendency of the sludge to attract rodents, insects and other organisms that can spread disease)
- Trace elements

Biosolids that meet the higher of two standards for all three of these measures are designated exceptional quality (EQ) biosolids. EQ biosolids have fewer reporting and monitoring requirements and virtually no restrictions on use. Use is restricted for biosolids that do not meet the higher standard by any of these three measures. The following is a short discussion of each of these measurements of biosolids quality.

3.7.2 Pathogen Requirements

Pathogen requirements define two classes of biosolids - Class A and Class B. Class A is the higher standard and requires complete destruction of pathogens before disposal. Class B requirements call for reducing pathogens before disposal and applying the biosolids to land in such a way that pathogens are further reduced.

To be classified as Class A, biosolids must be treated using one of the EPA's Processes to Further Reduce Pathogens (PFRP), or an equivalent process. These processes include composting, heat drying, heat treatment, thermophilic aerobic digestion, beta ray irradiation, gamma ray irradiation, and pasteurization. Regardless of the process used, Class A biosolids must not exceed maximum allowable fecal coliform density or Salmonella bacteria density.

Class B biosolids must be treated using one of the EPA's Processes to Significantly Reduce Pathogens (PSRP), or an equivalent process. These processes include aerobic digestion, air drying, anaerobic digestion, composting, and lime stabilization.

3.7.3 Vector Attraction Requirements

Biosolids must meet one of the following requirements for reducing vector attraction if they are to be applied to land without restrictions:

- Volatile solids in the sludge shall be reduced by a minimum of 38 percent.
- The specific oxygen uptake rate for sludge treated by aerobic digestion shall be less than or equal to 1.5 mg oxygen per hour per gram of total solids at a temperature of 20°C.
- Aerobic processes shall treat the sludge for a minimum of 14 days with an average temperature of at least 45°C and a minimum temperature of 40°C.
- Alkali addition shall raise the pH of the sludge to a minimum of 12 for two hours and maintain the pH at a minimum of 11.5 for an additional 22 hours without additional alkali.

The use of the land where the biosolids is applied is restricted if vector attraction reduction is achieved by measures, such as injecting the biosolids below the surface of the land or disposing of them on the surface and incorporating them into the soil within six hours.

3.7.4 Trace Elements

Ten elements typically found in biosolids have been identified as critical. Two limits have been set for each of these trace elements: Exceptional Quality (EQ) and a ceiling limit. If all the trace elements are below the EQ limit, then no restrictions are placed on loading rates. If any of the trace elements are over the ceiling limit, then the biosolids are not suitable for land application. If the trace elements fall between these two limits, restrictions are placed on loading rates.

3.7.5 Biosolids Use

Table 3-6 outlines some of the general restrictions on the use of biosolids depending on the quality of the biosolids.

Table 3-6 | Biosolids Use Restrictions Based on Quality Rating

Biosolids Quality Rating by Category			Use Restrictions
Pathogens	Vector Attraction	Trace Elements	
EQ	EQ	EQ	No restrictions are imposed on application or use with regard to pathogens, vector attraction, or trace elements.
Class B	EQ	EQ	Application is subject to EPA defined waiting periods for crops, grazing, and public access. Biosolids cannot be distributed for home use, in bags, or in containers.
EQ	-	EQ	Biosolids must be injected or tilled into the soil. Biosolids cannot be distributed for home use, in bags, or in containers.
EQ	EQ	-	Bulk application must not exceed EPA defined cumulative loading rates. Biosolids distributed in bags or containers are subject to annual loading rate restrictions.
All Other Biosolids Qualities			Application is subject to trace loading requirements and pathogen waiting periods. Biosolids must be injected or tilled into the soil and cannot be distributed for home use, in bags, or in containers.

EQ – Exceptional Quality Biosolids

3.7.6 Biosolids Land Application Site Criteria

Site criteria for land applying class B biosolids includes geological formation, flood plain proximity, groundwater and surface water proximity, topography, and soils, as well as method of application. Table 3-7 contains an overview of some of the general criteria contained in OAR 340-050.

Land application of class B biosolids at sites used for agricultural purposes requires special management considerations. These relate to access to the site, types of crops grown, plant nutrient-uptake rates, timing and duration of biosolids application (i.e., site life and seasonal constraints), and grazing restrictions. A brief discussion of each of these issues follows.

- Access. Controlled access must be provided for municipal class B biosolids application sites for 12 months following surface application of biosolids. Controlled access is defined as public entry or traffic being unlikely. Privately owned rural land is typically assumed to have controlled access, while public lands such as parks may require fencing to ensure access control.
- Crops. Class B Biosolids are not to be used directly on fruits or vegetables which may be eaten raw. As a general rule, crops grown for human consumption should not be planted within 14 months of application of class B biosolids. If the edible parts will not be in contact with the biosolid amended soil, or if the crop will be processed or treated prior to marketing in such a manner to ensure that pathogen contamination is not a concern, this requirement may be waived by DEQ. There are no restrictions on planting times for crops not grown for direct human consumption.
- Nutrient Loading. The application of Class B biosolids to agricultural land should not exceed the annual nitrogen loading required for maximum crop yield. Biosolids are, therefore, typically managed according to their fertilizer value. Biosolids may be applied above agronomic rates on a onetime basis or less than once per year so long as runoff, nuisance conditions, and groundwater concerns are adequately addressed. In cases of higher than agronomic application rates, the acceptable loading rate and application frequency is typically based on nitrogen accumulation and annual nitrogen use.
- Site Life. Class B biosolids disposal sites generally have a limited application life, which may be determined by the chemistry of the soil and the metals loading from the biosolids. Site life is determined by dividing lifetime biosolids loading limits (based on the most limiting constituent) by the annual application rate.
- Seasonal Constraints. The main consideration in land applying class B Biosolids on sloping ground is to avoid surface runoff and soil erosion. Additionally, class B biosolids application should be restricted to the dry season to prevent soil damage that may occur from equipment traffic during the wet season.
- Grazing Restrictions. Grazing animals should not be allowed on pasture or forage for 30 days after application of class B Biosolids.
- Site Monitoring and Reporting. As previously noted, site monitoring is typically not required where "EQ" biosolids are applied at or below agronomic rates based on crop nitrogen requirements. However, if class B biosolids contain high concentrations of heavy metals or other toxic elements, or if crop nitrogen requirements are exceeded on a regular basis, soil monitoring and special management practices may be required. At the discretion of DEQ, monitoring wells and groundwater background characterization and/or monitoring may be required on any site on a case by case basis.

Table 3-7 | Site Criteria for Class B Biosolids Application

Parameter	Criteria
Geology	Must have a stable formation
Within Flood Plain	Restricted period of application and incorporation of biosolids
Groundwater	At time of application; 4-foot minimum depth to permanent groundwater; 1-foot minimum depth to temporary groundwater
Topography	Must have appropriate management to eliminate surface runoff
Slope less than or equal to 12%	• Surface application of liquid dewatered or dried biosolids
Slope greater than 12% but less than 20%	• Direct incorporation of liquid biosolids into the soil, surface application of dewatered or dried biosolids
Soils	• Minimum rooting depth of 24 inches • No rapid leaching • Avoid saline or alkali soil • pH of 6.5 to 8.2 for heavy metal accumulator crops, or pH can be raised by adding lime to the soil.
Method of Application & Proximity to Water Bodies	Buffer strips may be required to protect water bodies. Size depends on method of application and proximity to sensitive area (determined at discretion of DEQ), generally as follows: • Direct injection: no limit required • Truck spreading: less than 50 foot buffer strip • Spray irrigation: 300 to 500 foot buffer strip • Near ditch, pond, channel, or waterway: greater than 50 foot buffer strip • Near domestic water source or well; greater than 200 foot buffer strip

3.8 RELIABILITY AND REDUNDANCY REQUIREMENTS

The EPA has established minimum standards for mechanical, electrical, fluid systems, and component reliability for all new or expanding sewerage facilities, including treatment plants. These reliability standards establish minimum levels of reliability for three classes of sewerage facilities. Pump stations associated with, but physically removed from the actual treatment works may have a different classification than the treatment works itself.

The purpose of these reliability standards is to ensure that the treatment facilities will operate effectively on a day-to-day basis and that provisions are made for operation during power failures, flooding, peak loads, equipment failures, and maintenance shutdowns. These reliability and redundancy standards are designed to ensure that unacceptable degradation of the receiving water will not occur due to the interrupted operation of specific treatment process or unit operation.

The reliability classification will be based on the water quality and public health consequences of a component or system failure. Specific requirements pertaining to treatment plant unit processes for each reliability class are described in EPA's technical bulletin, Design Criteria for Mechanical, Electric, and Fluid System and Component Reliability, EPA 430-99-74-001. EPA and DEQ guidelines for classifying sewerage works are summarized as follows:

- Reliability Class I. These are works whose discharge, or potential discharge, (1) is into public water supply, shellfish, or primary contact recreation waters, or (2) as a result of its volume and/or character, could permanently or unacceptably damage or affect the receiving waters or public health if normal operations were interrupted. Examples of Reliability Class I works are those with a discharge or potential discharge near drinking water intakes, into shellfish waters, near areas used for water contact sports, or in dense residential areas.
- Reliability Class II. These are works whose discharge, or potential discharge, as a result of its volume and/or character, would not permanently or unacceptably damage or affect the receiving waters or public health during periods of short-term operations interruptions, but could be damaging if continued interruption of normal operations were to occur (on the order of several days). Examples of a Reliability Class II works are works with a discharge or potential discharge moderately distant from shellfish areas, drinking water intakes, areas used for water contact sports, and residential areas.
- Reliability Class III. These are works not otherwise classified as Reliability Class I or Class II.

Table 3-8 contains the typical redundancy requirements for treatment plant and pump station components that are designed in accordance with the EPA Reliability Class I standards. DEQ requires all pump stations be designed to reliability Class I standards. For treatment plants, DEQ typically requires Class I reliability standards during the low flow season and Class II standards during the high flow season. One of the goals of treatment plant redundancy is for the treatment plant to have the ability to meet effluent permit limits with any unit removed from service. Major maintenance activities should be scheduled for the low flow season. Therefore, in practice, treatment facilities must be designed to treat the maximum month dry weather flow with any unit removed from service. During wet weather conditions, the DEQ typically allows treatment facilities to be designed such that all treatment units are required to treat the peak wet weather flow.

Table 3-8 | EPA Reliability Class I Requirements

System Component	Capacity/Redundancy Requirements
Raw Sewage Pumps	Handle peak flow with largest unit out of service. As a minimum, the Peak flow is defined as the flow associated with a 5-year, 24-hour storm.
Mechanical Bar Screens	Provide one backup with either manual or mechanical cleaning (manual cleaning acceptable if only two screens)
Grit Removal	Provide a minimum of two units.
Primary Sedimentation	Handle 50% of design flow capacity with largest unit out of service. Design flow is defined as the flow used as the design basis of the component.
Activated Sludge Process	A minimum of two equal size basins. No backup basin required.
Aeration Blowers	Supply the design air capacity with the largest unit out of service. Provide a minimum of two units.
Air Diffusers	Allow for the isolation of largest section of diffusers (within a basin) without measurably impairing oxygen transfer.
Secondary Sedimentation	Handle 75% of design flow capacity with largest unit out of service. Design flow is defined as the flow used as the design basis of the component.
Disinfection Contact Basin	Handle 50% of the design flow with largest unit out of service. Design flow is defined as the flow used as the design basis of the component.
Effluent Pumps	Handle peak flow with largest unit out of service. Peak flow is defined as the maximum wastewater flow expected during the design period of the treatment works.
Electrical Power	Two separate and independent sources of electrical power shall be provided, either from two separate utility substations or from a single substation and a plant based generator. Designated backup source shall have sufficient capacity to operate all vital components, critical lighting, and ventilation during peak flow conditions, except that components used to support the secondary processes need not be included as long as treatment equivalent to sedimentation and disinfection is provided.

3.9 COLLECTION SYSTEM DESIGN CRITERIA

The requirements and regulations covering the design and sizing of the collection piping portion of the wastewater conveyance system include both City design standards and DEQ guidelines. The City has Public Works Design Standards that apply to all public sewer improvements within existing and proposed public right-of-way and public utility easements, as well as to all improvements to be maintained by the City. This includes both gravity collection piping and pump stations.

The City design criteria dictates that the collection system piping must be designed to convey all flows projected at the ultimate development of land within the tributary area based on current land use designations. Although this may result in capacities greater than those needed during the 20-year planning period, sewage collection lines are, by their very nature, unsuited for incremental expansion without extensive capital outlays. Under DEQ guidelines, there is one allowable exception to this requirement as it relates to large diameter trunk sewers serving tributary areas that are not expected to develop for 30 or more years. However, none of the proposed new gravity sewers within the study area fall under this category.

The City Public Works Design Standards and associated details implement and clarify current DEQ standards as contained in OAR 340-052 and DEQ design guidelines. Table 3-9 includes a list of the minimum allowable slope based on mainline pipe sizes.

Table 3-9 | Minimum Mainline Pipe Slopes

Inside Pipe Diameter (inches)	% Slope (ft/100 ft)
8	0.40
10	0.28
12	0.22
15	0.15
18	0.12
21	0.10
24	0.09
27	0.08

3.10 PUMP STATION AND FORCEMAIN DESIGN CRITERIA

DEQ has extensive design guidelines for public pump stations. Under the authority granted by OAR 340-052, DEQ has established requirements and guidelines for the design of public sewage pump stations. These design guidelines include OAR 340-052 Appendix B and various design memoranda issued by DEQ. DEQ has established 20-years as being the proper planning period for pump stations. Table 3-10 below summarizes design criteria assumed for new pump stations or the upgrades of the existing pump stations.

Table 3-10 | Recommended Minimum Pump Station Design Criteria

Category	Minimum Design Criteria
Design Flows	• 20-year peak instantaneous flow
Pump Station Structure	
• Wetwell Type	• Precast concrete, hatches with integral hatches/fall protection
• Operational Storage	• Based on pump starts or overflow storage as appropriate
• Valve Vault	• Precast concrete vault adjacent to wetwell
• Overflow	• Provide bypass in accordance with DEQ historical design requests.
Pumps	
• Pump Station Capacity	• Convey design flow with largest single unit out of service
• Type	• Submersible pumps
• Number	• 2 minimum
• Motor Size	• HP as required, 480 volt, 3 phase power preferred
• Min. Pump Cycle Time	• 6 minutes (10 starts per hour total)
• Pump Retrieval	• Jib or davit crane installed on or adjacent to wetwell
Force Mains	
• Minimum Size & Material	• 4-inch, C-900 PVC, Class 52 Ductile Iron or fused HDPE
• Min Velocity / Max Velocity	• 3.5 fps / ±8 fps
Instrumentation & Control System	
• Location	• Building adjacent to pump station
• Control Building	• CMU block
• Pump Speed Control	• Soft starters or VFDs if required by City or utility company
• Flow Measurement	• Mag meter in vault downstream of valve.
Auxiliary Power	
• Type	• Permanent diesel generator w/ATS
• Location	• Control building adjacent to P.S.
• Fuel Supply	• Sub-base tank, 24 hour minimum or as required by City
• Silencer	• Critical grade, insulated
Telemetry	
• Type	• Match City system, programmed per City direction
• Alarms	• Remote alarms as required by City

CHAPTER 4

EXISTING WASTEWATER FACILITIES

Chapter Outline

4.1 Introduction
4.2 General Overview of Existing Wastewater Facilities
4.3 History and Development of Wastewater System
4.4 Wastewater Collection System
- 4.4.1 Service Area and User Connections
- 4.4.2 Drainage Basins
- 4.4.3 Gravity Collection System
- 4.4.4 Inflow and Infiltration
- 4.4.5 Known Collection System Non-Compliance Issues
- 4.4.6 Collection System Deficiencies

4.5 Existing Wastewater Treatment and Disposal System
- 4.5.1 Plant Performance
- 4.5.2 Influent Pump Station
- 4.5.3 Headworks
- 4.5.4 Lagoons
- 4.5.5 Disinfection System
- 4.5.6 Irrigation Pump Station
- 4.5.7 Surface Water Outfall
- 4.5.8 Recycled Water Disposal System
- 4.5.9 Wastewater Treatment Plant Operational Problems
- 4.5.10 Summary of Treatment and Disposal System Deficiencies

4.6 Wastewater System Operator Licensing
4.7 Wastewater System Funding Mechanisms
- 4.7.1 Wastewater User Fees
- 4.7.2 System Development Charges
- 4.7.3 Annual Sewer System Costs
- 4.7.4 Debt Service
- 4.7.5 Sewer SDC and Capital Improvement Funds

EXISTING WASTEWATER FACILITIES CHAPTER 4

4.1 INTRODUCTION

This chapter provides an inventory of the existing wastewater system components that serve the study area. This inventory includes a description of funding mechanisms and operation and maintenance budgets. The evaluation of these specific systems and the development of improvement alternatives are performed in other chapters of this study.

4.2 GENERAL OVERVIEW OF EXISTING WASTEWATER FACILITIES

The wastewater system that serves the study area consists of a conventional gravity collection system that conveys wastewater to the treatment plant. The collection system includes only a single large pump station located at the wastewater treatment plant. The collection system does include two small grinder stations that serve individual residences. But, these stations are small and relatively easy to operate and maintain. There are no other large wastewater pump stations in the collection system. A single pump station in community of this size is unusual. There are typically more. Since the City only has a single pump station, the system if very efficient to operate and maintain. The Main Pump Station and the treatment plant are located on the north side of the City. Vehicular access to the site is from Olney Street. The Main Pump Station receives all water from the gravity collection system and lifts it into the treatment plant headworks. The headworks includes a mechanical screen to remove large solids, a Parshall flume for flow measurement, and a composite sampler. Primary and secondary treatment is provided by a four-cell lagoon system. The first two lagoon cells have floating mechanical aerators. Lagoon cells 3 and 4 are do not have aerators. During the winter months, treated effluent is discharged to Beaver Creek. The effluent is disinfected by the addition of chlorine. A contact chamber provides chlorine contact time. At the downstream end of the contact chamber, a sulfur dioxide solution is added to remove any remaining chlorine prior to discharge. During the summer months, treated effluent is land-applied at an agricultural field located south of the City. The effluent is disinfected using chlorine prior to land application. The treatment plant site is also the City's main public works yard and includes an office building for the public works department and buildings for shop space and equipment storage.

Detailed maps of the collection system are included in Appendix B. Detailed descriptions of the major components of the wastewater system are included below.

4.3 HISTORY AND DEVELOPMENT OF WASTEWATER SYSTEM

The publicly owned and operated community sewer system was initially installed in the late 1960's. Prior to this, residents in the City had individual septic systems with drain fields. The original system included a lift station, a headworks, two facultative lagoons, a chlorine contact chamber, and a discharge to Beaver Creek. The lift station, headworks, and chlorine contact chamber were located on the south dike near the center of the lagoon cells. The pump station pumped raw sewage into cell 1. The two lagoon cells were operated in series and effluent from cell 2 was disinfected prior to discharge to Beaver Creek. The plant as originally constructed discharged during the winter months, and all wastewater was stored in the lagoons during the summer months. The two lagoon cells that were constructed in the 1960's remain in service and are now known as cells 1 and 2. All of the other facilities from the 1960's project have been replaced as described below.

In the late 1970's, the treatment plant was improved. The improvements included the conversion of the influent pump station to a submersible pump station, the addition of two new lagoon cells (i.e., cells 3 and 4), new transfer piping from cells 1 and 2 to cells 3 and 4. A new chlorine contact chamber, new chlorine feed equipment, and a new outfall to Beaver Creek. The improved plant continued to operate under a winter discharge, summer storage operational scheme with discharge to Beaver Creek only occurring during the winter months. All of the components that were constructed or modified in the late 1970's remain in service except for the influent pump station and the headworks.

This operational scheme continues to this day, with the raw wastewater split between cells 1 and 2 and effluent from cells 1 and 2 routed to cell 3 and effluent from cell 3 routed to cell 4. In the 2000's, the City also added a sulfur dioxide feed system to dechlorinate effluent prior to discharge to Beaver Creek.

In 2007, a new influent pump station and headworks were constructed. These facilities replaced the existing pump station and headworks and currently remain in service. The new pump station and headworks were constructed near the southwest corner of the treatment plant site near the site entrance road. The headworks includes screening equipment to remove large solids that were causing problems with the floating mechanical aeration equipment. The 2007 project also included new piping to better distribute raw wastewater in cells 1 and 2.

In 2011, the City installed the irrigation pump station, the pipeline to the irrigation site, and the sprinkler equipment at the irrigation site. This project also included improvements to the chemical feed systems at the plant. These improvements gave the City the ability to dispose of effluent during the summer months using the land application system. No major improvements to the treatment plant have been made since 2011.

Like the treatment plant, the original collection system was installed in the late 1960s. The original collection system extended from a pump station located at the treatment plant south to Olney Street, then east to 9th Street and 4th Street. The line on 9th Street extended south to Del Mar Drive, then west to 11th Street, then south along 11th Street to serve the downtown area between Cleveland and Main Streets west of 8th Street. The line on 4th Street extended south to Clover Street and generally served the older parts of the City between Clover Street and Washington Street east of 8th Street. All of these sewer lines remain in place today, but some upgrades have occurred.

Several additions to the original system have been made since it was originally constructed. The area between Del Mar Drive and Michael Way from 9th Street to 4th Street was generally developed in the early 1970s. The area that includes Maple Court, Oak Street, and Locust Street was generally developed in the early to mid 1970s. The area between Cleveland and Lincoln Streets from 11th to 8th Street was generally developed in the late 1970s. The area between Del Mar Drive and Lincoln Street from 11th Street to 8th Street was generally developed in the mid 1990s. The area around Lincoln Court west of 11th Street was developed in the late 1990s. Windermere Meadows was developed in the mid 1990s. The area around Caleb Street west of 11th Street was developed in the late 2000s. Willamette Street east of 1st Street was developed in the mid 2000s. The large residential areas on the east side of the UGB that are generally east of Grizzly Street and Highberger Street were also developed in the mid 2000s. Clover Court was developed around 2017.

In addition to development projects some of the original collection system piping that was installed in the late 1960s has also been upgraded. The main trunk sewer from the 9th Street/Olney Street Intersection all the way to the treatment plant influent pump station was replaced with a new 24 inch sewer pipe in the mid 2000s. The line on 4th Street between Del Mar Street and Clover Street was upsized to 12 inch HDPE pipe. There have also been a few other minor upgrades to the original collection system. The most current map of the collection system is included in Appendix B.

4.4 WASTEWATER COLLECTION SYSTEM

This subsection provides an overview of the existing wastewater collection system within the study area with an emphasis on flow routing as well as known and reported problems.

4.4.1 Service Area and User Connections

As of October 2020, the City's system currently served 1,366 user connections. These connections consist of dwellings, commercial services, and industrial services (Table 4-1). There are no large industrial or commercial users that currently discharge to the sewer system.

Table 4-1 | Sewer User Summary (as of October 2020)

User Classification	Number of Connections
Residential	1294
Commercial	35
Public	24
Industrial	10
Non Profit	3
Total	1,366

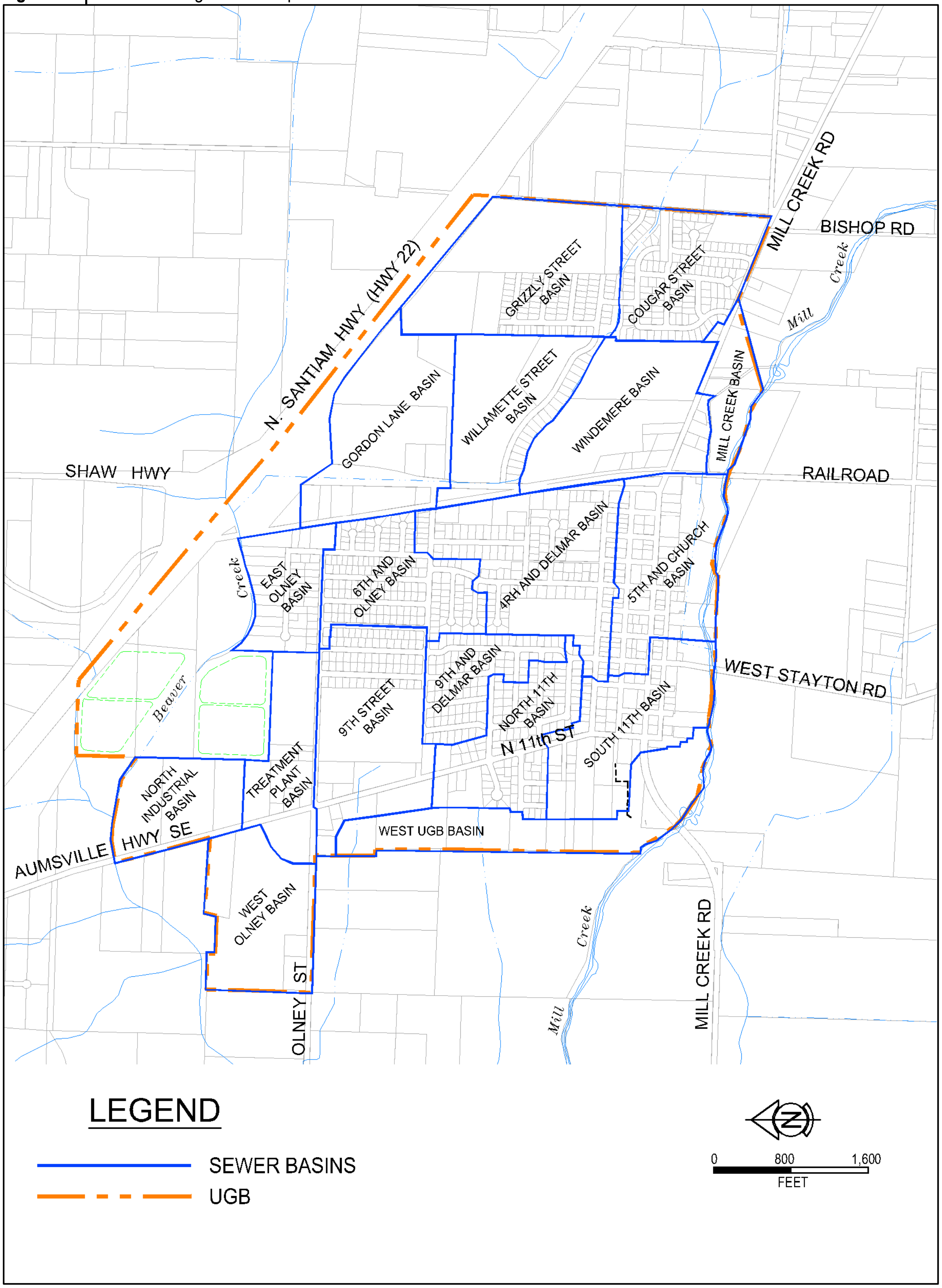
4.4.2 Drainage Basins

To aid in the analysis of the collection system, it is convenient to divide the collection system into separate drainage basins. The basin boundaries are based on a combination of factors including topography, urban growth boundaries, as well as the existing drainage patterns and trunk sewer locations. The collection system is divided into 18 distinct basins as shown in Figure 4-1. The approximate area within each of the major sewer drainage basins is listed in Table 4-2.

Table 4-2 | Sewer Drainage Basin Areas

Basin	Total Area (Acres)	Sewered Area (Acres)	Non-Sewered Area (Acres)
North Industrial Basin	28	0	28
West Olney Basin	39	0	39
Treatment Plant Basin	28	28	0
East Olney Basin	23	23	0
9th Street Basin	54	44	10
6th & Olney Basin	37	37	0
Gordon Lane Basin	55	0	55
West UGB Basin	44	0	44
North 11th Basin	36	32	4
9th & Del Mar Basin	24	24	0
4th & Del Mar Basin	60	54	6
Willamette Street Basin	43	7	36
South 11th Basin	45	36	9
5th & Church Basin	46	44	2
Windemere Basin	52	52	0
Grizzly Street Basin	62	42	20
Cougar Street Basin	40	36	4
Mill Creek Basin	16	0	16
Totals	732	459	273

Figure 4-1 | Sewer Drainage Basin Map



4.4.3 Gravity Collection System

The collection system serving City includes approximately 65,500 feet of mainline pipe. Of this amount, approximately 9,600 feet is privately owned and remaining mainline piping is owned and maintained by the City. Pipe sizes range from 6-inch to 24-inch diameter (Figure 4-2). Most of the piping is 8-inch diameter. The collection system does not include any large pump stations. There are two small grinder pump stations that serve two homes in the City. But, these are relatively small facilities that are straight-forward to operate and maintain. All wastewater drains by gravity to the influent pump station located at the wastewater treatment plant. The original collection system was built in 1960s. The original collection system utilized primarily concrete pipe. Most of the original 1960s piping remains in service. The original collection system has been extended over the years. Since the 1970s most extensions have been made using PVC pipe. As a result of this history, most of the mainline piping is either concrete or PVC (Figure 4-3), with small portions of other materials.

Most pipelines installed after the original sewer system use more modern (e.g., PVC) pipe materials and generally leak much less than 1960s era concrete pipe. Most new construction has utilized PVC pipe with rubber gaskets.

Figure 4-2 | Pipe Inventory by Diameter

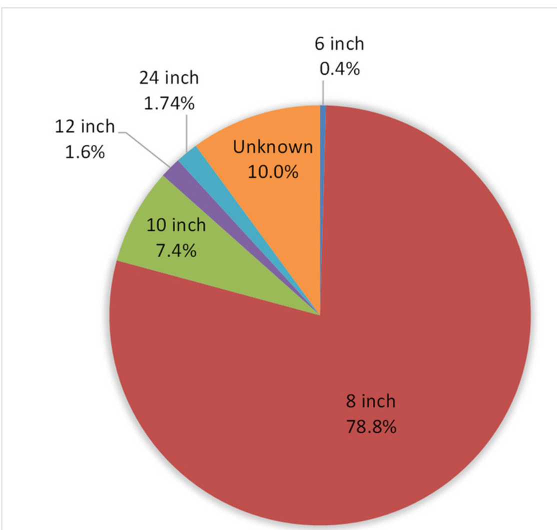
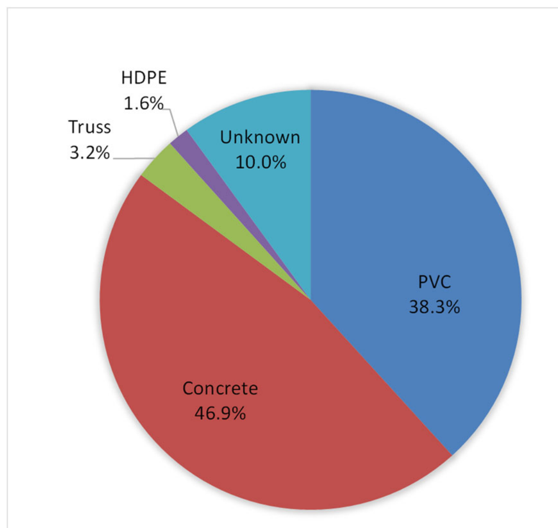


Figure 4-3 | Pipe Inventory by Material



4.4.4 Inflow and Infiltration

The City's collection system is typical of many western Oregon sewer systems in that it experiences higher flows during the winter months because of infiltration and inflow (I/I). The average dry weather flow measured at the WWTP during the months of May through and October is approximately 0.35 MGD. The average flow during the wet weather months (November through April) is approximately 0.73 MGD. The highest daily flows measured most years are well over 2.0 MGD. The ratio between average dry weather flow and the peak day flow is approximately 6. This ratio is common for similar municipal collection systems in Western Oregon. Despite the fact that no known raw sewage overflows from the collection system have ever been documented, significant portions of the collection system surcharge during large winter storms. This includes the main trunk sewer line along Olney Street from 9th Street east to 4th Street and south along 4th Street. This surcharging indicates that high I/I flows cause capacity issues in the system. High I/I flows are problematic for a number of reasons. I/I utilizes reserve capacity and ultimately decreases the useful life of the gravity collection system. I/I is also a burden to the treatment facilities since it must be treated and discharged as though it was wastewater. This increases operations and maintenance costs.

The high amount of I/I collected by the City's gravity collection network is common for similar systems. The original collection system that was constructed in the 1960s utilized concrete pipe. The joints between each section were sealed using concrete mortar or antiquated rubber joint systems. Over time, the concrete mortar cracks and breaks and the antiquate rubber joints fail, creating a pathway for groundwater infiltration at every joint. As a result, groundwater infiltration rates in systems with old concrete pipe are high.

As the City's collection system continues to age and deteriorate, groundwater infiltration rates are likely to increase. As such, the City must continue to implement I/I corrective improvements in order to keep infiltration rates at their current levels. Alternatives for I/I correction are considered in Chapter 6.

4.4.5 Known Collection System Non-Compliance Issues

There are a number of areas in the collection system that will likely experience compliance problems unless significant upgrades are completed within the planning period. These include the replacement or reconstruction of over-capacity and faulty sewers that contribute significant I/I. Continued I/I control efforts are needed in the collection system regardless if growth within the collection system occurs. The specific projects are discussed in more detail in Chapter 6.

4.4.6 Collection System Deficiencies

Problems with the Collection System were identified from meetings and discussions with City staff and from field investigations. In the early morning hours of January 6th of 2021, flow measurements were collected at various locations in the collection system. Since this work was performed at night, virtually all of the flow was from I/I rather that wastewater. This data collection effort was immediately after a large winter storm. Daily rainfall amounts measured at the treatment plant the preceding three days were 1.74, 1.57, and 1.55 inches. During the early morning hours of January 6th, 2021, the collection system not surcharged, but much of the system was surcharged the previous day. The observations and data from this work effort was used as a basis for many of the collection system problems noted below (Table 4-3).

During major winter storms, portions of the collection system surcharge due to inadequate trunk sewer capacity and large amounts of infiltration and inflow. The shortcomings in the existing system can generally be divided into the following categories; lack of capacity, end of useful life, and infiltration and inflow problems. A short discussion of each of these categories follows. The deficiencies listed in this chapter are largely based on field observations and operational problems. Since components of the collection system (i.e., gravity collection piping) are not monitored on a full-time basis, this list of deficiencies should not be considered all-inclusive. As described in Chapter 6, several additional collection system deficiencies exist that are revealed through quantitative analysis.

- Lack of Capacity. This type of problem results from pipes that are too small to handle the peak sewage flows. This problem is a result of peak sewage flows increasing either due to development upstream or deterioration of the upstream system (i.e., increased I/I). Portions of the gravity collection piping appear to lack the capacity to convey peak flows.

- End of Useful Life. This type of problem is the result of old, damaged, or worn-out facilities that no longer function as designed. The most common example of this type of problem includes broken or collapsed pipes. The correction of these types of problems requires replacement or reconstruction of the existing system.
- High Infiltration/Inflow. I/I flows in the collection system utilize capacity in the sewer mains which was intended for sanitary sewage. Large amounts of I/I result in surcharged sewers which can lead to overflows.

Large amounts of infiltration and inflow is far and away the most significant problem in the City's collection system. It is the underlying cause of the capacity problems in the trunk sewers. Alternatives for I/I correction are considered in Chapter 6. Table 4-3 outlines the major known problem areas, as well as the category that the problem falls under.

Table 4-3 | Known Collection System Deficiencies

Location (note 1)	**Problem Category**
Olney Street Sewer from 9th Street to 4th Street	Lack of Capacity, Surcharging, High I/I
4th Street Sewer from Olney Street to Del Mar Drive	Lack of Capacity, Surcharging, High I/I
Collection System Piping East of Manhole at 5th & Church Streets	High I/I
4th & Delmar Sewer Basin	High I/I
North 11th Sewer Basin	High I/I
9th Street Sewer Basin	High I/I

4.5 EXISTING WASTEWATER TREATMENT AND DISPOSAL SYSTEM

The City of Aumsville owns, operates and maintains the wastewater treatment plant (WWTP) serving the community. The WWTP is located on the north side of the City on Beaver Creek and is entirely located within the urban growth boundary. Vehicular access to the WWTP is from Olney Street. The WWTP consists of an influent pump station, a headworks, four treatment lagoons, effluent disinfection facilities, and an irrigation pump station. Treated wastewater is discharged to Beaver Creek during the winter discharge season (November 1-May 30). During the summer months, treated effluent is used to irrigate a small area at the treatment plant and about 55 acres of cropland located south of the City. Throughout this document, the 55 acre irrigation site is referred to as the "South Irrigation Site."

The wastewater facilities are schematically presented in Figure 4-4. A general layout of the treatment facilities are shown in Figure 4-5 and Figure 4-6. A summary of the design data for the facilities is presented in Table 4-4. The following subsections provide an evaluation of the performance of the existing plant as well as a brief description of each to the individual unit processes that comprise the treatment facility.

Table 4-4 | Existing Treatment Plant Design Data

Influent Pump Station – See Table 4-7				
Influent Screening				
• Type	• Shaftless spiral fine screen			
• Screen Opening Size	• ¼ Inch			
• Manufacturer/Model	• Parkson Helisieve			
Influent Flow Measurement				
• Type	• Open channel Parshall Flume			
• Size	• 12 inch			
• Location	• Headworks			
• Flow Meter Manufacturer	• ISCO Ultrasonic Level Sensor			
• Range	• 55 – 7,200 gpm			
Lagoon/Features	Cell 1	Cell 2	Cell 3	Cell 4
• Type	• Aerated	• Aerated	• Facultative	• Facultative
• Aerator Number	• 3	• 4	• None	• None
• Aerator Manufacturer	• Aqua Aerobic	• Aqua Aerobic	• NA	• NA
• Aerator Model	• CFSS	• CFSS	• NA	• NA
• Aerator Size	• 5 HP	• 5 HP	• NA	• NA
• Average Surface Area	• 7.63 Ac	• 6.66 Ac	• 7.80 Ac	• 6.34 Ac
• Top of Dike Elevation	• 350.5 ft	• 350.5 ft	• 347.0 ft	• 347.0 ft
• Maximum Water Elevation	• 348.5 ft	• 348.5 ft	• 345.0 ft	• 345.0 ft
• Minimum Water Elevation	• 344.5 ft	• 344.5 ft	• 340.5 ft	• 340.5 ft
• Pond Bottom Elevation(1)	• 342.5 ft	• 342.5 ft	• 338.0 ft	• 338.0 ft
• Minimum Freeboard	• 2 ft	• 2 ft	• 2 ft	• 2 ft
• Maximum Water Depth	• 6 ft	• 6 ft	• 7 ft	• 7 ft
• Minimum Water Depth	• 5 ft	• 5 ft	• 2.5 ft	• 2.5 ft
• Maximum Storage Volume	• 7.6 Ac –ft	• 6.7 Ac –ft	• 35.1 Ac –ft	• 28.5 Ac –ft
Disinfection Facilities				
• Type	• Onside Chlorine Generation			
• Capacity	• 20 pounds per day			
• Day Tank Size	• 70 gallons			
• Salt Delivery	• 40 pound bags			
• System	• Winter Discharge	• WWTP Site Irrigation	• Center Pivot	
• Typical Dosing Rate	• 1.2 mg/L	• 2.0 mg/L	• 2.0 mg/L	
• Typical Discharge Rate	• 0.9 mgd	• 0.36 mgd	• 0.7 mgd	
• Typical Chlorine Usage	• 9 lb per day	• 6 lb per day	• 12 lb per day	
• Typical Salt Consumption	• 27 pounds per day	• 18 pounds per day	• 36 pounds per day	
• Metering Pump Number	• 1	• 1	• 1	
• Metering Pump Type	• Diaphragm	• Diaphragm	• Diaphragm	
• Metering Pump Capacity	• 8 gph	• 5 gph	• 7.7 gph	
• Metering Pump On/Off Control	• Manual	• Automatic	• Automatic	
• Metering Pump Dosage Control	• Manual	• Manual	• Manual	
• Injection Point	• Contact Chamber	• Pump discharge pipe	• Pump discharge pipe	
• Chemical Mixing	• 1.5 hp static mixer	• Natural turbulence	• Natural turbulence	
• Contact Chamber Type	• Buried 60” Pipe	• Buried piping	• Buried 10” Pipe to pivot	
• Contact Volume	• 40,300 gallons	• Not determined	• 31,000 gallons	
• Contact Time	• 60 min. @ 0.9 mgd	• Not determined	• 60 min. @ 0.7 mgd	

Table 4-4 | Existing Treatment Plant Design Data

Dechlorination Facilities (winter discharge only)		
• Type	• Sulfur Dioxide Gas	
• Chemical Delivery	• 150 pound cylinders	
• Typical Dosing Rate	• 0.6 mg/L	
• Typical Discharge Rate	• 0.9 mgd	
• Typical Usage Rate	• 4.5 ppd	
• Rotameter Capacity	• 5 ppd	
• Total Storage Capacity	• 2 150 pound cylinders	
• On/Off Control	• Manual	
• Dose Control	• Manual	
• Carrier Water Source	• Potable Water from City	
• Injection Point	• Downstream end of chlorine contact chamber	
• Chemical Mixing	• Natural turbulence from contact chamber outlet weir	
Winter Effluent Flow Measurement & Sampling		
• Primary Device	• 1.5 foot rectangular weir with end contractions	
• Device Location	• Downstream end of contact chamber	
• Measurement Range	• 0.2 – 2 MGD	
• Flow Meter	• Stevens mechanical meter	
• Effluent Sampler	• Refrigerated automatic composite sampler	
• Sample Location	• From downstream end of contact chamber	
Beaver Creek Outfall (winter discharge)		
• Type	• Single port outfall to Beaver Creek	
• Material	• Ductile Iron	
• Size	• 12-inch	
Irrigation Pump Station		
• Purpose	• Dry season discharge to WWTP site irrigation and 64 acre reuse site	
• Pump Type & Number	• 2 Vertical Turbine, Constant Speed	
• Pump Size	• WWTP site irrigation pump = 10 HP, 55 acre reuse site irrigation pump = 25 HP	
• Pump Capacity	• WWTP site irrigation pump = 250 gpm, 55 acre reuse site irrigation pump = 500 gpm	
• Pump Control	• WWTP site irrigation = manual, 55 acre reuse site = automatic	
Strainer		
• Purpose	• To strain large particles from the irrigation water prior to 55 acre pivot	
• Location	• Irrigation pump discharge piping	
• Backwashing	• Manual	
Forcemain		
• Length	• 7,600 feet (to 55 acre reuse site)	
• Diameter	• 10 inches	
Irrigation System	South reuse site	WWTP Site
• Irrigated Area	• 55 acres	• 2 acres
• Irrigation Method	• Center Pivot	• Buried hard piped system
• Application Rate	• 500 gpm	• 250 gpm
Emergency Power System	None. Backup power generator is installed for the influent pump station and headworks only. None for the rest of the treatment plant	

Figure 4-4 | Existing Wastewater Treatment Plant Schematic

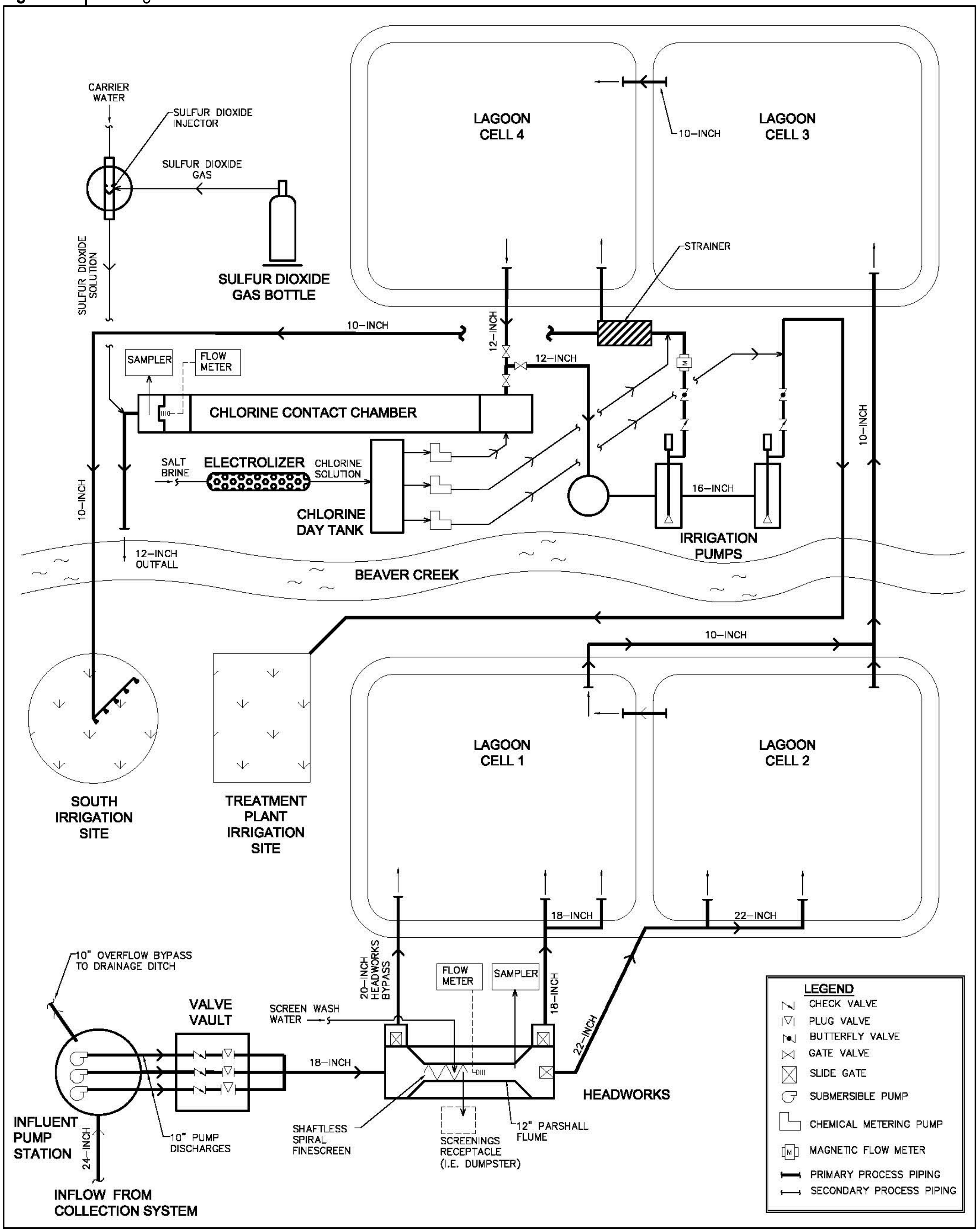


Figure 4-5 | Overview of Existing Wastewater Treatment Facilities

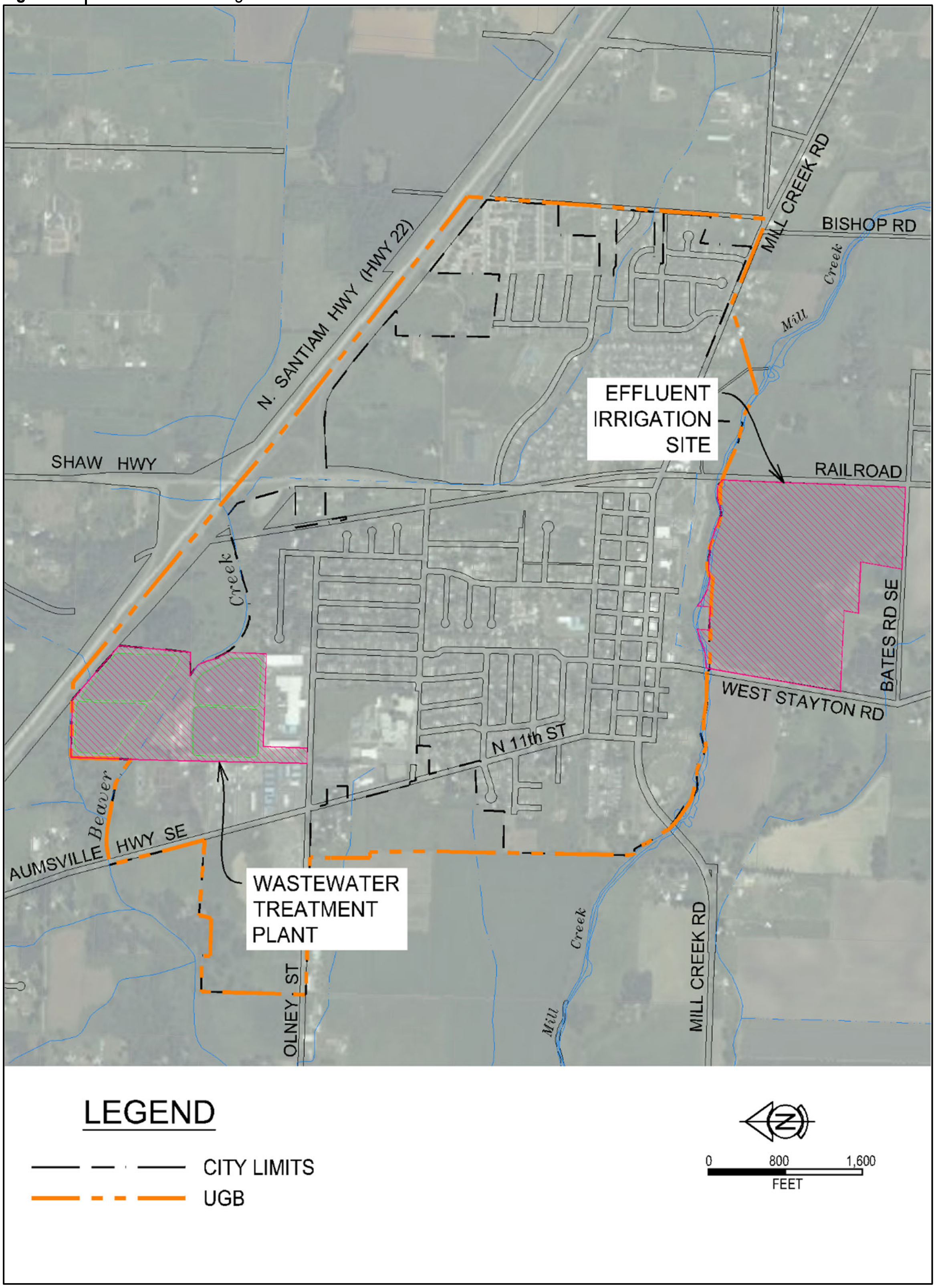
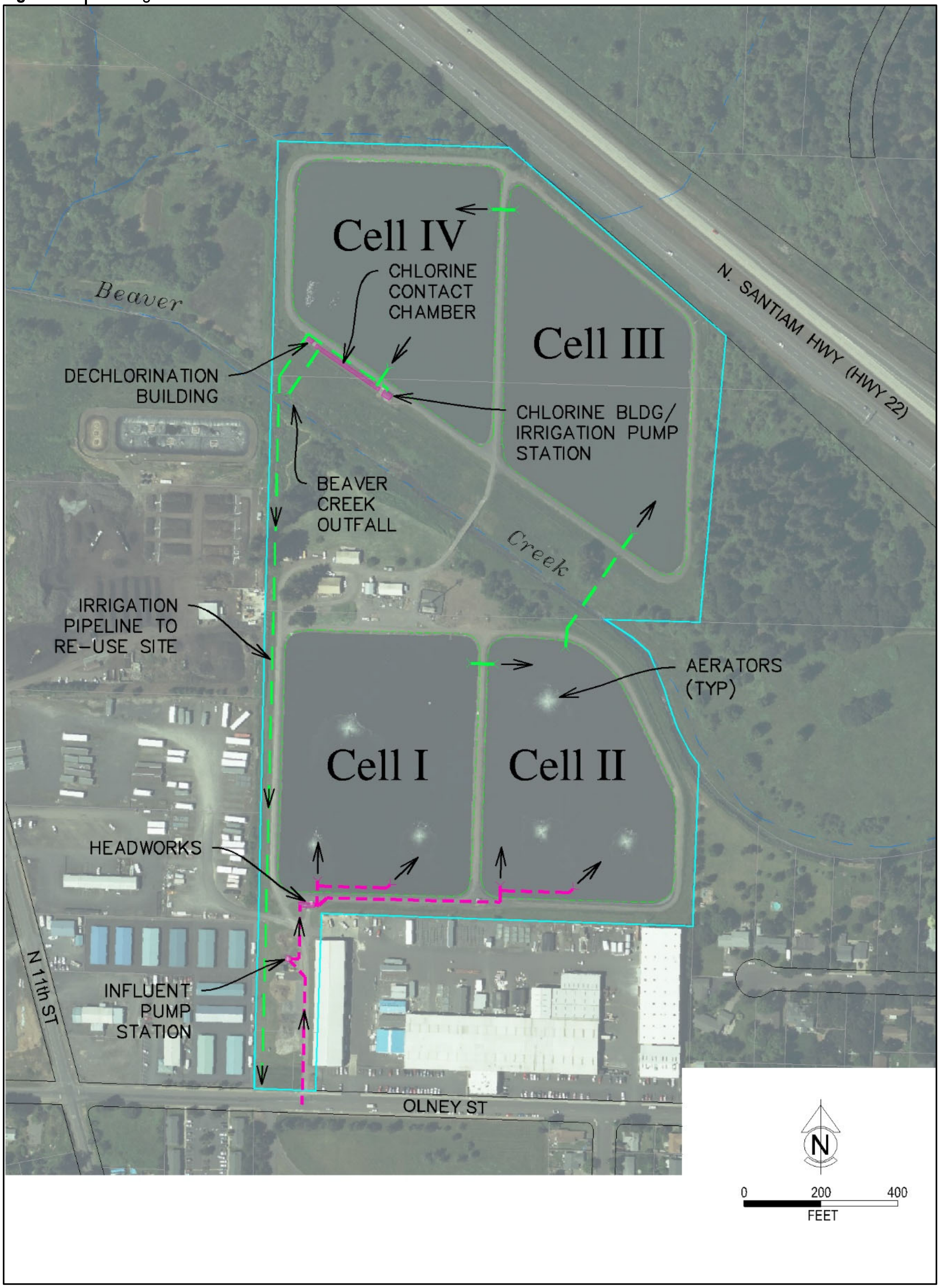


Figure 4-6 | Existing Wastewater Treatment Plant



4.5.1 Plant Performance

The City's existing NPDES permit requires the production of effluent BOD, TSS, and ammonia concentrations below 30 mg/L, 50 mg/L, and 3.6 mg/L respectively on an average monthly basis during the winter discharge season. Average monthly effluent BOD, TSS, and ammonia concentrations are listed in Table 4-5 for the last five discharge seasons. As demonstrated in Table 4-5, the existing plant is capable of reliably meeting the effluent BOD and TSS concentration limits under existing loading conditions. However, the plant cannot meet the ammonia limit (note bold text in Table 4-5). This is not unexpected since lagoon based treatment plants do not significantly reduce ammonia concentrations. Since the treatment is unable to produce effluent with the ammonia concentrations below the limits in the NPDES permit, improvements will be needed early in the planning period.

Table 4-5 | Treatment Plant Average Monthly Effluent Concentrations (mg/L)

Discharge Season	Parameter	November	December	January	February	March	April	Average
2015-2016	BOD (mg/L)	3.1	3.1	4.9	3.4	3.3	7.0	4.1
	TSS (mg/L)	10.2	9.6	11.3	6.5	4.0	7.6	8.2
	Ammonia (mg/L)	**7.9**	**10.1**	**11.1**	**13.3**	**11.2**	**10.8**	**10.7**
2016-2017	BOD (mg/L)	3.9	3.5	5.7	7.9	2.6	5.8	4.9
	TSS (mg/L)	6.5	8.3	11.8	19.6	11.4	8.0	10.9
	Ammonia (mg/L)	**6.6**	**10.6**	**14.6**	**9.5**	**9.9**	**10.4**	**10.3**
2017-2018	BOD (mg/L)	3.9	2.2	4.1	3.8	10.3	8.1	5.4
	TSS (mg/L)	4.3	10.3	11.7	9.1	11.1	13.4	10.0
	Ammonia (mg/L)	**11.3**	**15.7**	**10.7**	**15.1**	**9.7**	**11.3**	**12.3**
2018-2019	BOD (mg/L)	3.7	2.7	3.1	4.4	5.0	8.8	4.6
	TSS (mg/L)	4.1	3.9	7.4	8.6	9.2	8.7	7.0
	Ammonia (mg/L)	**6.3**	**13.8**	**15.9**	**14.7**	**13.0**	**11.6**	**12.6**
2019-2020	BOD (mg/L)	8.3	3.5	4.2	5.0	5.0	6.3	5.4
	TSS (mg/L)	2.2	5.0	11.8	14.8	14.8	7.3	9.3
	Ammonia (mg/L)	**10.4**	**13.2**	**16.2**	**14.5**	**12.1**	**12.1**	**13.1**
Average	BOD (mg/L)	4.6	3.0	4.4	4.9	5.2	7.2	4.9
	TSS (mg/L)	5.5	7.4	10.8	11.7	10.1	9.0	9.1
	Ammonia (mg/L)	**8.5**	**12.7**	**13.7**	**13.4**	**11.2**	**11.2**	**11.8**

Note: Existing effluent BOD, TSS, and ammonia maximum monthly average permit limits are 30 mg/L, 50 mg/L, and 3.6 mg/L respectively.

In addition to the effluent concentration limits, the City's discharge permit also limits the total amount of pollutant that may be discharged by setting mass load limits. Mass load limits are determined by multiplying the effluent concentration of a pollutant by the effluent flow rate. Mass load limits are usually expressed in pounds of pollutant per day. Since flow and concentration are multiplied, increases in the flow rate must be offset by decreases in the pollutant concentration in order to maintain a constant effluent mass load. The existing permit allows for the discharge of 170 pounds per day of BOD and 280 pounds per day of TSS on a monthly average basis during the winter discharge season. The permit does not include a mass load limit for ammonia. Average monthly effluent BOD and TSS mass loads are listed in Table 4-6 for the last five discharge seasons. It is clear from an examination of Table 4-6 that the existing plant is able to consistently produce an effluent quality that allows the City to meet the permitted effluent mass loads for BOD and TSS.

Table 4-6 | Treatment Plant Average Monthly Effluent BOD and TSS mass loads (pounds per day)

Discharge Season	Parameter	November	December	January	February	March	April	Average
2015-2016	BOD (mg/L)	20.1	28.1	47.1	26.6	31.1	56.9	35.0
	TSS (mg/L)	66.9	86	109.3	51	36.9	62.1	68.7
2016-2017	BOD (mg/L)	34.2	29.7	43.4	70.3	27	42.9	41.3
	TSS (mg/L)	56.5	69.6	90.2	174.5	118.3	59	94.7
2017-2018	BOD (mg/L)	34.3	18.7	25.7	26.5	48.1	78.2	38.6
	TSS (mg/L)	37.7	86.8	73.4	63.4	51.6	129.2	73.7
2018-2019	BOD (mg/L)	10	17.5	19.8	20.6	35.8	59.5	27.2
	TSS (mg/L)	11.6	25.5	46.5	41.2	65.1	54.9	40.8
2019-2020	BOD (mg/L)	38.8	13.1	37	31.3	31.3	32.1	30.6
	TSS (mg/L)	11.6	18.5	102.7	93	94.2	37.4	59.6
Average	BOD (mg/L)	27.5	21.4	34.6	35.1	34.7	53.9	34.5
	TSS (mg/L)	36.9	57.3	84.4	84.6	73.2	68.5	67.5

Note: Existing effluent BOD and TSS, maximum monthly mass load permit limits are 170 ppd and 280 ppd respectively.

4.5.2 Influent Pump Station


Figure 4-7 | Existing Influent Pump Station

Wastewater from the collection system flows by gravity to the influent pump station located at the wastewater treatment plant. The pump station pumps all wastewater to the treatment plant headworks.

The Influent Pump Station is located on the west side of the treatment plant entrance road between Olney Street and the treatment plant. The station was constructed in 2007 and is in good overall condition.

The station consists of a concrete wet well, a valve vault, an automatic level control system, and an auxiliary power generator. Three 45 hp submersible pumps are located in the 12-foot diameter concrete wet well. Each pump discharge pipe is fitted with a check valve and isolation valve located in the valve vault. The pumps discharge into an 18-inch, ductile iron forcemain that conveys wastewater to the treatment plant headworks. The forcemain is approximately 140 feet long. In October 2020, the wet well was inspected and found to be in good condition. The pump discharge piping within the wet well is stainless steel and also in good condition. The wet well and discharge piping should serve the City well for the remainder of the planning period. The station includes no provisions for hydrogen sulfide control. The treatment plant headworks was inspected as part of this planning effort and appeared to be in good condition with little sign of hydrogen sulfide corrosion.

The Influent Pump Station is equipped with an automatic transfer switch and an onsite diesel generator to provide backup power. The primary level control element is a submerged pressure transducer in the wet well. The pump control panel, variable frequency drives, and the automatic transfer switch are located in a wood framed weather shelter next to the wet well. The generator is mounted in a manufacturer's weather enclosure next to the wet well. The station is equipped with radio telemetry that enables the City to monitor the station using the City's SCADA system. Alarm notifications are provided by an autodialer located at the SCADA base station at the City shops building. The station has a dedicated 10 inch overflow pipe that conveys overflow from the wet well to an adjacent drainage ditch. The station has been well maintained and is in good condition. The main structural and mechanical components of the station will serve the City well for the remainder of the planning period. The pumps, control system, and backup power generator will likely require some sort of overhaul during the planning period due to age of the equipment and normal wear and tear. These improvements are included in the list of recommended capital improvements described in Chapter 7. However, work of this nature is often considered maintenance rather than a capital improvement project.

Table 4-7 contains a summary of some of the important characteristics of pump station.

Table 4-7 | Influent Pump Station Design Data

General	
▪ Construction date(s)	2007
▪ Type	Submersible
Firm Capacity (1)	6.48 mgd @ 41 ft TDH
Wetwell	
▪ Type	Concrete
▪ Size	12' diameter
▪ Depth (rim to bottom)	24.9 ft.
▪ Working Depth (bottom to inlet)	6.8 ft.
Pumps	
▪ Type	Submersible
▪ Number	3
▪ Manufacturer & Model	Xylem Flygt NP 3202/641
▪ Motor Size & Speed	45 HP 1780 RPM
▪ Speed Control	VFD
▪ Power Supply	480-Volt 3-Phase
Force Main	
▪ Size & Type	18" Ductile Iron
▪ Length	140 ft.
▪ FM Discharge	WWTP Headworks
Hydrogen Sulfide Control	none
Auxiliary Power	
▪ Type & Location	200 KW Fixed Gen
▪ Fuel Supply	Diesel
▪ Transfer Switch	Automatic
Telemetry	City SCADA System
Overflow	10" Pipe from wet well to drainage ditch

(1) Firm based on the largest single out of service.

4.5.3 Headworks

Wastewater from the City is pumped from the Influent Pump Station to the Headworks. The headworks provides screening of the incoming raw wastewater, measurement of influent flow and sampling of the influent.

The raw wastewater from the Influent Pump Station force main discharges into a small chamber upstream of the fine screen. Slide gates are used to direct flow to either thefine screen o r a bypass line to lagoon cell 1. Under normal operating conditions all wastewater is routed through the fine screen. The bypass to cell 1 is only intended to be used for maintenance purposes. The fine screen is a Parkson Model HLS500XL Hycor Helisieve unit with a capacity of 6.5 MGD. The screen opening size is ¼- inch diameter. Screened material is removed from the channel by a shaftless auger. The screenings are washed, compacted, and dewatered before being discharged into a dumpster for final disposal at a landfill.

Downstream of the screen, the wastewater flows through a 12-inch Parshall flume for flow measurement. The water surface depth upstream of the flume is measured with an ultrasonic level sensor and this level measurement is converted into a flow rate using published flume tables. This is performed electronically by the influent flow meter. The influent flow meter is located in a small fiberglass enclosure next to the flow headworks structure.

Figure 4-8 | WWTP Headworks

Downstream of the Parshall Flume, the wastewater is split using a weir. A portion of the flow is routed to cell 1 and the remaining flow is routed to cell 2. A refrigerated composite wastewater sampler draws samples from this flow splitting chamber. The sampler is used to obtain influent samples for BOD, TSS, and ammonia testing. The sampler is also located in the fiberglass enclosure next to the headworks structure.

The headworks was constructed in 2007 at the same time as the Influent Pump Station. Overall, the facility is relatively new and in good condition. The main structural and mechanical components of the headworks will serve the City well for the remainder of the planning period. The mechanical components of the screen and the control system will likely require some sort of overhaul during the planning period due to age of the equipment and normal wear and tear. These improvements are included in the list of recommended capital improvements described in Chapter 7. However, work of this nature is often considered maintenance rather than a capital improvement project.

4.5.4 Lagoons

The treatment plant includes four lagoons that provide the bulk of the treatment. The first two lagoon cells are equipped with mechanical aerators. Flow from the headworks is split and lagoon cells 1 and 2 are operated in parallel. The discharge from cells 1 and 2 is combined and routed through cells 3 and 4 in series.

The lagoons provide sedimentation, biological treatment, and sludge digestion. The lagoons also provide storage for non-discharging periods. The lagoon bottoms were constructed using native clay liners. The interior dike slopes are covered with riprap to protect the dikes from wave action.

There are a few periods throughout the year when the City is unable to discharge to either Beaver Creek or the irrigation sites. In the spring, after the end of the winter discharge season (April 30) the irrigation sites are sometimes too wet to receive water. In July, the grass seed crop at the main irrigation site is typically harvested and no irrigation can occur. In the fall before the start of the winter discharge season, the irrigation sites can sometimes be too wet to receive water. During these times, all wastewater must be stored in the lagoons and the City must lower the water levels in the lagoons in anticipation of these storage periods.

In order to meet the storage needs, the lagoons are designed with water level controls that allow the operator to lower water levels in anticipation of the storage needs. It is possible to draw the water levels in the lagoons down to about 2.5 feet. However, the City does not typically do this. Cells 1 and 2 are typically operated near maximum water levels. This provides better treatment and is necessary to prevent the surface aerators from disturbing the bottom of the lagoon. Most storage is provided in cells 3 and 4. The water levels in cells 3 and 4 are lowered to store water during non-discharging periods.

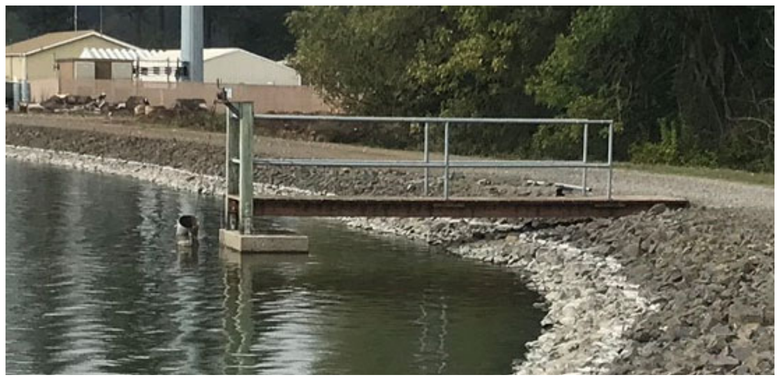


Figure 4-9 | Typical Lagoon Outlet Structure

Each lagoon cell is fitted with an outlet control structure, that can be used to control the water level. The structures are designed with an intake pipe on a rotating elbow. The City can raise and lower the pipe as desired. These structures were installed in 1978 and are becoming increasingly difficult to use due to corrosion of the rotating elbow. It is unlikely that these structures will reliably function for the remainder of the planning period and the City should plan for upgrades. The recommended improvements are discussed in Chapter 7.

The lagoons have been in service for many years and sludge has never been removed from the lagoons. As such, a fair amount of sludge has accumulated over the years. The City periodically measures the depth of sludge in the lagoons. Most recently, sludge depths were measured in July of 2020. The average depth in cells 1, 2, 3, and 4 were about 19 inches, 17 inches, 13 inches, and 10 inches respectively. The City is currently adding a probiotic chemical formulation to the lagoons in an effort to enhance sludge digestion. The City has been adding this chemical or the last few years, but has not seen a significant decrease in the sludge depths. Sludge depths greater than about 12 inches are likely to reduce the treatment efficiency of the ponds. Therefore, the City should plan to remove sludge from the lagoons during the planning period if the lagoons are to remain in service. Prior to removing the sludge, the City will need to prepare and obtain DEQ approval of a Biosolids Management Plan in accordance with DEQ requirements.

In 1992, a lagoon leakage test was performed to determine the seepage rate from lagoon cells. Though this test is old, the results are still considered relevant as there is no reason to suspect that seepage rates from the lagoons have increased since the test was conducted. The test showed that the seepage rates were very low with cell 3 having the highest seepage rate of 0.072 inches per day. This is significantly less than required for a new lagoon cell by current DEQ guidelines. Therefore, seepage from the lagoons it not anticipated to be a problem during the planning period.

Based on the above information, is has been assumed for this planning effort that the lagoon dikes and liners are in good condition and will serve the City for the remainder of the planning period. Therefore, no improvements to the dikes and liners are included in the capital improvement plan.

4.5.5 Disinfection System

Figure 4-10 | Chlorine Contact Chamber Inlet Structure

The City uses an onsite chlorine generation system to produce a dilute sodium hypochlorite solution that is used to disinfect the treated effluent prior to discharge. The chemical feed equipment is located in a small masonry building near the chlorine contact chamber. A new chlorine generator was installed in the summer of 2021. The onsite chlorine generation system uses a salt brine solution and electricity to generate the sodium hypochlorite solution. The system includes a salt brine tank, an electrolysis cell, and a small storage tank for the sodium hypochlorite system. The system is capable of producing about 20 pounds of chlorine per day. Chemical metering pumps are used to pump the sodium hypochlorite solution to each injection point. There is a dedicated chemical feed pump for each injection point. These include the chlorine contact chamber for winter discharge, the piping to the center pivot for irrigation at the South Irrigation Site, and the piping to the irrigation site located at the treatment plant property. It is likely that several mechanical components of the system (e.g., electrolysis cell, metering pumps, etc.) will need to be replaced at some point during the planning period due to age and normal wear and tear. However, this work is generally considered routine maintenance and the recommended capital improvement projects described herein do not include these items.

During the winter discharge season, chlorine contact time is provided in a contact chamber located along the south berm of lagoon cell 4. The chamber includes inlet and outlet chamber with the bulk of the volume provided in a buried 60-inch concrete pipe. A vertical mixer is located in the upstream end of the contact chamber and is used to mix the Sodium Hypochlorite with the effluent. At the downstream end of the chlorine contact chamber, chlorine is removed from the effluent prior to discharge. A sulfur dioxide gas feed system is used for this purpose. This system consists of a 150-pound gas cylinder, and a vacuum feed system that mixes the gas with a carrier water. The carrier water is injected into the effluent stream prior to discharge. The system is capable of removing up to 5 pounds per day of residual chlorine. The dichlorination equipment is located in masonry building on the downstream side of the chlorine contact chamber.

For disposal of wastewater at the irrigation sites, chlorine contact time is provided in the pipelines to the irrigation sites. The sodium hypochlorite solution is fed into each pipeline at the treatment plant and residual disinfection levels, total coliform testing is performed at each irrigation site. Irrigated effluent is not dechlorinated.

The chemical feed pumps that supply sodium hypochlorite are started and stopped automatically when each of the irrigation pumps are started and stopped. The chlorine dose to each system is controlled manually. The chemical feed pump that supplies sodium hypochlorite for the winter discharge system is started and stopped manually and the dosage is controlled manually. The dechlorination system is also started and stopped manually and the dosage is controlled manually. The onsite sodium hypochlorite generation system is controlled automatically to maintain a water level in the sodium hypochlorite storage tank.

Overall, the disinfection equipment is relatively simple and should serve the City for the remainder of the planning period with normal maintenance. Some elements of the system (e.g., onsite generation system, metering pumps, chlorine contact chamber, may need to be upsized during the planning period due to increased wastewater flows caused by population growth. The need for these types of improvements are discussed in Chapter 7.

Figure 4-11 | Chlorine Contact Chamber Outlet and Dechlorination Building

4.5.6 Irrigation Pump Station

The effluent from lagoon cell 4 can be diverted to the irrigation pump station for discharge during the dry weather irrigation season. Effluent from cell 4 is piped to a small effluent sump. The sump has a discharge pipe that feeds two vertical turbine pumps that are mounted in pump cans. The pumps are located next to the building that houses the chlorination equipment. The building

Figure 4-12 | Irrigation Pump Station

consists of two rooms. One room has the chlorination equipment discussed above. The other room houses the irrigation pump discharge piping, flow meters, and control equipment.

The station includes a dedicated pump for each irrigation site. A 25 horsepower pump coveys water to the South Irrigation Site and a 10 horsepower pump is used to convey water to the irrigation site located at the treatment plant. The pump discharge piping passes through the adjacent building. The discharge piping is equipped with isolation valves, check valves, chemical injectors where the chlorine solution is added, and pressure switches to monitor pump performance. The 25 horsepower irrigation pump discharge piping also includes a magnetic flow meter that is located in the building. The piping that conveys water to the South Irrigation Site is equipped with a strainer to remove large solids prior to center pivot sprinkler. The screen is located adjacent to the building.

The irrigation pumps operate at a constant speed and the motor starters are located in the building adjacent to the station. Alarm conditions are monitored using the City's SCADA system.

Overall, the station is in good condition and should serve the City well for the remainder of the planning period. One shortcoming worth noting is the lack of redundant pumps. The pump that supplies water to the South Irrigation Site is a critical element of the overall plant. If this pump were to fail and require replacement or other major service, the station would be unavailable for several weeks. This could be a major problem depending on lagoon water levels. It the lagoon levels are relatively high and the City needs to irrigate to lower the levels, a prolonged period without the irrigation pump could lead to the need to discharge to Beaver Creek to prevent water from overtopping the lagoon dikes. This would be an out of season discharge that would be a major permit violation. The lack of redundancy is something the City may wish to consider addressing during the planning period. Recommended improvements are discussed in Chapter 7.

4.5.7 Surface Water Outfall

During the wet weather months (November – May), treated effluent is discharged to Beaver Creek on the south side of lagoon cell 4. The outfall is a 10-inch pipe fitted with a flapper-style check valve. There is no diffuser on the end of the ductile pipe.

Figure 4-13 | Existing Discharge to Beaver Creek

4.5.8 Lab, Office Space, and Backup Power Generator

The City has a small lab with some office space in the shop building on the north side of lagoon cell 1. The City has outgrown this space and additional laboratory and office space would improve the facility. There is also no backup power system for the lagoon aeration equipment, the lab & office building, the disinfection equipment, and the irrigation pumps. This is another shortcoming that should be addressed during the planning period.

4.5.9 Recycled Water Disposal System

During the dry weather months (June – October), treated effluent is pumped from the irrigation pump station to one of two irrigation sites. The first site is located at the treatment plant site is about 2 acres in size. The site is located between the City's shop building complex and Beaver Creek on the south side of Beaver Creek. Effluent is distributed on using a set sprinkler system that includes impact sprinklers fed by buried piping.

The City's primary irrigation site is located south of the City at site that is about 7,000 feet from the treatment plant. Throughout this document, this site is referred to as the "South Irrigation Site." Effluent is pumped from the irrigation pump station to a center pivot located at the site though a 10-inch diameter pipeline. The property is owned by the City and is about 75 acres in size. Vehicular access to the site if from South 8th Street. The site is equipped with a center pivot irrigation sprinkler that is about 1050 feet long. The area under the pivot is approximately 55 acres. The site is equipped with a control station that the City uses to control the center pivot and can remotely control the irrigation pump station.

4.5.10 Wastewater Treatment Plant Operational Problems

At the present time, the wastewater treatment plant generally functions at an acceptable level. The City has been diligent over the years about making improvements to the facility. Aerators have been added to the lagoons, the influent pump station and headworks are relatively new. The City has improved the effluent disinfection chemical feed systems and added dry weather irrigation facilities. Taken together these individual improvements represent a significant upgrade to the treatment process.

There are issues that are likely to arise during the planning period due to aging mechanical facilities. However, these can be corrected by typical maintenance activities. The biggest operational issue at the treatment plant is that is cannot meet the NPDES permit limits for effluent ammonia concentrations (see section 3.3). The existing lagoon facilities are simply not capable of reliably removing ammonia to concentrations below the limits set forth in the NPDES permit. Significant improvements to the facility will be required in order achieve compliance with the effluent ammonia limit. The recommended improvements are discussed in Chapter 7.

4.5.11 Summary of Treatment and Disposal System Deficiencies

The following bullet points provide a summary of the treatment and disposal system deficiencies and issues that are identified above.

- The existing treatment plant is unable to comply with the ammonia limits listed in the NDPES permit.
- The pumps, controls, and generator at the Influent Pump Station will likely require an overhaul due to age and normal wear and tear.

- Various mechanical components of the headworks screen and control system will likely require an overhaul during the planning period due to age and normal wear and tear.
- The lagoon transfer structures will reach the end of their useful life during the planning period.
- Sludge accumulation in the lagoons is becoming significant, and the City should plan to remove sludge during the planning period.
- The irrigation pump station lacks redundancy. Particularly for the pump delivering water to the South Irrigation Site. This lack of redundancy may lead to lagoon water management problems if the pump were to fail during a critical time.
- The City has outgrown the existing lab and office space and much of the treatment facilities lack a backup power generation system.

4.6 WASTEWATER SYSTEM OPERATOR LICENSING

The City's wastewater collection system currently requires a level 2 certification for operation. The City's existing treatment system also requires a level 2 certification. It is unlikely that the certification for the operations of the collection system will change after the implementation of the improvements recommended int this plan. However, DEQ may require a level 3 certification for the operations of the treatment plant once the proposed improvements are completed. As such, the City may need to work with operations staff to provide the training and testing needed for the higher classification.

4.7 WASTEWATER SYSTEM FUNDING MECHANISMS

Funding for the City's existing wastewater system comes from two major sources, user fees and system development charges (SDCs). Since SDCs cannot be used to finance operation and maintenance costs of a wastewater system, the O&M and repair costs must be financed from user fees.

4.7.1 Wastewater User Fees

User fees are monthly charges to all residences, businesses, and other users that are connected to the wastewater system. User fees are established by the city council and are typically the sole source of revenue to finance wastewater system operation and maintenance. The City typically charges a flat fee for wastewater service. The current fee schedule is shown in Table 4-8. The City does have a few larger users that pay a consumption charge in addition to the flat fee.

The anticipated revenue from sewer billings for the fiscal year 2021/2022 is budgeted to be approximately $904,000. Including other various charges and interest earnings, the total sewer fund revenues, for the 2021/2022 fiscal year are budgeted to be approximately $921,000.

The City's sewer fund must provide sufficient revenues to properly operate and maintain the wastewater system and provide reserves for normally anticipated replacement of key system components such as pumps, motors, pump station control equipment, chemical feed equipment, manholes and sewer collection piping. Although the City relies exclusively on sewer fees for operation and maintenance costs, the sewer fund is typically not adequate to finance major capital improvements without outside funding sources.

Table 4-8| Existing Wastewater User Fee Schedule

User Category	Base Charge Inside City	Base Charge Outside City	Consumption Charge Per 1000 gallons
Single User Domestic	$49.73	$99.46	none
Single User – Senior Rate	$39.76	$79.52	none
Multiple Dwellings – Per Unit	$49.73	$99.46	none
Apartments Combined with Business – Per Unit	$49.73	$99.46	none
Businesses	$56.35	$112.70	none
Small Church	$49.73	$99.46	none
Large Church	$56.35	$112.70	$0.48
School	$56.35	$112.70	$0.48
Large Commercial/Industrial	$56.35	$112.70	$0.48

4.7.2 System Development Charges

A system development charge (SDC) is a fee collected by the City as each piece of property is developed. SDCs are used to finance necessary capital improvements and municipal services required by the development. SDCs can be used to recover the capital costs of infrastructure required as a result of the development, but cannot be used to finance operation and maintenance costs.

The SDCs consist of two portions, reimbursement fee and the improvement fee. The reimbursement fee portion is the only portion of the SDC that is guaranteed to be available to the City to use towards repayment of loans for capital improvement projects, since the improvement fee portion of the SDC is available as an SDC credit for developers who complete wastewater system projects that are identified in the City's CIP (on which the SDCs are based).

The City charges different SDC fees based on the size of the water meter installed at each property. The current fee structure is listed in Table 4-9. Over the last three fiscal years, the City has collected an average of about $200,000 in wastewater system development charges.

Table 4-9| Existing Wastewater User Fee Schedule

Meter Size	SDC Fee
¾ Inch	$6,444.98
1 Inch	$10,763.12
1 ½ Inch	$21,461.78
2 Inch	$34,351.74
3 Inch	$68,767.94
4 Inch	$107,437.82
6 Inch	$214,811.18
8 Inch	$343,710.78
10 Inch	$494,136.62

4.7.3 Annual Sewer System Costs

Annual operations and maintenance costs are recurring costs typically funded through user rates. The City's budget for 2020/2021 fiscal year includes various expenditures as listed below (Table 4-10). The total expenditures for the fiscal year are approximately $887,400. This includes a transfer of about $100,000 to the sewer improvement fund. The debt service payments are for a loan that the City obtained in 2009 to pay for upgrades to the wastewater system.

Table 4-10 | Sewer Utility Fund Expenditures 2021/2022 Fiscal Year

Item	Budget
Personnel & Services	$ 467,000
Materials and Services	$ 184,000
Capital Outlays	$ 18,000
Transfers	$ 198,000
Debt Service	$ 142,000
TOTAL EXPENDITURES	**$ 1,009,000**

4.7.4 Debt Service

The City is currently retiring debt for loan that was used to fund improvements to the wastewater system in 2009. The loan was part of a financial assistance package for the Oregon Economic and Community Development Department (OECDD). The original loan term was 25 years with a variable interest rate and payment schedule. The interest rate varies between 2% and 4%. The original loan amount was $2,205,000. The annual payments vary slightly, but are about $140,000 per year. The loan is scheduled to be retired at the end of 2034. The current outstanding balance is about $1,565,000. The City is currently in the process of renegotiating the loan with OECDD and anticipates a slight reduction in the annual payment as a result.

4.7.5 Sewer SDC and Capital Improvement Funds

The City currently has two funds that are used to save money for capital improvements. These include a Sewer SDC fund and a Sewer Improvement fund. At the end of the 2021/2022 fiscal year, the City anticipates balances of approximately $1,100,000 and $800,000 respectively in these two funds.

CHAPTER 5

WASTEWATER FLOWS AND LOADS

Chapter Outline

5.1 Introduction
5.2 Population
  5.2.1 Historic and Future Population
5.3 Wastewater Flows
  5.3.1 Wastewater Treatment Plant Flow Records
  5.3.2 Wastewater System Existing Flow Estimates
  5.3.3 Summary of Existing Wastewater Flows
  5.3.4 Wastewater Flow Projections
  5.3.5 Drainage Basin Service Area Flows
5.4 Wastewater Loads
  5.4.1 City Wastewater Treatment Plant Load Records
  5.4.2 Load Projections

WASTEWATER FLOWS AND LOADS

CHAPTER 5

5.1 INTRODUCTION

In order to select and size both collection and treatment facilities for the planning period, projected wastewater flows and contaminate loadings must be determined. The projected flows and contaminate loadings were determined based on a number of variables including the following:

- Rate of projected population increase
- Land use zoning within the UGB
- Projected per capita and per acre flowrates and organic loadings.

This chapter develops wastewater flow and loading projections which are used for sizing the collection system components as well as the treatment plant components. The projected design flowrates were determined based on a number of variables including zoning of land within the service area, anticipated development density at buildout and within a 20-year planning period, and projected per capita and per acre flowrates.

5.2 POPULATION

Population projections serve as the basis for future wastewater flow projections. Much of the challenge in projecting the growth of the wastewater system relates to the difficulty in accurately tracking or projecting actual populations.

This section evaluates anticipated growth from a review of several data sources; including historical population data (census information & PSU estimates), County coordinated population projections, and anticipated development.

5.2.1 Historic and Future Population

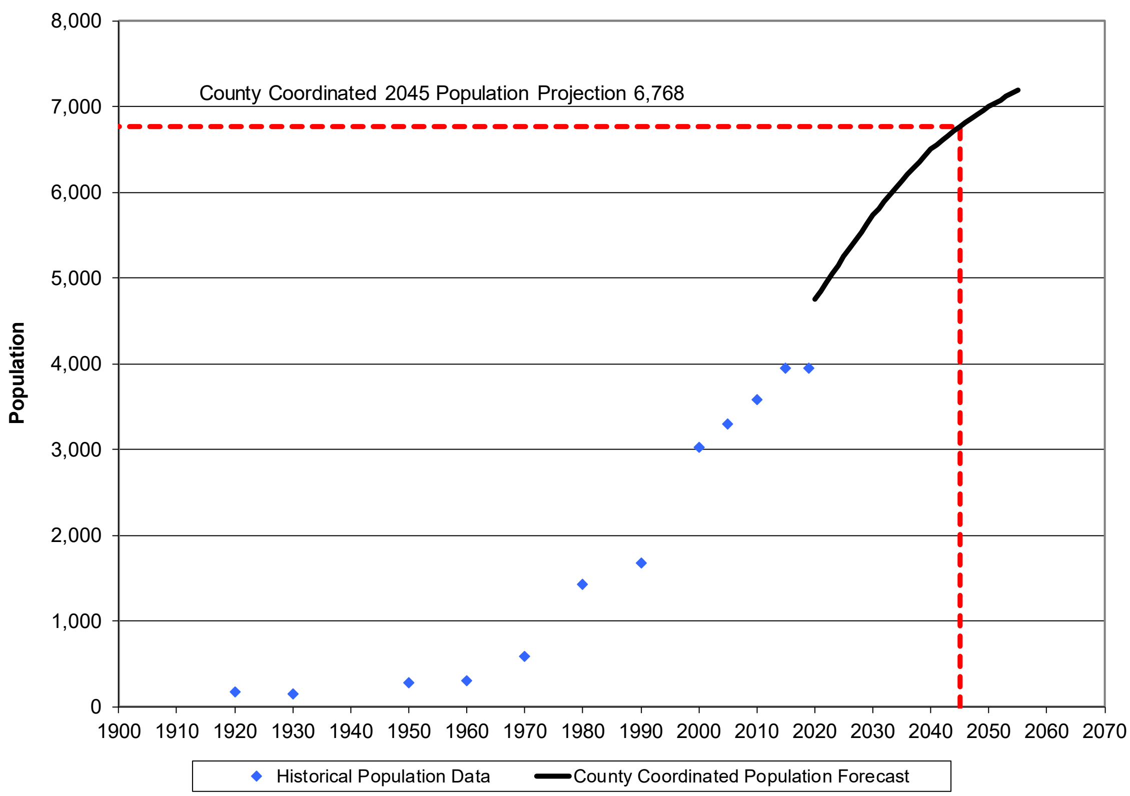
Population histories provide a tool for determining the future growth rate of the municipal wastewater system. The population in Aumsville has increased steadily over the years. Figure 5-1 shows the population trends in Aumsville from 1920 to the present time.

In June of 2017, population projections for Marion County were prepared by the Portland State University Population Research Center (PSUPRC). The County Coordinated population estimates are plotted together with historical population trends in Figure 5-1. The PSUPRC estimates the population of Aumsville to reach 6,768 by 2045. The projected population estimates are listed by year in Table 5-1.

Table 5-1 | Aumsville Population Projections

Year	Population
2030	5,731
2035	6,141
2040	6,501
2045	6,768

Figure 5-1 | Population Growth Trend



5.3 WASTEWATER FLOWS

Wastewater facility evaluation and design typically account for the following standard flow rates:

- Average dry-weather flow (ADWF) - Average daily wastewater flow during the dry-weather months of May through October
- Average wet-weather flow (AWWF) - Average daily wastewater flow during the wet weather months of November through April
- Average annual flow (AAF) - Daily wastewater flow averaged over the entire year
- Maximum-month dry-weather flow (MMDWF) - Maximum monthly flow during the dry weather months

- Maximum-month wet-weather flow (MMWWF) - Maximum monthly flow during the wet weather months
- Peak-day flow (PDF) - Maximum one-day flow during the weather months
- Peak-hour flow (PHF) - Maximum flow over a short duration (peak hour).

5.3.1 Wastewater Treatment Plant Flow Records

The City's treatment plant Discharge Monitoring Reports (DMRs) filed with the DEQ for the period from November 2015 through October 2020 were evaluated to identify flow patterns and evaluate current flows to the plant.

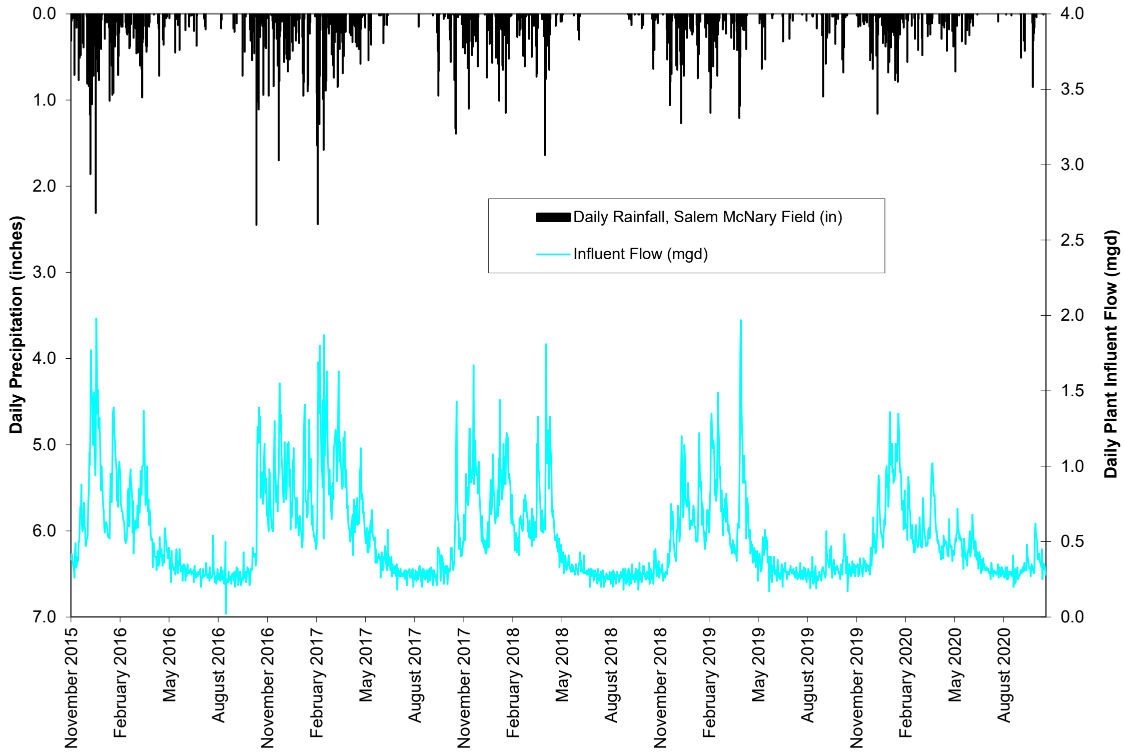
Wastewater flows in Aumsville are strongly influenced by precipitation (Figure 5-2). This is common for wastewater collection systems in Western Oregon. Winter rains cause groundwater levels to rise. The groundwater enters the collection system through faults and cracks in the collection piping and manholes (infiltration) and through direct connections to storm drainage collection facilities (inflow). Infiltration and inflow (I/I) results in increased flows measured at the treatment plant. As shown in Figure 5-2, plant inflows during the winter months are significantly higher than flows during the dry summer months. This can also be seen in Table 5-2 where the various flow components are tabulated for the last four years in millions of gallons per day (MGD). The recommendations in this plan (Chapter 6) include establishing a sewer rehabilitation and replacement program during the planning period. These efforts should be targeted at infiltration that is cost effective to remove.

Table 5-2 | Summary of Wastewater Treatment Plant Flow Data November 2015 through October 2020.

Water Year (1)	ADWF (MGD)	AAF (MGD)	AWWF (MGD)	MMDWF (MGD)	MMWWF (MGD)	PDF (MGD)
2016	0.368	0.553	0.741	0.743	1.165	1.980
2017	0.372	0.627	0.887	0.517	1.021	1.550
2018	0.298	0.528	0.762	0.370	0.915	1.870
2019	0.324	0.499	0.677	0.407	0.910	1.970
2020	0.372	0.487	0.604	0.489	0.975	1.360
Average	0.347	0.539	0.734	0.505	0.997	1.750
Maximum	0.372	0.627	0.887	0.743	1.165	1.980

Notes
1. Water year is November through October starting in November prior to the year listed.

Figure 5-2 | Precipitation Effects on Plant Influent Flow



5.3.2 Wastewater System Existing Flow Estimates

The DEQ has published guidelines for the estimation of wet weather flows in Western Oregon. The purpose of these guidelines is to identify a methodology that can be used to estimate wastewater flows if no surcharging in the collection system were to occur. In most systems such as Aumsville's where large amounts of I/I enter the collection piping and manholes, large portions of the system surcharge during high flow conditions associated with wet weather. This surcharging tends to decrease the amount of I/I that could occur if the surcharging were not present. In theory, the existing wet weather flows measured today are influenced by this phenomenon and the wet weather flows to the wastewater treatment plant would actually be higher if no surcharging were to occur. It is important to consider the flowrates in the absence of surcharging because as the improvements described in this plan are implemented, the bottlenecks that cause the surcharging will be removed and the wet weather flows to the treatment plant may increase beyond the flows currently measured today.

In order to estimate the wet weather flow components that would occur in the absence of bottlenecks, the DEQ has published guidelines that describe a methodology to correlate wastewater flows to rainfall during moderate rainfall events when surcharging is believed to be absent. This mathematical correlation is then used to extrapolate flows at higher rainfall events associated with peak wet weather flow conditions.

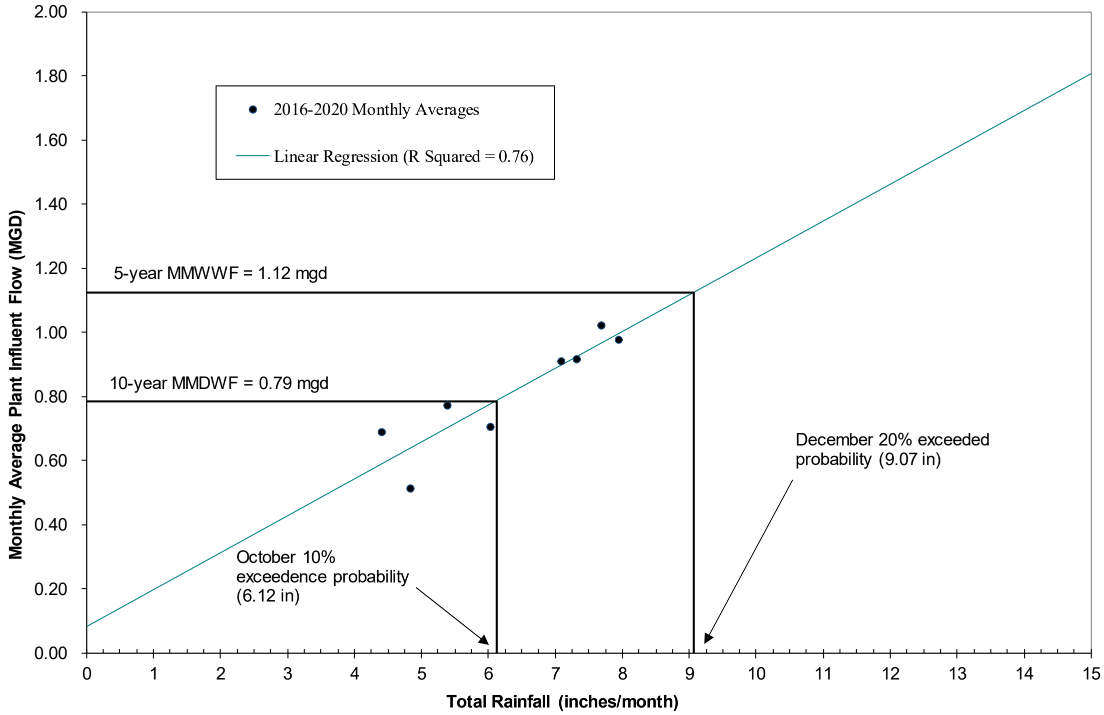
To establish a relationship between monthly rainfall and average monthly flow, the average monthly wastewater flowrates for the wet weather months are plotted against their corresponding monthly rainfall values. The monthly average flow and corresponding rainfall totals for the 2015 through 2020 winter months are plotted in Figure 5-3. A linear regression is performed to establish the relationship between monthly rainfall and average monthly flow. This relationship can be used to predict plant inflows as a function of monthly rainfall depth.

The Maximum Month Dry Weather Flow (MMDWF) is the monthly average flow between May and October where ground water is high. The MMDWF typically occurs during a high rainfall event either in May or October. For the purposes of this report, the MMDWF is defined by the 10-year recurrence interval. Therefore, the MMDWF may be estimated by the highest monthly flowrate with a 10-year recurrence interval. The linear regression established in Figure 5-3 may be used to determine the MMDWF if the monthly rainfall total associated with a 10-year recurrence interval is known. Rainfall depths corresponding to various exceedance probabilities have been calculated for the weather station at the Salem Airport[3]. This data set is assumed to be generally representative of rainfall patterns in Aumsville. The highest monthly rainfall total during the May through October dry weather season occurs in October, the rainfall depth associated with the 90% exceedance probability (i.e., 10-year recurrence interval) is 6.12 inches. Using this rainfall depth and the relationship established in Figure 5-3 the MMDWF can be estimated. As shown in Figure 5-3, the MMDWF is approximately 0.78 MGD.

The Maximum Month Wet Weather Flow (MMWWF) represents the highest monthly average attained during the winter period of high groundwater. For the weather station in Salem, the highest monthly average rainfall occurs in December. In the same manner used to determine the MMDWF, the rainfall depth associated with an 80% probability of exceedance (i.e., 5-year recurrence interval) for the month of December is used in the correlation between plant flows and rainfall to determine the MMWWF. Again, using the rainfall data from the Salem Weather Station, the December rainfall total associated with the 80% exceedance probability is 9.07 inches. Using this rainfall depth and the relationship established in Figure 5-3 the MMWWF can be estimated. As shown in Figure 5-3, the MMWWF using this methodology is approximately 1.12 MGD.

[3] U.S. Dept. of Commerce, NOAA, Climatography of the United States No. 20, Salem McNary AP, OR

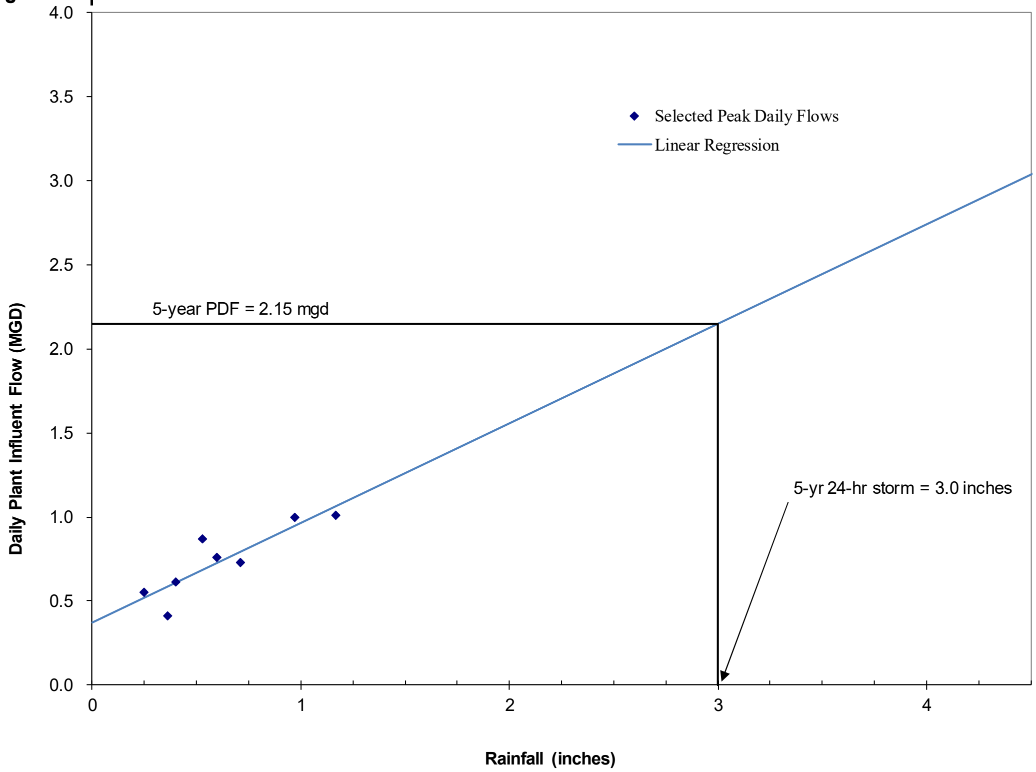
Figure 5-3 | MMWWF and MMDWF Determination



The Peak Day Flow (PDF) that would occur in the absence of bottlenecks may be estimated by determining the peak daily flow associated with a 5-year storm. This PDF will occur under saturated subsurface conditions when the influence of rainfall on infiltration and inflow is the strongest. The PDF is determined by plotting observed peak average daily flow against the corresponding daily rainfall depths. The 5-year 24-hour rainfall depth is used in a linear regression of the data to determine the PDF. The data used to determine the PDF is plotted in Figure 5-4. These data points were carefully selected to ensure that groundwater levels were saturated for the period over which flow data was collected. The data were also screened to ensure that the flow measurements were not collected under significantly surcharged conditions as this would tend to decrease the flow measurements and result in erroneously low estimates. The 5-year 24-hour rainfall depth for Aumsville is approximately 3.0 inches[4]. Using this rainfall depth and the relationship established in Figure 5-4 the PDF associated with a 5-year 24-hour storm can be estimated. As shown in Figure 5-4, the PDF is approximately 2.15 MGD.

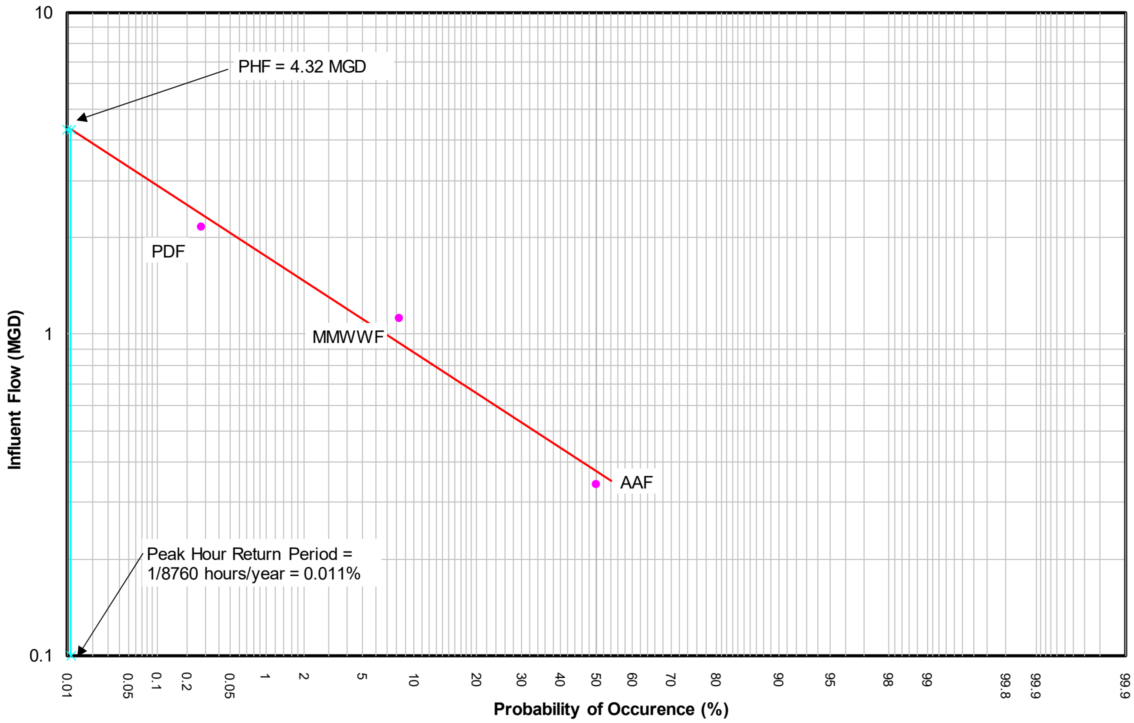
[4] U.S Dept. of Commerce, NOAA, Atlas 2, Volume X (Oregon), figure 26

Figure 5-4 | PDF Determination



A statistical approach is used to determine the Peak Hour Flow (PHF) that would occur in the absence of bottlenecks. This approach assumes that a particular year includes a 5-year storm with high groundwater conditions producing the MMWWF and the PDF. During this 5-year storm the PHF occurs within the peak day. These assumptions enable one to determine the portion of the year over which each flow component occurred. For example, the MMWWF occurs 1/12 of the time or with an 8.33% probability, the AAF occurs half of the time or with a 50% probability, and so on. The rainfall depth is assumed to be a random variable with a log-normal probability distribution. If this assumption is accurate, the AAF, MMWWF, and PDF should plot as a straight line on log-probability paper. These flow components are plotted on Figure 5-5. Since the PHF occurs 1 hour out of this hypothetical year (i.e., 1/8760 or 0.011% probability), by extrapolating a linear regression to a probability of 0.011%, the PHF may be determined. Using this approach the PHF is approximately 4.32 MGD as shown in Figure 5-5.

Figure 5-5 | PHF Determination



5.3.3 Summary of Existing Wastewater Flows

Table 5-3 includes a summary of existing flow estimates presented in the previous sections. These flow estimates will be used throughout the remainder of this document. The wet weather flow components (i.e., MMDWF, MMWWF, PDF, PHF) for the City's system are intended to be the theoretical maximum values that would occur if all bottlenecks in the system were to be removed.

Table 5-3 | Summary of Existing Flow Estimates

Flow Component	Value (mgd)
Average Dry Weather Flow (ADWF)	0.35
Average Annual Flow (AAF)	0.54
Average Wet Weather Flow (AWWF)	0.73
Maximum Month Dry Weather Flow (MMDWF)	0.79
Maximum Month Wet Weather Flow (MMWWF)	1.12
Peak Day Flow (PDF)	2.15
Peak Hour Flow (PHF)	4.32

5.3.4 Wastewater Flow Projections

This section builds on the discussions of population projections in Section 5.2 and the existing flow estimates listed in Table 5-3. Projections of future wastewater flows through the planning period were based on the existing flows combined with flow from the anticipated population growth. Peaking factors were used to estimate the increases in flows during wet weather periods. The flow projections presented herein are based on the population growth projections prepared by the Portland State University Population Research Center. These are values for the population within the UGB and are likely to be somewhat higher than the actual population that will be served by the City's system. Therefore, basing the flow projections on the overall population within the UGB may result in slight over-estimates of the flows and loads. However, this approach is more conservative and will allow the City to consider extending wastewater service to all areas within the UGB that are not currently served by the City's wastewater system. For this reason, using the overall population within the UGB is considered appropriate for this planning effort.

It is also important to note that the flow projections listed below include the existing peak flow estimates listed in Table 5-3. These flow estimates are theoretical estimates of wastewater flow that might occur in the absence of surcharging (Section 5.3.2). These flows are significantly higher than the measured flows (Table 5-2). Therefore, a comment on the applicability of the following flow projections is appropriate. These flow estimates are generally considered useful for sizing new facilities, but not useful for determining when certain components of the wastewater system (e.g., pump stations and trunk sewers) should be upgraded to increase capacity. In the case of existing pump stations, other information such as pump run times should also be evaluated to determine if the flows to the station are exceeding pump capacity.

The projected wastewater flowrates were based on the following assumptions.

- Population growth will occur in accordance with the projections in Section 5.2.
- Flow rates will increase in proportion to population increase.
- The per capita average dry weather flow rate associated with the population increase will remain constant during the planning period at a value of 90 gallons per capita per day.
- There will be no contribution from "wet" industries during the planning period. Commercial and industrial development will be "dry" with flows comparable to residential developments.
- The ratio of industrial and commercial development to municipal population will remain constant over the planning period.
- The City's infiltration and inflow reduction program will prevent any increase in infiltration and inflow into the existing collection system. In other words, existing I/I contributions will remain constant.
- All growth will occur in conformance with current land use policies as outlined in the City's Comprehensive Plan.
- The increase in the AWWF over the planning period is equal to twice the increase in the ADWF.
- The increase in the MMDWF over the planning period is equal to twice the increase in the ADWF.
- The increase in the MMWWF over the planning period is equal to three times the increase in the ADWF.
- The increase in the PDF over the planning period is equal to four times the increase in the ADWF.
- The increase in the PHF over the planning period is equal to five times the increase in the ADWF.

Based on these assumptions, the future estimates of wastewater flow listed in Table 5-4 were prepared.

Table 5-4 | Future Wastewater Flow Projections

Year	Service Population	Projected Wastewater Flows (MGD)						
		ADWF	AAF	AWWF	MMDWF	MMWWF	PDF	PHF
2025	5253	0.46	0.719	0.98	1.02	1.47	2.62	4.91
2030	5731	0.50	0.783	1.07	1.11	1.60	2.79	5.12
2035	6141	0.54	0.838	1.14	1.18	1.71	2.94	5.31
2040	6427	0.56	0.877	1.20	1.24	1.79	3.04	5.43
2045	6768	0.59	0.923	1.26	1.30	1.88	3.16	5.59

5.3.5 Drainage Basin Service Area Flows

The peak discharge from each basin was estimated to evaluate the capacity of the trunk sewers. Estimates of existing peak flows as well as projected peak flows associated with buildout were developed. In Chapter 6, the existing peak flows are used to determine existing deficiencies and the projected peak flows associated with buildout are used for sizing the recommended improvements. Flows associated with buildout conditions are used for sizing purposes because trunk sewers are not suited for incremental expansion. In small Cities like Aumsville it is generally more cost effect to install a sewer line sized for complete development of the upstream service area. This is due to the fact that the pipe sizes are relatively small (i.e., less than 24 inches in diameter). Over the life of a particular pipeline it is generally not cost effective to install a smaller diameter pipe (e.g., a 12-inch diameter pipe), then later replace this pipe with a larger pipe (e.g., 18-inch diameter pipe) before the smaller diameter pipe has reached the end of its useful life. Due to the relatively long life-cycle of modern pipeline materials (i.e., 70+ years), it is usually more cost effective to install a larger pipe sized for buildout of the upstream basin. For this reason, peak flows associated with complete buildout of the UGB are used in this plan to size the trunk sewers in the City.

The peak flow from each basin at buildout conditions was determined by summing the following quantities.

- Existing average dry weather flow multiplied by a peaking factor of 3
- Existing I/I contribution
- Additional base sewage flow from growth multiplied by a peaking factor of 3
- I/I from future development

The existing ADWF as measured at the treatment plant was allocated to each sewer basin by the ratio of the sewered area within each basin to total sewered area of the City. The existing I/I contribution from each basin was estimated based field measurements of I/I during a high flow event in January 2021. These field measurements were collected at the outlet of each basin. The percentage of I/I from each basin was calculated based on these measurements. This percentage was used to allocate the peak hour I/I to each basin.

The additional ADWF associated with growth in the basin was determined by multiplying estimates of sewage flow per acre (Table 5-5) by the area of undeveloped land for each land use within each basin. A peaking factor of three was applied to these values to estimate PHF from new development. The additional I/I from future development was determined by multiplying 1,600 gallons per acre per day by the total undeveloped area within each basin. This allowance for I/I in currently undeveloped areas is used only to size the collection system piping serving those areas. The overall I/I collected in the City is anticipated to remain relatively constant due to the recommended rehabilitation and replacement program described later in this document (Chapter 6).

Table 5-5 | Flow Rates Per Acre Used for Estimates of Flow from Undeveloped Areas

Land use	Flow (gallons/acre/day)
Single Family Residential	1,500
Multi-Family Residential	2,500
Commercial	1,500
Industrial	1,500
Interchange Development	1,500

Using the approach described above, the existing peak flows and the projected peak flows at buildout were determined for each basin (Table 5-6). It is important to note that the peak flows listed in Table 5-6 are for complete buildout of the land within the study area. For this reason these peak flows are greater than the flows listed in the previous subsection (Table 5-4). The flows in Table 5-6 are generally useful for sizing the gravity collection system piping while the flows listed in Table 5-4 are useful for evaluating the treatment plant and pump stations.

Table 5-6 | Projected Drainage Basin Service Area Flows at Buildout of the System

Basin	Total Area (Acres)	Existing Sanitary Flow (MGD)	Existing I/I (MGD)	**Existing PHF (MGD)**	Future Sanitary Flow (MGD)	Future I/I (MGD)	**Buildout PHF (MGD)**
North Industrial Basin	28	0.000	0.000	**0.000**	0.042	0.045	**0.171**
West Olney Basin	39	0.000	0.000	**0.000**	0.059	0.062	**0.238**
Treatment Plant Basin	28	0.022	0.136	**0.203**	0.000	0.000	**0.203**
East Olney Basin	23	0.018	0.022	**0.076**	0.000	0.000	**0.076**
9th Street Basin	54	0.021	0.414	**0.476**	0.016	0.015	**0.538**
6th & Olney Basin	37	0.029	0.491	**0.580**	0.000	0.000	**0.580**
Gordon Lane Basin	55	0.000	0.000	**0.000**	0.083	0.088	**0.336**
West UGB Basin	44	0.000	0.000	**0.000**	0.043	0.038	**0.168**
North 11th Basin	36	0.025	0.571	**0.647**	0.006	0.006	**0.671**
9th & Del Mar Basin	24	0.019	0.038	**0.095**	0.000	0.000	**0.095**
4th & Del Mar Basin	60	0.043	0.785	**0.913**	0.015	0.010	**0.968**
Willamette Street Basin	43	0.006	0.041	**0.058**	0.044	0.028	**0.217**
South 11th Basin	45	0.029	0.284	**0.370**	0.023	0.014	**0.451**
5th & Church Basin	46	0.035	0.225	**0.329**	0.003	0.003	**0.342**
Windemere Basin	52	0.041	0.124	**0.247**	0.000	0.000	**0.247**
Grizzly Street Basin	62	0.033	0.058	**0.158**	0.030	0.032	**0.280**
Cougar Street Basin	40	0.029	0.082	**0.167**	0.006	0.006	**0.192**
Mill Creek Basin	16	0.000	0.000	**0.000**	0.024	0.026	**0.098**
Totals	732	0.350	3.27	**4.32**	0.39	0.37	**5.87**

5.4 WASTEWATER LOADS

In addition to the expected wastewater flow, evaluation and design of wastewater facilities requires estimates of the expected loads of various pollutants in the wastewater. Treatment facilities must be designed with operating capacity to treat the highest expected loads of pollutants over the planning period. Pollutants used as design parameters for this study were biochemical oxygen demand (BOD; sometimes referred to as a five-day oxygen demand expressed as BOD_5), ammonia, and total suspended solids (TSS). The following classifications of wastewater pollutant loads were used.

- Average Load – Average daily wastewater load.
- Maximum Month Load – Daily wastewater load during the maximum month.

5.4.1 City Wastewater Treatment Plant Load Records

The City's treatment plant Discharge Monitoring Reports (DMRs) filed with the DEQ for the period from November 2015 through October 2020 were evaluated to identify loading patterns and evaluate current loads to the plant. This data set includes BOD and TSS measurements every other week from 24 hour composite samples taken from the wastewater treatment plant influent flow stream. The City does not normally measure influent ammonia concentrations. Therefore, there is no influent ammonia data available. In order to estimate ammonia loading rates, common values from the engineering literature are used below to develop future loading projections.

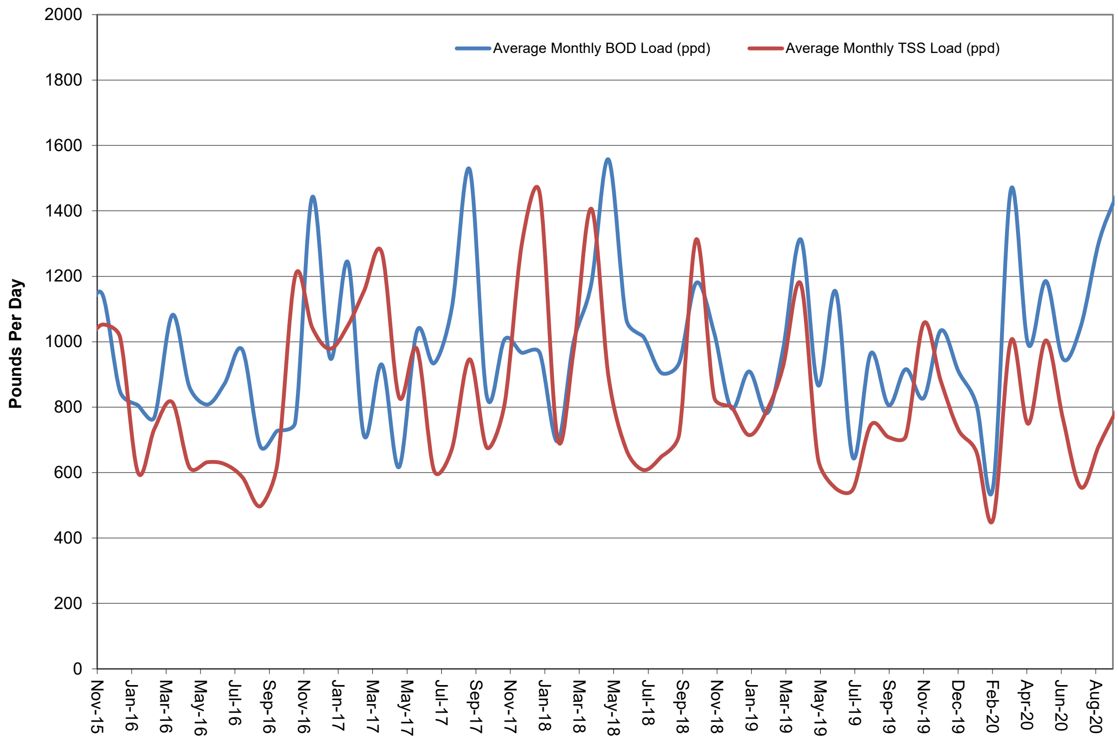
Pollutant loads in pounds per day were calculated for BOD, TSS, and ammonia using the data sets described above. Pollutant load calculations were based on the concentration for each pollutant multiplied by the influent flow on the day the sample was collected.

The average monthly influent BOD and TSS loads measured at the treatment plant from November 2015 through October 2020 are plotted in Table 5-7.

Table 5-7 | Summary of Plant CBOD and TSS Loading Data 2015 through 2020.

	BOD Load (pounds per day)		TSS Load (pounds per day)	
Time Period	Average Annual	Maximum Month	Average Annual	Maximum Month
November 2015 - October 2016	903	1145	743	1052
November 2016 - October 2017	1024	1526	955	1272
November 2017 - October 2018	1057	1557	952	1453
November 2018 - October 2019	927	1313	756	1176
November 2019 - October 2020	1069	1464	782	1056
Average	996	1401	839	1202

Figure 5-6 | Plant BOD and TSS Loading History



5.4.2 Load Projections

This section builds on the discussions of population projections in Section 5.2 and the existing load data listed in Table 5-7. Projections of future wastewater loads through the planning period were based on the existing loads combined with loads from the anticipated population growth. Peaking factors were used to estimate the increases in loading rates for the peak month.

The projected wastewater loading rates were based on the following assumptions.

- Population growth will occur in accordance with the projections in Section 5.2.
- BOD, TSS, and Ammonia loading rates will increase in proportion to population increase.
- A unit loading rate of 0.24 pounds per person per day will be used for estimates of average annual and maximum monthly BOD loading rates. This value is approximately equal to the existing average loading rate to the plant.
- A unit loading rate of 0.22 pounds per person per day will be used for estimates of average annual suspended solids loading rates. This value is approximately equal to the existing average loading rate to the plant.
- A unit loading rate of 0.022 pounds per person per day will be used for estimates of average annual Ammonia loading rates.
- A peaking factor of 1.5 will be applied to the average annual loading rates to estimate the peak monthly loading rates. This ratio is similar to the ratio from the data set summarized in Table 5-7.

Based on these assumptions, the future estimates of influent wastewater loads listed in Table 5-8 were prepared.

Table 5-8 | Future Wastewater Load Projections

Year	Service Population	BOD (ppd)		TSS (ppd)		Ammonia (ppd)	
		Average Annual	Max Month	Average Annual	Max Month	Average Annual	Max Month
2025	5253	1286	1929	1138	1706	116	173
2030	5731	1400	2101	1243	1864	126	189
2035	6141	1499	2248	1333	2000	135	203
2040	6427	1567	2351	1396	2094	141	212
2045	6768	1649	2474	1471	2206	149	223

CHAPTER 6

COLLECTION SYSTEM EVALUATION

Chapter Outline

6.1 Introduction
6.2 Collection System Operation, Maintenance, & Rehabilitation
 6.2.1 Need for System-Wide Preventative Maintenance
 6.2.2 Present Maintenance Practices
 6.2.3 Recommended Collection System Maintenance Program (Program – 1)
6.3 Collection System Deficiencies
 6.3.1 Gravity Main Capacity Analysis
 6.3.2 Collection System Improvements to Serve Currently Undeveloped Areas
 6.3.3 Summary of Collection System Deficiencies
6.4 Collection System Alternatives
 6.4.1 No Action
 6.4.2 Reroute Sewage
 6.4.3 Upgrade Existing Facilities
 6.4.4 Infiltration/Inflow Reduction
 6.4.5 Construct New Facilities
6.5 Recommended Collection System Improvements
 6.5.1 Improvements to the Existing Gravity Collection System
 6.5.2 Extensions to Serve Undeveloped Areas
6.6 Summary of Recommendations

COLLECTION SYSTEM EVALUATION

CHAPTER 6

6.1 INTRODUCTION

This chapter includes an analysis of the collection system. The first subsection focuses on operation, maintenance, and rehabilitation of the collection system. This is followed by the development of alternatives for potential improvements to the wastewater collection system.

This chapter addresses the following key questions:

- What are the current collection system operation and maintenance practices and how can they be improved?
- What are the existing collection system deficiencies?
- What collection system components are likely to become deficient during the planning period or prior to complete buildout of the system?
- What are the alternatives for correcting existing and projected deficiencies?

The existing and projected collection system deficiencies are presented. Where appropriate different alternatives for addressing each of the deficiencies are presented and discussed. The alternatives are evaluated against each of the collection system deficiencies to generate complete collection system recommendation. In Chapter 7, the treatment system is evaluated and alternatives for correcting treatment system deficiencies are identified and evaluated.

6.2 COLLECTION SYSTEM OPERATION, MAINTENANCE, & REHABILITATION

This section discusses the need for maintenance of the gravity sewer collection piping and provides recommendations for the basic elements necessary for a maintenance program. The need for system-wide preventive maintenance is addressed first, and then the general recommended approaches to collection system maintenance are outlined.

6.2.1 Need for System-Wide Preventative Maintenance

Maintenance of sewerage systems is necessary to ensure the proper operation of the facilities and to obtain the full useful life of those facilities. Sanitary sewer systems represent significant investment of public capital. If a sewer system is allowed to fall into disrepair because of the lack of maintenance, it will not operate efficiently or as designed. Health problems and property damage may result from sanitary sewer backups, surcharging and/or overflows. Without proper maintenance, a system's capacity can be reduced by debris clogging, root intrusion growth, structural damage, infiltration and inflow (I/I), and other factors that eventually lead to failures throughout the system. Repair of failed sections of a sanitary sewer system are costly, quite often exceeding the original cost of construction. In spite of this, many jurisdictions do not adequately fund the level of maintenance necessary to protect their investment in the sewerage system. Collection system maintenance can be separated into two types: preventive and corrective.

Preventive maintenance involves scheduled inspection of the system and data gathering to identify problem areas and analysis of this data so that scheduled maintenance can be targeted at specific problems. As a general rule, as preventative maintenance increases, the amount of corrective maintenance required decreases.

Corrective maintenance, often referred to as emergency maintenance, is typically performed when the sewer system fails to convey sewage. Causes for initiating corrective maintenance may include blockages, solids buildup, excessive I/I, flooding and sewer breaks. Corrective maintenance requires immediate action, and the jurisdiction will typically pay a premium to have this work performed.

6.2.2 Present Maintenance Practices

At the present time, the City has an informal, but fairly effective, maintenance program. The City's existing operation and maintenance budget allows the City to clean and inspect every mainline in the system at a minimum of 5-year intervals. The City does not have a formal budget line item for I/I corrective measures, but does perform manhole rehabilitation and spot repairs on an annual basis as needed. This work is typically funded from the operation and maintenance budget. As described below, this plan recommends establishing a formal collection system maintenance program that includes a specific budget for annual cleaning TV inspection, and corrective work.

6.2.3 Recommended Collection System Maintenance Program (Program – 1)

The City's original collection system was constructed in 1960 and collects large amount of I/I. Therefore, it is important that the City dedicate funds on an annual basis to adequately maintain the system. The City should consider inspecting and cleaning about 20% of the system each year. At this rate, the City can inspect the entire system about once every 5 years. The City should also create an annual budget for manhole rehabilitation and spot repairs of mainlines and service laterals. Over the planning period, the collection system will continue to age and deteriorate and it will become increasingly important for the City to make annual repairs in order to keep the system in good condition. Therefore, the City should formalize the annual maintenance program at a funding rate of $30,000 per year and not divert these funds for other needs. This funding rate should be sufficient to clean and TV inspect about 20% of the system each year and rehabilitate manholes and make spot repairs. This amount should be sufficient for the immediate future, but the City should evaluate this funding rate at 5-year intervals along with the list of problems observed through television inspections to ensure that the program is able to adequately address the needs of the system. Initial maintenance activities should be focused on rehabilitating leaking manholes, making spot repairs in the mainline piping, and working with customers to repair service laterals with high rates of infiltration. The City should also consider smoke testing the collection system to identify illicit connections to the sewer system.

6.3 COLLECTION SYSTEM DEFICIENCIES

The purpose of this section is to determine the components of the existing collection system that are or will become deficient. This includes components that lack capacity to convey existing peak flows or will lack capacity as flows increase due to growth. Some collection system deficiencies were identified in Chapter 4. This section is intended to supplement those discussions. Together with the deficiencies listed in Chapter 4, the intent of this section is to present an overall list of deficiencies that must be addressed by the City.

6.3.1 Gravity Main Capacity Analysis

The peak design flows developed in Chapter 5 were used as the basis for an evaluation of the existing sanitary sewer trunk lines. Pipe sizes, lengths, slopes, and locations were determined from City records and field surveys. The evaluation was limited to the main trunk lines conveying sewage through the basins. This approach was taken since most of the pipes within a basin will actually encounter only a fraction of the capacity of the pipe. Typical practice is to construct sewer lines with pipe no smaller than 8-inches in diameter. This facilitates solids conveyance, cleaning, and maintenance. In the upper ends of the drainage basins, flows do not approach the capacity of the 8-inch diameter pipes. Therefore, it is not necessary to model all of the smaller diameter pipes in the collection system.

A model of the main trunk lines was developed using the SWMM5 hydraulic model. The hydraulic model simulates the routing of flow through the collection system. SWMM5 is a fully dynamic model that can simulate backwater, surcharging, split flows, and looped connections that occur in sewer systems. The peak drainage basin service area flows (Table 5-6) were used as inputs to the model. Both the existing peak flows and the projected peak flows associated with buildout were used in the modeling effort. The existing peak flows were used to determine existing deficiencies, and the projected peak flows associated with buildout were used for sizing the recommended improvements. The choice to use flow projections associated with buildout of the collection system for trunk sewer sizing is based on the fact that buried sewer collection pipes are not well suited for incremental expansion. Cases rarely exist where it is appropriate to size trunk sewers for 20 year flow projections. The design life of buried sewer collection pipes is 50-70 years. Therefore, it is not cost effective to upsize these sewer pipelines at 20-year intervals. It is more cost effective to size these facilities to convey projected peak flows associated with buildout of the entire upstream basin.

The existing and projected flow estimates were added to the main trunk lines where their respective basins discharge into the main trunk lines. The model was run until steady-state flow conditions were achieved. These steady state conditions were used to locate the collection system deficiencies. This approach is somewhat conservative since, in reality, the peak drainage basin service area flows only persist for a short period of time (e.g., a few hours). After these peaks, the flows will begin to decrease and steady state conditions are not likely to actually occur. Though somewhat conservative, this steady-state approach is reasonable for smaller systems like Aumsville.

The model was used to identify capacity deficiencies. Capacity deficiencies are defined as locations where overflows occur and flow does not reach the treatment plant, or where a pipe is surcharged and the hydraulic grade line (HGL) is within a specified distance from the ground surface. For the purposes of this analysis, pipe surcharge is allowed. When the modeled water surface reached a level less than 6 feet from the ground surface (freeboard less than 6 feet) a deficiency was identified. The 6-foot freeboard deficiency criterion was determined to be appropriate for short-term peak flows and adequate to protect from overflows. Basement flooding was not considered to be a significant concern given the relatively limited number of basements in the City and the lack of historical basement flooding complaints. For shallow pipes (pipes with less than 8 feet of available freeboard measured from ground to top of pipe) a capacity deficiency criterion that allows no more than 2 feet of surcharge was used instead of 6 feet minimum freeboard allowed for deeper pipes. The capacity deficiencies identified by the hydraulic analysis indicate where improvements may be needed to ensure that overflows do not occur and that adequate capacity is provided.

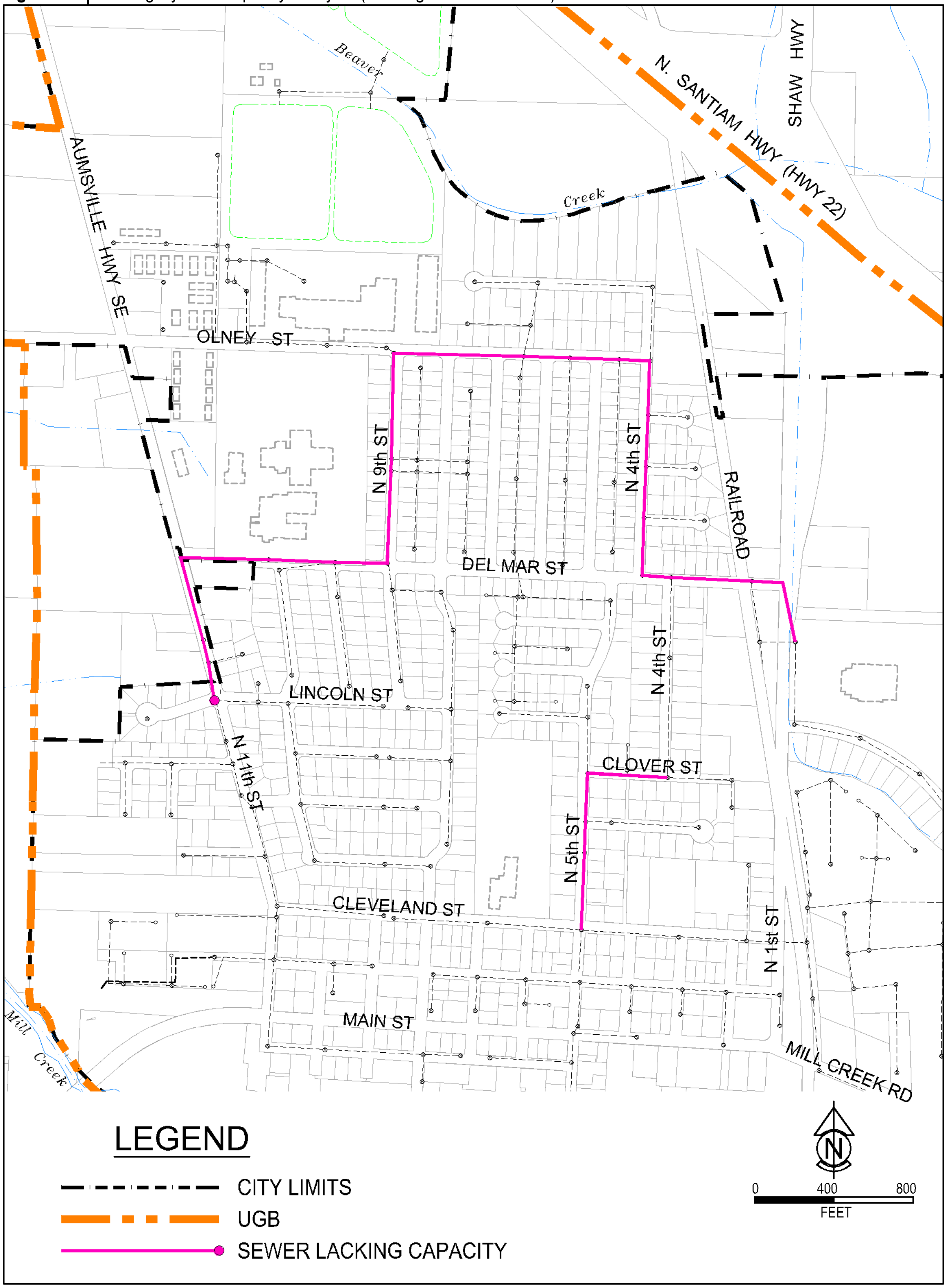
The hydraulic model was used to identify capacity deficiencies in the existing trunk sewer system as shown in Figure 6-1. As noted above, the flows used for this analysis are the existing peak drainage basin service area flows (Table 5-6). The hydraulic model predicts widespread surcharging throughout the City. The surcharging extends well beyond the limits indicated in Figure 6-1. However, this widespread surcharging is generally the result of the undersized trunk sewers shown in Figure 6-1. Therefore, not all surcharged manholes are shown in Figure 6-1 for the sake of clarity. The model predicts surface flooding and trunk sewers lacking capacity at the following locations.

- Olney Street from 9th Street to 4th Street
- 4th Street from Olney Street to Del Mar Drive
- Del Mar Drive from 4th Street to 1st Street
- Clover Street from 4th Street to 5th Street
- 5th Street from Clover Street to Church Street
- 9th Street from Olney Street to Del Mar Drive
- Del Mar Drive from 9th Street to 11th Street
- 11th Street from Del Mar Drive to Cleveland Street

6.3.2 Collection System Improvements to Serve Currently Undeveloped Areas

In addition to the sewers lacking capacity, there are a number of areas within the City that are currently undeveloped and/or areas that lack gravity sewer service. New gravity mainlines or pump stations will need to be installed to serve these areas as they develop. Current City ordinances require that mainlines required to serve these areas be installed at the expense of the developer. These lines should be sized as required to serve all upstream areas. The recommended improvements to serve the undeveloped areas are discussed below in Section 6.5.2.

Figure 6-1 | Existing System Capacity Analysis (Existing Flow Conditions)



6.3.3 Summary of Collection System Deficiencies

The known deficiencies described in Chapter 4 have been combined with the deficiencies described above to develop a complete list of collection system deficiencies. These deficiencies are listed in Table 6-1.

Table 6-1 | Summary of Collection System Deficiencies

Location	Problem Category
Olney Street Sewer from 9th Street to 4th Street	Lack of Capacity (pipe size too small)
4th Street Sewer from Olney Street to Del Mar Drive	Lack of Capacity (pipe size too small)
Del Mar Drive Sewer from 4th Street to 1st Street	Lack of Capacity (pipe size too small)
Clover Street Sewer from 4th Street to 5th Street	Lack of Capacity (pipe size too small)
5th Street Sewer from Clover Street to Church Street	Lack of Capacity (pipe size too small)
9th Street Sewer from Olney Street to Del Mar Drive	Lack of Capacity (pipe size too small)
Del Mar Drive Sewer from 9th Street to 11th Street	Lack of Capacity (pipe size too small)
11th Street Sewer from Del Mar Drive to Cleveland Street	Lack of Capacity (pipe size too small)
Collection System Piping East of Manhole at 5th & Church Streets	High I/I
4th & Delmar Sewer Basin	High I/I
North 11th Sewer Basin	High I/I
9th Street Sewer Basin	High I/I

6.4 COLLECTION SYSTEM ALTERNATIVES

The shortcomings identified in Table 6-1, will need to be addressed by several measures including the implementation a comprehensive I/I correction program and increasing the size of trunk sewers. New gravity sewers and pump stations may be needed to serve areas of the City that are currently undeveloped.

Facilities planning requires the examination of a broad range of alternatives for each portion of the wastewater system. This section examines the alternatives for collecting wastewater within the study area and conveying it to the point of treatment. This section develops and screens wastewater collection alternatives using criteria such as land requirements, topographic constraints, reliability, operational flexibility, construction and long-term O&M costs, and regulatory restrictions. The alternatives listed in this section represent the tools used in the facilities planning effort to address the previously listed deficiencies in order to provide a comprehensive long-term solution for the City's collection system.

6.4.1 No Action

The no action approach implies that no improvements will be made to the existing collection system (excluding maintenance or repairs). Obviously, this approach is recommended for those areas of the system which have sufficient capacity to convey the design flows and are in acceptable condition. Although this approach may be justified in isolated areas within the system on a case-by-case basis where there is insufficient capacity to convey peak design flows (i.e., minor surcharging for short periods of time), this approach is effectively eliminated by DEQ guidelines and regulations.

Although it is always an option to not improve the system, the result will be health risks, damage to existing facilities, sanitary sewer overflows, environmental pollution, compliance issues, and inconveniences where sewage collection and facilities are inadequate. Furthermore, delaying required improvements almost inevitably leads to a greater future problem. However, to ensure that system improvements are justified, it is necessary to consider the costs and advantages of proposed improvements against the risks entailed by the no action alternative. It should be noted that since resources are limited and the sewer system cannot be upgraded all at one time, the phasing plan adopted by the City for the improvements will in effect require that the no action alternative be adopted on a temporary basis for all but the first phase improvements.

6.4.2 Reroute Sewage

Under this option, sewage would be diverted or rerouted from one sewer basin or system to another. This approach is practical in cases where an existing sewer has capacity in excess of that needed to convey design flows from that basin, and where flow diversion is practical from a construction and topographic standpoint. One of the drawbacks of this option is that it usually results in leaving the older, under-capacity, sewer lines in place. If these older pipelines are in poor condition, they will continue to collect I/I and will eventually need to be rehabilitated. Therefore, another advantage of upsizing existing pipelines is that it results in beneficial I/I control. For the City’s system, some rerouting options were considered, but were ultimately eliminated from further consideration in favor of upsizing the existing pipelines. This was based on the idea that replacing the existing pipelines with larger lines eliminates older piping from the system that collects large amounts of I/I.

6.4.3 Upgrade Existing Facilities

This approach involves constructing replacement pipes or pump stations to provide adequate capacity for the design flows. This is the most obvious alternative since it provides assurance that the sewage collection system can convey the design flows through the City and that overflows will be kept to a minimum, which in turn limits the City's liability and health risks to residents.

6.4.4 Infiltration/Inflow Reduction

As stated previously, the collection system collects large amounts of I/I during the winter months. While reduction of the existing I/I flows and minimization of future I/I flows is important, experience in Western Oregon has shown that the goal of complete elimination of I/I is unreasonable and largely unattainable. For the purposes of this study, it was assumed that I/I reduction efforts would keep I/I amounts at their current level. In other words, no reduction in existing flows is assumed as a result of the recommended sewer rehabilitation and replacement program (i.e., Program-1). This assumption is based on the idea that I/I reduction should be an ongoing work effort included in the City’s maintenance budget indefinitely. This approach is recommended because as the I/I corrective work is performed, other areas in the collection system will continue to age and deteriorate and new I/I sources will appear over time. These new I/I sources will replace the I/I sources that were removed as a result of the corrective work. This assumption may turn out to be somewhat conservative. If so, future flow projections during the next planning cycle can be adjusted accordingly.

6.4.5 Construct New Facilities

The construction of new collection system components including trunk sewers, lift stations, and force mains is the only method considered herein for providing service to undeveloped areas. This method basically involves extending the conventional gravity collection system into the undeveloped areas and installing new pump stations where topographical limitations require.

6.5 RECOMMENDED COLLECTION SYSTEM IMPROVEMENTS

The remainder of this section describes the recommended improvements to the collection system. Written descriptions are provided for each improvement project. The locations of the projects are shown in Figure 6-2 and Figure 6-3. These figures are included at the end of this section for formatting purposes. The recommended project budgets for each project are listed in Table 6-2 A detailed breakdown of the construction costs, contingency, design, and administration costs are included in Appendix C.

As noted previously, the recommended pipe sizes and capacities are based on complete buildout of the UGB in its current configuration. The decision to size pipelines to convey peak flows associated with buildout conditions is based on the fact that buried pipelines are not well suited for incremental expansion. In other words, it is more cost effective in the long-run to install pipelines sized for complete buildout of the upstream basin rather than for 20-year flow projections.

To address the I/I problems in the collection system, the I/I reduction plan (i.e., Program-1) is recommended. This program is discussed in greater detail above.

To provide service to areas that are currently undeveloped, future pump station locations and conceptual gravity piping alignments are also recommended. It is important to note that the actual alignment of these sewers will likely change from those shown when the undeveloped areas are platted and the public right of ways are established.

6.5.1 Improvements to the Existing Gravity Collection System

This section includes a description of the recommended improvements to the existing gravity collection piping. As described above, most of the existing collection system piping is adequately sized to convey the peak flows at buildout of the study area. However, some of the main trunk lines are undersized and will need to be upsized. These are discussed below.

- *Olney Street Sewer (9th Street to 4th Street) (Project G-1)*

The existing 10-inch diameter pipeline lacks the capacity to convey existing and projected peak flows and surcharges on a regular basis. This pipeline is also relatively old and collects a significant amount of I/I. The recommended improvements include replacing the existing pipeline with approximately 1,150 feet of new 18-inch diameter pipe in the same alignment as the existing pipe. The project also includes the replacement of the manholes and service laterals. The total recommended budget for this project is $438,000. A detailed breakdown of this budget is included in Appendix C.

- *4th Street Sewer (Olney Street to Del Mar Drive) (Project G-2)*

The existing 10-inch diameter pipeline lacks the capacity to convey existing and projected peak flows and surcharges on a regular basis. This pipeline is also relatively old and collects a significant amount of I/I. The recommended improvements include replacing the existing pipeline with approximately 1,100 feet of new

18-inch diameter pipe in the same alignment as the existing pipe. The project also includes the replacement of the manholes and service laterals. The total recommended budget for this project is $414,000. A detailed breakdown of this budget is included in Appendix C.

- *9th Street Sewer (Olney Street to Del Mar Drive) (Project G-3)*

The existing 10-inch diameter pipeline lacks the capacity to convey existing and projected peak flows. This pipeline is also relatively old and collects a significant amount of I/I. The recommended improvements include replacing the existing pipeline with approximately 950 feet of new 15-inch diameter pipe in the same alignment as the existing pipe. The project also includes the replacement of the manholes and service laterals. The total recommended budget for this project is $328,000. A detailed breakdown of this budget is included in Appendix C.

- *Del Mar Drive Sewer (9th Street to 11th Street) (Project G-4)*

The existing 10-inch diameter pipeline lacks the capacity to convey existing and projected peak flows. This pipeline is also relatively old and collects a significant amount of I/I. The recommended improvements include replacing the existing pipeline with approximately 950 feet of new 12-inch diameter pipe in the same alignment as the existing pipe. The project also includes the replacement of the manholes and service laterals. The total recommended budget for this project is $268,000. A detailed breakdown of this budget is included in Appendix C.

- *5th Street Sewer (4th/Clover Intersection to 5th/Cleveland Intersection) (Project G-5)*

The project includes upsizing the sewer mainline in Clover Street between 4th & 5th Streets and the mainline in 5th Street from Clover Street to Cleveland Street. The existing 8-inch diameter pipes lack the capacity to convey existing and projected peak flows and surcharge on a regular basis. These pipes also are also relatively old. The recommended improvements include replacing the existing pipes with approximately 1,080 feet of new 12-inch diameter pipe in the same alignment as the existing pipes. The project also includes the replacement of the manholes and service laterals. The total recommended budget for this project is $355,000. A detailed breakdown of this budget is included in Appendix C.

- *11th Street Sewer (Del Mar Drive to Lincoln Street) (Project G-6)*

The existing 8-inch diameter pipeline lacks the capacity to convey existing and projected peak flows. This pipeline is also relatively old and collects a significant amount of I/I. The recommended improvements include replacing the existing pipeline with approximately 660 feet of new 12-inch diameter pipe in the same alignment as the existing pipe. The project also includes the replacement of the manholes and service laterals. The total recommended budget for this project is $216,000. A detailed breakdown of this budget is included in Appendix C.

- *Del Mar Drive Sewer (4th/Delmar Intersection to Gordon/1st Intersection) (Project G-7)*

The existing 8-inch diameter pipe on Del Mar Drive east of the Del Mar/4th Street Intersection lacks the capacity to convey the projected peak flows from the undeveloped areas in the north east part of the City. This area includes the Gordon Lane Sewer Basin. To serve these areas, a new 12-inch diameter pipe is recommended. The line entering the manhole at the intersection of 4th and Del Mar from the east has a significant vertical drop. The new pipeline should be constructed at the maximum depth possible (i.e., about 0.25 feet above the outlet invert) from this manhole and at minimum grades to the east. This will result in the deepest pipe installation possible and will increase the amount of area that can be served by gravity sewers in the Gordon Lane Sewer Basin. From the manhole at the 4th Street/Del Mar Drive Intersection, the new pipeline will extend east to 1st Street. This will require an auger bore crossing of the railroad tracks. From 1st

Street the pipeline will extend south and connect to the exiting 8 inch pipe that continues on to Willamette Street. The recommended improvements include a total pipeline length of approximately 800 feet. The project also includes about four new manholes and the replacement of the service laterals along Del Mar Drive. The total recommended budget for this project is $356,000. A detailed breakdown of this budget is included in Appendix C.

6.5.2 Extensions to Serve Undeveloped Areas

Several areas of undeveloped land exist inside the study area. Some of these parcels will be served by relatively short extensions of the existing system that are relatively obvious. The sewer basin boundaries shown in Figure 6-2 and Figure 6-3 indicate the location from which gravity sewers should be extended to serve undeveloped areas. In general, all areas within a particular sewer basin should be served from the existing sewer lines in that sewer basin. As the undeveloped areas within the City develop, adjustments of the sewer basin boundaries are inevitable and acceptable as long as the adjustments are relatively minor.

The relatively short extensions that are needed to serve some undeveloped pockets in the City are not discussed in this section since the needed line extensions are relatively obvious. This section is mainly focused on the improvements needed to serve the larger undeveloped sewer basins within the study area. These include the West Olney Basin, the Gordon Lane Basin, West UGB Basin, and the Mill Creek Basin. The following subsections describe the improvements required to serve these areas. Project budgets are presented for pump station and forcemains needed to serve these areas. Gravity sewers will also be needed to serve these areas. In the Gordon Lane Basin, the gravity sewers will connect to the existing gravity collection system near the intersection of 1st Street and Gordon Lane (See Project G-7). In the West Olney, West UGB, and Mill Creek Basin, the gravity sewers will drain to pump stations. Project budgets are not presented for the gravity sewers since the future right of way alignments cannot be known at this time. Overall, it is envisioned that the gravity sewers, pump stations, and forcemains needed to serve these areas will be constructed and paid for by developers rather than from City funds. These improvements are included in this plan to illustrate how these areas are to be served and how flow from these areas is to be routed though the City's collection system. The pipeline sizes for the recommended improvements discussed above, are based on the flow routing shown in Figure 6-2 and Figure 6-3. Therefore, it is important that new facilities installed to serve these areas be connected to the existing system as shown in these figures.

- *West Olney Basin Pump Station and Forcemain (Project E-1)*

The West Olney Basin is an undeveloped basin located northwest corner of the City. The basin consists of a four relatively large tax lots. The ground surface in this area generally slopes to the northwest and is too low in elevation to be served by gravity sewers from the City's system. Any development in this area will require new gravity sewers, a pump station, and a forcemain. The pump station should be constructed at a sufficient depth to extent gravity sewers from the pump station to the edge of the basin boundary. The Pump Station should be located near the northwest corner of the basin. A forcemain pipe will be needed to convey the water to the gravity collection system in Olney Street. The pump station should be sized for a minimum firm capacity of 0.24 mgd or about 165 gallons per minute. Figure 6-2 shows the conceptual location of the station and forcemain. The station should consist of a concrete wet well, two solids-handling submersible pumps, a valve vault, and a small building to house the pump control equipment and the backup power generator. The forcemain will generally run south and east from the pump station site and connect to the gravity piping in Olney Street. The pipeline length is estimated to be about 2,300 feet. A 4 inch diameter forcemain pipe should be sufficient. The total recommended budget for this project is

$1,582,000. A detailed breakdown of these costs is included in Appendix C. It is envisioned that these facilities will be constructed by a private developer. Figure 6-2 also shows a conceptual layout of the gravity sewer piping that drains to the pump station. However, this is simply to demonstrate the concept. The actual sewer alignments will vary depending on the property development details. That said, the gravity sewer lines should be designed in accordance with the City's design standards with pipes no smaller than 8-inches in diameter.

- *Gordon Lane Basin Gravity Sewers (Project E-2)*

The Gordon Lane Sewer Basin is an undeveloped basin located in the northeast corner of the City. The area primarily consists of commercial and industrial property. The ground surface generally slopes from the east to the west. Therefore, the most of the basin should be able to be served by gravity. Project G7 described above includes a pipeline extension east from the Del Mar Drive/4th Street Intersection to First Street. Once this project is completed, new sewer lines can be extended north and east from 1st Street to serve this area. It is important to note that all gravity sewers downstream of this connection point are currently operating at their capacity and will need to be upsized before service can be extended into the Gordon Lane Basin. This includes projects G1, G2, and G7. All three of these projects must be completed before new sewers are extended to serve the Gordon Lane Basin. Figure 6-2 shows a conceptual alignment for the Gordon Lane Basin gravity sewer extensions, but these alignments are just to demonstrate the concept. Since the alignments of the future right of ways and the details of the development are not known at this time, it is premature to provide a cost estimate for these sewer lines. It is envisioned that these sewer extensions will be constructed and paid for by developers. Therefore, there is no real reason to present the costs in this document. That said, the gravity sewer lines should be designed in accordance with the City's design standards with pipes no smaller than 8-inches in diameter.

- *West UGB Pump Station and Forcemain (Project E-3)*

The West UGB Basin is an undeveloped basin located along the western edge of the UGB. The basin consists of lots zoned for residential use. The ground surface in this area generally slopes to the west and is too low in elevation to be served by gravity sewers from the existing gravity sewers in the area. Any development in this area will require new gravity sewers, a pump station, and a forcemain. The pump station should be constructed at a sufficient depth to extent gravity sewers from the pump station to the northern and southern edges of the basin. The Pump Station should be located near the center of the basin as shown in Figure 6-3. A forcemain pipe will be needed to convey the water to the gravity collection system in 11th Street. The forcemain must discharge into one of the manholes in 11th Street north of the 11th Street/Lincoln Street Intersection. The sewer lines upstream of this intersection do not have the capacity to accept the flow from the basin. The pump station should be sized for a minimum firm capacity of 0.17 mgd or about 120 gallons per minute. Figure 6-2 shows the conceptual location of the station and forcemain. The station should consist of a concrete wet well, two solids-handling submersible pumps, a valve vault, and a small building to house the pump control equipment and the backup power generator. The forcemain will generally run east from the pump station site and connect to the gravity piping in 11th Street. The pipeline length is estimated to be about 750 feet. A 4 inch diameter forcemain pipe should be sufficient. The total recommended budget for this project is $1,365,000. A detailed breakdown of these costs is included in Appendix C. It is envisioned that these facilities will be constructed by a private developer. Figure 6-3 also shows a conceptual layout of the gravity sewer piping that drains to the pump station. However, this is simply to demonstrate the concept. The actual sewer alignments will vary depending on the property development details. That said, the gravity sewer lines should be designed in accordance with the City's design standards with pipes no smaller than 8-inches in diameter.

- *Mill Creek Basin Pump Station and Forcemain (Project E-4)*

The Mill Creek Basin is an undeveloped basin located southeast corner of the City. The basin consists of lots zoned for industrial use. The ground surface in this area generally slopes to the south and is too low in elevation to be served by gravity sewers from the City's system. Any development in this area will require new gravity sewers, a pump station, and a forcemain. The pump station should be constructed at a sufficient depth to extent gravity sewers from the pump station to the edge of the basin boundaries. The Pump Station should be located near the center of the basin. A forcemain pipe will be needed to convey the water to the gravity collection system in Mill Creek Road. The pump station should be sized for a minimum firm capacity of 0.17 mgd or about 120 gallons per minute. Figure 6-3 shows the conceptual location of the station and forcemain. The station should consist of a concrete wet well, two solids-handling submersible pumps, a valve vault, and a small building to house the pump control equipment and the backup power generator. The forcemain will generally run north from the pump station site and connect to the gravity piping in Mill Creek Road. The pipeline length is estimated to be about 500 feet. A 4 inch diameter forcemain pipe should be sufficient. The total recommended budget for this project is $1,330,000. A detailed breakdown of these costs is included in Appendix C. It is envisioned that these facilities will be constructed by a private developer. Figure 6-3 also shows a conceptual layout of the gravity sewer piping that drains to the pump station. However, this is simply to demonstrate the concept. The actual sewer alignments will vary depending on the property development details. That said, the gravity sewer lines should be designed in accordance with the City's design standards with pipes no smaller than 8-inches in diameter.

6.6 SUMMARY OF RECOMMENDATIONS

The recommended improvements described above are summarized in Table 6-2 and are shown in the figures below. These improvements will result in a sewage collection system with the capacity needed to convey flows from within the planning area assuming development to current zoning densities.

The recommended improvements are based on the complete development of the land within the UGB. Therefore, some of the improvements may not be required during the planning period. The improvements address existing deficiencies, as well as potential deficiencies at the end of the planning period and at buildout. Only the improvements that address the existing deficiencies are required at this time. The remaining deficiencies are growth dependent. Of these, some may be required before the end of the planning period and some may not. The improvements are prioritized in Chapter 8.

The alignment of future lines through the undeveloped portions of town has not yet been definitively determined. The final alignment of sewer lines in these areas should be determined as property develops. Sewer lines should be placed within right-of-ways whenever possible. If the City Limits or UGB are to be expanded in the future, the sewer system should be re-examined to determine where additions are needed and if alternate alignments are justified.

Table 6-2 | Recommended Collection System Improvements

Project Code	Project Description	Recommended Diameter/Capacity	Length	Project Cost (1)
Improvements to the Existing Gravity Collection System				
G-1	Olney Street Sewer (9th Street to 4th Street)	18	1150	$438,000
G-2	4th Street Sewer (Olney Street to Del Mar Drive)	18	1100	$414,000
G-3	9th Street Sewer (Olney Street to Del Mar Drive)	15	950	$328,000
G-4	Del Mar Drive Sewer (9th Street to 11th Street)	12	950	$268,000
G-5	5th Street Sewer (4th/Clover Intersection to 5th/Cleveland Intersection)	12	1080	$355,000
G-6	11th Street Sewer (Del Mar Drive to Lincoln Street)	12	660	$216,000
G-7	Del Mar Drive Sewer (4th/Delmar Intersection to Gordon/1st Intersection)	12	800	$356,000
Sewer System Extension Projects				
E-1	West Olney Basin Pump Station and Forcemain	4” / 0.24 mgd	2300	$1,582,000
E-2	Gordon Lane Basin Gravity Sewers		NA	
E-3	West UGB Basin Pump Station and Forcemain	4” / 0.17 mgd	750	$1,365,000
E-4	Mill Creek Basin Pump Station and Forcemain	4” / 0.17 mgd	500	$1,330,000
General Collection System				
Pgm-1	Annual Sewer Collection System Rehabilitation Program (Program – 1)	-	-	$30,000 per year

(1) Costs are in 2021 dollars. ENR 20 Cities Index = 12,200

Figure 6-2 | Recommended Collection System Improvements - North

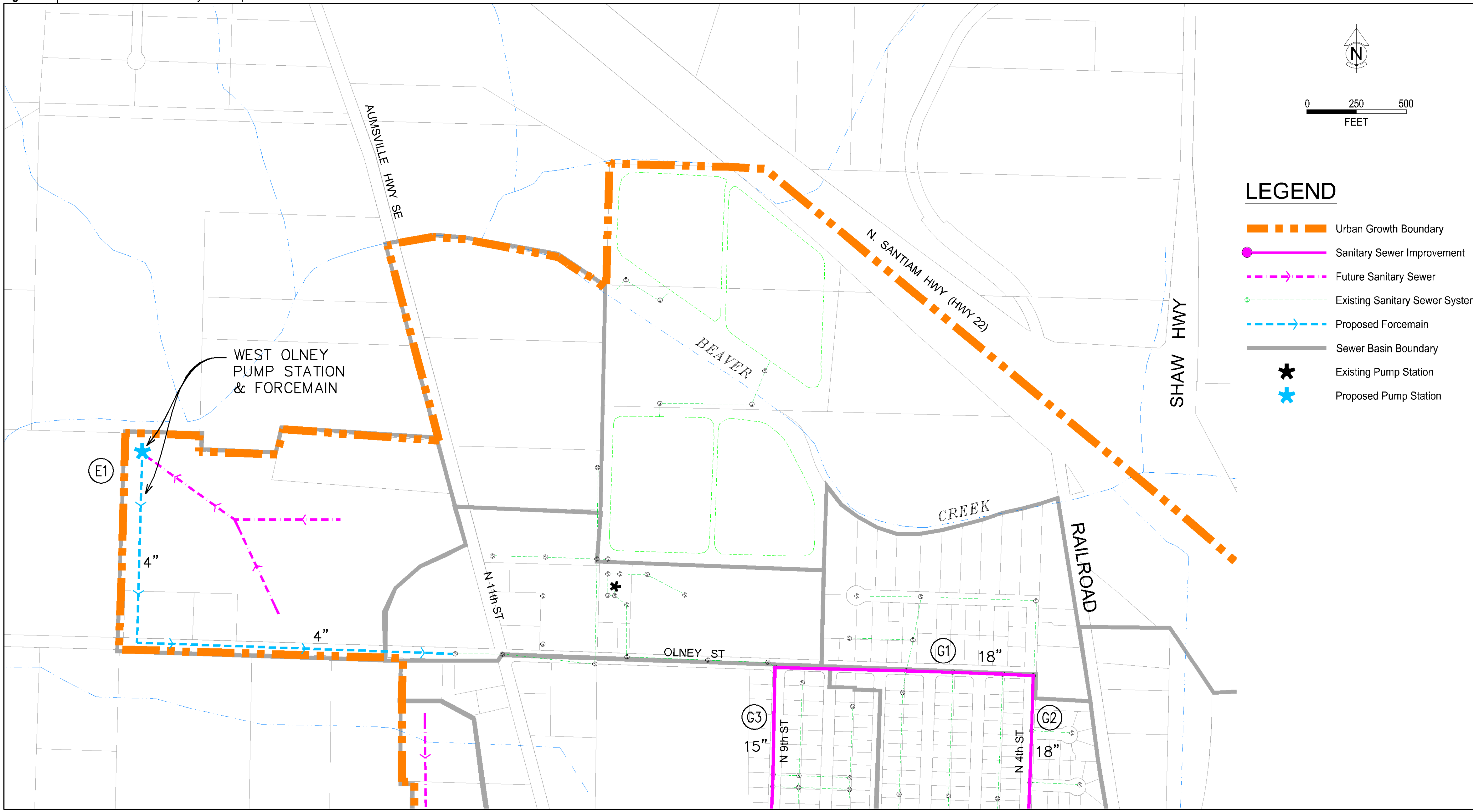


FIGURE 6-2

Figure 6-3 | Recommended Collection System Improvements – South

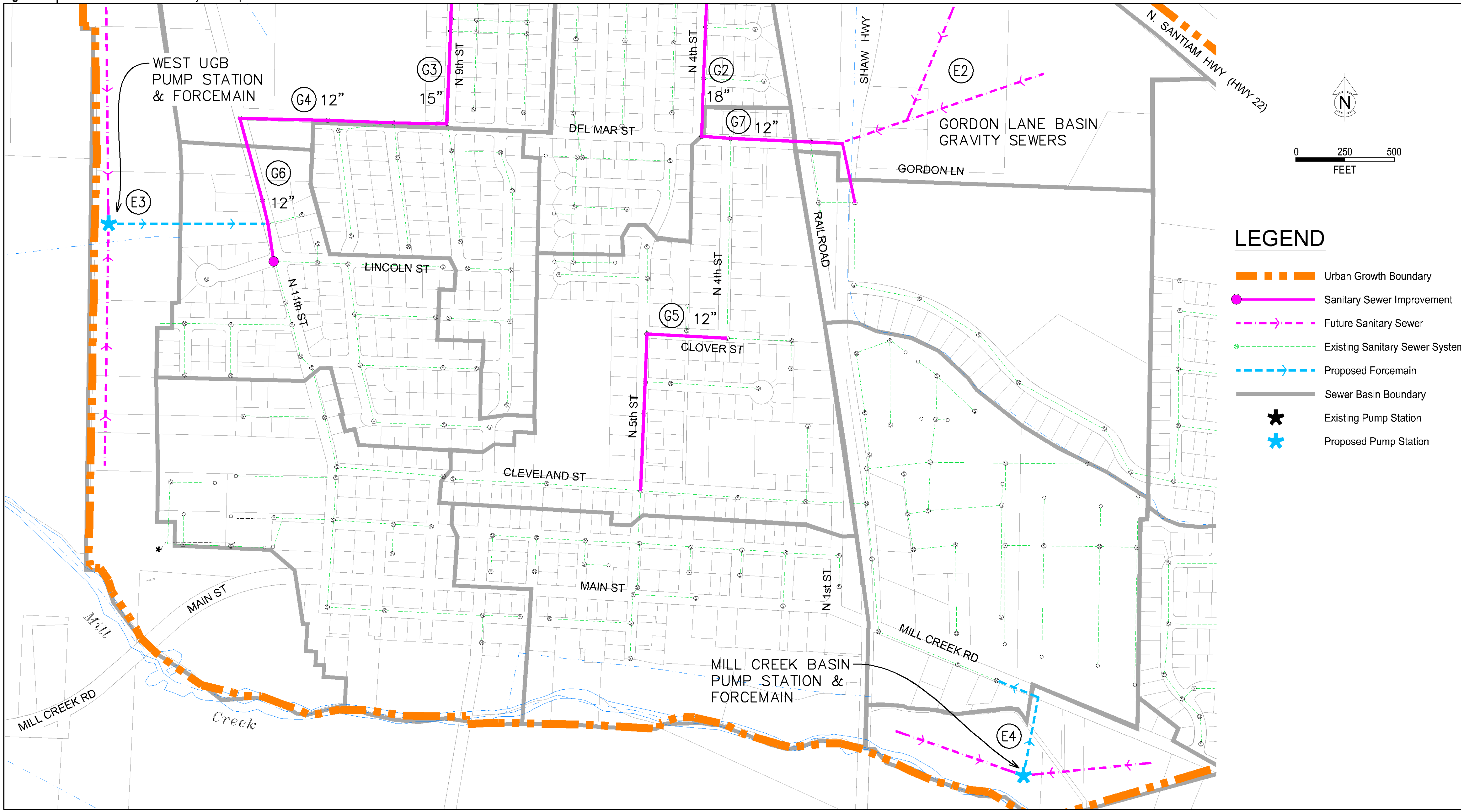


FIGURE 6-3

CHAPTER 7

TREATMENT SYSTEM EVALUATION

Chapter Outline

7.1 Introduction
7.2 Existing Treatment System Deficiencies
7.3 Treatment System Evaluation
- 7.3.1 Influent Pump Station
- 7.3.2 Hydraulic Storage Capacity
- 7.3.3 Organic Treatment Capacity
- 7.3.4 Discharge Facilities Capacity Evaluation
- 7.3.5 Chlorine Contact Chamber Capacity
- 7.3.6 Receiving Stream Capacity
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- 7.5.1 Treatment Alternative 1: Sequencing Batch Reactors (SBR)
- 7.5.2 Treatment Alternative 2: Aerated Lagoons with Fixed Film Process
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- 7.5.4 Other Treatment Plant Alternatives
- 7.5.5 Comparison of Alternatives
- 7.5.6 Preferred Alternative (Project T-1)

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TREATMENT SYSTEM EVALUATION

CHAPTER 7

7.1 INTRODUCTION

Chapter 4 includes a listing of existing treatment system deficiencies (Section 4.5.11). This chapter builds on the information from Chapter 4 by evaluating the existing treatment system with respect to future flows and loads. The deficiencies identified in Chapter 4 are first summarized. This is followed by a detailed analysis of the existing treatment and disposal system with respect to future flows and loads. The purpose of this analysis is to identify treatment system components that are likely to become deficient during the planning period as a result of increased flows and loads due to growth. A comprehensive list of existing and projected shortcomings is then presented.

The second portion of this chapter includes a listing of the recommended improvements to address each deficiency. In some cases, the recommended improvement is relatively straightforward and a detailed alternatives analysis is not included. In cases where the recommended improvement is not obvious, a more detailed alternatives analysis is presented. This chapter concludes with a listing of the recommended improvements for the treatment system.

7.2 EXISTING TREATMENT SYSTEM DEFICIENCIES

For completeness, the treatment system shortcomings identified in Chapter 4 are listed in this subsection. These shortcomings include the following items.

- The existing treatment plant is unable to comply with the ammonia limits listed in the NDPES permit.
- The pumps, controls, and generator at the Influent Pump Station will likely require an overhaul due to age and normal wear and tear.
- Various mechanical components of the headworks screen and control system will likely require an overhaul during the planning period due to age and normal wear and tear.
- The lagoon transfer structures will reach the end of their useful life during the planning period.
- Sludge accumulation in the lagoons is becoming significant, and the City should plan to remove sludge during the planning period.
- The irrigation pump station lacks redundancy. Particularly for the pump delivering water to the South Irrigation Site. This lack of redundancy may lead to lagoon water management problems if the pump were to fail during a critical time.
- The City has outgrown the existing lab and office space and much of the treatment facilities lack a backup power generation system.

7.3 TREATMENT SYSTEM EVALUATION

This section includes a quantitative evaluation of the treatment plant with respect to the projected wastewater flows and loadings. The purpose of this analysis is to identify treatment system components that are likely to become deficient during the planning period as a result of increased flows and loads due to population growth.

7.3.1 Influent Pump Station

The existing influent pump station is relatively new and in good condition. The station is equipped with three equally sized pumps. The firm capacity of the station is 6.48 MGD with two of the three pumps running. In the last 5 years, the largest daily flow recorded at the treatment plant was about 2 MGD. This included a large winter storm in December of 2015. The projected peak hourly flow at end of the planning period is estimated to be about 5.6 MGD. Therefore, the pumping capacity of the station should be sufficient for the remainder of the planning period and the work required at the pump station is mainly to address normal wear and aging of the mechanical and electrical components.

7.3.2 Hydraulic Storage Capacity

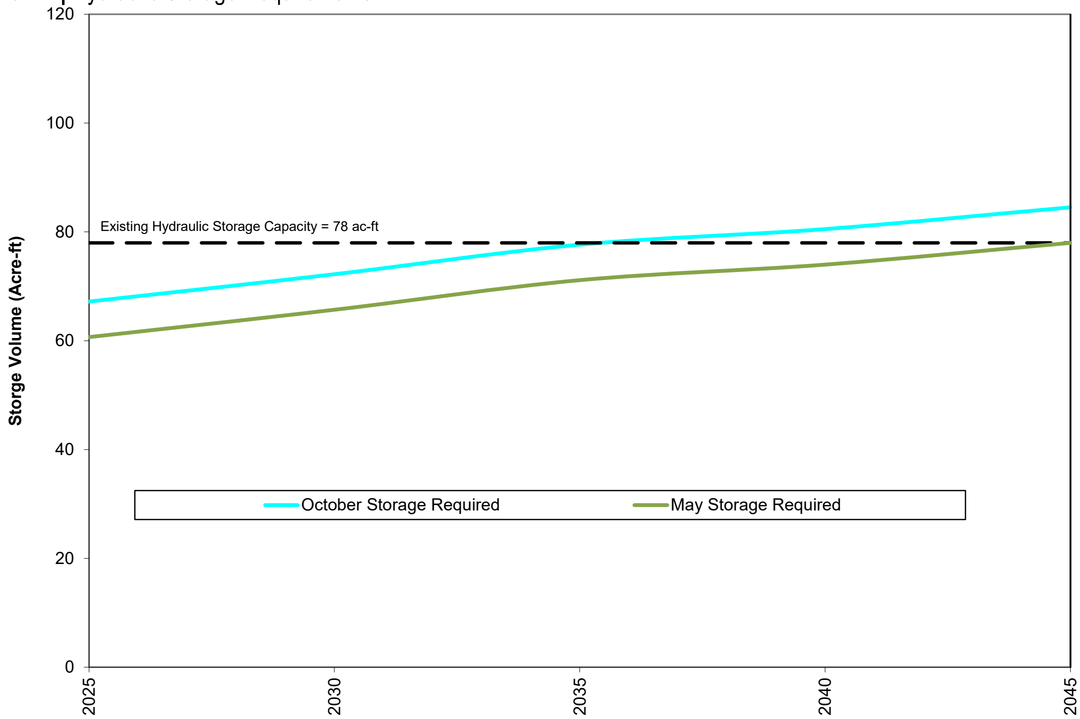
Throughout the year, there are two periods of time when the City is unable to discharge treated effluent from and all wastewater that flows into the plant must be stored in the lagoons. This occurs in the spring and late fall. The City's current discharge permit does not allow discharge to the receiving stream to occur between May 1 and November 1. During a wetter than average spring, the irrigation sites can be too wet to receive water until early June and all wastewater must be stored in the lagoons. During wetter that average fall conditions, the City may need to stop irrigating by the end of September and water must be stored in the lagoons until the start of the winter discharge season on November 1.

The existing storage capacity provided by the lagoons is approximately 78 acre-feet (Table 4-4). To evaluate the adequacy of this volume a water balance can be performed for the spring and late fall. The water balance includes summing all the water inputs and outputs from the lagoons to estimate the total storage requirements. Water balances were performed for various years during the planning period to estimate the total storage requirements for each year. The resulting storage requirements are plotted with the storage capacity of the treatment system in Figure 7-1. The calculations show that the storage requirements for the fall are slightly greater than the spring. Therefore, fall storage requirements control the sizing of the lagoons. The calculations are based on the following assumptions.

- Based on flow record, the average influent flow during wetter than average spring and fall conditions is approximately 1.4 times the average dry weather flow for the entire non-discharge season of May 1 – October 31. Therefore, a peaking factor of 1.4 is used to estimate influent flow during the spring and fall storage seasons.
- Zero wastewater outflow
- The pan evaporation is 4.59 inches and 2.3 inches for May and October respectively [5]. Pan evaporation is multiplied by a pan coefficient of 0.745 to estimate the free surface evaporation from the lagoons[6].
- The rainfall is 3.1 inches and 4.2 inches for May and October respectively[6].

[5] Western Regional Climate Center data for Corvallis State University Weather Station
[6] Western Regional Climate Center data for Stayton, Oregon

Figure 7-1 | Hydraulic Storage Requirements



The water balance calculations show that the existing facilities as currently operated lack the storage volume needed to store water during the spring and fall storage seasons for the entire planning period. At the present time, the storage volumes are acceptable. However, as flows increase in response to the anticipated growth, the above analysis shows that the storage requirements will exceed the capacity of the lagoons at the about the mid-point of the planning period. Therefore, improvements or operational changes will be needed to increase the storage capacity of the plant or decrease the volume of water that must be stored.

7.3.3 Organic Treatment Capacity

The lagoons provide primary and secondary treatment of the waste stream. The organic treatment capacity of the lagoons is finite. If this capacity is exceeded compliance problems will result. The organic treatment capacity of the lagoons varies depending upon many factors. These include the water temperature, the flowrate through the lagoons, and the water level or volume in the lagoons. Assuming maximum month wet weather flows, winter time temperatures, and average water depths, a kinetic analysis of the lagoons using typical kinetic values shows that the lagoons should be able to treat about 1300 pounds of BOD per day at the design year maximum month wet weather flow of 1.88 MGD. The projected BOD load at the end of the planning period is about 1650 pounds per day (Table 5-8) which is greater than the estimated treatment capacity of the lagoons. This is a fairly simplistic analysis, but it does demonstrate that the lagoons lack the organic treatment capacity needed at the end of the planning period. Therefore, improvements to increase the organic treatment capacity are needed.

In addition to BOD removal, the existing lagoons are not capable of reducing effluent ammonia concentrations to the levels required by the NDPES permit. Therefore, improvements are needed for this reason as well.

7.3.4 Discharge Facilities Capacity Evaluation

Once water enters the first lagoon cell, the flowrate through the plant is controlled by the discharge rate selected by the operator. During the winter months, the discharge rate is adjusted by opening and closing a valve on the cell 4 outlet piping. Water flows through the valve to the chlorine contact chamber and through the contact chamber to the outfall pipeline and ultimately to Beaver Creek. Winter discharge occurs entirely by gravity. During the summer season, a vertical turbine pump near the cell 4 outlet pipe is used to convey water to the irrigation site. This pump operates at a constant speed and the discharge rate during the summer months is currently fixed by the size of the existing pump.

An analysis of the various hydraulic facilities used to convey water from cell 1 all the way through the plant to the outfall was performed and the piping is currently capable of conveying about 1.5 MGD without excessive head loss. For the purposes of this study, the firm capacity of the winter discharge facilities will be taken as 1.5 MGD. During the summer discharge season (May – October) the irrigation pump is used to discharge effluent at a current rate of about 500 gallons per minute or 0.72 MGD.

To determine if these capacities are adequate, water balances were performed on a seasonal basis. The water balances include summing all the inputs and outputs from the lagoons to determine the minimum discharge rate that is needed to convey the treated water through the plant and dispose of water that accumulated during the previous non-discharging period. Water balances were performed for various years during the planning period to estimate the required minimum discharge rate for each year.

As the City grows, flow to the plant will steadily increase and the amount of water that must be discharged will also increase. For winter discharge operation, the minimum required discharge rates are plotted with the discharge capacity of the treatment plant in Figure 7-2. For summer irrigation operation, the minimum required irrigation rates are plotted with the irrigation capacity of the treatment plant in Figure 7-3. The water balance calculations are based on the following assumptions.

- While the total winter discharge season is 184 days, winter discharge only occurs over 170 days. This assumption is to account for days when the receiving stream flows are too low to receive discharge.
- While the total summer season is 181 days, the summer discharge (i.e., irrigation) only occurs over 95 days during the summer months. This assumption is to account for days when the fields are being harvested and when irrigation would otherwise damage the crop.
- The average November – April rainfall depth is 38.74 inches[7].
- The average May – October rainfall depth is 13.56 inches[8].
- There is no evaporation during the winter discharge season.
- The average May – October pan evaporation is 32.76 inches[9].
- Pan evaporation is multiplied by a pan coefficient of 0.745 to estimate the free surface evaporation from the lagoons, which equals 28.4 inches.
- Zero lagoon seepage. This is conservative since some seepage from the lagoons will occur.
- 78 acre-feet of water stored in the lagoons must be discharged during the winter and summer discharge seasons.

[7] Western Regional Climate Center data for Stayton Oregon
[8] Western Regional Climate Center data for Stayton Oregon
[9] Western Regional Climate Center data for Corvallis State University Weather Station

Figure 7-2 | Required Plant Winter Discharge Rate

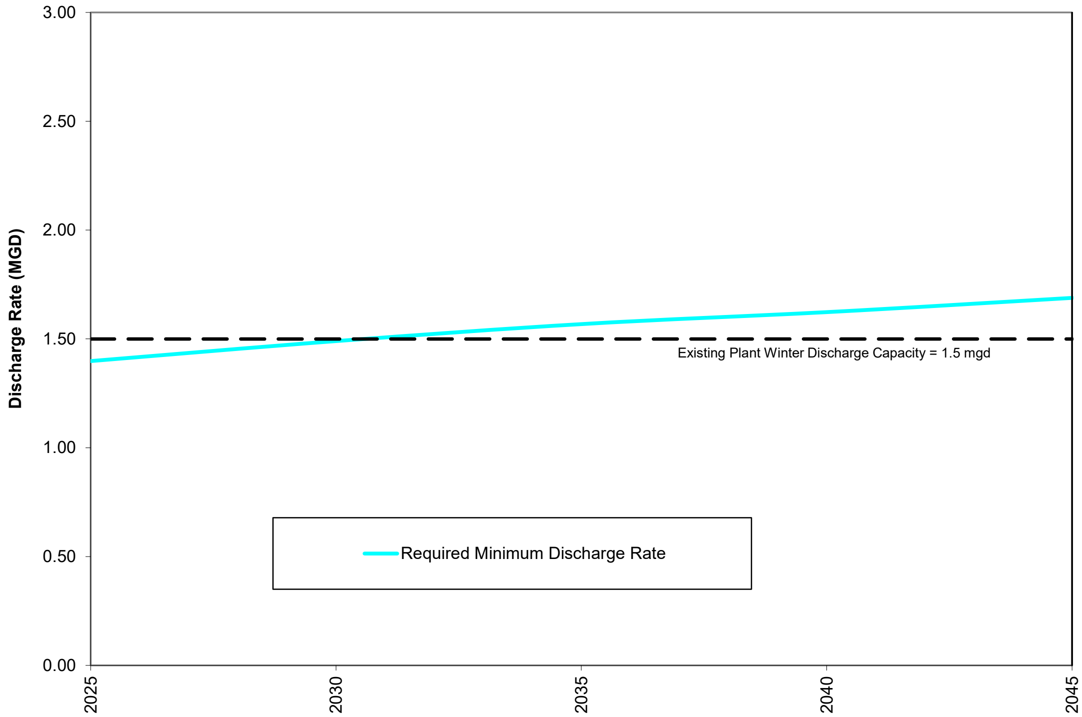
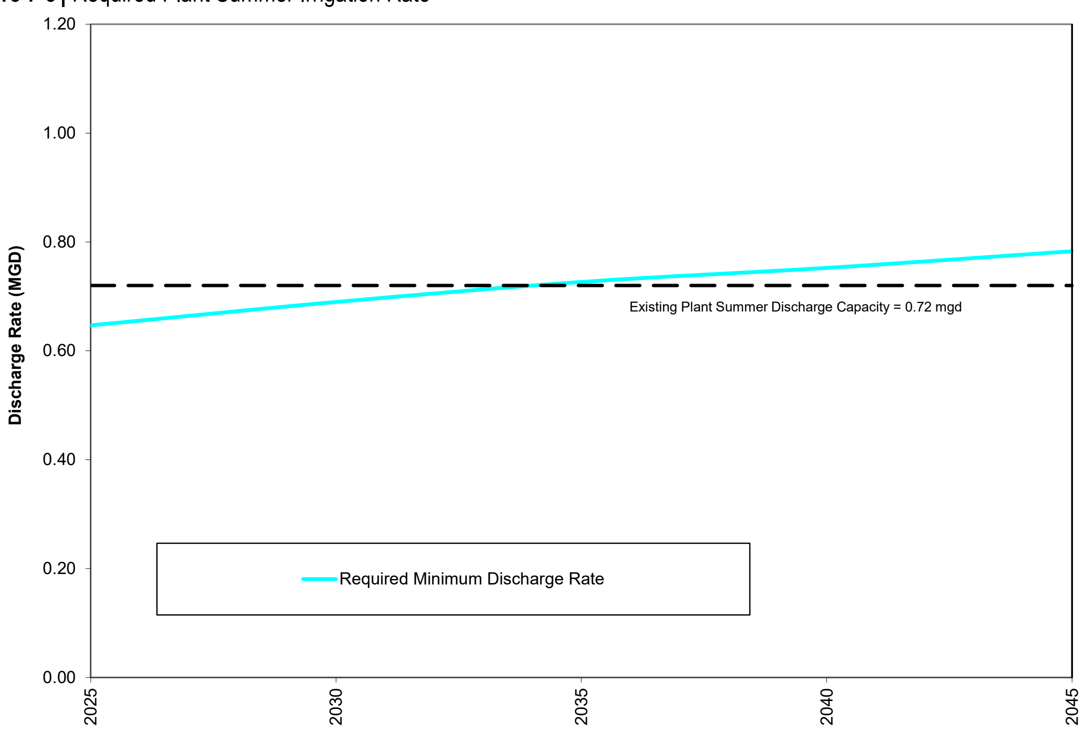


Figure 7-3 | Required Plant Summer Irrigation Rate



As shown in Figure 7-2 and Figure 7-3, the discharge rates required to dispose of the increased wastewater flows that are anticipated to occur during the planning period are greater than the current discharge capacity of the winter outfall facilities and the existing irrigation pumping facilities. Therefore, improvements to increase the plant discharge rates will be needed during the planning period.

7.3.5 Chlorine Contact Chamber Capacity

Chlorine is added to disinfect the effluent prior to disposal. Disinfection by chlorine requires contact time with the effluent. During the winter discharge season, contact time is provided in the chlorine contact chamber that is south of cell 4. During the summer irrigation season contact time is provided in the pipeline between the treatment plant and the irrigation site. Contact chambers are typically sized to provide 60 minutes of contact time at average discharge rates. Using this value, the capacity of the winter-discharge contact chamber is about 0.9 MGD and the capacity of the summer irrigation contact chamber is about 0.7 MGD. As shown above in Figure 7-2 and Figure 7-3, the City is going to need to discharge at higher rates during the planning period. This is true for both the winter and summer conditions. Therefore, improvements to increase the amount of contact time are required during the planning period.

7.3.6 Receiving Stream Capacity

Treated effluent is discharged to Beaver Creek during the wet weather discharge season (November – April). Discharge to the receiving stream is regulated by the City's existing NPDES permit (Section 3.3). The NPDES permit requires effluent BOD and TSS concentrations below 30 mg/L and 50 mg/L respectively. Total BOD and TSS effluent mass loads are also limited to 170 and 280 pounds per day on an average monthly basis respectively. At effluent BOD and TSS concentrations of 30 mg/L and 50 mg/L respectively, the discharge rate cannot exceed 0.68 mgd (170 ppd ÷ 30 mg/L ÷ 8.34 = 0.68 mgd). The City routinely discharges at higher rates than 0.68 mgd and is allowed to do so because effluent BOD and TSS concentrations are typically lower than 30 mg/l and 50 mg/L respectively.

As growth in the community continues, the amount of water that will need to be discharged will increase. Water balance calculations (Figure 7-2) show that the City will need to discharge at average rate of approximately 1.8 MGD at the end of the planning period. In order to discharge at 1.8 MGD in compliance with the permitted mass loads, effluent BOD and TSS concentrations must be below 11 mg/L and 18 mg/L respectively. The existing treatment facilities are not capable of consistently producing water of the quality needed to discharge 1.8 MGD. Therefore, improvements will be needed to increase the overall BOD and TSS removal efficiency of the plant.

7.3.7 Capacity of Land Application Facilities

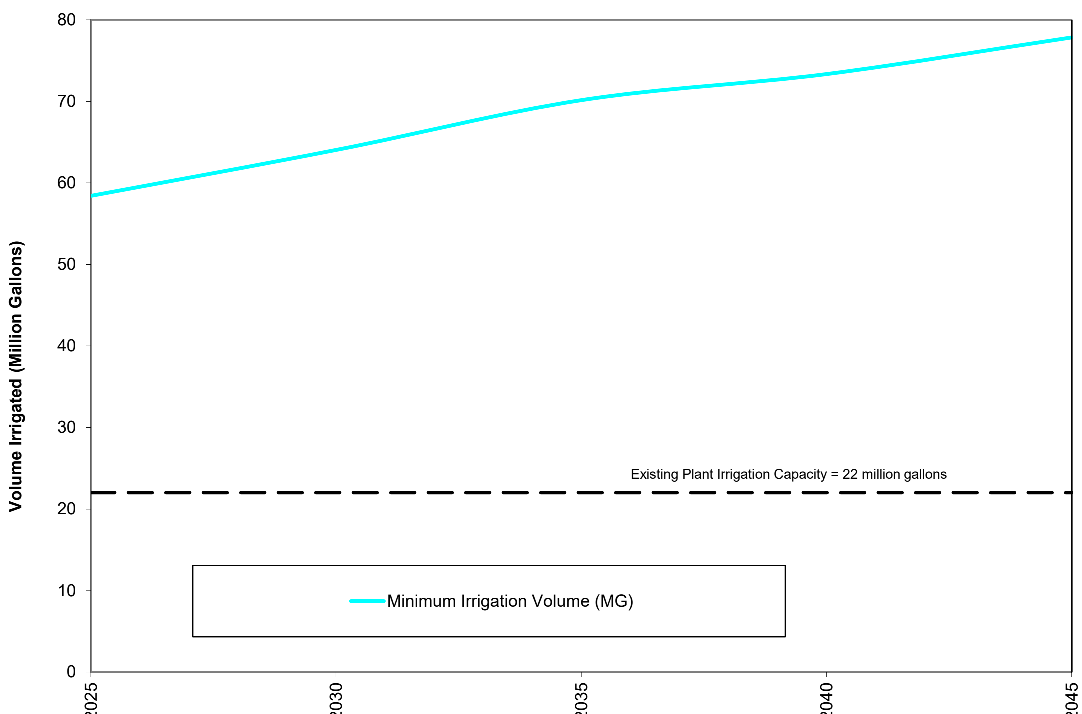
During the dry weather irrigation season (May – October), treated effluent is disposed by irrigating a grass seed crop at the City's irrigation site located south of the City. The total area that is currently irrigated is approximately 55 acres. Effluent is distributed on the field using a center pivot irrigation sprinkler. During the irrigation season (May-October), grass seed crops can accept about 20 inches of supplemental irrigation[10] on average. This is in addition to precipitation that naturally falls on the fields. In practice, grass seed growers do not generally irrigate the crops when pollination is occurring and during harvest. As such, the practical application rate is less than 20 inches. For the purposes of this plan, the average gross irrigation rate is assumed to be about 15 inches per year. This value will be used for the remainder of the calculations in this section. Multiplying the gross irrigation rate (15 inches per year) by the total area available for irrigation (55 acres) and converting units results in a total irrigation capacity of about 22 million

[10] Oregon Crop Water Use and Irrigation Requirements, Table 5, OSU Extension Service

gallons per year. In other words, the exiting land disposal system can accept approximately 22 million gallons per year on average during the May – October irrigation season.

To determine if 22 million gallons per year is sufficient to dispose of effluent during the summer irrigation season, water balance calculations were performed for the May through October irrigation season. The assumptions used for the water balance calculations are generally the same as used above (section 7.3.4). The increase in the minimum volume of water that must be irrigated over the planning period is shown in Figure 7-4. As shown in Figure 7-4, the minimum amount of water that must be irrigated is already greater than the capacity of the existing land application site. The calculated minimum amount of water that must be irrigated is based on the assumption that the lagoon water levels will be reduced to minimum levels by the end of the irrigation season. In practice, the City has not typically done this. The water levels are only nominally decreased during the summer irrigation season. This approach has worked successfully because the lagoons provide more storage volume that is currently needed in the Fall (Figure 7-1). However, as the City continues to grow and flows increase, The City will need to get more aggressive about lowering the lagoon water levels during the irrigation season in order to ensure that adequate storage is available for the fall storage season. In order to accomplish this, the City is going to need to make improvements that either reduce the amount of water that must be irrigated during the summer season or increase the area of land that is being irrigated.

Figure 7-4 | Minimum Irrigation Volume Requirements



7.4 SUMMARY OF TREATMENT SYSTEM DEFICIENCIES

The previous subsection (section 7.3) includes an analysis of the plant with respect to its ability to treat and dispose of the future flows and loadings anticipated during the planning period. This analysis revealed a number shortcomings that will likely need to be addressed during the planning period. In addition to these projected shortcomings, a number of existing shortcomings were also identified in Chapter 4 (see section 7.2). For the sake of completeness, all of the existing and projected deficiencies are summarized in Table 7-1.

Table 7-1 | Summary of Treatment System Deficiencies

Deficiency Number	Description
D-1	The existing treatment plant is unable to comply with the ammonia limits listed in the NDPES permit..
D-2	The pumps, controls, and generator at the Influent Pump Station will likely require an overhaul due to age and normal wear and tear.
D-3	Various mechanical components of the headworks screen and control system will likely require an overhaul during the planning period due to age and normal wear and tear.
D-4	The lagoon transfer structures will reach the end of their useful life during the planning period.
D-5	Sludge accumulation in the lagoons is becoming significant, and the City should plan to remove sludge during the planning period.
D-6	The existing lagoons as currently operated lack the hydraulic storage capacity needed to adequately store water during the non-discharging periods of the year for the remainder of the planning period.
D-7	The irrigation pump station lacks redundancy. Particularly for the pump delivering water to the South Irrigation Site. This lack of redundancy may lead to lagoon water management problems if the pump were to fail during a critical time
D-8	The lagoons lack the organic treatment capacity needed to adequately treat the projected organic loading at the end of the planning period
D-9	The existing piping used to convey water from cell 1 all the way through the plant to the outfall during the winter discharge season lacks the capacity needed to convey the projected flows at the end of the planning period
D-10	The existing irrigation pump lacks the capacity to convey the projected minimum summer discharge rate at the end of the planning period.
D-11	The existing chlorine contact chamber lacks the capacity required to treat the projected flows at the end of the planning period
D-12	The exiting treatment plant is not capable of reliably reducing effluent BOD and TSS concentrations to the levels required in the NPDES with the flows projected at the end of the planning period.
D-13	The existing land application facilities are not large enough to adequately dispose of the projected wastewater disposal requirements at the end of the planning period.
D-14	The City has outgrown the existing lab and office space and much of the treatment facilities lack a backup power generation system.

7.5 TREATMENT PLANT IMPROVEMENT ALTERNATIVES ANALYSIS

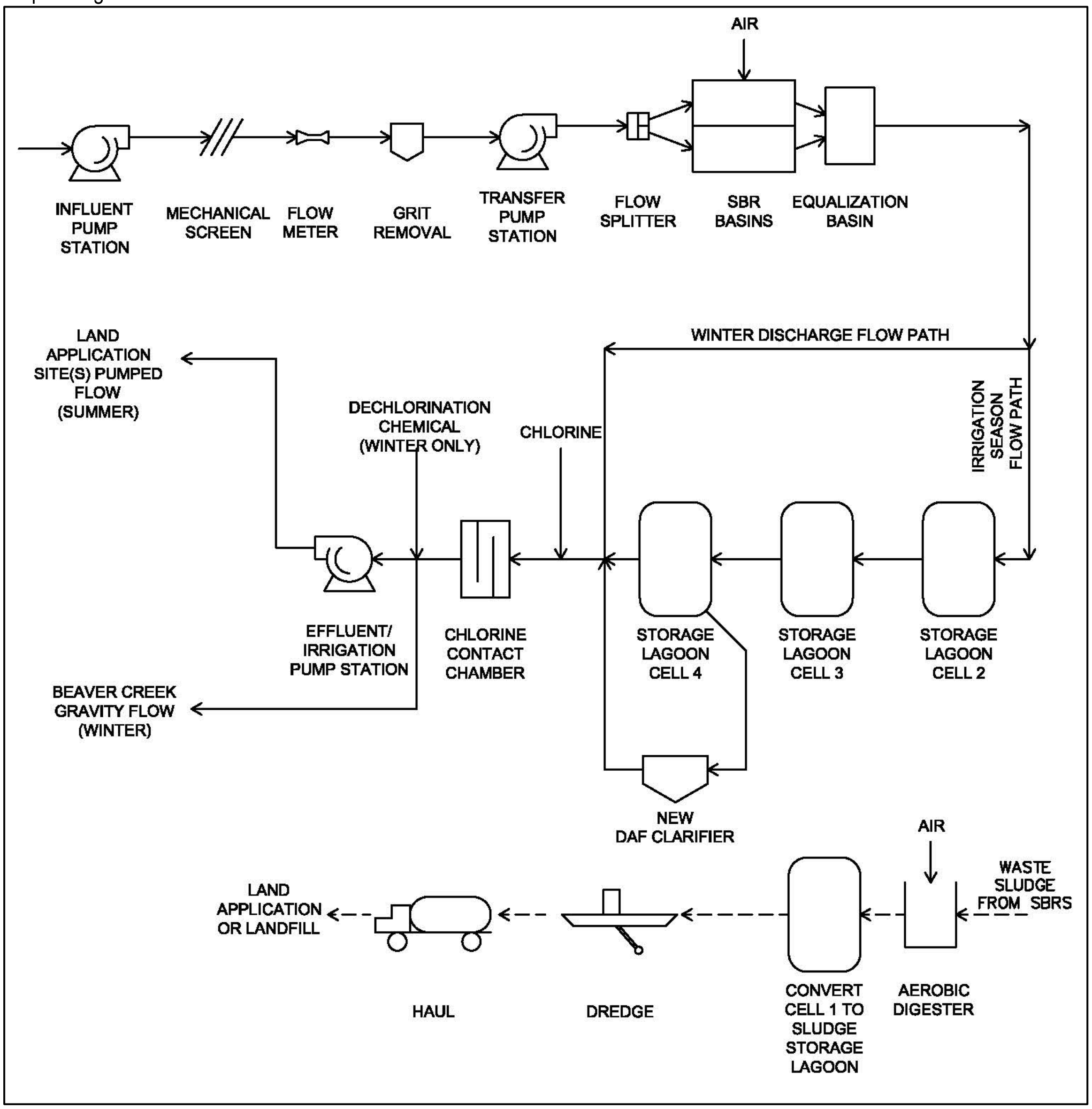
The following subsections describe various treatment plant alternatives that address the deficiencies listed above. An overall description of each alternative is provided along with a listing of some of the key design criteria for each option. Cost estimates are developed and presented for each alternative. A comparison of the alternatives with respect to monetary and non-monetary factors is presented. Finally, the rationale for the selected alternative is presented.

7.5.1 Treatment Alternative 1: Sequencing Batch Reactors (SBR)

A schematic representation of this alternative is included below (Figure 7-5). This alternative includes the following components.

- New pumps and controls for the influent pump station to address Deficiency D-2, Table 7-1.
- Overhaul the fine screen at the headworks to address Deficiency D-3, Table 7-1.
- New grit removal system downstream of the existing headworks to minimize grit accumulation in the SBR basins.
- New transfer pump station to convey water from the grit removal system to the SBR tankage.
- Two new SBR basins and blower building for the aeration blowers. The SBRs will provide the bulk of the treatment and will address Deficiencies D-1, D-8, and D-12 in Table 7-1).
- New equalization basin downstream of the SBR.
- Add a second irrigation pump to improve system redundancy and increase pumping capacity (see Deficiencies D-7 and D-10 Table 7-1).
- Improve and modernize the chlorine feed equipment.
- New chlorine contact chamber to address Deficiency D-11, Table 7-1.
- Improve and modernize the dechlorination system.
- Upsize the outfall pipeline.
- Expansion of the effluent reuse system to address Deficiency D-13, Table 7-1.
- New packaged DAF clarifier for polishing the water stored in the lagoons during the winter months.
- Removal of the biosolids from the existing lagoons to address Deficiency D-5, Table 7-1.
- Two new aerobic digester tanks for waste sludge digestion.
- Convert lagoon cell 1 into a sludge storage lagoon and construct new transfer piping to address Deficiency D-4, Table 7-1.
- Convert lagoon cells 2 – 4 into effluent storage lagoons and construct new transfer piping to address Deficiencies D-4, D-6 and D-9, Table 7-1. Under this alternative, there is no need to replace the transfer pipe between cells 2 and 3 since the flowrate between these cells will be significantly reduced thereby addressing Deficiency D-9, Table 7-1.
- New laboratory and office space and backup power generator to address Deficiency D-14, Table 7-1.

Figure 7-5 | Schematic Diagram – Treatment Alternative 1
Sequencing Batch Reactors



Under this alternative, a new extended air activated sludge plant would be constructed to treat the wastewater and reduce BOD, TSS, and ammonia levels. Several configurations of extended air activated sludge treatment processes are available. For the purposes of this planning effort, the sequencing batch reactor (SBR) process was chosen for detailed analysis. However, other configurations such as conventional aeration tanks or oxidation ditches followed by clarifiers are likely to be similar in overall capital costs. The SBR process eliminates the need for clarifier equipment and often is the lowest cost of the options since it is most suitable for common wall construction of the various tankage. Common wall construction decreases the amount of concrete required for the facility and thereby decreases overall costs.

Under this alternative, all wastewater would be treated in the SBRs. During the winter months (November-April), treated effluent would be disinfected and discharged to Beaver Creek. During the summer months (May-October) treated effluent from the SBR would be discharged into the lagoons. During the spring and fall storage seasons, treated effluent would be stored in the lagoons and the water levels in the lagoons would rise. During the irrigation season (June-September) effluent from the lagoons would be disinfected and pumped to the irrigation sites. In order to provide storage for the spring and fall non-discharge periods, the water levels in the lagoons would need to be drawn down to minimum levels by the end of April and again by the end of September. This will require discharging from the lagoons directly during the winter months. To remove any algae that might grow in the lagoon water, a small packaged DAF clarifier is recommended to polish the lagoon water prior to discharge. It is envisioned that the discharge from the DAF clarifier would be blended with the effluent from the SBR prior to disinfection and discharge to Beaver Creek. The DAF clarifier would not be used during the summer season.

The SBR should be sized to reduce effluent BOD, TSS, and ammonia levels below 10 mg/L, 10 mg/L, and 1 mg/L respectively on a year-around basis. This will address deficiencies D-1, D-8, and D-12 in Table 7-1. The City should also consider designing the SBR for denitrification during the summer season. This will reduce the amount of nitrogen that is discharged to the storage lagoons during the spring and fall storage season and during the summer irrigation season. It is important to minimize the nitrogen loading to the lagoons to minimize algae growth and benthic nitrogen rebound in the lagoon water since water from the lagoons will need to be discharged during the winter months.

The waste activated sludge from the SBR process would be routed to two aerobic digester tanks for further stabilization. Stabilized sludge from the aerobic digester would be conveyed to cell 1 for long term storage. cell 1 would be removed from the normal treatment train and used exclusively for sludge storage. Cells 2 and 4 would be used for storage of SBR effluent when discharge from the plant is not allowed and to further treat discharge from cell 1.

SBR's treat the wastewater in a fill, treat, settle, and decant sequence. The decant rates are typically high and not suitable for downstream disinfection processes. Therefore, an equalization basin is proposed to attenuate the high flows during the decant portion of the treatment sequence. Effluent from the equalization basin would be routed to a new chlorine contact chamber during the winter months and to lagoon cell 2 during the summer months. A new chlorine contact chamber with a larger overall volume is needed to provide adequate contact time (see Deficiency D-11, Table 7-1). A new outfall pipeline will also need to be constructed to convey the higher flows anticipated during the planning period.

During the winter months, the storage lagoons (cells 2 – 4) will eventually fill as a result of rainfall that falls on the surface. The water in the storage lagoons should meet the BOD, TSS, and ammonia concentration limits in the City's permit. As such, this water can be discharged directly. However, the City's permit also includes mass load limits in addition to concentration limits. Algae growth in the storage lagoons has the potential to make it challenging for the City to comply with the mass load limits in the permit. In order to remove the algae, a packaged DAF clarifier is recommended to further treat the lagoon water prior to discharge. This is considered a better approach than routing the lagoon water back through the SBRs. The SBRs are not well suited for algae removal and the additional flow of clean water will add operational complexity making the SBR process harder to control.

During the summer irrigation season, it is anticipated that effluent from the SBR's will be routed to the effluent storage lagoon cells (i.e., cells 2 - 4). Since the pumping rates to the irrigation equipment are fixed by the capacity of the irrigation distribution equipment (i.e., the sprinklers), the lagoons are needed to serve as an equalization basin. Over the course of the summer irrigation season, plant operators will draw the water levels in the storage lagoons down to minimum levels by irrigating effluent from the storage lagoons. The improvements will include the installation of a second irrigation pump to improve redundancy and increase the capacity of the system. The existing irrigation site is not large enough to accept all of the flow anticipated during the planning period. As such, the City will need to look for additional irrigation sites. There is a large hazelnut orchard located south of the City. This orchard is located on the east side of West Stayton Road between Porter Road and Shaff Road. It is believed that this orchard currently purchases water from the Santiam Water Control District and the owners may be receptive to using recycled water from the City instead. The budgets recommended for this alternative are based on the assumption that the City will be able to negotiate an agreement with the owners of the orchard and the recommended budget for this alternative includes the funds needed to extending the irrigation pipeline to this site.

The recommended improvements include continuing to use chlorine for disinfection rather than UV light or some other disinfection process. This decision is based on several factors. The City already has chlorine feed equipment that can be used and City staff is already familiar with chlorine disinfection. Finally, during the summer irrigation season, the effluent from the lagoons may have some algae that would interfere with UV disinfection. Algae tends to shield water from the UV light. Therefore, UV is not a suitable disinfection option for lagoon effluent even if algae concentrations are expected to be low. The recommended project budget includes funds to modernize and improve the chlorine feed system and sulfur dioxide disinfection system. Final decisions about the specific chemicals use and the equipment to install can be made during the final design process.

This alternative includes overhauling the existing influent pump station and the headworks screen. The screening equipment will need to remain in service to remove rags and debris that would accumulate in the SBR basins and foul the SBR equipment. On the downstream side of the headworks screen, a new grit removal chamber and transfer pump station will be needed. These facilities are show in Figure 7-6. A grit removal system recommended to minimize the amount of grit accumulation in the SBR basins. The transfer pump station is needed to covey water from the headworks area to the SBR basins. A new pipeline will be needed from the transfer pump station to the SBR basins.

A significant amount of sludge (see deficiency D-5 Table 7-1) has accumulated in the lagoons and this alternative includes removing the sludge as part of the overall project. Sludge removal is necessary in order to effectively use the lagoons for effluent storage as proposed under this alternative. It envisioned that the City would hire a contractor to dredge, dewater, and haul the sludge to a landfill for disposal. It may be possible to land-apply the sludge at a lower cost than landfilling. However, the City of Salem has locked up most of the land in the area for their own biosolids disposal program. Therefore, it may be challenging to find a site that is not being used by the City of Salem. For planning purposes, it is assumed that the dewatered biosolids will be hauled to landfill. However, as the project moves forward, the City may want to consider other options.

Conceptual site plans for this alternative are shown in Figure 7-6 and Figure 7-7. These site plans are intended to convey the intent of the conceptual design and significant refinements are anticipated during the final design phase.

Figure 7-6 | Conceptual Site Plan- Treatment Alternative 1 – Headworks Area

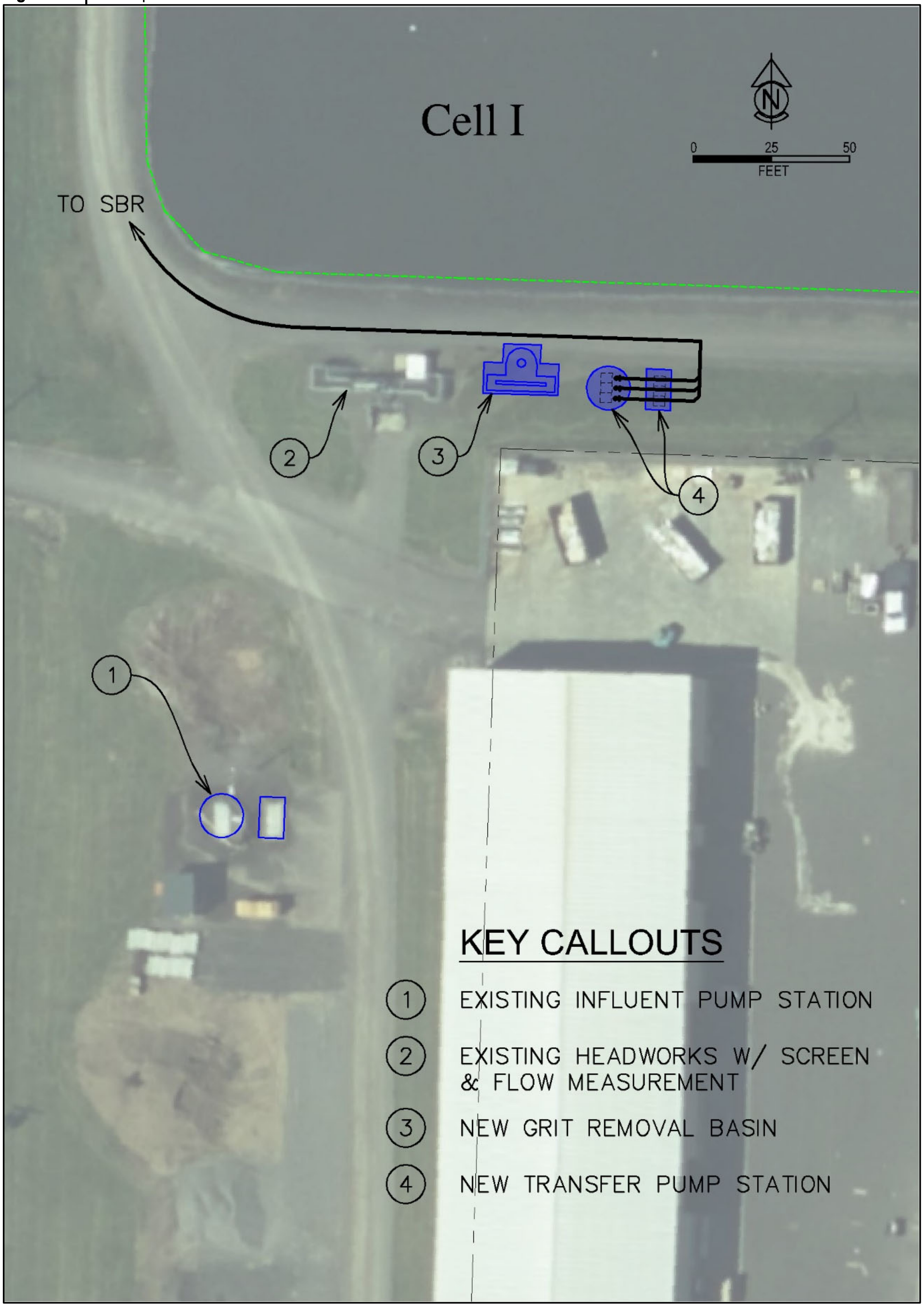
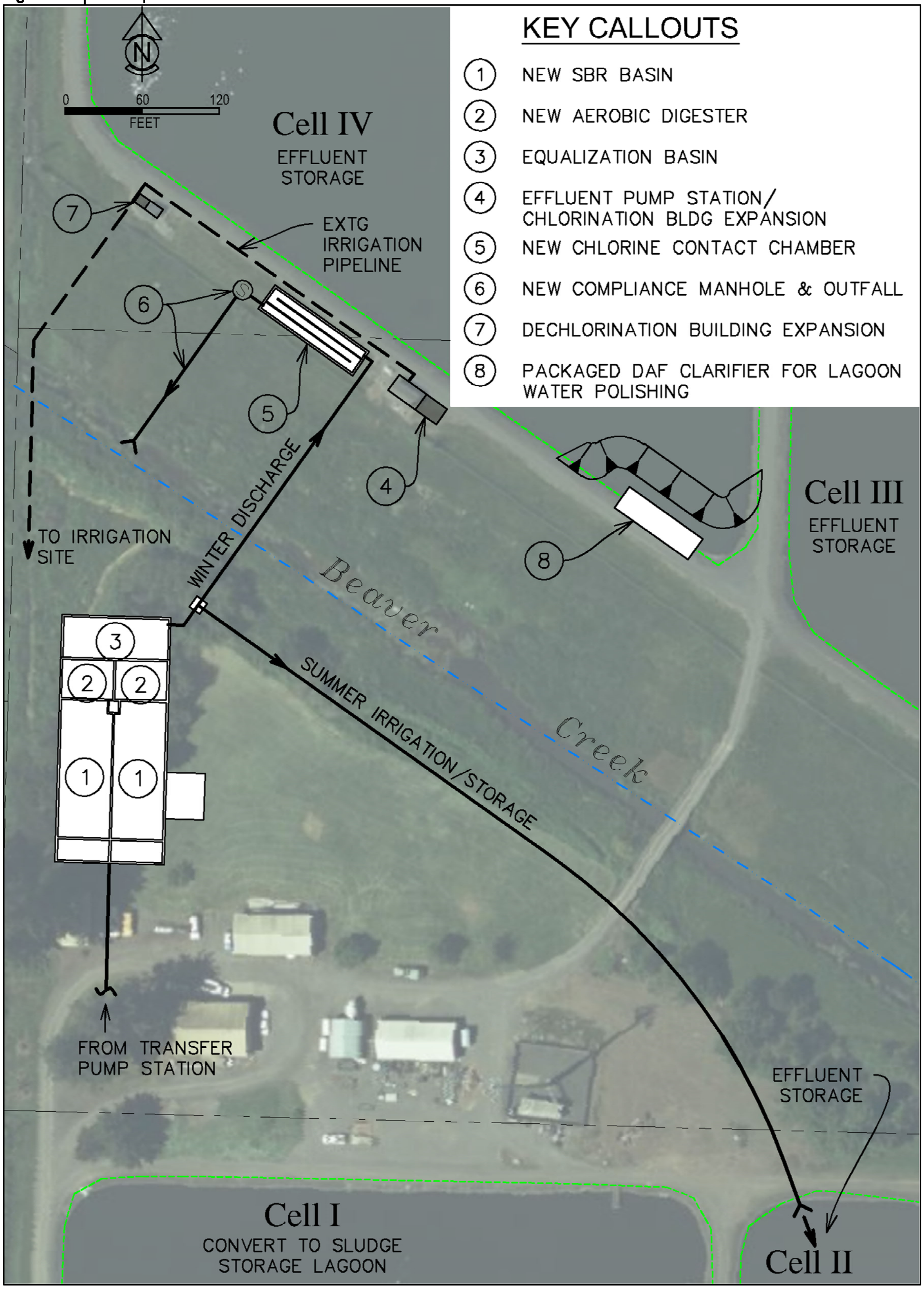


Figure 7-7 | Conceptual Site Plan- Treatment Alternative 1 – SBR Area



Preliminary design data for this alternative are listed below (Table 7-2). It should be noted that the information presented in Table 7-2 is preliminary and will need to be verified and refined by the design engineer. A cost estimate for this alternative was prepared (Table 7-3). A detailed breakdown of this cost estimate is included in Appendix C. The estimates of annual operation and maintenance costs are the additional costs associated with the new facilities. These costs should be added to the City's existing annual O&M budget.

Table 7-2 | Preliminary Design Data – Treatment Alternative 1
Sequencing Batch Reactors

General	
EPA Reliability Class	Class I
Septage Receiving	Not allowed
Anticipated Effluent Quality	
Monthly Average BOD	< 10 mg/L
Monthly Average TSS	< 10 mg/L
Monthly Average Ammonia	< 1 mg/L
Effluent E.coli	< 126 organisms / 100 mL
Influent Pump Station	
Type	Submersible
Firm Capacity	6.4 mgd
Pump Number	3
Headworks	
Screen Opening Size	6 mm
Mechanical Screen Number	1
Redundant Screening	Manual Bar Screen
Grit Removal System	Vortex Grit Chamber
Grit Chamber Number	1
Transfer Pump Station	
Type	Submersible
Firm Capacity	6.4 mgd
Pump Number	3
Alkalinity Adjustment	Assume influent alkalinity sufficient for full nitrification (City's water source is groundwater)
Secondary Treatment	
Process	Sequencing Batch Reactors
Type	Extended Aeration with Denitrification During Summer Months
Sizing	Sized to treat all flows up to the peak day flow
Basin Number	2
Volume Per Basin	664,000 gallons
Total Volume	1.33 million gallons
Average Sludge Production	1235 ppd at 0.75 lbs per lb of BOD, 17,300 gallons per day at 0.85% solids
Equalization Basin	
Units	1
Total Volume	200,000 gallons
Effluent Flow Control	Actuated Modulating Valve

Table 7-2 | Preliminary Design Data – Treatment Alternative 1
Sequencing Batch Reactors

Lagoon/Features	Cell 1	Cell 2	Cell 3	Cell 4
Use	Sludge Storage	Effluent Storage	Effluent Storage	Effluent Storage
Aeration Equipment	None	None	None	None
Surface Area	7.6 Ac	6.7 Ac	7.8 Ac	6.3 Ac
Maximum Water Depth	6 ft	6 ft	7 ft	7 ft
Minimum Water Depth	NA	2 ft	2 ft	2 ft
Maximum Storage Volume	none	26.8 Ac-ft	39 Ac-ft	31.5 Ac-ft
Winter Lagoon Water Polishing				
Type	Dissolved Air Floatation (DAF) clarifier			
Treatment Capacity	300 gpm			
Disinfection System				
Type	Onsite chlorine generation			
Contact Chamber Type	Baffled Concrete Tank			
Contact Chamber Volume	104,000 gallons			
Contact Time	75 minutes at MMWWF (2 mgd) 30 minutes at Peak Flows (5 mgd)			
Dechlorination System	Sulfur dioxide gas			
Irrigation Pump Station				
Type	Vertical Turbine Pumps in Cans			
Firm Capacity	0.72 mgd			
Total Capacity	1.44 mgd			
Pump Number	2			
Effluent Reuse Sites				
Existing Site Capacity	22 million gallons			
Minimum Capacity Needed for New site	60 million gallons			
Solids Handling				
Type	Aerobic Digesters with long term storage in cell 1			
Biosolids Classification	Class B			
Number of Digester Basins	2			
Sludge Yield	990 lbs per day (0.8 lbs digested sludge per lb WAS)			
Digester MCRT	25 days (with decanting to thicken to 1% solids)			
Total Digester Volume	300,000 gallons			
Sludge Storage Lagoon Size	7.7 acres			
Max. Sludge Depth in Lagoon	3 feet			
Solids Storage Capacity	2.5 million pounds at 4% solids			
Estimated Biosolids Removal Frequency	Every 7 years (at design loading)			

Table 7-3 | Planning Level Cost Estimate – Treatment Alternative 1
Sequencing Batch Reactors

Component	Estimated Cost(1)
Capital Costs	
Construction Costs	$16,407,000
Construction Contingency (@ 10%)	$1,641,000
Engineering, Legal, & Administration (@ 20%)	$3,281,000
Permitting (@ 2%)	$328,000
Total Capital Costs	**$21,657,000**
Additional Annual Operations and Maintenance Costs(2)	
Power Costs	$42,000
Operation and Maintenance Costs	$224,000
Total Additional Annual Operation and Maintenance Costs(2)	**$266,000**

(1) Costs are in 2021 dollars. ENR 20 Cities Index = 12,200
(2) These annual costs are in addition to the City's existing O&M costs. The City's annual O&M budget will need to be increased by these amounts.

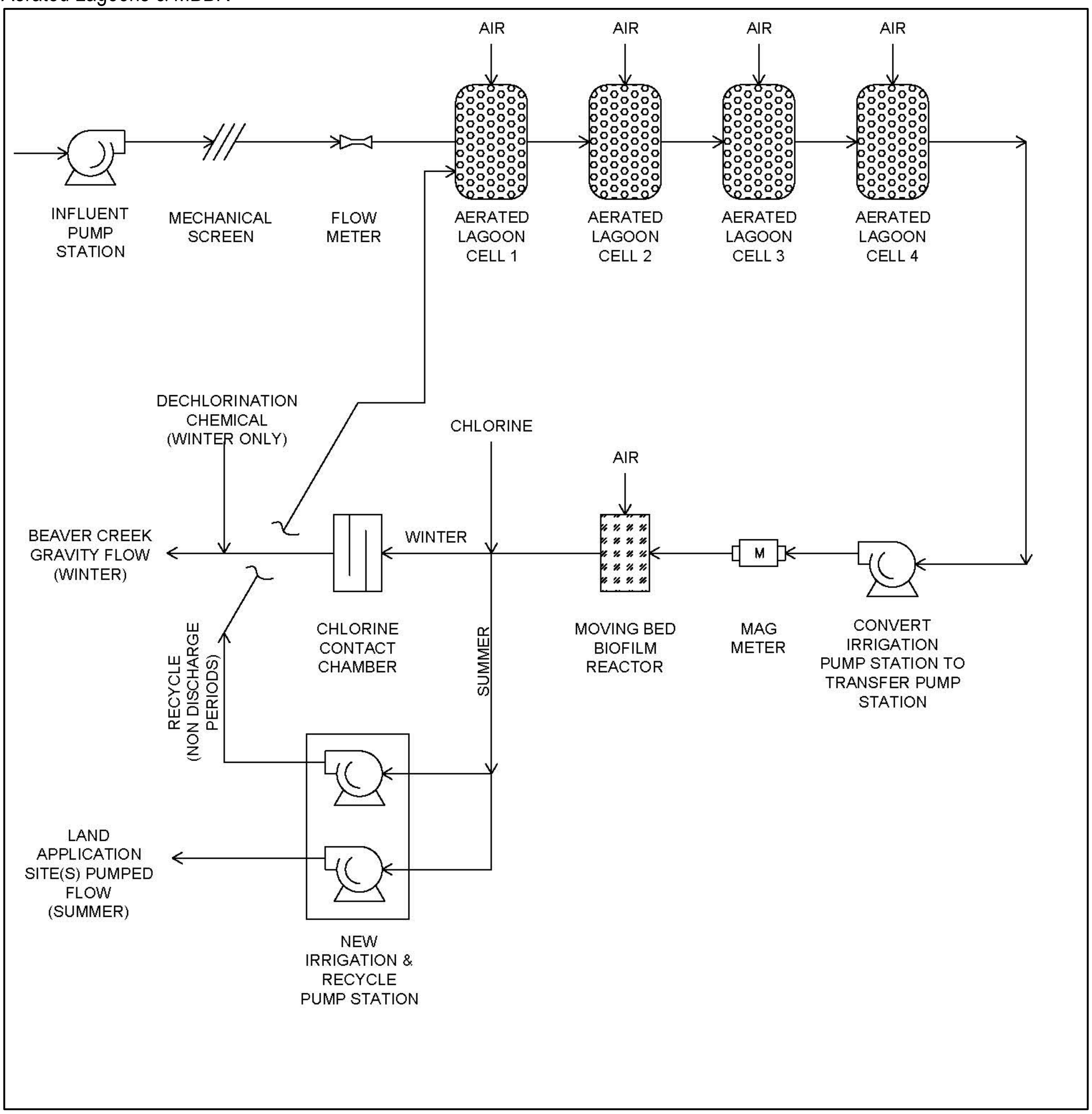
7.5.2 Treatment Alternative 2: Aerated Lagoons with Fixed Film Process

A schematic representation of this alternative is included below (Figure 7-8). This alternative includes the following components.

- New pumps and controls for the influent pump station to address Deficiency D-2, Table 7-1.
- Overhaul the fine screen at the headworks to address Deficiency D-3, Table 7-1.
- The installation of a larger, more-efficient, diffused, aeration system in lagoon cells 1 through 4 to increase the organic treatment capacity and address Deficiencies D-8 & D-12 in Table 7-1. The diffused aeration system will replace the mechanical surface aerators. The diffused aeration system will allow the water levels in the lagoons to be lowered further than is possible with the mechanical aeration equipment. Therefore, more storage can be provided with the diffused aeration system to address Deficiency D-6, in Table 7-1).
- Construct new control structures and transfer piping to address Deficiencies D-4 and D-9, Table 7-1.
- Convert the irrigation pump station to a transfer pump station to convey water from lagoon cell 4 to the fixed film unit process.
- Construction a new fixed film process to reduce ammonia levels in the effluent to address Deficiency D-1 in Table 7-1.
- Construct a new building to house the electrical control systems and blowers for the lagoon and fixed film process aeration systems.
- Improve and modernize the chlorine feed equipment.
- New chlorine contact chamber to address Deficiency D-11, Table 7-1.
- Improve and modernize the dechlorination system.
- Upsize the outfall pipeline.

- Construct a new building to house new irrigation pumps, new recycle pumps, and the chlorination and dichlorination systems. The new irrigation pumps will be designed to address Deficiencies D-7 and D-10 in Table 7-1. The recycle pumps are needed to ensure that water is always being run through the fixed film process even during non-discharging period. The fixed film process is a biological process that cannot simply be turned on and off. Water must be run through the process at all times.
- Expansion of the effluent reuse system to address Deficiency D-13, Table 7-1.
- Removal of the biosolids from the existing lagoons to address Deficiency D-5, Table 7-1.
- New laboratory and office space and backup power generator to address Deficiency D-14, Table 7-1.

Figure 7-8 | Schematic Diagram – Treatment Alternative 2
Aerated Lagoons & MBBR



Under this alternative, the organic treatment capacity of the plant would be increased by adding diffused aeration equipment to all four lagoon cells. Diffused aeration systems tend to have higher capital costs than floating mechanical aerators. But they tend to be more efficient and consume less power and therefore often have lower life cycle costs. The other advantage of diffused aeration over floating mechanical aeration is that the water levels in the lagoons can be drawn down to shallower depths. At shallow depths, floating aerators will scour the lagoon bottoms. This doesn't happen with diffused aeration systems. The ability to draw the water levels down lower will enable the City to provide the needed storage volume during the non-discharging periods.

The proposed diffused aeration system will reduce the effluent BOD, but will not reliably reduce ammonia concentrations to the limits needed to comply with the City's permit. Aerated lagoons do not reliably remove ammonia in wastewater and other processes must be used. The proposed improvements include the installation of a fixed film process after the aerated lagoons to remove ammonia. A couple different fixed film processes are available including submerged aerated rock filters and moving bed bioreactors. For this study, moving bed bioreactors (MBBRs) were chosen for detailed analysis. MBBRs consist of concrete tanks with diffused aeration systems at the bottom of each tank. The tanks are filled with a semi-buoyant growth media that is moved around the tank by the turbulence created by the aeration system. A biological fixed film grows on the media and this film creates the environment needed for the growth of microorganisms that consume ammonia. A submerged aerated rock filter consists of a basin with an aeration grid at the bottom that is filled with rock. The rock provides the surface area for the fixed film and the aeration grid is buried under the rock. The advantage of MBBRs over aerated rock filters is that it is easier to access the aeration equipment for repairs because it is not covered with rock. The surface area of the growth media in MBBRs is also much higher than the surface area of the rock typically used in rock filters. Therefore, MBBR basins can typically be smaller than aerated rock filters. For these reasons, the MBBR is considered a slightly better approach. However, during final design, the City may chose consider a submerged rock filter in greater detail. An example of a submerged rock filter system is the SAGR system manufactured by a company called Nexom.

In order to convey water from lagoon cell 4 to the MBBR, the existing irrigation pump station would be converted to a transfer pump station and used for this purpose. The improvements would include the installation of a second pump and a control system with variable frequency drives that enabled operations staff to control the pumping rate from cell 4 to the MBBR.

Under this alternative, water would flow through the lagoons and the MBBR on a continuous basis. During the winter months effluent from the MBBR would be routed to a chlorine contact chamber for disinfection and discharge to Beaver Creek. During the summer months, effluent would be routed to the chlorine contact chamber for disinfection and then to an irrigation pump station for disposal at the reuse sites. During the storage season, effluent from the MBBR would be routed back to lagoon cell 1 using a set of recycle pumps. The MBBR is a biological process that cannot be easily started and stopped. Therefore, the improvements must include a means of cycling water through the MBBR even during non-discharging periods. Prior to the spring and fall storage seasons, the water levels in the lagoon cells would need to be lowered to provide the needed storage volume.

A new blower/electrical building would be constructed next to the MBBR and would house the main electrical switchgear for the plant, the main control systems, and the blowers for the lagoon and MBBR aeration systems.

The recommended improvements include continuing to use chlorine for disinfection rather than UV light or some other disinfection process. This decision is based on several factors. The City already has chlorine feed equipment that can be used and City staff is already familiar with chlorine disinfection. Finally, during the summer irrigation season, the effluent from the MBBR may have some algae that would interfere with UV disinfection. Algae tends to shield water from the UV light. Therefore, UV is not a suitable disinfection option for effluent with the potential for algae even if the algae concentrations are expected to be low. The recommended project budget includes funds to modernize and improve the chlorine feed system and sulfur dioxide disinfection system. It is envisioned that much of this equipment will be salvaged and relocated to the new chemical feed building. That said, final decisions about the specific chemicals use and the equipment to install can be made during the final design process.

Since the existing irrigation pump station is being used to transfer water from cell 4 to the MBBR, a new irrigation pump station will be needed after the chlorine contract chamber. It is envisioned that this station will include a wet well with four vertical turbine pumps mounted above the wet well. Two of the pumps will be used to pump effluent to the reuse sites. The other two pumps will be used to cycle water through the plant during non-discharge periods. It is also envisioned that this building will include a separate room for the chlorination and dichlorination equipment.

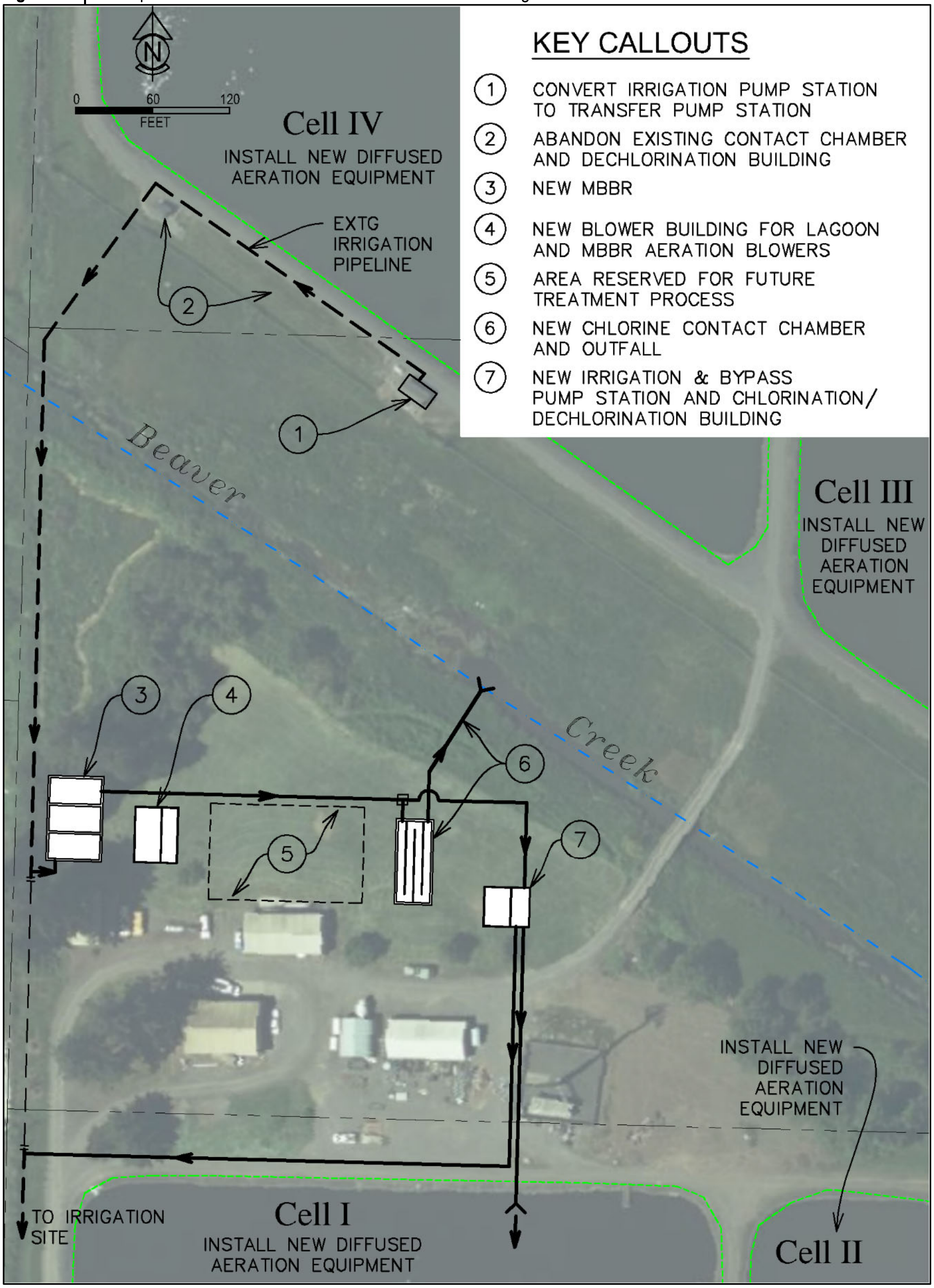
The existing irrigation site is not large enough to accept all of the flow anticipated during the planning period. As such, the City will need to look for additional irrigation sites. There is a large hazelnut orchard located south of the City. This orchard is located on the east side of West Stayton Road between Porter Road and Shaff Road. It is believed that this orchard currently purchases water from the Santiam Water Control District and the owners may be receptive to using recycled water from the City instead. The budgets recommended for this alternative are based on the assumption that the City will be able to negotiate an agreement with the owners of the orchard and the recommended budget for this alternative includes the funds needed to extending the irrigation pipeline to this site.

This alternative includes overhauling the existing influent pump station and the headworks screen. The screening equipment will need to remain in service to remove rags and debris that would accumulate in the lagoons and foul the aeration equipment.

A significant amount of sludge (see deficiency D-5 Table 7-1) has accumulated in the lagoons and this alternative includes removing the sludge as part of the overall project. Sludge removal is necessary in order to improve the organic treatment capacity of the plant. It envisioned that the City would hire a contractor to dredge, dewater, and haul the sludge to a landfill for disposal. It may be possible to land-apply the sludge at a lower cost than landfilling. However, the City of Salem has locked up most of the land in the area for their own biosolids disposal program. Therefore, it may be challenging to find a site that is not being used by the City of Salem. For planning purposes, it is assumed that the dewatered biosolids will be hauled to a landfill. However, as the project moves forward, the City may want to consider other options.

A conceptual site plan for this alternative is shown in and Figure 7-9. This plan is intended to convey the intent of the conceptual design and significant refinements are anticipated during the final design phase.

Figure 7-9 | Conceptual Site Plan – Treatment Alternative 2 Aerated Lagoons with Fixed Film Process



Preliminary design data for this alternative are listed below (Table 7-4). It should be noted that the information presented in Table 7-4 is preliminary and will need to be verified and refined by the design engineer. A cost estimate for this alternative was prepared (Table 7-5). A detailed breakdown of this cost estimate is included in Appendix C. The estimates of annual operation and maintenance costs are the additional costs associated with the new facilities. These costs should be added to the City's existing annual O&M budget.

Table 7-4 | Preliminary Design Data – Treatment Alternative 2
Aerated Lagoons with Fixed Film Process

General				
EPA Reliability Class	Class I			
Septage Receiving	Not allowed			
Anticipated Effluent Quality				
Monthly Average BOD	< 10 mg/L			
Monthly Average TSS	< 10 mg/L			
Monthly Average Ammonia	< 1 mg/L			
Effluent E.coli	< 126 organisms / 100 mL			
Influent Pump Station				
Type	Submersible			
Firm Capacity	6.4 mgd			
Pump Number	3			
Headworks				
Screen Opening Size	6 mm			
Mechanical Screen Number	1			
Redundant Screening	Manual Bar Screen			
Grit Removal System	None			
Alkalinity Adjustment	Assume influent alkalinity sufficient for full nitrification (City's water source is groundwater)			
Lagoon/Features	Cell 1	Cell 2	Cell 3	Cell 4
Use	Treatment	Treatment	Treatment	Treatment
Aeration Equipment	Diffused	Diffused	Diffused	Diffused
Surface Area	7.6 Ac	6.7 Ac	7.8 Ac	6.3 Ac
Maximum Water Depth	6 ft	6 ft	7 ft	7 ft
Minimum Water Depth	5 ft	4 ft	2 ft	2 ft
Maximum Storage Volume	7.6 Ac-ft	13.4 Ac-ft	39 Ac-ft	31.5 Ac-ft
Transfer Pump Station				
Type	Vertical Turbine Pumps in cans			
Firm Capacity	2 mgd			
Pump Number	2			
Moving Bed Bioreactor (MBBR)				
Number of tanks	3			
Volume per tank	72,000 gallons			
HRT	2.6 Hours @ 2 mgd			

Table 7-4 | Preliminary Design Data – Treatment Alternative 2
Aerated Lagoons with Fixed Film Process

Disinfection System	
Type	Onsite chlorine generation
Contact Chamber Type	Baffled Concrete Tank
Contact Chamber Volume	83,500 gallons
Contact Time	60 minutes @ 2 mgd
Dechlorination System	Sulfur dioxide gas
Irrigation Pump Station	
Type	Vertical Turbine Pumps Over Wet Well
Firm Capacity	0.72 mgd
Total Capacity	1.44 mgd
Pump Number	2
Recycle Pump Station	
Type	Vertical Turbine Pumps Over Wet Well
Firm Capacity	0.5 mgd
Total Capacity	1 mgd
Pump Number	2
Effluent Reuse Sites	
Existing Site Capacity	22 million gallons
Minimum Capacity Needed for New site	60 million gallons
Solids Handling	
Type	Long Term Storage in Lagoon cells
Estimated Biosolids Removal Frequency	Every 10 years (at design loading)

Table 7-5 | Planning Level Cost Estimate – Treatment Alternative 2
Aerated Lagoons with Fixed Film Process

Component	**Estimated Cost(1)**
Capital Costs	
Construction Costs	$14,236,000
Construction Contingency (@ 10%)	$1,424,000
Engineering, Legal, & Administration (@ 20%)	$2,847,000
Permitting (@ 2%)	$285,000
Total Capital Costs	**$18,792,000**
Additional Annual Operations and Maintenance Costs(2)	
Power Costs	$59,000
Equipment Operation and Maintenance Costs	$128,000
Total Additional Annual Operation and Maintenance Costs(2)	**$187,000**

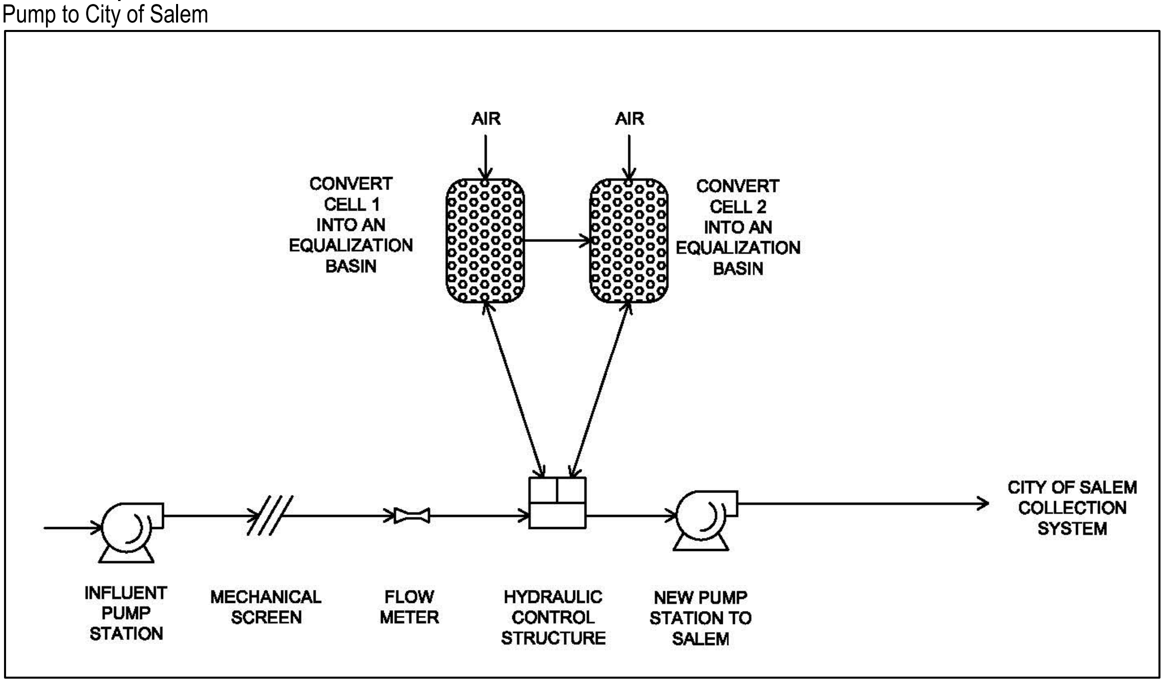
(1) Costs are in 2021 dollars. ENR 20 Cities Index = 12,200
(2) These annual costs are in addition to the City's existing O&M costs. The City's annual O&M budget will need to be increased by these amounts.

7.5.3 Treatment Alternative 3: Pump Wastewater to the City of Salem

Under this alternative a new pump station and effluent pipeline would be constructed to convey raw wastewater to the City of Salem. This would eliminate the need to make major improvements to the treatment plant and most of the existing treatment facilities would be abandoned. It is envisioned that the existing influent pump station and headworks screen will remain in service. Leaving the screening facilities in service is considered beneficial because removing the trash and other large debris will minimize the potential for clogging in the relatively long pipeline required to convey water to the City of Salem. It is also envisioned that lagoon cells 1 and 2 will remain in service and be used as equalization basins during peak flow periods. This will allow the construction of a slightly smaller pump station and pipeline to convey the wastewater to the City of Salem. A schematic representation of this alternative is included below (Figure 7-10). This alternative includes the following components.

- New pumps and controls for the influent pump station to address Deficiency D-2, Table 7-1.
- Overhaul the fine screen at the headworks to address Deficiency D-3, Table 7-1.
- Conversion of lagoon cells 1 & 2 to equalization basins.
- Construction of a new pump station to convey water to the City of Salem.
- Construction of a new pipeline to convey water to the City of Salem.
- Removing biosolids from all of the lagoon cells.
- Decommissioning lagoon cells 2 & 3, the irrigation pump station, the chlorine contact chamber, the chlorine and sulfur dioxide feed systems, and the effluent irrigation site.

Figure 7-10 | Schematic Diagram – Treatment Alternative 3
Pump to City of Salem



As part of the facilities planning process, preliminary discussions with the City of Salem were conducted to verify whether or not this option was feasible and to estimate fees that Salem would charge. Based on these discussions, it was determined that the proposed forcemain from Aumsville would need to connect to a pipeline known as the “East Salem Interceptor” near the intersection of Macleay Road and Elma Street (Figure 7-11) in Salem. The City of Salem also expressed concerns about the ability of the East Salem Interceptor to accept peak flows from Aumsville. For this reason, the proposed improvement include converting lagoon cells 1 & 2 into equalization basins to decrease peak flows during large storm events. It is envisioned that the pump station and forcemain will be sized to convey the peak monthly flow, but not the peak day or peak hour flow. During very large storm events, peak flows that exceed the capacity of the new pump station will cause water to back up into lagoon cells 1 & 2 for short term storage. As peak flows recede, the pump station would eventually drain the lagoons to minimum levels. To prevent the water in the lagoons from going septic, it is envisioned that the existing aeration system will remain in service, but will only be used as needed. During large winter storms, the wastewater is highly diluted and relatively cold. Therefore, it may be possible to maintain aerobic conditions without the need for mechanical aeration. If this proves to be the case, the floating aerators can be left off. It is also envisioned that some minimum amount of water will remain in cells 1 & 2 at all times to minimize odor that might be generated if the lagoons were completely drained.

Under low and moderate flow conditions, water will be pumped through the existing headworks and screening facility to a new pump station. This alternative includes keeping the screening facility in service to minimize the amount of trash and solid materials that could potentially accumulate in the pipeline to Salem. On the downstream side of the headworks, water will flow into a new pump station that will only overflow into the lagoons when inflow exceeds the pumping capacity of the station. The new pump station will pump water to the City of Salem through a new pipeline. The static lift along the proposed pipeline alignment is relatively high. Therefore, it is anticipated that two pumps in series will be needed. The forcemain is also relatively long and a system to control the generation of hydrogen sulfide will be needed. For planning purposes, a calcium nitrate feed system is anticipated.

Several routes for the pipeline were considered for the planning period. These basically included routing the pipeline through the City of Turner or constructing a new pipeline along Highway 22. Of these options, the pipeline along Highway 22 is shorter and considered to be the best choice. The Highway 22 right of way is relatively wide and there is quite a bit of space within the right of way on the north side of the highway. This location will minimize the amount of hard surface restoration required for the pipeline installation. The preliminary pipeline alignment shown in Figure 7-11 was chosen for this analysis. The total length of the pipeline is about 39,500 feet.

Figure 7-11 | Treatment Alternative 3 - Preliminary Pipeline Alignment to the City of Salem

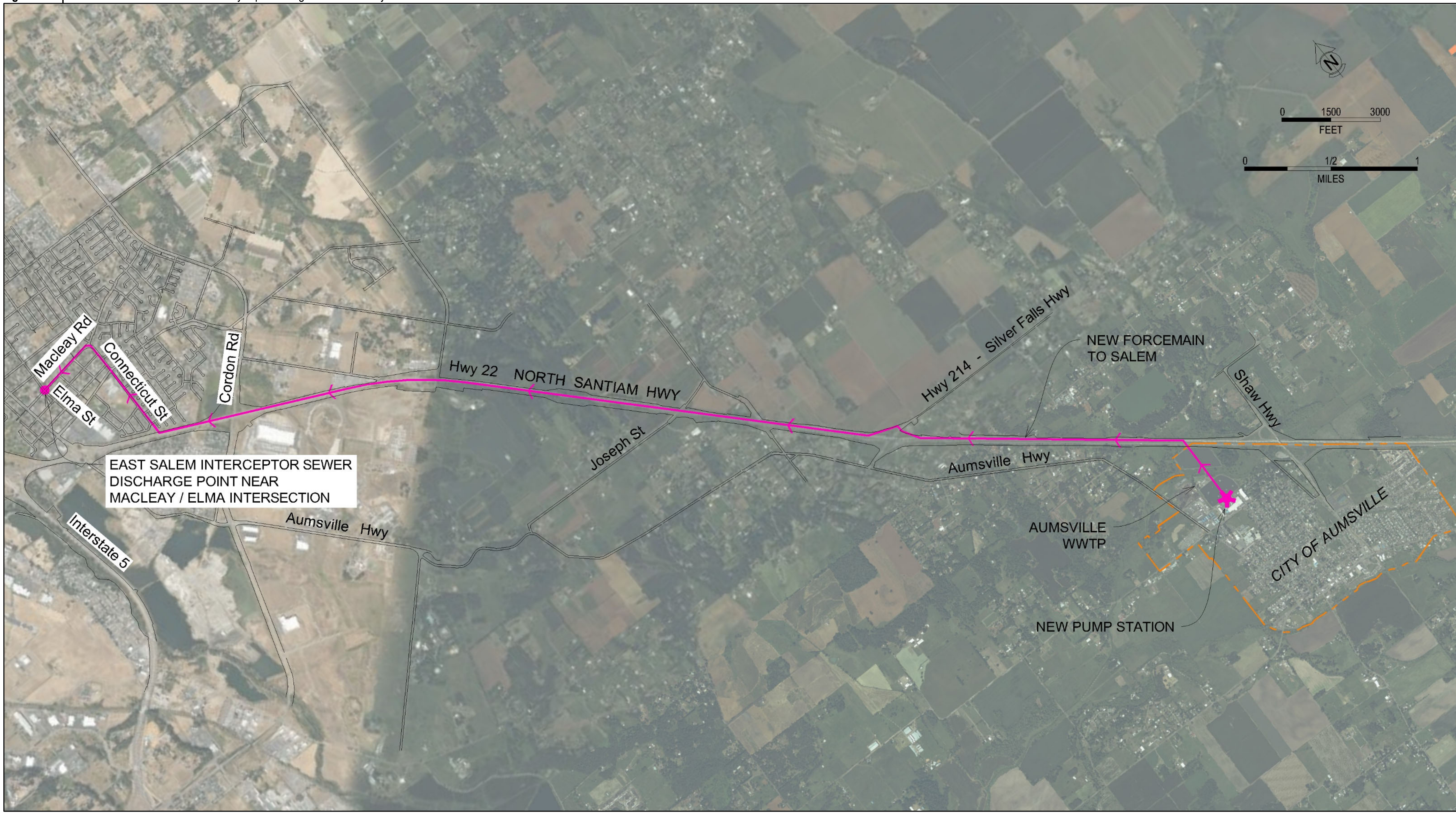


FIGURE 7-11

Under this alternative Aumsville will need to make payments to the City of Salem to accept and treat the wastewater. Based on discussions with Salem, the current wholesale rate is $3.61 per 100 cubic feet of wastewater. This is the same rate that Salem currently charges the City of Turner. Aumsville will also need to pay Salem system development charges (SDC). On a preliminary basis, Salem has indicated that the full SDC payment would not be necessary and have suggested that Aumsville would only need to pay the reimbursement portion of the SDC fee. This is currently about $1,340 per connection. The City of Salem also expressed a willingness to accept the SDC payments in annual installments over a 20 to 25 year period. These conditions are used for the analysis presented in this chapter. However, it should be understood that these conditions are preliminary and subject to change. Should this alternative be selected for implementation, a key early step will include establishing a formal agreement between Salem and Aumsville that will establish the payment amounts and other conditions of service. Based on the preliminary information provided by the City, the annual disposal costs are listed in Table 7-6.

Table 7-6 | City of Salem Disposal Costs – Treatment Alternative 3
Pump Wastewater to the City of Salem

Item	Value
Annual City of Salem Usage Charge	
Existing Average Annual Wastewater Flow (mgd)	0.54 mgd
Total Annual Wastewater Volume (million gallons)	197.1
Cell 1 & 2 Rainfall Discharged to City of Salem (million gallons)	11.5
Total Flow Discharge to the City of Salem (100 Cubic Feet)	278,900
City of Salem Unit Charge ($ per 100 cubic feet)	$3.61
Annual City of Salem Usage Charge	**$1,007,000**
Annual City of Salem SDC Charge	
Estimated Number of Connections	1,400
Reimbursement Portion of SDC Fee ($ per connection)	$1,340
Total SDC Charge	$1,876,000
Annualized amount over 25 years	**$75,000**
Total Estimated Annual City of Salem Charges	**$1,082,000**

This alternative includes overhauling the existing influent pump station and the headworks screen, and decommissioning the remaining wastewater treatment and disposal facilities including lagoon cell 3, lagoon cell 4, the irrigation pump station, the chlorination and dechlorination systems, the chlorine contact chamber, the irrigation pipeline, and the effluent reuse site.

A significant amount of sludge (see deficiency D-5 Table 7-1) has accumulated in the lagoons and this alternative includes removing the sludge as part of the overall project. Sludge removal is necessary in order in order to decommission lagoon cells 3 and 4 and to convert lagoon cells 1 & 2 into equalization basins. It is envisioned that the City would hire a contractor to dredge, dewater, and haul the sludge to a landfill for disposal. It may be possible to land-apply the sludge at a lower cost than landfilling. However, the City of Salem has locked up most of the land in the area for their own biosolids disposal program. Therefore, it may be challenging to find a site that is not being used by the City of Salem. For planning purposes, it is assumed that the dewatered biosolids will be hauled to a landfill. However, as the project moves forward, the City may want to consider other options.

Preliminary design data for this alternative are listed below (Table 7-7). It should be noted that the information presented in Table 7-2 is preliminary and will need to be verified and refined by the design engineer. A cost estimate for this alternative was prepared (Table 7-8). A detailed breakdown of this cost estimate is included in Appendix C. The estimates of annual operation and maintenance costs are the additional costs associated with the new facilities. These costs should be added to the City's existing annual O&M budget.

Table 7-7 | Preliminary Design Data – Treatment Alternative 3
Pump Wastewater to the City of Salem

General				
EPA Reliability Class	Class I			
Septage Receiving	Not allowed			
Influent Pump Station				
Type	Submersible			
Firm Capacity	6.4 mgd			
Pump Number	3			
Headworks				
Screen Opening Size	6 mm			
Mechanical Screen Number	1			
Redundant Screening	Manual Bar Screen			
Grit Removal System	None			
Lagoon/Features	Cell 1	Cell 2	Cell 3	Cell 4
Use	Equalization	Equalization	None,	None,
Aeration Equipment	Diffused	Diffused	decommission	decommission
Surface Area	7.6 Ac	6.7 Ac		
Maximum Water Depth	6 ft	6 ft		
Minimum Water Depth	2 ft	2 ft		
Maximum Storage Volume	30.4 Ac-ft	26.8 Ac-ft		
Salem Pump Station				
Type	Tandem, submersible pumps			
Firm Capacity	2 mgd			
Pump Number	4 (two sets of two pumps in series)			
Hydrogen Sulfide Control	Calcium Nitrate Feed System or Similar			
Solids Handling				
Type	None other than incidental accumulation in equalization basins			
Estimated Biosolids Removal Frequency	Every 30 years (at design loading)			

Table 7-8 | Planning Level Cost Estimate – Treatment Alternative 3
Pump Wastewater to the City of Salem

Component	**Estimated Cost**(1)
Capital Costs	
Construction Costs	$14,338,000
Construction Contingency (@ 10%)	$1,434,000
Engineering, Legal, & Administration (@ 20%)	$2,868,000
Permitting (@ 3%)	$430,000
Easement Acquisition	$150,000
Total Capital Costs	**$19,220,000**
Additional Annual Operations and Maintenance Costs (2)	
Power Costs	$6,000
Equipment Operation and Maintenance Costs	-$70,000
Estimated Annual City of Salem Charges (Table 7-6)	$1,082,000
Total Additional Annual Operation and Maintenance Costs (2)	**$1,018,000**

(1) Costs are in 2021 dollars. ENR 20 Cities Index = 12,200
(2) These annual costs are in addition to the City's existing O&M costs. The City's annual O&M budget will need to be increased by these amounts. Negative numbers indicate savings and a reduction in the annual O&M costs.

7.5.4 Other Treatment Plant Alternatives

A potential alternative that was not evaluated in detail as part of this planning effort is the construction of Membrane Bioreactor (MBR) plant. Membrane bioreactors are a type of activated sludge process that utilize membranes to separate the mixed liquor solids from the final effluent. In more traditional activated sludge processes (e.g., Alternative 1), the mixed liquor solids are separated from the final effluent by gravity settling. There is a practical upper limit for the mixed liquor concentration that will settle under gravity. If the mixed liquor concentration is too high, the settling characteristics decrease and poor effluent quality results. The MBR process eliminates this problem by using membrane filters rather than gravity settling. Membrane filters allow MBR systems to be operated at much higher mixed liquor concentrations which ultimately decreases the overall footprint of the treatment facilities. The other advantage of MBRs is that they produce a very-high quality effluent. In some cases, MBR facilities can be an effective solution.

MBR's have a number of disadvantages. They are often not a cost-effective solution for facilities that have high peak storm flow events like Aumsville. This is due to the cost of the additional membrane filters needed to process the higher flow. MBR's also require aeration of the membrane filter basins. This aeration cost is in addition to the aeration for the biological process. As such, MBR's tend to consume more power than traditional activated sludge processes. MRB's also require chemical cleaning of the membrane filters to maintain the filtering capacity. This adds to the overall capital cost and operation cost. Finally, the membranes must be replaced at approximately 10 year intervals. This also increases operational costs.

The authors of this report have completed several detailed evaluations of membrane bioreactor alternatives as part of facilities planning efforts for other City's. As a result of this work, the authors determined that an MBR alternative in Aumsville will have a significantly higher capital cost that the other alternatives evaluated above. The MBR is also have higher O&M costs. For these reasons, the MBR alternative was not considered further. That said, MBR treatment technology is rapidly developing and the City may want to consider evaluating the potential for an MBR plant during the preliminary design phase of the treatment plant improvement project.

7.5.5 Comparison of Alternatives

This subsection presents a comparison of the treatment plant alternatives described above. A financial comparison is presented first. This is followed by a comparison of the advantages and disadvantages of each of the alternatives.

For the financial comparison, the total monthly user rate for each alternative is estimated. This calculation is based on the assumption that a low interest loan will be used to fund the capital improvements. The additional debt service associated with this loan is added to the existing user rate. The additional operation and maintenance cost for each alternative are also added to the existing user rate. Therefore, the estimated future user rate includes the sum of the existing user rate, the additional debt service for the capital construction costs, and the additional O&M costs for each alternative. The calculations are summarized in Table 7-9. As demonstrated, Alternative 2 has the lowest financial impact to the users and Alternative 3 has the highest. The estimated user rate is based on the assumption that the entire project will be funded by a low interest loan. There some funding programs that offer grant funds. If the City is successful at acquiring grant funds for the project, the future user rates will decrease.

In addition to monetary factors, the selection of a preferred alternative should also be based on non-monetary factors such as those listed in Table 7-10.

Table 7-9 | Monthly User Rate Comparison

Treatment Alternative	**1**	**2**	**3**
Description	Sequencing Batch Reactors (SBR)	Aerated Lagoons with Fixed Film Process	Pump Wastewater to the City of Salem
Capital Construction Cost	$21,657,000	$18,792,000	$19,220,000
Loan Amount	$21,657,000	$18,792,000	$19,220,000
Interest Rate	2.5%	2.5%	2.5%
Loan Term (years)	25	25	25
Annual Debt Service	$1,175,454	$1,019,953	$1,043,183
Additional O&M Cost	$266,000	$186,680	($64,000)
Annual City of Salem Charges	0	0	$1,082,000
Total Additional Annual Costs	$1,441,454	$1,206,633	$2,061,183
Number of Customer Accounts	1340	1340	1340
Monthly Rate Increase	$89.64	$75.04	$128.18
Existing User Rate	$50.00	$50.00	$50.00
Total Future User Rate	**$139.64**	**$125.04**	**$178.18**

Table 7-10 | Comparison of Treatment Plant Alternatives – Non-monetary Factors

Alternative 1: Sequencing Batch Reactors (SBR)	Alternative 2: Aerated Lagoons with Fixed Film Project	Alternative 3: Pump Wastewater to the City of Salem
Advantages		
▪ Provides a higher level of treatment than Alternative 2 ▪ Better suited to accommodate future permitting changes than Alternative 2. The SBR is a flexible process than can be modified to achieve different treatment goals.	▪ Lowest overall cost ▪ Easiest to operate	▪ Best long-term solution. The high cost of wastewater treatment in Aumsville is mostly due to the small receiving stream (Beaver Creek). This option eliminates the need to discharge to Beaver Creek and has the potential to be best long-term solution for the City.
Disadvantages		
▪ Higher cost than Alternative 2 ▪ More challenging to operate than Alternative 2. ▪ Ammonia rebound in the water stored in the lagoons may cause problems.	▪ No similar installations in Oregon ▪ Somewhat of unproven system in Oregon ▪ The lack of a clarification process after the MBBR is somewhat risky and unproven. ▪ Less operator control than Alternative 1	▪ Extremely high costs. ▪ Relies on City of Salem ▪ Highest potential for environmental issues due to pipeline construction in previously undisturbed areas. ▪ Hydrogen sulfide control in the forcemain will be an operational challenge

7.5.6 Preferred Alternative (Project T-1)

Alternative 3 (Pump Wastewater to the City of Salem) has the potential to be the best long-term solution for the City. Most of the challenges with wastewater treatment in Aumsville are the result of the relatively small size of the stream into which the City discharges effluent (Beaver Creek). Due to the small size of Beaver Creek, there will always be the potential for future regulatory changes that will require the City to provide a higher level of treatment (i.e., construct more treatment facilities). For example, the DEQ may eventually add a total nitrogen limit to the City's permit. If so, additional treatment facilities will be needed. This will always be an issue in the City as long as effluent is discharged to Beaver Creek. Unfortunately, there are no larger streams within a reasonable proximity to the City. The only alternative that eliminates the Beaver Creek outfall is Alternative 3. Unfortunately, the costs to construct the infrastructure needed along with the user charges from the City of Salem, render this alternative the most expensive of the three options.

Alternative 2 is the lowest cost alternative. However, Alternative 2 will not produce the same quality of effluent as Alternative 1. Alternative 1 is a modification of the activated sludge process which offers the operators more control and flexibility than Alternative 2. Alternative 1 provides a higher overall level of treatment. For example, it will be possible to denitrify the wastewater during the spring, summer, and fall months when flows are lower. This will reduce the overall amount of nitrogen available in the system. This is not possible with Alternative 2. It is expected that Alternative 1 will also produce effluent with lower BOD and TSS concentrations than Alternative 2. Also, Alternative 2 is somewhat of an unproven technology in

Oregon. There are no similar installations in the State. Alternative 2 also lacks a clarification or filtration step after the MBBR. This is somewhat risky as the biofilm can slough off of the growth media and degrade the effluent quality. For this reason, it is common to install a clarifier or filter after the MBBR. Based on discussions with a reputable manufacturer, the system proposed in Aumsville is a very lightly loaded MBBR. Therefore, the biofilms are expected to be thin and not overly susceptible to sloughing. Nonetheless, there is some risk with this alternative that really does not exist for Alternative 1. Looking beyond the current planning period, Alternative 1 will likely be able to serve the City longer before there is a need to add additional treatment processes. This is because Alternative 1 should be able to produce a higher quality effluent. Therefore, looking out over a longer planning horizon than 20 years, Alternative 1 has the potential to be the lowest cost option over the long-run. Alternative 1 also has less risk than Alternative 2. SBRs are common in Oregon and are a well-established treatment technology. That said, the future is difficult to predict, and implementing Alternative 2 at this time would be reasonable choice to reduce the overall cost of the project.

Based on discussions with City staff, Alternative 1 (SBR) has been selected at the preferred alternative. This decision is based on the idea that the SBR is a more proven technology with less overall risk. As such, the slightly higher cost is worth the benefit. Throughout the remainder of this document, the implementation of Alternative 1 will be referred to as Project T-1 with a total recommended project budget of $21,675,000. The reader is referred to subsection 7.5.1 for a description of the proposed improvements.

7.6 NPDES PERMITTING MODIFICATION

The recommended treatment plant improvements (Project T-1), will result in a plant that will produce effluent that is suitable for surface water discharge during the dry weather months under the Willamette Basin Standards. Therefore, it may be possible to discharge to Beaver Creek in May and October if sufficient flow in the stream is available. During the dry weather season, the flows in Beaver Creek eventually drop low enough that it cannot accept the City's discharge without unacceptable water quality impacts. However, during wetter than average conditions in May and October, the flow in Beaver Creek will likely be high enough to receive effluent without significant water quality impacts. At the present time, the City's NPDES permit does not allow discharge to Beaver Creek from May 1 through October 31. Therefore, a permit modification much be obtained in order to discharge in May and October. It is unclear if DEQ will be willing or able to approve this change to the City's permit. However, as the City proceeds with the implementation of project T-1, it is recommended that the City seek a permit amendment to allow discharge in May and October as long as the flow in Beaver Creek is sufficiently high. This will reduce the amount of water that must be stored and re-treated using the DAF clarifier and thereby lower operational costs for the City.

CHAPTER 8

CAPITAL IMPROVEMENT PLAN

Chapter Outline

8.1 Introduction
8.2 Prioritized Improvements
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8.2.2 Prioritized Groups
8.2.3 Prioritized Capital Improvement Projects
8.2.4 Environmental Impact
8.3 Basis of Costs
8.3.1 Accuracy of Cost Estimates
8.3.2 Adjustment of Cost Estimates over Time
8.3.3 Engineering and Administrative Costs and Contingencies
8.4 Construction Cost Estimates
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8.4.2 Pump Station Improvement Costs
8.4.3 Wastewater Treatment Improvement Costs
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8.5.1 Local Funding Sources
8.5.2 State and Federal Grant and Loan Programs
8.5.3 Funding Recommendations

CAPITAL IMPROVEMENT PLAN

8.1 INTRODUCTION

As documented in the previous sections, there is a need for wastewater system improvements within the study area to correct existing and projected deficiencies. Some of these deficiencies are more critical than others. Some deficiencies existing under current conditions, while other deficiencies will manifest as the City grows and/or the existing systems continue to age.

Recommended improvements for specific components of the City's wastewater system have been described in previous chapters. This chapter builds on that work by assigning a priority to each of the improvement recommendations. The cost estimates have been developed to a conceptual level, for planning and budgeting purposes. More detailed cost estimates will be necessary as the projects are implemented.

8.2 PRIORITIZED IMPROVEMENTS

A prioritizing process is required since the scope of the proposed improvements is large. Projects that resolve immediate deficiencies should naturally have a higher priority than long-term, growth-related improvements. The following approach is designed to provide a basis for evaluating and ranking the improvement projects.

8.2.1 Prioritization Criteria

The assignment of a particular project or capital improvement program to a priority level was made after an evaluation using the following criteria:

- Public Health/Environmental Concerns—Projects targeted to resolve existing or near-term regulatory compliance issues were assigned the highest priority.
- Capacity or Size Deficiencies—The severity of the deficiency was considered and compared with the service improvements provided by the replacement components. The projected 'yield' or cost-benefit ratio of a project was used to assign a priority of high, medium or low.
- Consumed Infrastructure—Projects to replace damaged or deteriorated infrastructure, particularly those facilities that have reached the end of their useful life and no longer function as designed were assigned a higher priority.
- City Priority—Projects identified by City operations and maintenance personnel to be high priority due to operational or maintenance problems.
- Development Demand —The anticipated timeframe for the development of land within the service area of proposed improvements was considered. Projects to serve approved or near-term developments were given higher priority, while improvements targeted to long term developments were deferred.

8.2.2 Prioritized Groups

In order to assist the City with their planning, scheduling and construction efforts each improvement project was assigned to one of three priority levels. The priority levels are:

- Priority 1—Near Term Improvements

  These projects are targeted to problem areas needing immediate attention. They have been developed to resolve existing or near-term system deficiencies, resolve regulatory compliance issues or to serve known near-term anticipated developments. It is recommended that Priority 1 improvements are undertaken as soon as practical. The Priority 1 improvements are further broken into Class A and Class B Priorities, with Class A being the most important projects.

- Priority 2—Intermediate Improvements

  These projects will be needed beyond the near term of the Priority 1 projects to provide service to anticipated future developments or to address problems with existing infrastructure that is likely to become deficient during the planning period. Although not critical at this time, Priority 2 improvements should be considered as improvement projects that will be upgraded to Priority 1 at some point during the planning period.

- Priority 3—Long Term Improvements/Possible Future Need

  These projects are needed to improve system reliability or to supply future demands if land develops to the zoned densities. While important, they are not considered to be critical at the present time. If possible, projects in this category should be incorporated into ongoing citywide development and improvement projects to capture the savings associated with concurrent construction. Projects that will need to be constructed by developers in conjunction with future developments were assigned to this group.

8.2.3 Prioritized Capital Improvement Projects

To aid in the development of a wastewater system capital improvement program (CIP), each improvement project was examined and assigned to one of the priority classes described above. Table 8-1 is a comprehensive listing of these projects. The locations of the various projects are shown in Figure 8-1 and Figure 8-2 below. The reader is referred to previous chapters of this report for more detailed descriptions of the individual projects.

At a minimum, all of the Priority 1 and Priority 2 improvements should be included in the CIP. The Priority 3 improvements are largely growth driven. In general, it is envisioned that the Priority 3 improvements will be constructed as part of future development and that the developer will pay for the improvements. Should the City desire to promote development in certain areas, selected Priority 3 improvements may also be included in the CIP. Work on the Priority 1A improvements should begin immediately after agency approval and City adoption of this plan. A key early first step is the procurement of a funding plan for the Priority 1A improvements. This work effort will include meeting with the various funding agencies to evaluate funding assistance alternatives. The funding plan should also include preparation of a financial analysis of the wastewater utility that includes recommendations for utility rate and SDC fee increases.

Table 8-1 | Recommended Capital Improvement Priorities

Project Code (1)	Project	Priority	Total Estimated Project Cost (2)
T-1	WWTP Improvements – Sequencing Batch Reactors	1A	$21,675,000
G-1	Olney Street Sewer (9th Street to 4th Street)	1B	$438,000
G-2	4th Street Sewer (Olney Street to Del Mar Drive)	1B	$414,000
G-3	9th Street Sewer (Olney Street to Del Mar Drive)	1B	$328,000
G-4	Del Mar Drive Sewer (9th Street to 11th Street)	1B	$268,000
G-5	5th Street Sewer (4th/Clover Intersection to 5th/Cleveland Intersection)	1B	$355,000
		Subtotal Priority 1….	**$ 23,478,000**
G-6	11th Street Sewer (Del Mar Drive to Lincoln Street)	2	$216,000
G-7	Del Mar Drive Sewer (4th/Delmar Intersection to Gordon/1st Intersection)	2	$356,000
		Subtotal Priority 2….	**$ 572,000**
E-1	West Olney Basin Pump Station and Forcemain	3	$1,582,000
E-2	Gordon Lane Basin Gravity Sewers	3	Note 3
E-3	West UGB Basin Pump Station and Forcemain	3	$1,365,000
E-4	Mill Creek Basin Pump Station and Forcemain	3	$1,330,000
		Subtotal Priority 3….	**$ 4,277,000**
		TOTAL….	**$ 28,327,000**
Recurring Annual Programs			
Pgm-1	Annual Sewer Collection System Rehabilitation Program (Program – 1)		$30,000
		Subtotal Recurring Annual Programs….	**$ 30,000**

(1) Project Code Legend:
G = Gravity Sewer T = Treatment E = Sewer System Extension Pgm = Improvement Program
(2) See Section 8.3 for basis of project cost estimates. Costs in 2021 dollars ENR = 12,200
(3) Cost estimates not prepared for Gordon Lane Basin gravity sewers because these will likely be constructed by private developers

Figure 8-1 | Recommended Capital Improvement Priorities - North

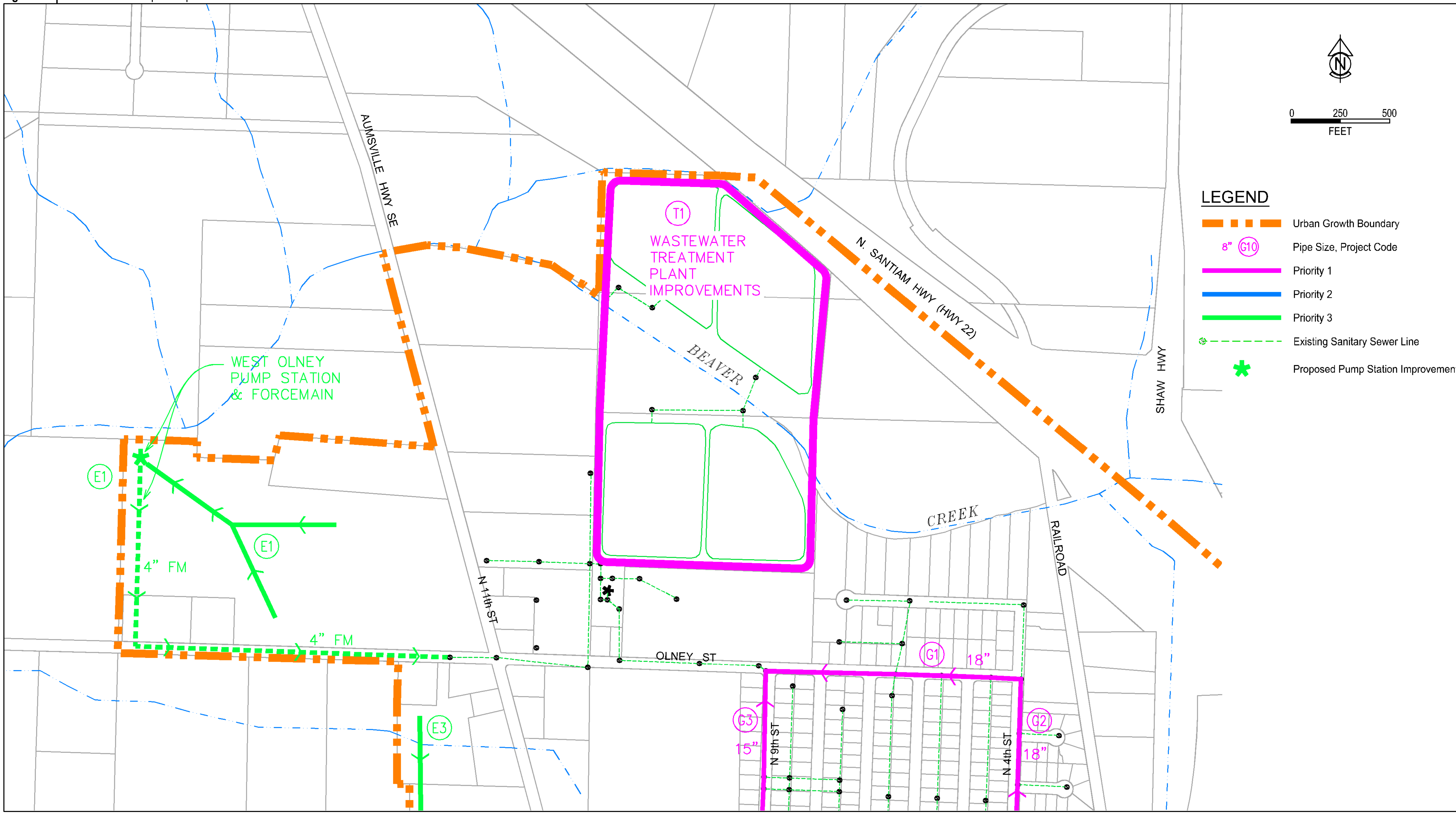

FIGURE 8-1

Figure 8-2 | Recommended Capital Improvement Priorities – South

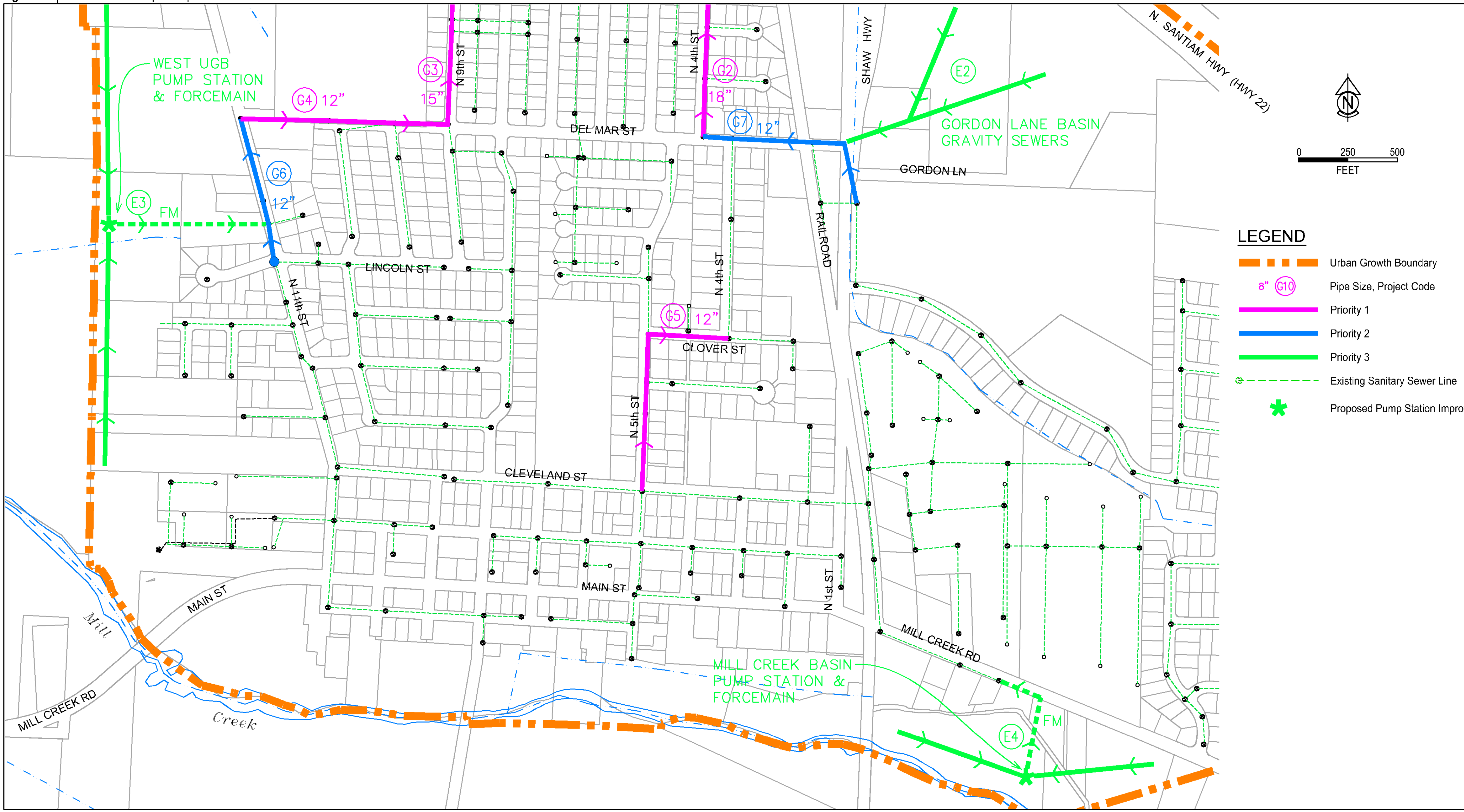

FIGURE 8-2

8.2.4 Environmental Impact

It should be noted that while the improvements recommended in this report are not anticipated to have significant adverse impacts on the environment, each CIP project will need to undergo project-specific environmental review (as applicable) as part of the preliminary and final design process. The scope of the environmental review and permitting requirements will vary from project to project. Should the City choose to pursue State or Federal funding assistance for a particular project, the funding agency will have specific environmental review requirements that must be completed prior to the award of a funding package.

8.3 BASIS OF COSTS

In order to forecast municipal capital expenditures, cost estimates have been prepared for each improvement alternative. The preparation methodology and intended use of these cost estimates are summarized below.

8.3.1 Accuracy of Cost Estimates

The accuracy and precision of cost estimates is a function of the level to which improvement alternatives are developed (i.e., detail and design) and the techniques used in preparing the actual estimate. Estimates are typically divided into three basic categories as follows:

- Planning Level Estimate. These are order-of-magnitude estimates made without detailed engineering design data. They are often performed at the zero to 2 percent stage of project completion and typically range from 35 percent over, to 25 percent below the final project cost. A relatively large contingency is typically included to reduce the risk of underestimating. This is particularly important since many times the project financing must be secured before the detailed design can proceed.
- Budgetary Estimates. This level of estimate is prepared during the preliminary design phase using process flow sheets, preliminary layouts and equipment details. This type of estimate is typically accurate to +30 and –15 percent of the final project cost.
- Engineer's Estimate. This estimate is prepared on the basis of well-defined engineering data, typically when the construction plans and specifications are completed. The estimating process at this level relies on piping and instrument diagrams, electrical diagrams, equipment data sheets, structural drawings, geotechnical data and a complete set of specifications. This estimate is sometimes called a definite estimate. The engineer's estimate is expected to be accurate within +15 percent to –5 percent of the pricing secured during the bidding process.

The project costs prepared as part of this study are planning level estimates. Actual project costs will depend on the final project scope, labor and material costs, market conditions, construction schedule, and other variables at the time the project is built. These variables are typically uncertain at the time planning level estimates are prepared. Prior to the implementation of each of the recommended projects, the City should update the cost estimates during the preliminary design phase. As more detailed information becomes available, more accurate cost estimates can be prepared.

8.3.2 Adjustment of Cost Estimates over Time

A commonly used indicator to evaluate the change of construction costs over time is the Engineering News-Record (ENR) construction cost index. The index is computed from the prices for structural steel, Portland cement, lumber, and common labor, and is based on a value of 100 in the year 1913. The construction costs developed in this analysis are based on 2021 ENR 20 City Construction Cost Index of 12,200. As the planning period elapses, the costs presented in this study can be updated to the present, by applying the ratio of the current cost index to the index used during the preparation of the estimate.

8.3.3 Engineering and Administrative Costs and Contingencies

The cost of engineering services for major projects typically covers special investigations, pre-design reports, topographic surveying, geotechnical investigations, contract drawings and specifications, construction administration, inspection, project start-up, the preparation of O&M manuals, and performance certifications. Depending on the size and type of the project, engineering costs may range from 16 to 25 percent of the contract cost when all of the above services are provided. The lower percentage applies to large projects without complex mechanical systems. The higher percentage applies to smaller, more complex projects that require the integration of a complex design into an existing facility and where full-time inspection is required by the funding agencies or desired by the Owner.

The City will have administrative costs associated with any construction project. These include internal planning and budgeting costs, administration of engineering and construction contracts, legal services, and coordination with regulatory and funding agencies.

8.4 CONSTRUCTION COST ESTIMATES

The planning level estimates for the improvements recommended in this study are based on a number of assumptions as follows. The cost estimates reflect projects bid in late winter or early spring for summer construction. The estimates are based on construction costs of similar historical projects and on current estimates solicited from material and equipment vendors. The estimates are expected to have accuracies of +35 percent and –25 percent of the actual project cost. The following sections describe the cost estimating process for the various categories of projects.

8.4.1 Gravity Collection System Improvement Costs

The cost estimates for the proposed gravity pipeline improvements were based on the following assumptions.

- Normal depth sewer pipeline construction (i.e, approximately 12 feet or less).
- 8 inch gravity pipeline construction cost (materials, installation & surface restoration, etc.) - $150 per foot
- 10 inch gravity pipeline construction cost (materials, installation & surface restoration, etc.) - $160 per foot
- 12 inch gravity pipeline construction cost (materials, installation & surface restoration, etc.) - $170 per foot
- 15 inch gravity pipeline construction cost (materials, installation & surface restoration, etc.) - $200 per foot
- 18 inch gravity pipeline construction cost (materials, installation & surface restoration, etc.) - $220 per foot

- New Manholes (materials, installation, and surface restoration) - $6,000 each
- Service Laterals (materials, installation, and surface restoration) - $3,000 each
- Railroad & Highway Bores - $1000 per foot
- Construction Contingencies - 10% of estimated construction cost
- Engineering Costs (surveying, engineering design, and construction administration) - 20% of estimated construction cost
- Legal, Permits & Administrative Costs (permitting, administration, legal, easement acquisition and financing) - 10% of estimated construction cost

8.4.2 Pump Station Improvement Costs

Construction costs for new pump stations include site preparation, foundation, wet well construction, building, pumps, mechanical piping, emergency power generation, and electrical and instrumentation. Project costs have been based on historical construction cost information for similarly sized projects, discussions with manufacturers, and the assumption that the pump stations will be constructed in accordance with the pump station design criteria listed in Chapter 3. A construction contingency of 10%, an engineering design cost of 20% and an administrative, legal and permitting cost of 10% was assumed for these projects.

8.4.3 Wastewater Treatment Improvement Costs

Construction costs for the wastewater treatment plant improvements include site preparation and foundations, buildings, tankage, treatment equipment for each unit process, associated mechanical piping and pumping, chemical feed equipment, yard piping, outfall piping, and electrical and instrumentation.

A construction contingency of 10% of the estimated construction cost was used for the treatment plant estimates. Engineering, legal, and administration costs were assumed to be 20% of the estimated construction cost. Permitting costs were assumed to be 2% of the estimated construction cost unless otherwise noted.

8.5 FUNDING SOURCES

As a general rule, small communities are not able to finance major wastewater system improvements without some form of government funding such as low interest loans or grants. It is anticipated that the funding for the recommended capital improvement plan outlined in this report will be secured from multiple sources, including system development charges (SDCs), monthly user fees, as well as state and federal grant and loan programs. The following section outlines the major local and State/Federal funding programs that may be available for these projects.

8.5.1 Local Funding Sources

To a large degree, the type and amount of local funding used for the improvements will depend on the amount of grant funding obtained and the requirements of any loan funding. Local revenue sources for capital improvements include ad valorem taxes (property taxes), various types of bonds, user fees, connection fees and SDCs. Local revenue sources for operating costs include ad valorem taxes and user fees. The following sections discuss local funding sources and financing mechanisms that are most commonly used for the type of capital improvements presented in this study.

8.5.1.1 User Fees

User fees are monthly charges to all residences, businesses, and other users that are connected to the system. User fees are established by the City Council and are typically the sole source of revenue to finance operation and maintenance. These fees are periodically modified to account for changes in operation and maintenance costs, and the need for new improvements. Although user fees are not always sufficient to finance major capital construction projects, they can be used to repay long term financing. The reader is referred to Section 4.7.1 for a description of the City's current user fee structure.

8.5.1.2 System Development Charge Revenues

A system development charge (SDC) is a fee collected by the City as each piece of property is developed. SDCs are used to finance necessary capital improvements and municipal services required by the development. SDCs can be used to recover the capital costs of infrastructure required as a result of the development, but cannot be used to finance either operation and maintenance, or replacement costs. The reader is referred to Section 4.7.2 for information on the City's current SDC charges.

As established in ORS 223, a SDC can have two principal elements, the reimbursement fee and the improvement fee. Fees are collected at issuance of building permits. The reimbursement portion of the SDC is the fee for buying into either existing capital facilities or those that are under construction. The reimbursement fee represents a charge for utilizing excess capacity in an existing facility that was paid for by other parties. The revenue from this fee is typically used to repay existing improvement loans. The improvement portion of the SDC is the fee designed to cover the costs of capital improvements that must be constructed to provide an increase in capacity.

8.5.1.3 Connection Fees

Many cities charge connection fees to cover the cost of connecting a new development to the municipal sewer system. There are two types of connection fees. The first is for newly constructed connections and is designed to cover the cost of City inspections at the time of connection to the collection system. The second type of fee is designed to defray the City's administrative cost of setting up a new account and is charged against newly constructed connections, as well as transfers of an existing service to a new owner.

8.5.1.4 Capital Construction Fund

Capital construction funds, or sinking funds, are often established as a budget line item to set aside money for a particular construction purpose. A set amount from each annual budget is deposited in a sinking fund until sufficient reserves are available to complete the project. Such funds can also be developed from user fee revenues or from SDCs. The City currently maintains two capital construction funds. The status of these funds is discussed in Chapter 4 (see section 4.7.4).

8.5.1.5 General Obligation Bonds

The sale of municipal general obligation bonds is a traditional method of funding municipal improvement projects. General obligation bonds utilize the City's basic taxing authority and are retired with property taxes based on an equitable distribution of the bonded obligation across the City's assessed valuation. General obligation bonds are normally associated with the financing of facilities that benefit an entire community and must be approved by a majority vote of the City's voters.

General obligation bonds are backed by the City's full faith and credit, as the City must pledge to assess property taxes sufficient to pay the annual debt service. This portion of the property tax is outside the State constitutional limits that restrict property taxes to a fixed percentage of the assessed value. The City may use other sources of revenue, including user fee revenues, to repay the bonds. If it uses other funding sources to repay the bonds, the amount collected as taxes is reduced commensurately.

The general procedure followed when financing improvements with general obligation bonds is typically as follows:

- Determination of the capital costs required for the improvement
- An election by the voters to authorize the sale of bonds
- The bonds are offered for sale
- The revenue from the bond sale is used to pay the capital cost of the project(s)

General obligation bonds can be "revenue supported", wherein a portion of the user fee is pledged toward repayment of the bond debt. The advantage of this method is that the need to collect additional property taxes to retire the bonds is reduced or eliminated. Such revenue supported general obligation bonds have most of the advantages of revenue bonds in addition to a lower interest rate and ready marketability.

The primary disadvantage with the use of general obligation bonds is that the debt incurred by this method is often added to the debt ratios of the City. This has the potential to limit flexibility of the municipality to issue debt for other purposes.

8.5.1.6 Revenue Bonds

Revenue bonds are similar to general obligation bonds, except they rely on revenue from the sales of the utility (i.e., user fees) to retire the bonded indebtedness. The primary security for the bonds is the City's pledge to charge user fees sufficient to pay all operating costs and debts service. Because the reliability of the source of revenue is relatively more speculative than for general obligation bonds, revenue bonds typically have slightly higher interest rates.

The general shift away from ad valorem property taxes makes revenue bonds a frequently used option for payment of long-term debt. Many communities prefer revenue bonding, because it ensures that no additional taxes are levied. In addition, repayment of the debt obligation is limited to system users since repayment is based on user fees.

One advantage with revenue bonds is that they do not count against a City's direct debt. This feature can be a crucial advantage for a municipality near its debt limit. Rating agencies closely evaluate the amount of direct debt when assigning credit ratings. There are normally no legal limitations on the amount of revenue bonds that can be issued; however, excessive issue amounts are generally unattractive to bond buyers because they represent high investment risks.

Under ORS 288.805-288.945, Cities may elect to issue revenue bonds for revenue producing facilities without a vote of the electorate. Certain notice and posting requirements must be met and a sixty (60) day waiting period is mandatory.

The bond lender typically requires the City to provide two additional securities for revenue bonds that are not required for general obligation bonds. First, the City must set user fees such that the net projected cash flow from user fees plus interest will be at least 125% of the annual debt service (a 1.25 debt coverage ratio). Secondly, the City must establish a bond reserve fund equal to maximum annual debt service or 10% of the bond amount, whichever is less.

8.5.1.7 Improvement Bonds

Improvement (Bancroft) bonds are an intermediate form of financing that are less than full-fledged general obligation or revenue bonds. This form of bonding is typically used for Local Improvement Districts.

Improvement bonds are payable from the proceeds of special benefit assessments, not from general tax revenues or user fees. Such bonds are issued only where certain properties are recipients of special benefits not occurring to other properties. For a specific improvement, all property within the designated improvement district is assessed on the same basis, regardless of whether the property is developed or undeveloped. The assessment is designed to divide the cost of the improvements among the benefited property owners. The manner in which it is divided is in proportion to the direct or indirect benefits to each property. The assessment becomes a direct lien against the property, and owners have the option of either paying the assessment in cash, or applying for improvement bonds. If the improvement bond option is taken, the City sells Bancroft Improvement Bonds to finance the construction, and the assessment is paid over 20 years in 40 semiannual installments plus interest.

The assessments against the properties are usually not levied until the actual cost of the project is determined. Since the determination of actual costs cannot normally be determined until the project is completed, funds are not available from assessments for the purpose of paying costs at the time of construction. Therefore, some method of interim financing must be arranged.

The primary disadvantage to this source of revenue is that the development of an assessment district is very cumbersome and expensive when facilities for an entire City are contemplated. Therefore, this method of financing should only be considered for discrete improvements to the collection system where the benefits are localized and easily quantified.

8.5.1.8 Certificates of Participation

Certificates of Participation are a form of bond financing that is distinct from revenue bonds. While it is more complex, and typically has a higher interest rate than revenue bonds, it is a process controlled by the City Council, and it does not have to be referred to the voters. This can result in significant time savings.

8.5.1.9 Ad Valorem Property Taxes

Ad valorem property taxes were often used in the past as a revenue source for public utility improvements. These taxes were the traditional means of obtaining revenue to support all local governmental functions. Ad valorem taxation is a financing method that applies to all property owners that benefit, or could potentially benefit from an improvement, whether the property is developed or not. The construction costs for the improvement project are shared proportionally among all property owners based on the assessed value of each property. Ad valorem taxation, however, is less likely to result in individual users paying their proportionate share of the costs as compared to their benefits.

8.5.2 State and Federal Grant and Loan Programs

Several state and federal grant and loan programs are available to provide financial assistance for municipal wastewater system improvements. The primary sources of funding available for wastewater system financing are Rural Utilities Service (RUS), Special Public Works Fund (SPWF), the Water/Wastewater (W/W) Financing Program, the Community Development Block Grant (CDBG) program, and the Clean Water State Revolving Fund (CWSRF).

8.5.2.1 USDA Rural Development

USDA Rural Development (RD) provides federal loans and grants to rural municipalities, counties, special districts, Indian tribes, and not-for-profit organizations to construct, enlarge, or modify water treatment and distribution systems and wastewater collection and treatment systems. Preference is given to projects in low-income communities with populations below 10,000.

Borrowers of RD loans must be able to demonstrate the following:

- Monthly user rates must be at or above the local area-wide average.
- They have the legal authority to borrow and repay loans, to pledge security for loans, and to operate and maintain the facilities and services.
- They are financially sound and able to manage the facility effectively.
- They have a financially sound facility based on taxes, assessments, revenues, fees, or other satisfactory sources of income to pay for all facility costs including O&M and to retire indebtedness and maintain a reserve.

The maximum RD loan term is 40 years, but the finance term may not exceed statutory limitations on the agency borrowing the money or the expected useful life of the improvements. The reserve can typically be funded at 10 percent per year over a ten-year period. Interest rates for RD loans vary based on median household income, but tend to be lower than those obtained in the open market.

8.5.2.2 Oregon Infrastructure Finance Authority

The Oregon Infrastructure Finance Authority (IFA) manages a number of grant and low interest loan programs as described in the following sections.

Special Public Works Fund

The IFA administers the Special Public Works Fund (SPWF) program. The SPWF is a lottery-funded loan and grant program that provides funding to municipalities, counties, special districts, and public ports for infrastructure improvements to support industrial/manufacturing and eligible commercial economic development. Eligible commercial economic development is defined as commercial activity that is marketed nationally, or internationally, and attracts business from outside Oregon. Funded projects are usually linked to a specific private sector development and the resulting direct job creation (i.e., firm business commitment), of which 30% of the created jobs must be "family wage" jobs. The program also funds projects that build infrastructure capacity to support industrial/manufacturing development where recent interest by eligible business(s) can be documented.

The SPWF is primarily a loan program, although grant funds are available based on economic need of the community. Although the maximum loan term is 25 years, loans are generally made for 20-year terms. The maximum loan amount for projects funded with direct SPWF money is $1 million, while the maximum for projects financed with bond funds is $10 million.

Water/Wastewater Financing Program

The IFA also administers the W/W Financing Program, which gives priority to projects that provide system-wide benefits and helps communities meet the Clean Water Act or the Safe Drinking Water Act standards. It is intended to assist local governments that have been hard hit with state and federal mandates for public drinking water systems and wastewater systems. In order to be eligible for this program, the system must be out of compliance with federal or state rules, regulations or permits, as evidenced by issuance of Notice of Non-Compliance by the appropriate regulatory agency. The funded project must be needed to meet state or federal regulations. Priority is given to communities under economic distress.

Similar to the SPWF, the W/W Financing Program is primarily a loan program, although grant funds are available in certain cases, based on economic need of the community. Although the maximum loan term is 25 years, loans are generally made for 20-year terms. The maximum loan amount for projects funded with direct W/W money is $500,000, while the maximum for projects financed with bond funds is $10 million.

Economic and Community Development Block Grant (CDBG)

The IFA administers the CDBG, but the funds are from the U.S. Department of Housing and Urban Development (HUD), so all federal grant management rules apply to the program. The federal eligibility standards are strict. There are two subcategories of Public Works projects eligible for funding, "Public Water and Wastewater," and "Public Works for New Housing." Only the former is considered in this discussion.

Grants are available for critically needed construction, improvement, or expansion of publicly owned water and wastewater systems for the benefit of current residents. Generally, projects must be necessary to resolve regulatory compliance problems identified by state and/or federal agencies and the project must serve a community that is comprised of more than 51% of low and moderate income persons.

The program separates projects into three parts. Grants are available for:

- Preliminary Engineering and Planning Projects

  Generally, these grants fund preparation or update of Water System Master Plans and Wastewater Facility Plans, as required by the Oregon Department of Environmental Quality or Oregon Health Division. In addition, funds for grant administration and preparation of a final design funding application can be included in the project budget. All plans produced with grant funds must be approved by the appropriate regulatory agency. Grants of up to $10,000 can also be made for problem identification studies to delineate problems and corrective measures, as required by a regulatory agency.

- Final Design and Engineering Projects

  Final design and engineering, bid specifications, environmental review, financial feasibility, rate analysis, grant administration, and preparing a construction funding application are all eligible project activities. The final design, plans and specifications must be approved by the appropriate regulatory agency before a grant will be awarded.

- Construction Projects

  These grants fund construction and related activities, grant administration, and land/permanent easement acquisition.

  IFA has established an evaluation system that gives priority to projects that provide system-wide benefits. The overall maximum grant amount per water or wastewater project is $2,000,000 (including all planning, final engineering, and construction). The project cannot be divided locally into phases with the expectation of receiving more than one $2,000,000 grant. In order to qualify for grant funding under this program, the water user rates must be at or above statewide averages.

8.5.2.3 Clean Water State Revolving Fund (CWSRF)

The Clean Water State Revolving Fund loan program provides low-cost loans to public agencies for the planning, design or construction of various projects that prevent or mitigate water pollution. The Oregon Department of Environmental Quality administers the program. Eligible agencies include federally recognized Indian tribal governments, cities, counties, sanitary districts, soil and water conservation districts, irrigation districts, various special districts and certain intergovernmental entities.

Four different types of loans are available within the program including loans for planning, design, construction, and local community projects. A portion of the fund is reserved for small communities, planning and green projects. All loans, except for planning loans, include an annual loan fee on the outstanding balance. Interest rates for the loan program change quarterly based on a percentage of the national municipal bond rate. Those percentages vary from 25 percent to 55 percent of the bond rate. For example, with a quarterly bond rate of 3.75 percent, CWSRF interest rates range from .94 percent to 2.06 percent depending on the length of the loan repayment period. Interest rates are found on DEQ’s website. The low-interest rates and terms inherent with these loans make this program an attractive alternative to the municipal bond market. For example, a $4 million, 20-year loan with a CWSRF interest rate one-percentage point lower than a bond would reduce the interest cost by about $500,000 over the life of the loan.

DEQ accepts new applications year-round. Applicants must provide information on the project’s water quality benefits, environmental impact and estimated cost. Applications are available by contacting DEQ’s regional project officers as listed on DEQ’s website.

8.5.3 Funding Recommendations

Based on the infrastructure improvements and cost projections presented in this plan, the existing user fee and SDC fee structures are not be sufficient to meet the planning period goals. This plan accordingly recommends that the City complete a full review of its user fee and SDC rate structure and update these fees accordingly. Should the City choose to pursue funding assistance from one of the state and federal agencies an important early step is to schedule a "one stop meeting" with Oregon Infrastructure Finance Authority (IFA). These meetings are designed to gather staff from the various federal and state funding agencies to evaluate the applicability of the various funding sources to a particular municipal project.

APPENDIX A

NPDES PERMIT

State of Oregon Department of Environmental Quality

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM WASTE DISCHARGE PERMIT

Oregon Department of Environmental Quality
Western Region – Salem Office
4026 Fairview Industrial Dr. SE,
Salem, OR 97302
Telephone: 503-378-8240

Issued pursuant to ORS 468B.050 and the federal Clean Water Act

ISSUED TO:

City of Aumsville
595 Main St.
Aumsville, OR 97325

SOURCES COVERED BY THIS PERMIT:

Type of Waste	Outfall Number	Outfall Location
Treated Wastewater	001	Latitude: 44.85° Long: -122.88°
Recycled Water Reuse	002	Specified in Recycled Water Use Plan

FACILITY LOCATION:

955 Olney St.
Aumsville, OR 97325
County: Marion

EPA Permit Type: Minor

RECEIVING STREAM INFORMATION:

WRD Basin: Willamette
USGS Sub-Basin: Middle Willamette
Receiving Stream name: Beaver Creek
NHD Reach Code: 17090007000130 (20.1%)
LLID: 1229274448403-2.9

Issued in response to Application No. 961075 received July 16, 2013. This permit is issued based on the land use findings in the permit record.

Ranei Nomura Digitally signed by Ranei Nomura Date: 2021.09.01 11:30:39 -07'00'

Ranei Nomura, Water Quality Manager Western Region	September 1, 2021 Issuance Date	October 1, 2021 Effective Date

PERMITTED ACTIVITIES

Until this permit expires or is modified or revoked, the permittee is authorized to: 1) operate a wastewater collection, treatment, control and disposal system; and 2) discharge treated wastewater to waters of the state only from the authorized discharge point or points in Schedule A in conformance with the requirements, limits, and conditions set forth in this permit.

Unless specifically authorized by this permit, by another NPDES or Water Pollution Control Facility permit, or by Oregon statute or administrative rule, any other direct or indirect discharge of pollutants to waters of the state is prohibited.

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SCHEDULE A: WASTE DISCHARGE LIMITS

1. Outfall 001 – Permit Limits

During the term of this permit, the permittee must comply with the limits in the following table:

Table A1: Permit Limits

Parameter	Units	Average Monthly	Average Weekly	Daily Maximum
Effluent Flow (May 1 to Oct. 31)	MGD	No discharge (Daily max limit = 0 MGD)		
BOD_5 (Nov. 1 – Apr. 30)	mg/L	30	45	-
	lb/day	170	250	340
	% removal	85	-	-
TSS (Nov. 1 – Apr. 30)	mg/L	50	80	-
	lb/day	280	420	560
	% removal	65	-	-
Chlorine, Total Residual (Nov. 1 – Apr. 30) (See note a)	mg/L	0.01	-	0.02
Total Ammonia Final (Nov. 1 – Apr. 30) (See note b)	mg/L	3.3	-	8.3
pH (Nov. 1 – Apr. 30)	SU	Instantaneous limit between a daily minimum of 6.5 and a daily maximum of 8.9		
E. coli (Nov. 1 – Apr. 30) (See note c)	#/100 mL	Must not exceed a monthly geometric mean of 126, no single sample may exceed 406		

Notes:

a. DEQ has established a minimum Quantitation Limit of 0.05 mg/L for Total Residual Chlorine. In cases where the average monthly or maximum daily limit for Total Residual Chlorine is lower than the Quantitation Limit, DEQ will use the reported Quantitation Limit as the compliance evaluation level.

b. The final ammonia limit is effective after completion of the compliance schedule in Schedule C.

c. If a single sample exceeds 406 *E. coli* organisms/100 mL, the permittee may take at least 5 consecutive re-samples at 4-hour intervals beginning within 28 hours after the original sample was taken. A geometric mean of the 5 re-samples that is less than or equal to 126 *E. coli* organisms/100 mL demonstrates compliance with the limit.

2. Regulatory Mixing Zone

Pursuant to OAR 340-041-0053, the permittee is granted a regulatory mixing zone as described below:

The regulatory mixing zone is that portion of Beaver Creek where the effluent mixes with 25 percent of the stream flow. The Zone of Initial Dilution (ZID) is that portion of Beaver Creek where the effluent mixes with 10 percent of the stream flow.

3. Use of Recycled Water

The permittee is authorized to distribute recycled water if it is:

a. Treated and used according to the criteria listed in Table A2.

b. Managed in accordance with its DEQ-approved Recycled Water Use Plan unless exempt as provided in Schedule D4.

c. Used in a manner and applied at a rate that does not adversely affect groundwater quality.

d. Applied at a rate and in accordance with site management practices that ensure continued agricultural, horticultural, or silvicultural production and does not reduce the productivity of the site.

e. Irrigated using sound irrigation practices to prevent:

  i. Offsite surface runoff or subsurface drainage through drainage tile;

  ii. Creation of odors, fly and mosquito breeding, or other nuisance conditions; and

  iii. Overloading of land with nutrients, organics, or other pollutants.

Table A2: Recycled Water Limits

Class	Level of Treatment (after disinfection unless otherwise specified)	Beneficial Uses
C.	Class C recycled water must be oxidized and disinfected. Total coliform may not exceed: • A median of 23 total coliform organisms per 100 mL, based on results of the last 7 days that analyses have been completed. • 240 total coliform organisms per 100 mL in any two consecutive samples.	Class C recycled water may be used for: • Class D and non-disinfected uses. • Irrigation of processed food crops; irrigation of orchards or vineyards if an irrigation method is used to apply recycled water directly to the soil. • Landscape irrigation of golf courses, cemeteries, highway medians, or industrial or business campuses. • Industrial, commercial, or construction uses limited to: industrial cooling, rock crushing, aggregate washing, mixing concrete, dust control, nonstructural firefighting using aircraft, street sweeping, or sanitary sewer flushing.

4. Biosolids

The permittee may land apply biosolids or provide biosolids for sale or distribution, subject to the following conditions:

a. The permittee must manage biosolids in accordance with its DEQ-approved Biosolids Management Plan and Land Application Plan.

b. The permittee must apply biosolids at or below the agronomic rates approved by DEQ in order to minimize potential groundwater degradation.

c. The permittee must obtain written site authorization from DEQ for each land application site prior to land application (see Schedule D6) and follow the site-specific management conditions in the DEQ-issued site authorization letter.

d. Prior to application, the permittee must ensure that biosolids meet one of the pathogen reduction standards under 40 CFR 503.32 and one of the vector attraction reduction standards under 40 CFR 503.33.

e. The permittee must not apply biosolids containing pollutants in excess of the ceiling concentrations shown in the table below. The permittee may apply biosolids containing pollutants in excess of the pollutant concentrations, but below the ceiling concentrations, however, the total quantity of biosolids applied cannot exceed the cumulative pollutant loading rates in the table below.

Table A3: Biosolids Limits

Pollutant (See note a)	**Ceiling concentrations (mg/kg)**	**Pollutant concentrations (mg/kg)**	**Cumulative pollutant loading rates (kg/ha)**
Arsenic	75	41	41
Cadmium	85	39	39
Copper	4300	1500	1500
Lead	840	300	300
Mercury	57	17	17
Molybdenum	75	–	–
Nickel	420	420	420
Selenium	100	100	100
Zinc	7500	2800	2800

Note:
a. Biosolids pollutant limits are described in 40 CFR 503.13, which uses the terms *ceiling concentrations*, *pollutant concentrations*, and *cumulative pollutant loading rates*.

SCHEDULE B: MINIMUM MONITORING AND REPORTING REQUIREMENTS

1. Reporting Requirements

The permittee must submit to DEQ monitoring results and reports as listed below.

Table B1: Reporting Requirements and Due Dates

Reporting Requirement	Frequency	Due Date (See note a)	Report Form (See note b)	Submit To:
Tables B2, B3, B4, and B5 Influent Monitoring, Effluent Monitoring, Receiving Stream Monitoring, and Lagoon Monitoring	Monthly	By the 15th of the following month	Specified in Schedule B. Section 2 of this permit	Electronic reporting as directed by DEQ
Recycled Water Annual Report (See Schedule D3)	Annually	By January 15th of the following year	Electronic copy in the DEQ-approved format	Attached via electronic reporting as directed by DEQ Electronic copy to DEQ Water Reuse Program Coordinator
Inflow and Infiltration Report (See Schedule D1)	Annually	By February 15th of the following year	Electronic copy in a DEQ-approved format	Attached via electronic reporting as directed by DEQ
Sludge Depth Survey Report (See Schedule D9)	Annually	By February 15th of the following year	Electronic copy in a DEQ-approved format	Attached via electronic reporting as directed by DEQ
Wastewater Solids Annual Report (See Schedule D5) (See note c)	Annually when solids are removed, if Biosolids Management Plan not developed	By February 19th of the following year	Electronic copy in the DEQ-approved format	Attached via electronic reporting as directed by DEQ Electronic copy to DEQ Biosolids Program Coordinator
Biosolids Annual Report (See Schedule D6) (See note c)	Annually when solids are removed, if Biosolids Management Plan developed	By February 19th of the following year	Electronic copy in the DEQ-approved form	Attached via electronic reporting as directed by DEQ DEQ Biosolids Program Coordinator

Reporting Requirement	Frequency	Due Date (See note a)	Report Form (See note b)	Submit To:
Industrial User Survey (See Schedule D11)	Every 5 years	Submit by no later than 24 months after permit effective date	1 electronic copy and 1 hard copy in a DEQ approved format	• 1 Hard copy to DEQ Pretreatment Coordinator • 1 Electronic copy to Compliance Officer
Update and Obtain DEQ-Approved Recycled Water Use Plan	Once	December 1, 2021	Electronic copy in the DEQ-approved form	Attached via electronic reporting as directed by DEQ Electronic copy to DEQ Water Reuse Program Coordinator
Outfall Inspection Report (See Schedule D12)	Once per permit cycle	Submit by 02/15/2024	Electronic copy in a DEQ-approved format	Attached via electronic reporting as directed by DEQ

Notes:
a. For submittals that are provided to DEQ by mail, the postmarked date must not be later than the due date.
b. All reporting requirements are to be submitted in a DEQ-approved format, unless otherwise specified in writing.
c. A report will only be submitted if solids are removed from the lagoons.

2. Monitoring and Reporting Protocols

a. **Electronic Submissions**

The permittee must submit to DEQ the results of monitoring indicated in Schedule B in an electronic format as specified below.

i. The permittee must submit monitoring results required by this permit via DEQ-approved web-based Discharge Monitoring Report (DMR) forms to DEQ via electronic reporting. Any data used to calculate summary statistics must be submitted as a separate attachment approved by DEQ via electronic reporting.

ii. The reporting period is the calendar month.

iii. The permittee must submit monitoring data and other information required by this permit for all compliance points by the 15th day of the month following the reporting period unless specified otherwise in this permit or as specified in writing by DEQ.

b. **Test Methods**

The permittee must conduct monitoring according to test procedures in 40 CFR part 136 and 40 CFR part 503 for biosolids or other approved procedures as per Schedule F.

c. **Detection and Quantitation Limits**

i. Detection Level (DL) – The DL is defined as the minimum measured concentration of a substance that can be distinguished from method blank results with 99% confidence. The DL is derived using the procedure in 40 CFR part 136 Appendix B and evaluated for reasonableness relative to method blank concentrations to ensure results reported above the DL are not a result of routine background contamination. The DL is also known as the Method Detection Limit (MDL) or Limit of Detection (LOD).

ii. Quantitation Limits (QLs) – The QL is the minimum level, concentration or quantity of a target analyte that can be reported with a specified degree of confidence. It is the lowest level at which the entire analytical system gives a recognizable signal and acceptable calibration for the analyte. It is normally equivalent to the concentration of the lowest calibration standard adjusted for sample weights, volumes, preparation and cleanup procedures employed. The QL as reported by a laboratory is also sometimes referred to as the Method Reporting Limit (MRL) or Limit of Quantitation (LOQ).

d. **Sufficient Sensitivity of Quantitation Limits**

The Laboratory QLs (adjusted for any dilutions) for analyses performed to demonstrate compliance with permit limits or as part of effluent characterization, meet at least one of the requirements below:

i. The QL is at or below the level of the water quality criterion for the measured parameter.

ii. The QL is above the water quality criterion but the amount of the pollutant in a facility's discharge is high enough that the method detects and quantifies the level of the parameter in the discharge.

iii. The QL has the lowest sensitivity of the analytical methods procedure specified in 40 CFR 136.

iv. The QL is at or below those defined in Oregon DEQ list of quantitation limits posted online at the DEQ permitting website.

v. Matrix effects are present that prevent the attainment of QLs and these matrix effects are demonstrated according to procedures described in EPA's "*Solutions to Analytical Chemistry Problems with Clean Water Act Methods*", March 2007. If using alternative methods and taking appropriate steps to eliminate matrix effects does not eliminate the matrix problems, DEQ may authorize in writing re-sampling or allow a higher QL to be reported.

e. **Quality Assurance and Quality Control**

i. Quality Assurance Plan – The permittee must develop and implement a written Quality Assurance Plan that details the facility sampling procedures, equipment calibration and maintenance, analytical methods, quality control activities and laboratory data handling and reporting. The QA/QC program must conform to the requirements of 40 CFR 136.7.

ii. If QA/QC requirements are not met for any analysis, the permittee must re-analyze the sample. If the sample cannot be re-analyzed, the permittee must re-sample and analyze at the earliest opportunity. If the permittee is unable to collect a sample that meets QA/QC requirements, then the permittee must include the result in the discharge monitoring report (DMR) along with a notation (data qualifier). In addition, the permittee must explain how the sample does not meet QA/QC requirements. The permittee may not use the result that failed the QA/QC requirements in any calculation required by the permit unless authorized in writing by DEQ.

iii. Flow measurement, field measurement, and continuous monitoring devices - The permittee must:

(A) Establish verification and calibration frequency for each device or instrument in the quality assurance plan that conforms to the frequencies recommended by the manufacturer.

(B) Verify at least once per year that flow-monitoring devices are functioning properly according to manufacturer's recommendation. Calibrate as needed according to manufacturer's recommendations.

(C) Verify at least weekly that the continuous monitoring instruments are functioning properly according to manufacturer's recommendation unless the permittee demonstrates a longer period is sufficient and such longer period is approved by DEQ in writing.

iv. The permittee must develop a receiving water sampling and analysis plan that incorporates QA/QC prior to sampling. This plan must be kept at the facility and made available to DEQ upon request.

f. **Reporting Sample Results**

i. The permittee must report the laboratory DL and QL as defined above for each analyte, with the following exceptions: pH, temperature, BOD_5, $CBOD_5$, TSS, Oil & Grease, hardness, alkalinity, bacteriological analytes, and nitrate-nitrite. For temperature and pH, neither the QL nor the DL need to be reported. For the other parameters listed above, the permittee is only required to report the QL and only when the result is ND.

ii. The permittee must report the same number of significant digits as the permit limit for a given parameter.

iii. Chemical Abstracts Service (CAS) Numbers. CAS numbers (where available) must be reported along with monitoring results.

iv. (For Discharge Monitoring Reports) If a sample result is above the DL but below the QL, the permittee must report the result as the DL preceded by DEQ's data code "e". For example, if the DL is 1.0 µg/l, the QL is 3.0 µg/L and the result is estimated to be between the DL and QL, the permittee must report "e1.0 µg/L" on the DMR. This requirement does not apply in the case of parameters for which the DL does not have to be reported.

v. (For Discharge Monitoring Reports) If the sample result is below the DL, the permittee must report the result as less than the specified DL. For example, if the DL is 1.0 µg/L and the result is ND, report "<1.0" on the discharge monitoring report (DMR). This requirement does not apply in the case of parameters for which the DL does not have to be reported.

g. **Calculating and Reporting Mass Loads**

The permittee must calculate mass loads on each day the parameter is monitored using the following equation:

Flow (in MGD) X Concentration (in mg/L) X 8.34 = Pounds per day

i. Mass load limits all have two significant figures unless otherwise noted.

ii. When concentration data are below the DL: To calculate the mass load from this result, use the DL. Report the mass load as less than the calculated mass load. For example, if flow is 2 MGD and the reported sample result is <1.0 µg/L, report "<0.02 lb/day" for mass load on the DMR (1.0 µg/L x 2 MGD x conversion factor = 0.017 lb/day, round off to 0.02 lb/day).

iii. When concentration data are above the DL, but below the QL: To calculate the mass load from this result, use the detection level. Report the mass load as the calculated mass load preceded by "e". For example, if flow is 2 MGD and the reported sample result is e1.0 µg/L, report "e0.02 lb/day" for mass load on the DMR (1.0 µg/L x 2 MGD x conversion factor = 0.017 lb/day, round off to 0.02 lb/day).

3. Monitoring and Reporting Requirements

a. The permittee must monitor influent just after the mechanical screen, prior to entering the primary lagoons, and report results in accordance with Table B1 and the table below:

Table B2: Influent Monitoring Requirements

Item or Parameter	Units	Time Period	Minimum Frequency	Sample Type / Required Action (See note a)	Report Statistic (See note b)
Flow (50050)	MGD	Year-round	Daily	Metered	Monthly Average Daily Maximum
BOD_5 (00310)	mg/L	Year-round	1/week	24-hour composite	Monthly Average
TSS (00530)	mg/L	Year-round	1/week	24-hour composite	Monthly Average
pH (00400)	SU	Year-round	3/week	Grab	Monthly Maximum Monthly Minimum

Notes:

a. In the event of equipment failure or loss, the permittee must notify DEQ and deploy new equipment to minimize interruption of data collection. If new equipment cannot be immediately deployed, the permittee must perform grab measurements.

b. When submitting DMRs electronically, the permittee must submit all data used to determine summary statistics in a DEQ-approved format as a spreadsheet via electronic reporting unless otherwise directed by DEQ.

b. The permittee must monitor effluent at Outfall 001 just after the chlorine contact chamber, prior to dechlorination. The final chlorine residual sample is taken just after dechlorination prior to discharging to Beaver Creek. Report results in accordance with Table B1 and the table below:

Table B3: Effluent Monitoring Requirements

Item or Parameter	**Units**	**Time Period**	**Minimum Frequency**	**Sample Type/ Required Action** (See note a)	**Report Statistic** (See note b)
Flow (50050)	MGD	Year-round	Daily	Metered	Monthly Average Daily Maximum
BOD_5 (00310)	mg/L	Nov. 1 – Apr. 30	1/week	24-hour composite	Monthly Average Maximum Weekly Average
BOD_5 (00310)	lb/day	Nov. 1 – Apr. 30	1/week	Calculation	Daily Maximum Monthly Average Maximum Weekly Average
BOD_5 Percent Removal (81010) (See note c)	%	Nov. 1 – Apr. 30	Monthly	Calculation based on monthly average BOD_5 concentration values	Monthly Average
TSS (00530)	mg/L	Nov. 1 – Apr. 30	1/week	24-hour composite	Monthly Average Maximum Weekly Average
TSS (00530)	lb/day	Nov. 1 – Apr. 30	1/week	Calculation	Daily Maximum Monthly Average Maximum Weekly Average
TSS Percent Removal (81011) (See note c)	%	Nov. 1 – Apr. 30	Monthly	Calculation based on monthly average TSS concentration values	Monthly Average
pH (00400)	SU	Nov. 1 – Apr. 30	3/week	Grab	Daily Maximum Daily Minimum
Chlorine, Total Residual (50060)	mg/L	Nov. 1 – Apr. 30	Daily	Grab	Daily Maximum Monthly Average
Chlorine Used (81400)	lb/day	Nov. 1 – Apr. 30	Daily	Measurement	Daily Maximum Monthly Average
Temperature (00010)	ºC	Nov. 1 – Apr. 30	3/week	Grab	Daily Maximum 7-day Rolling Average of Daily Maximums
E. coli (51040)	#/100 mL	Nov. 1 – Apr. 30	2/week	Grab	Daily Maximum Monthly Geometric Mean

Item or Parameter	**Units**	**Time Period**	**Minimum Frequency**	**Sample Type/ Required Action** (See note a)	**Report Statistic** (See note b)
Nitrogen, ammonia total [as N] (00610) (See note d)	mg/L	Nov. 1 – Apr. 30	1/week	24-hour composite	Daily Maximum Monthly Average
Nitrogen, ammonia total [as N] (00610)	mg/L	Jan. 2023 through Dec. 2024 (See note e)	Monthly	24-hour composite	Monthly Maximum
Alkalinity as $CaCO_3$ (00410)	mg/L	Jan. 2023 through Dec. 2024 (See note e)	Monthly	24-hour composite	Monthly Maximum
$CBOD_5$ (80082)	mg/L	Jan. 2023 through Dec. 2024 (See note e)	Monthly	24-hour composite	Monthly Maximum
Dissolved Oxygen (00300)	mg/L	Jan. 2023 through Dec. 2024 (See note e)	Monthly	Grab	Monthly Minimum
Total Kjeldahl Nitrogen (TKN) (00625)	mg/L	Jan. 2023 through Dec. 2024 (See note e)	Monthly	24-hour composite	Monthly Maximum
Nitrate (NO_3) Plus Nitrite (NO_2) Nitrogen (00630)	mg/L	2024: Jan., Apr., Nov., and Dec.	Monthly	24-hour composite	Monthly Maximum
Oil and Grease (00556)	mg/L	2024: Jan., Apr., Nov., and Dec.	Monthly	Grab	Monthly Maximum
Total Phosphorus (00665)	mg/L	2024: Jan., Apr., Nov., and Dec.	Monthly	24-hour composite	Monthly Maximum
Total Dissolved Solids (70295)	mg/L	2024: Jan., Apr., Nov., and Dec.	Monthly	24-hour composite	Monthly Maximum

Item or Parameter	Units	Time Period	Minimum Frequency	Sample Type/ Required Action (See note a)	Report Statistic (See note b)

Notes:

a. In the event of equipment failure or loss, the permittee must notify DEQ and deploy new equipment to minimize interruption of data collection. If new equipment cannot be immediately deployed, the permittee must perform grab measurements. The permittee must perform any grab measurements for temperature between 2 PM and 4 PM at the minimum frequency noted in the table.

b. When submitting DMRs electronically, all data used to determine summary statistics must be submitted in a DEQ-approved format as a spreadsheet via electronic reporting unless otherwise directed by DEQ.

c. Percent Removal must be calculated on a monthly basis using the following formula:

$$Percent\ Removal = \frac{[Influent\ Concentration] - [Effluent\ Concentration]}{[Influent\ Concentration]} \times 100$$

Where:
Influent Concentration = Corresponding monthly average influent concentration based on the analytical results of the reporting period.
Effluent Concentration = Corresponding monthly average effluent concentration based on the analytical results of the reporting period.

d. Monitoring required after completion of the compliance schedule in Schedule C.

e. Monitoring is only required when discharging to the creek (Nov. 1 – Apr. 30).

c. The permittee must monitor Beaver Creek and report the results in accordance with Table B1 and the table below. The permittee must collect samples such that the effluent does not impact the samples (e.g., upstream for riverine discharges).

Table B4: Receiving Stream Monitoring Beaver Creek

Item or Parameter	Units	Time Period (See note a)	Minimum Frequency	Sample Type / Required Action (See note b)	Report Statistic (See note c)
Flow, stream (00056)	cfs	Nov. 1 – Apr. 30	1/week	Grab	Monthly Minimum Monthly Maximum Monthly Average
pH (00400)	SU	Jan. 2023 through Dec. 2024	Monthly	Grab	Monthly Minimum Monthly Maximum
Temperature (00010)	ºC	Jan. 2023 through Dec. 2024	Monthly	Grab	Monthly Maximum
Alkalinity as $CaCO_3$ (00410)	mg/L	Jan. 2023 through Dec. 2024	Monthly	Grab	Monthly Maximum
Total Ammonia (as N) (00610)	mg/L	Jan. 2023 through Dec. 2024	Monthly	Grab	Monthly Maximum
Total Kjeldahl Nitrogen (TKN) (00625)	mg/L	Jan. 2023 through Dec. 2024	Monthly	Grab	Monthly Maximum
Dissolved Oxygen (00300)	mg/L	Jan. 2023 through Dec. 2024	Monthly	Grab	Monthly Minimum
$CBOD_5$ (80082)	mg/L	Jan. 2023 through Dec. 2024	Monthly	Grab	Monthly Maximum

Note:

a. Monitoring is only required when discharging to the creek (Nov. 1 - April 30).

b. In the event of equipment failure or loss, the permittee must notify DEQ and deploy new equipment to minimize interruption of data collection. If new equipment cannot be immediately deployed, the permittee must perform grab measurements. If the failure or loss is for continuous temperature monitoring equipment, the permittee must perform grab measurements daily between 2 PM and 4 PM until continuous monitoring equipment is redeployed.

c. When submitting DMRs electronically, all data used to determine summary statistics must be submitted in a DEQ-approved format as a spreadsheet via electronic reporting unless otherwise directed by DEQ.

4. Lagoon Monitoring Requirements

The permittee must monitor the lagoon freeboard and report the results in accordance with Table B1 and the table below.

Table B5: Lagoon Monitoring Requirements

Item or Parameter	Units	Time Period	Minimum Frequency	Sample Type /Required Action (See note a)	Report Statistic (See note b)
Lagoon #1 Freeboard (82564)	Feet	Year-round	Weekly	Visual Measurement (See note a)	Monthly Maximum Monthly Minimum
Lagoon #2 Freeboard (82564)	Feet	Year-round	Weekly	Visual Measurement	Monthly Maximum Monthly Minimum
Lagoon #3 Freeboard (82564)	Feet	Year-round	Weekly	Visual Measurement	Monthly Maximum Monthly Minimum
Lagoon #4 Freeboard (82564)	Feet	Year-round	Weekly	Visual Measurement	Monthly Maximum Monthly Minimum

Notes:

a. Measurements may be taken with a yardstick.

b. When submitting DMRs electronically, all data used to determine summary statistics must be submitted in a DEQ-approved format as a spreadsheet via electronic reporting unless otherwise directed by DEQ.

5. Recycled Water Monitoring Requirements: Outfall 002

The permittee must monitor recycled water for Outfall 002 as listed below. The samples must be representative of the recycled water delivered for beneficial reuse at a location identified in the Recycled Water Use Plan.

Table B6: Recycled Water Monitoring

Item or Parameter	Time Period	Minimum Frequency	Sample Type/ Required Action	Report
Total Flow (MGD) and Quantity Irrigated (inches/acre) (See note a)	See Recycled Water Use Plan	Daily	Measurement	See DEQ Recycled Water Annual Report Form
Quantity Chlorine Used (lbs)	See Recycled Water Use Plan	Daily	Measurement	See DEQ Recycled Water Annual Report Form
Chlorine, Total Residual (mg/L)	See Recycled Water Use Plan	Daily	Grab	See DEQ Recycled Water Annual Report Form
pH	See Recycled Water Use Plan	2/Week	Grab	See DEQ Recycled Water Annual Report Form
Total Coliform (See note b)	See Recycled Water Use Plan	Weekly (Class C)	Grab	See DEQ Recycled Water Annual Report Form
Nitrogen Loading Rate (lbs/acre-year)	See Recycled Water Use Plan	Annually	Calculation	See DEQ Recycled Water Annual Report Form
Nutrients: Total Kjeldahl Nitrogen, Nitrate + Nitrite as Nitrogen Total Ammonia as Nitrogen Total Phosphorus	See Recycled Water Use Plan	Quarterly (See Schedule F Section E18 for definition of quarterly)	Grab	See DEQ Recycled Water Annual Report Form

Note:

a. 1 acre inch = 27,154 gallons of water

b. Calculations of the median total coliform levels in Classes A – C are based on the results of the last seven days that analyses have been completed.

6. Biosolids Monitoring Requirements

The permittee must monitor biosolids land applied or produced for sale or distribution as listed below. The samples must be representative of the quality and quantity of biosolids generated and undergo the same treatment process used to prepare the biosolids. Results must be reported as required in the biosolids management plan described in Schedule D.

Table B7: Biosolids Monitoring

Item or Parameter	Minimum Frequency	Sample Type
Nutrient and conventional parameters (% dry weight unless otherwise specified): Total Kjeldahl Nitrogen (TKN) Nitrate-Nitrogen (NO_3-N) Total Ammonia Nitrogen (NH-N) Total Phosphorus (P) Potassium (K) pH (S.U.) Total Solids Volatile Solids	As described in the DEQ-approved Biosolids Management Plan, but not less than the frequency in Table B8	As described in the DEQ-approved Biosolids Management Plan
Pollutants: As, Cd, Cu, Hg, Pb, Mo, Ni, Se, Zn, mg/kg dry weight	As described in the DEQ-approved Biosolids Management Plan, but not less than the frequency in Table B8.	As described in the DEQ-approved Biosolids Management Plan
Pathogen reduction	As described in the DEQ-approved Biosolids Management Plan, but not less than the frequency in Table B8.	As described in the DEQ-approved Biosolids Management Plan
Vector attraction reduction	As described in the DEQ-approved Biosolids Management Plan, but not less than the frequency in Table B8.	As described in the DEQ-approved Biosolids Management Plan
Record of biosolids land application: date, quantity, location.	Each event	Record the date, quantity, and location of biosolids land applied on site location map or equivalent electronic system, such as GIS.

Table B8: Biosolids Minimum Monitoring Frequency

Quantity of biosolids land applied or produced for sale or distribution per calendar year		Minimum Sampling Frequency
(dry metric tons)	(dry U.S. tons)	
Less than 290	Less than 320	Once per year
290 to 1,500	320 to 1,653	Once per quarter (4x/year)
1500 to 15,000	1,653 to 16,535	Once per 60 days (6x/year)
15,000 or more	16,535 or more	Once per month (12x/year)

SCHEDULE C: COMPLIANCE SCHEDULE

1. Compliance Schedule to Meet Final Effluent Limitation

The permittee must comply with the following schedule:

Table C1: Compliance Schedule for Ammonia

Compliance Date:	Requirement:
Within 12 months of permit effective date and annually thereafter (10/01/2022)	Submit to DEQ a written Progress Report outlining the progress made towards achieving the final effluent limitations.
Within 6 months of permit effective date (04/01/2022)	Submit to DEQ a draft Facility Plan that evaluates several alternatives and identifies the permittee's preferred alternative to comply with the ammonia final effluent limits. Permittee must revise documents in accordance with DEQ comments within 60 days of receiving DEQ comments.
Within 2 years of permit effective date (10/01/2023)	Submit a draft Preliminary Design Report for projects identified in the Facility Plan to DEQ for review and approval. City will request permit modification if needed for chosen alternative in facility plan. Permittee must revise documents in accordance with DEQ comments within 60 days of receiving DEQ comments.
Within 4 years of permit effective date (10/01/2025)	Submit a draft Final Design for projects identified in the Facility Plan to DEQ for review and approval. Permittee must revise documents in accordance with DEQ comments within 60 days of receiving DEQ comments.
Within 6 years of permit effective date (10/01/2027)	Complete construction of projects identified in the Facility Plan to comply with the final effluent limits for ammonia.
Within 7 years of permit effective date (10/01/2028)	Complete start up and process optimization for the projects. If permit limits are being achieved, submit a written notice of compliance with the ammonia final effluent limits in Schedule A. If limits are not being achieved submit a corrective action plan. Implement the corrective actions.
Within 8 years of permit effective date (10/01/2029)	Achieve the final limits for ammonia included in Schedule A of this permit.

2. Responsibility to Meet Compliance Dates

No later than 14 days following each compliance date listed in the table above, the permittee must notify DEQ in writing of its compliance or noncompliance with the requirements. Any reports of noncompliance must include the cause of noncompliance, any remedial actions taken, and a discussion of the likelihood of meeting the next scheduled requirement(s).

SCHEDULE D: SPECIAL CONDITIONS

1. Inflow and Infiltration

The permittee must submit to DEQ an annual inflow and infiltration report on a DEQ-approved form as directed in Table B1. The report must include the following:

a. An assessment of the facility's I/I issues based on a comparison of summer and winter flows to the plant.

b. Details of activities performed in the previous year to identify and reduce inflow and infiltration.

c. Details of activities planned for the following year to identify and reduce inflow and infiltration.

d. A summary of sanitary sewer overflows that occurred during the previous year. This should include the following: date of the SSO, location, estimated volume, cause, follow-up actions and if performed, the results of receiving stream monitoring.

2. Emergency Response and Public Notification Plan

The permittee must develop an Emergency Response and Public Notification Plan ("plan"), or ensure the facility's existing plan is current and accurate, per Schedule F, Section B, and Condition 8 within 6 months of permit effective date. The permittee must update the plan annually to ensure all information contained in the plan, including telephone and email contact information for applicable public agencies, is current and accurate. An updated copy of the plan must be kept on file at the facility for DEQ review. The latest plan revision date must be listed on the plan cover along with the reviewer's initials or signature.

3. Recycled Water Use Plan

The permittee must update and obtain a DEQ-approved Recycled Water Use Plan meeting the requirements in OAR 340-055-0025, by the date listed in Table B1. The permittee must maintain a DEQ-approved Recycled Water Use Plan meeting the requirements in OAR 340-055-0025. The permittee must submit this plan or any significant modifications to DEQ for review and approval with sufficient time to clear DEQ review and a public notice period prior to implementing changes to the recycled water program. The permittee must keep the plan updated. All plan revisions require written authorization from DEQ and are effective upon permittee's receipt of DEQ written approval. No significant modifications can be made to a plan for an administratively extended permit (after the permit expiration date). Conditions in the plan are enforceable requirements under this permit. DEQ will provide an opportunity for public review and comment on any significant plan modifications prior to approving or denying. Public review is not required for minor modifications, changes to utilization dates or changes in use within the recycled water class.

a. Recycled Water Annual Report – If the permittee distributes recycled water under a recycled water use plan, the permittee must submit a recycled water annual report by the date specified in Table B1: Reporting Requirements and Due Dates. The permittee must use the DEQ-approved recycled water annual report form. This report must include the monitoring data and analytical laboratory reports for the previous year's monitoring required under Schedule B.

4. Exempt Wastewater Reuse at the Treatment System

Recycled water used for landscape irrigation within the property boundary or in-plant processes at the wastewater treatment system is exempt from the requirements of OAR 340-055 if all of the following conditions are met:

a. The recycled water is an oxidized and disinfected wastewater.

b. The recycled water is used at the wastewater treatment system site where it is generated or at an auxiliary wastewater or sludge treatment facility that is subject to the same NPDES or WPCF permit as the wastewater treatment system.

c. Spray and/or drift from the use does not migrate off the site.

d. Public access to the site is restricted.

5. Wastewater Solids Annual Report

The permittee must submit a Wastewater Solids Annual Report by February 19 each year documenting removal of wastewater solids from the facility during the previous calendar year. The permittee must use the DEQ-approved wastewater solids annual report form. This report must include the volume of material removed and the name of the permitted facility that received the solids.

6. Biosolids Management Plan

Prior to distributing biosolids to the public, the permittee must develop and maintain a Biosolids Management Plan and Land Application Plan meeting the requirements in OAR 340-050-0031. The permittee must submit these plans and any significant modification of these plans to DEQ for review and approval with sufficient time to clear DEQ review and a public notice period prior to removing biosolids from the facility. The permittee must keep the plans updated. All plan revisions require written authorization from DEQ and are effective upon permittee's receipt of DEQ written approval. No significant modifications can be made to a plan for an administratively extended permit (after the permit expiration date). Conditions in the plans are enforceable requirements under this permit.

a. Annual Report

The permittee must submit a Biosolids Annual Report by February 19 each year documenting biosolids management activities of the previous calendar year as described in OAR 340-050-0035(6). The permittee must use the DEQ approved Biosolids Annual report form. This report must include the monitoring data and analytical laboratory reports for the previous year's monitoring specified under Schedule B.

b. Site Authorization

The permittee must obtain written authorization from DEQ for each land application site prior to its use. Conditions in site authorizations are enforceable requirements under this permit. The permittee is prohibited from land applying biosolids to a DEQ-approved site except in accordance with the site authorization, while this permit is effective and with the written approval of the property owner. DEQ may modify or revoke a site authorization following the procedures for a permit modification described in OAR 340-045-0055.

c. Public Participation

i. DEQ will provide an opportunity for public review and comment on any significant plan modifications prior to approving or denying. Public review is not required for minor modifications or changes to utilization dates.

ii. No DEQ-initiated public notice is required for continued use of sites identified in the DEQ-approved biosolids management plan.

iii. For new sites that fail to meet the site selection criteria in the biosolids management plan or that are deemed by DEQ to be sensitive with respect to residential housing, runoff potential, or threat to groundwater, DEQ will provide an opportunity for public comment as directed by OAR 340-050-0015(10).

iv. For all other new sites, the permittee must provide for public participation following procedures in its DEQ-approved land application plan.

d. Exceptional Quality Biosolids

The permittee is exempt from the requirements in condition 6b above, if:

i. Pollutant concentrations of biosolids are less than the pollutant concentration limits in Schedule A, Table A3: ;

ii. Biosolids meet one of the Class A pathogen reduction alternatives in 40 CFR 503.32(a); and

iii. Biosolids meet one of the vector attraction reduction options in 40 CFR 503.33(b)(1) through (8).

7. Wastewater Solids Transfers

a. *Within state.* The permittee may transfer wastewater solids including Class A and Class B biosolids, to another facility permitted to process or dispose of wastewater solids, including but not limited to: another wastewater treatment facility, landfill, or incinerator. The permittee must satisfy the requirements of the receiving facility. The permittee must report the name of the receiving facility and the quantity of material transferred in the wastewater solids annual report identified in Schedule B.

b. *Out of state.* If wastewater solids, including Class A and Class B biosolids, are transferred out of state for use or disposal, the permittee must obtain written authorization from DEQ, meet Oregon requirements for the use or disposal of wastewater solids, notify in writing the receiving state of the proposed use or disposal of wastewater solids, and satisfy the requirements of the receiving state.

8. Hauled Waste Control Plan

The permittee may accept hauled wastes at discharge points designated by the POTW after receiving written DEQ approval of a Hauled Waste Control Plan. Hauled wastes may include wastewater solids from another wastewater treatment facility, septage, grease trap wastes, portable and chemical toilet wastes, landfill leachate, groundwater remediation wastewaters and commercial/industrial wastewaters. A Hauled Waste Control Plan is not required in the event biological seed must be added to the process at the POTW to facilitate effective wastewater treatment.

9. Sludge Depth Survey

The permittee must complete a sludge depth survey annually. A report must be submitted to DEQ the following year by February 15, as listed in Table B1. The report must include the sludge depth throughout the lagoons and an evaluation of the impact of the sludge on plant efficiency and the potential for odors. See Schedule D, conditions 5, 6, and 7 for sludge removal requirements.

10. Operator Certification

a. Definitions

i. "Supervise" means to have full and active responsibility for the daily on site technical operation of a wastewater treatment system or wastewater collection system.

ii. "Supervisor" or "designated operator", means the operator delegated authority by the permittee for establishing and executing the specific practice and procedures for operating the wastewater treatment system or wastewater collection system in accordance with the policies of the owner of the system and any permit requirements.

iii. "Shift Supervisor" means the operator delegated authority by the permittee for executing the specific practice and procedures for operating the wastewater treatment system or wastewater collection system when the system is operated on more than one daily shift.

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

b. The permittee must comply with OAR Chapter 340, Division 49, "Regulations Pertaining to Certification of Wastewater System Operator Personnel" and designate a supervisor whose certification corresponds with the classification of the collection and/or treatment system as specified in the DEQ Supervisory Wastewater Operator Status Report. DEQ may revise the permittee's classification in writing at any time to reflect changes in the collection or treatment system. This reclassification is not considered a permit modification and may be made after the permit expiration date provided the permit has been administratively extended by DEQ. If a facility is re-classified, a certified letter will be mailed to the system owner from the DEQ Operator Certification Program. Current system classifications are publicized on the DEQ Supervisory Wastewater Operator Status Report found on the DEQ Wastewater Operator Certification Homepage.

c. The permittee must have its system supervised full-time by one or more operators who hold a valid certificate for the type of wastewater treatment or wastewater collection system, and at a grade equal to or greater than the wastewater system's classification.

d. The permittee's wastewater system may be without the designated supervisor for up to 30 consecutive days if another person supervises the system, who is certified at no more than one grade lower than the classification of the wastewater system. The permittee must delegate authority to this operator to supervise the operation of the system.

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

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

g. The permittee must notify DEQ in writing of the name of the system supervisor by completing and submitting the Supervisory Wastewater System Operator Designation Form. The most recent version of this form may be found on the DEQ Wastewater Operator Certification homepage *NOTE: This form is different from the Delegated Authority form. The permittee may replace or re-designate the system supervisor with another properly certified operator at any time and must notify DEQ in writing within 30 days of replacement or re-designation of the operator in charge. As of this writing, the notice of replacement or re-designation must be sent to Water Quality Division, Operator Certification Program, 700 NE Multnomah St, Suite 600, Portland, OR 97232-4100. This address may be updated in writing by DEQ during the term of this permit.

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

11. Industrial User Survey

Industrial User Survey

a. By the date listed in Table B1, the permittee must conduct an industrial user survey as described in 40 CFR 403.8(f)(2)(i-iii) to determine the presence of any industrial users discharging wastewaters subject to pretreatment and submit a report on the findings to DEQ. The purpose of the survey is to identify whether there are any industrial users discharging to the POTW, and ensure regulatory oversight of these discharges to state waters.

b. Should the DEQ determine that a pretreatment program is required, the permit must be reopened and modified in accordance with 40 CFR 403.8(e)(1) to incorporate a compliance schedule for development of a pretreatment program. The compliance schedule must be developed in accordance with the provisions of 40 CFR 403.12(k), and must not exceed twelve (12) months.

12. Outfall Inspection

By the date in Table B1, the permittee must inspect outfall 001 including the submerged portion of the outfall to document its integrity and to determine whether it is functioning as designed. The inspection must determine whether the outfall is intact, clear and fully functional. The inspection must verify the latitude and longitude of the outfall. The permittee must submit a written report to DEQ regarding the results of the outfall inspection by the date in Table B1. The report must include a description of the outfall as originally constructed, the condition of the current outfall and identify any repairs needed to return the outfall to satisfactory condition.

SCHEDULE E: PRETREATMENT ACTIVITIES

A pretreatment program is not part of this permit.

SCHEDULE F: NPDES GENERAL CONDITIONS

October 1, 2015 Version

SECTION A. STANDARD CONDITIONS

A1. Duty to Comply with Permit

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

A2. Penalties for Water Pollution and Permit Condition Violations

The permit is enforceable by DEQ or EPA, and in some circumstances also by third-parties under the citizen suit provisions of 33 USC § 1365. DEQ enforcement is generally based on provisions of state statutes and Environmental Quality Commission (EQC) rules, and EPA enforcement is generally based on provisions of federal statutes and EPA regulations.

ORS 468.140 allows DEQ to impose civil penalties up to $25,000 per day for violation of a term, condition, or requirement of a permit.

Under ORS 468.943, unlawful water pollution in the second degree, is a Class A misdemeanor and is punishable by a fine of up to $25,000, imprisonment for not more than one year, or both. Each day on which a violation occurs or continues is a separately punishable offense.

Under ORS 468.946, unlawful water pollution in the first degree is a Class B felony and is punishable by a fine of up to $250,000, imprisonment for not more than 10 years, or both.

The Clean Water Act provides that any person who violates permit condition, or any requirement imposed in a pretreatment program approved under sections 402(a)(3) or 402(b)(8) of the Act, is subject to a civil penalty not to exceed $25,000 per day for each violation.

The Clean Water Act provides that any person who negligently violates any condition, or any requirement imposed in a pretreatment program approved under section 402(a)(3) or 402(b)(8) of the Act, is subject to criminal penalties of $2,500 to $25,000 per day of violation, or imprisonment of not more than 1 year, or both.

In the case of a second or subsequent conviction for a negligent violation, a person shall be subject to criminal penalties of not more than $50,000 per day of violation, or by imprisonment of not more than 2 years, or both.

Any person who knowingly violates such sections, or such conditions or limitations is subject to criminal penalties of $5,000 to $50,000 per day of violation, or imprisonment for not more than 3 years, or both.

In the case of a second or subsequent conviction for a knowing violation, a person shall be subject to criminal penalties of not more than $100,000 per day of violation, or imprisonment of not more than 6 years, or both.

Any person who knowingly violates section any permit condition, and who knows at that time that he thereby places another person in imminent danger of death or serious bodily injury, shall, upon conviction, be subject to a fine of not more than $250,000 or imprisonment of not more than 15 years, or both.

In the case of a second or subsequent conviction for a knowing endangerment violation, a person shall be subject to a fine of not more than $500,000 or by imprisonment of not more than 30 years, or both.

An organization, as defined in section 309(c)(3)(B)(iii) of the CWA, shall, upon conviction of violating the imminent danger provision, be subject to a fine of not more than $1,000,000 and can be fined up to $2,000,000 for second or subsequent convictions.

Any person may be assessed an administrative penalty by the Administrator for violating any permit condition or limitation implementing any of such sections in a permit issued under section 402 of this Act.

Administrative penalties for Class I violations are not to exceed $10,000 per violation, with the maximum amount of any Class I penalty assessed not to exceed $25,000.

Penalties for Class II violations are not to exceed $10,000 per day for each day during which the violation continues, with the maximum amount of any Class II penalty not to exceed $125,000.

A3. Duty to Mitigate

The permittee must take all reasonable steps to minimize or prevent any discharge or sludge use or disposal in violation of this permit. In addition, upon request of DEQ, the permittee must correct any adverse impact on the environment or human health resulting from noncompliance with this permit, including such accelerated or additional monitoring as necessary to determine the nature and impact of the noncomplying discharge.

A4. Duty to Reapply

If the permittee wishes to continue an activity regulated by this permit after the expiration date of this permit, the permittee must apply for and have the permit renewed. The application must be submitted at least 180 days before the expiration date of this permit.

DEQ may grant permission to submit an application less than 180 days in advance but no later than the permit expiration date.

A5. Permit Actions

This permit may be modified, revoked and reissued, or terminated for cause including, but not limited to, the following:

a. Violation of any term, condition, or requirement of this permit, a rule, or a statute.
b. Obtaining this permit by misrepresentation or failure to disclose fully all material facts.
c. A change in any condition that requires either a temporary or permanent reduction or elimination of the authorized discharge.
d. The permittee is identified as a Designated Management Agency or allocated a wasteload under a total maximum daily load (TMDL).
e. New information or regulations.
f. Modification of compliance schedules.
g. Requirements of permit reopener conditions
h. Correction of technical mistakes made in determining permit conditions.
i. Determination that the permitted activity endangers human health or the environment.
j. Other causes as specified in 40 CFR §§ 122.62, 122.64, and 124.5.
k. For communities with combined sewer overflows (CSOs):

(1) To comply with any state or federal law regulation for CSOs that is adopted or promulgated subsequent to the effective date of this permit.
(2) If new information that was not available at the time of permit issuance indicates that CSO controls imposed under this permit have failed to ensure attainment of water quality standards, including protection of designated uses.
(3) Resulting from implementation of the permittee's long-term control plan and/or permit conditions related to CSOs.

The filing of a request by the permittee for a permit modification, revocation or reissuance, termination, or a notification of planned changes or anticipated noncompliance does not stay any permit condition.

A6. Toxic Pollutants
The permittee must comply with any applicable effluent standards or prohibitions established under Oregon Administrative Rule (OAR) 340-041-0033 and section 307(a) of the federal Clean Water Act for toxic pollutants, and with standards for sewage sludge use or disposal established under section 405(d) of the federal Clean Water Act, within the time provided in the regulations that establish those standards or prohibitions, even if the permit has not yet been modified to incorporate the requirement.

A7. Property Rights and Other Legal Requirements
The issuance of this permit does not convey any property rights of any sort, or any exclusive privilege, or authorize any injury to persons or property or invasion of any other private rights, or any infringement of federal, tribal, state, or local laws or regulations.

A8. Permit References
Except for effluent standards or prohibitions established under section 307(a) of the federal Clean Water Act and OAR 340-041-0033 for toxic pollutants, and standards for sewage sludge use or disposal established under section 405(d) of the federal Clean Water Act, all rules and statutes referred to in this permit are those in effect on the date this permit is issued.

A9. Permit Fees
The permittee must pay the fees required by OAR.

SECTION B. OPERATION AND MAINTENANCE OF POLLUTION CONTROLS

B1. Proper Operation and Maintenance
The permittee must at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) that are installed or used by the permittee to achieve compliance with the conditions of this permit. Proper operation and maintenance also includes adequate laboratory controls and appropriate quality assurance procedures. This provision requires the operation of back-up or auxiliary facilities or similar systems that are installed by a permittee only when the operation is necessary to achieve compliance with the conditions of the permit.

B2. Need to Halt or Reduce Activity Not a Defense
For industrial or commercial facilities, upon reduction, loss, or failure of the treatment facility, the permittee must, to the extent necessary to maintain compliance with its permit, control production or all discharges or both until the facility is restored or an alternative method of treatment is provided. This requirement applies, for example, when the primary source of power of the treatment facility fails or is reduced or lost. It is not a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit.

B3. Bypass of Treatment Facilities

a. Definitions
   (1) "Bypass" means intentional diversion of waste streams from any portion of the treatment facility. The permittee may allow any bypass to occur which does not cause effluent limitations to be exceeded, provided the diversion is to allow essential maintenance to assure efficient operation. These bypasses are not subject to the provisions of paragraphs b and c of this section.
   (2) "Severe property damage" means substantial physical damage to property, damage to the treatment facilities which causes them to become inoperable, or substantial and permanent loss of natural resources that can reasonably be expected to occur in the absence of a bypass. Severe property damage does not mean economic loss caused by delays in production.

b. Prohibition of bypass.
   (1) Bypass is prohibited and DEQ may take enforcement action against a permittee for bypass unless:
      i. Bypass was unavoidable to prevent loss of life, personal injury, or severe property damage;
      ii. There were no feasible alternatives to the bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment downtime. This condition is not satisfied if adequate backup equipment should have been installed in the exercise of reasonable engineering judgment to prevent a bypass that occurred during normal periods of equipment downtime or preventative maintenance; and
      iii. The permittee submitted notices and requests as required under General Condition B3.c.
   (2) DEQ may approve an anticipated bypass, after considering its adverse effects and any alternatives to bypassing, if DEQ determines that it will meet the three conditions listed above in General Condition B3.b.(1).

c. Notice and request for bypass.
   (1) Anticipated bypass. If the permittee knows in advance of the need for a bypass, a written notice must be submitted to DEQ at least ten days before the date of the bypass.
   (2) Unanticipated bypass. The permittee must submit notice of an unanticipated bypass as required in General Condition D5.

B4. Upset

a. Definition. "Upset" means an exceptional incident in which there is unintentional and temporary noncompliance with technology based permit effluent limitations because of factors beyond the reasonable control of the permittee. An upset does not include noncompliance to the extent caused by operation error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventative maintenance, or careless or improper operation.

b. Effect of an upset. An upset constitutes an affirmative defense to an action brought for noncompliance with such technology-based permit effluent limitations if the requirements of General Condition B4.c are met. No determination made during administrative review of claims that noncompliance was caused by upset, and before an action for noncompliance, is final administrative action subject to judicial review.

c. Conditions necessary for a demonstration of upset. A permittee who wishes to establish the affirmative defense of upset must demonstrate, through properly signed, contemporaneous operating logs, or other relevant evidence that:
   (1) An upset occurred and that the permittee can identify the causes(s) of the upset;
   (2) The permitted facility was at the time being properly operated;
   (3) The permittee submitted notice of the upset as required in General Condition D5, hereof (24-hour notice); and
   (4) The permittee complied with any remedial measures required under General Condition A3 hereof.

d. Burden of proof. In any enforcement proceeding the permittee seeking to establish the occurrence of an upset has the burden of proof.

B5. <u>Treatment of Single Operational Upset</u>
For purposes of this permit, a single operational upset that leads to simultaneous violations of more than one pollutant parameter will be treated as a single violation. A single operational upset is an exceptional incident that causes simultaneous, unintentional, unknowing (not the result of a knowing act or omission), temporary noncompliance with more than one federal Clean Water Act effluent discharge pollutant parameter. A single operational upset does not include federal Clean Water Act violations involving discharge without a NPDES permit or noncompliance to the extent caused by improperly designed or inadequate treatment facilities. Each day of a single operational upset is a violation.

B6. <u>Overflows from Wastewater Conveyance Systems and Associated Pump Stations</u>
a. Definition. "Overflow" means any spill, release or diversion of sewage including:
   (1) An overflow that results in a discharge to waters of the United States; and
   (2) An overflow of wastewater, including a wastewater backup into a building (other than a backup caused solely by a blockage or other malfunction in a privately owned sewer or building lateral), even if that overflow does not reach waters of the United States.
b. Reporting required. All overflows must be reported orally to DEQ within 24 hours from the time the permittee becomes aware of the overflow. Reporting procedures are described in more detail in General Condition D5.

B7. <u>Public Notification of Effluent Violation or Overflow</u>
If effluent limitations specified in this permit are exceeded or an overflow occurs that threatens public health, the permittee must take such steps as are necessary to alert the public, health agencies and other affected entities (for example, public water systems) about the extent and nature of the discharge in accordance with the notification procedures developed under General Condition B8. Such steps may include, but are not limited to, posting of the river at access points and other places, news releases, and paid announcements on radio and television.

B8. <u>Emergency Response and Public Notification Plan</u>
The permittee must develop and implement an emergency response and public notification plan that identifies measures to protect public health from overflows, bypasses, or upsets that may endanger public health. At a minimum the plan must include mechanisms to:
a. Ensure that the permittee is aware (to the greatest extent possible) of such events;
b. Ensure notification of appropriate personnel and ensure that they are immediately dispatched for investigation and response;
c. Ensure immediate notification to the public, health agencies, and other affected public entities (including public water systems). The overflow response plan must identify the public health and other officials who will receive immediate notification;
d. Ensure that appropriate personnel are aware of and follow the plan and are appropriately trained;
e. Provide emergency operations; and
f. Ensure that DEQ is notified of the public notification steps taken.

B9. <u>Removed Substances</u>
Solids, sludges, filter backwash, or other pollutants removed in the course of treatment or control of wastewaters must be disposed of in such a manner as to prevent any pollutant from such materials from entering waters of the state, causing nuisance conditions, or creating a public health hazard.

SECTION C. MONITORING AND RECORDS

C1. <u>Representative Sampling</u>
Sampling and measurements taken as required herein must be representative of the volume and nature of the monitored discharge. All samples must be taken at the monitoring points specified in this permit, and must be taken, unless otherwise specified, before the effluent joins or is diluted by any other waste stream,

body of water, or substance. Monitoring points must not be changed without notification to and the approval of DEQ. Samples must be collected in accordance with requirements in 40 CFR part 122.21 and 40 CFR part 403 Appendix E.

C2. Flow Measurements
Appropriate flow measurement devices and methods consistent with accepted scientific practices must be selected and used to ensure the accuracy and reliability of measurements of the volume of monitored discharges. The devices must be installed, calibrated and maintained to insure that the accuracy of the measurements is consistent with the accepted capability of that type of device. Devices selected must be capable of measuring flows with a maximum deviation of less than ± 10 percent from true discharge rates throughout the range of expected discharge volumes.

C3. Monitoring Procedures
Monitoring must be conducted according to test procedures approved under 40 CFR part 136 or, in the case of sludge (biosolids) use and disposal, approved under 40 CFR part 503 unless other test procedures have been specified in this permit.

For monitoring of recycled water with no discharge to waters of the state, monitoring must be conducted according to test procedures approved under 40 CFR part 136 or as specified in the most recent edition of Standard Methods for the Examination of Water and Wastewater unless other test procedures have been specified in this permit or approved in writing by DEQ.

C4. Penalties for Tampering
The federal Clean Water Act provides that any person who falsifies, tampers with, or knowingly renders inaccurate any monitoring device or method required to be maintained under this permit may, upon conviction, be punished by a fine of not more than $10,000 per violation, imprisonment for not more than two years, or both. If a conviction of a person is for a violation committed after a first conviction of such person, punishment is a fine not more than $20,000 per day of violation, or by imprisonment of not more than four years, or both.

C5. Reporting of Monitoring Results
Monitoring results must be summarized each month on a discharge monitoring report form approved by DEQ. The reports must be submitted monthly and are to be mailed, delivered or otherwise transmitted by the 15th day of the following month unless specifically approved otherwise in Schedule B of this permit.

C6. Additional Monitoring by the Permittee
If the permittee monitors any pollutant more frequently than required by this permit, using test procedures approved under 40 CFR part 136 or, in the case of sludge (biosolids) use and disposal, approved under 40 CFR part 503, or as specified in this permit, the results of this monitoring must be included in the calculation and reporting of the data submitted in the discharge monitoring report. Such increased frequency must also be indicated. For a pollutant parameter that may be sampled more than once per day (for example, total residual chlorine), only the average daily value must be recorded unless otherwise specified in this permit.

C7. Averaging of Measurements
Calculations for all limitations that require averaging of measurements must utilize an arithmetic mean, except for bacteria which must be averaged as specified in this permit.

C8. Retention of Records
Records of monitoring information required by this permit related to the permittee's sewage sludge use and disposal activities must be retained for a period of at least 5 years (or longer as required by 40 CFR part

503). Records of all monitoring information including all calibration and maintenance records, all original strip chart recordings for continuous monitoring instrumentation, copies of all reports required by this permit and records of all data used to complete the application for this permit must be retained for a period of at least 3 years from the date of the sample, measurement, report, or application. This period may be extended by request of DEQ at any time.

C9. Records Contents

Records of monitoring information must include:

a. The date, exact place, time, and methods of sampling or measurements;
b. The individual(s) who performed the sampling or measurements;
c. The date(s) analyses were performed;
d. The individual(s) who performed the analyses;
e. The analytical techniques or methods used; and
f. The results of such analyses.

C10. Inspection and Entry

The permittee must allow DEQ or EPA upon the presentation of credentials to:

a. Enter upon the permittee's premises where a regulated facility or activity is located or conducted, or where records must be kept under the conditions of this permit;
b. Have access to and copy, at reasonable times, any records that must be kept under the conditions of this permit;
c. Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this permit; and
d. Sample or monitor at reasonable times, for the purpose of assuring permit compliance or as otherwise authorized by state law, any substances or parameters at any location.

C11. Confidentiality of Information

Any information relating to this permit that is submitted to or obtained by DEQ is available to the public unless classified as confidential by the Director of DEQ under ORS 468.095. The permittee may request that information be classified as confidential if it is a trade secret as defined by that statute. The name and address of the permittee, permit applications, permits, effluent data, and information required by NPDES application forms under 40 CFR § 122.21 are not classified as confidential [40 CFR § 122.7(b)].

SECTION D. REPORTING REQUIREMENTS

D1. Planned Changes

The permittee must comply with OAR 340-052, "Review of Plans and Specifications" and 40 CFR § 122.41(l)(1). Except where exempted under OAR 340-052, no construction, installation, or modification involving disposal systems, treatment works, sewerage systems, or common sewers may be commenced until the plans and specifications are submitted to and approved by DEQ. The permittee must give notice to DEQ as soon as possible of any planned physical alternations or additions to the permitted facility.

D2. Anticipated Noncompliance

The permittee must give advance notice to DEQ of any planned changes in the permitted facility or activity that may result in noncompliance with permit requirements.

D3. Transfers

This permit may be transferred to a new permittee provided the transferee acquires a property interest in the permitted activity and agrees in writing to fully comply with all the terms and conditions of the permit and EQC rules. No permit may be transferred to a third party without prior written approval from DEQ. DEQ may require modification, revocation, and reissuance of the permit to change the name of the permittee and incorporate such other requirements as may be necessary under 40 CFR § 122.61. The permittee must notify DEQ when a transfer of property interest takes place.

D4. Compliance Schedule
Reports of compliance or noncompliance with, or any progress reports on interim and final requirements contained in any compliance schedule of this permit must be submitted no later than 14 days following each schedule date. Any reports of noncompliance must include the cause of noncompliance, any remedial actions taken, and the probability of meeting the next scheduled requirements.

D5. Twenty-Four Hour Reporting
The permittee must report any noncompliance that may endanger health or the environment. Any information must be provided orally (by telephone) to the DEQ regional office or Oregon Emergency Response System (1-800-452-0311) as specified below within 24 hours from the time the permittee becomes aware of the circumstances.

a. Overflows.
  (1) Oral Reporting within 24 hours.
    i. For overflows other than basement backups, the following information must be reported to the Oregon Emergency Response System (OERS) at 1-800-452-0311. For basement backups, this information should be reported directly to the DEQ regional office.
      (a) The location of the overflow;
      (b) The receiving water (if there is one);
      (c) An estimate of the volume of the overflow;
      (d) A description of the sewer system component from which the release occurred (for example, manhole, constructed overflow pipe, crack in pipe); and
      (e) The estimated date and time when the overflow began and stopped or will be stopped.
    ii. The following information must be reported to the DEQ regional office within 24 hours, or during normal business hours, whichever is earlier:
      (a) The OERS incident number (if applicable); and
      (b) A brief description of the event.
  (2) Written reporting postmarked within 5 days.
    i. The following information must be provided in writing to the DEQ regional office within 5 days of the time the permittee becomes aware of the overflow:
      (a) The OERS incident number (if applicable);
      (b) The cause or suspected cause of the overflow;
      (c) Steps taken or planned to reduce, eliminate, and prevent reoccurrence of the overflow and a schedule of major milestones for those steps;
      (d) Steps taken or planned to mitigate the impact(s) of the overflow and a schedule of major milestones for those steps; and
      (e) For storm-related overflows, the rainfall intensity (inches/hour) and duration of the storm associated with the overflow.

    DEQ may waive the written report on a case-by-case basis if the oral report has been received within 24 hours.
b. Other instances of noncompliance.
  (1) The following instances of noncompliance must be reported:
    i. Any unanticipated bypass that exceeds any effluent limitation in this permit;
    ii. Any upset that exceeds any effluent limitation in this permit;
    iii. Violation of maximum daily discharge limitation for any of the pollutants listed by DEQ in this permit; and
    iv. Any noncompliance that may endanger human health or the environment.

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

(3) A written submission must be provided within 5 days of the time the permittee becomes aware of the circumstances. The written submission must contain:
   - i. A description of the noncompliance and its cause;
   - ii. The period of noncompliance, including exact dates and times;
   - iii. The estimated time noncompliance is expected to continue if it has not been corrected;
   - iv. Steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance; and
   - v. Public notification steps taken, pursuant to General Condition B**7.**

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

D6. Other Noncompliance

The permittee must report all instances of noncompliance not reported under General Condition D4 or D5 at the time monitoring reports are submitted. The reports must contain:

a. A description of the noncompliance and its cause;
b. The period of noncompliance, including exact dates and times;
c. The estimated time noncompliance is expected to continue if it has not been corrected; and
d. Steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance.

D7. Duty to Provide Information

The permittee must furnish to DEQ within a reasonable time any information that DEQ may request to determine compliance with the permit or to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit. The permittee must also furnish to DEQ, upon request, copies of records required to be kept by this permit.

Other Information: When the permittee becomes aware that it has failed to submit any relevant facts or has submitted incorrect information in a permit application or any report to DEQ, it must promptly submit such facts or information.

D8. Signatory Requirements

All applications, reports or information submitted to DEQ must be signed and certified in accordance with 40 CFR § 122.22.

D9. Falsification of Information

Under ORS 468.953, any person who knowingly makes any false statement, representation, or certification in any record or other document submitted or required to be maintained under this permit, including monitoring reports or reports of compliance or noncompliance, is subject to a Class C felony punishable by a fine not to exceed $125,000 per violation and up to 5 years in prison per ORS chapter 161. Additionally, according to 40 CFR § 122.41(k)(2), any person who knowingly makes any false statement, representation, or certification in any record or other document submitted or required to be maintained under this permit including monitoring reports or reports of compliance or non-compliance will, upon conviction, be punished by a federal civil penalty not to exceed $10,000 per violation, or by imprisonment for not more than 6 months per violation, or by both.

D10. Changes to Indirect Dischargers

The permittee must provide adequate notice to DEQ of the following:

a. Any new introduction of pollutants into the POTW from an indirect discharger which would be subject to section 301 or 306 of the federal Clean Water Act if it were directly discharging those pollutants and;
b. Any substantial change in the volume or character of pollutants being introduced into the POTW by a source introducing pollutants into the POTW at the time of issuance of the permit.
c. For the purposes of this paragraph, adequate notice must include information on (i) the quality and quantity of effluent introduced into the POTW, and (ii) any anticipated impact of the change on the quantity or quality of effluent to be discharged from the POTW.

SECTION E. DEFINITIONS

E1. *BOD* or BOD_5 means five-day biochemical oxygen demand.
E2. *CBOD* or $CBOD_5$ means five-day carbonaceous biochemical oxygen demand.
E3. *TSS* means total suspended solids.
E4. *Bacteria* means but is not limited to fecal coliform bacteria, total coliform bacteria, *Escherichia coli* (*E. coli*) bacteria, and *Enterococcus* bacteria.
E5. *FC* means fecal coliform bacteria.
E6. *Total residual chlorine* means combined chlorine forms plus free residual chlorine
E7. *Technology based permit effluent limitations* means technology-based treatment requirements as defined in 40 CFR § 125.3, and concentration and mass load effluent limitations that are based on minimum design criteria specified in OAR 340-041.
E8. *mg/l* means milligrams per liter.
E9. *µg/l* means microgram per liter.
E10. *kg* means kilograms.
E11. m^3/d means cubic meters per day.
E12. *MGD* means million gallons per day.
E13. *Average monthly effluent limitation* as defined at 40 CFR § 122.2 means the highest allowable average of daily discharges over a calendar month, calculated as the sum of all daily discharges measured during a calendar month divided by the number of daily discharges measured during that month.
E14. *Average weekly effluent limitation* as defined at 40 CFR § 122.2 means the highest allowable average of daily discharges over a calendar week, calculated as the sum of all daily discharges measured during a calendar week divided by the number of daily discharges measured during that week.
E15. *Daily discharge* as defined at 40 CFR § 122.2 means the discharge of a pollutant measured during a calendar day or any 24-hour period that reasonably represents the calendar day for purposes of sampling. For pollutants with limitations expressed in units of mass, the daily discharge must be calculated as the total mass of the pollutant discharged over the day. For pollutants with limitations expressed in other units of measurement, the daily discharge must be calculated as the average measurement of the pollutant over the day.
E16. *24-hour composite sample* means a sample formed by collecting and mixing discrete samples taken periodically and based on time or flow.
E17. *Grab sample* means an individual discrete sample collected over a period of time not to exceed 15 minutes.
E18. *Quarter* means January through March, April through June, July through September, or October through December.
E19. *Month* means calendar month.
E20. *Week* means a calendar week of Sunday through Saturday.
E21. *POTW* means a publicly-owned treatment works.

APPENDIX B

COLLECTION SYSTEM MAP

TOWNSHIP 8 SOUTH, RANGE 1&2 WEST, W.M.

SCALE
HORIZ: VERIFY SCALE
VERT: BAR IS ONE INCH ON ORIGINAL DRAWING
0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

DSN.	DM
DRN.	TMT
CKD.	DM
DATE:	APR 2015

NO.	DATE	DESCRIPTION	BY
1			

REVISIONS

MAP UPDATED: 10-16-2015

FULL SIZE DRAWING = 36"x48"
(smaller drawing sizes are not to scale)

WESTECH ENGINEERING, INC.
CONSULTING ENGINEERS AND PLANNERS
3841 Fairview Industrial Dr. S.E., Suite 100, Salem, OR 97302
Phone: (503) 585-2474 Fax: (503) 585-3986
E-mail: westech@westech-eng.com

CITY OF AUMSVILLE, OREGON

SANITARY SEWER SYSTEM MAP
(ENTIRE CITY)

SHEET
1 OF 1

JOB NUMBER
2599.1100.0

APPENDIX C

DETAILED COST ESTIMATES

Recommended Budget Level Cost Estimates

Treatment Plant Alternative 1 Detailed Cost Estimate

Treatment Plant Alternative 2 Detailed Cost Estimate

Treatment Plant Alternative 3 Detailed Cost Estimate

RECOMMENDED BUDGET LEVEL COST ESTIMATES

Table C-1

Recommended Budget Level Cost Estimates
Aumsville Wastewater System Facilities Plan
2599.3010.0

Priority Ranking
1= priority 1A
1.5 = priority 1B
2 = priority 2
3 = priority 3

Project Code	Priority	Project & Location(s)	Size/capacity	Open Cut Length (ft)	Open Cut Pipe Cost ($/ft)	New Manholes Each	New Manhole Cost ($)	Rehabilitate Manhole Each	Service Laterals #	Service Lateral Cost ($)	Other Costs	Construction Cost	10% Construction Contingency	20% Engineering	10% Legal, Permits, Easement, Admin	Total Project	Rounded Total	*Total project costs rounded to nearest $1000*			
																		Priority 1A	Priority 1B	Priority 2	Priority 3
Improvements to Existing Gravity Collection System Improvements																					
G-1	1.5	Olney Street Sewer (9th Street to 4th Street)	18 inch	1150	$ 220.00	4	$ 24,000.00	0	12	$ 36,000.00	$ -	$ 313,000.00	$ 31,300.00	$ 62,600.00	$ 31,300.00	$ 438,200.00	$ 438,000	$0	$438,000	$0	$0
G-2	1.5	4th Street Sewer (Olney Street to Del Mar Drive)	18 inch	1100	$ 220.00	5	$ 30,000.00	0	12	$ 24,000.00	$ -	$ 296,000.00	$ 29,600.00	$ 59,200.00	$ 29,600.00	$ 414,400.00	$ 414,000	$0	$414,000	$0	$0
G-3	1.5	9th Street Sewer (Olney Street to Del Mar Drive)	15 inch	950	$ 200.00	2	$ 12,000.00	0	16	$ 32,000.00	$ -	$ 234,000.00	$ 23,400.00	$ 46,800.00	$ 23,400.00	$ 327,600.00	$ 328,000	$0	$328,000	$0	$0
G-4	1.5	Del Mar Drive Sewer (9th Street to 11th Street)	12 inch	950	$ 170.00	3	$ 18,000.00	0	6	$ 12,000.00	$ -	$ 191,500.00	$ 19,150.00	$ 38,300.00	$ 19,150.00	$ 268,100.00	$ 268,000	$0	$268,000	$0	$0
G-5	1.5	5th Street Sewer (4th/Clover Intersection to 5th/Cleveland Intersection)	12 inch	1080	$ 170.00	5	$ 30,000.00	0	20	$ 40,000.00	$ -	$ 253,600.00	$ 25,360.00	$ 50,720.00	$ 25,360.00	$ 355,040.00	$ 355,000	$0	$355,000	$0	$0
G-6	2	11th Street Sewer (Del Mar Drive to Lincoln Street)	12 inch	660	$ 170.00	5	$ 30,000.00	0	6	$ 12,000.00	$ -	$ 154,200.00	$ 15,420.00	$ 30,840.00	$ 15,420.00	$ 215,880.00	$ 216,000	$0	$0	$216,000	$0
G-7	2	Del Mar Drive Sewer (4th/Delmar Intersection to Gordon/1st Intersection) (1)	12 inch	800	$ 170.00	4	$ 24,000.00	0	7	$ 14,000.00	$ 80,000.00	$ 254,000.00	$ 25,400.00	$ 50,800.00	$ 25,400.00	$ 355,600.00	$ 356,000	$0	$0	$356,000	$0
Sewer System Extension Projects																					
E-1	3	West Olney Basin Pump Station and Forcemain (2)	4 inch	2300	$ 100.00					$ -	$ 900,000.00	$ 1,130,000.00	$ 113,000.00	$ 226,000.00	$ 113,000.00	$ 1,582,000.00	$ 1,582,000	$0	$0	$0	$1,582,000
E-2	3	Gordon Lane Basin Gravity Sewers										No Budget Determined for this Project									
E-3	3	West UGB Basin Pump Station and Forcemain (2)	4 inch	750	$ 100.00					$ -	$ 900,000.00	$ 975,000.00	$ 97,500.00	$ 195,000.00	$ 97,500.00	$ 1,365,000.00	$ 1,365,000	$0	$0	$0	$1,365,000
E-4	3	Mill Creek Basin Pump Station and Forcemain (2)	4 inch	500	$ 100.00					$ -	$ 900,000.00	$ 950,000.00	$ 95,000.00	$ 190,000.00	$ 95,000.00	$ 1,330,000.00	$ 1,330,000	$0	$0	$0	$1,330,000
Treatment System Improvements																					
T-1	1	New Sequencing Batch Reactor Treatment Plant (see Section 7.5.1 for description)	See separate estimate in Appendix C													$ 21,675,000.00	$ 21,675,000	$21,675,000	$0	$0	$0
																Totals	$ 28,327,000	$ 21,675,000	$ 1,803,000	$ 572,000	$ 4,277,000

Notes
1. The "other costs" column includes the cost for an auger bore crossing under the railroad.
2. The "other costs" column includes the costs for the new wasewater pump station
3. Costs are in 2021 dollars ENR Construction Cost Index = 12,200

TREATMENT PLANT ALTERNATIVE 1 COST ESTIMATE

Aumsville Facilities Plan

WWTP Alternative 1 - Sequencing Batch Reactor
Cost Estimate Summary

Component	Qty	Unit	Unit Cost	Total Cost
Influent Pump Station & Headworks Improvements	1	LS	$281,000	$ 281,000
Grit Chamber & Transfer Pump Station	1	LS	$880,000	$ 880,000
SBRs	1	LS	$3,286,000	$ 3,286,000
Equalization Basin	1	LS	$562,000	$ 562,000
Aerobic Digesters	1	LS	$1,011,000	$ 1,011,000
Existing Lagoon Modifications	1	LS	$324,000	$ 324,000
Blower & Electrical Building	1	LS	$927,000	$ 927,000
Auxiliary Power System	1	LS	$394,000	$ 394,000
Civil Site Work, Lab, & Office Space	1	LS	$1,933,000	$ 1,933,000
Packaged DAF & Filter System for Lagoon Effluent	1	LS	$1,201,000	$ 1,201,000
Effluent Pump Station & Chlorine Feed System Imps	1	LS	$754,000	$ 754,000
Chlorine Contact, Dechlorination, & Outfall Imps	1	LS	$773,000	$ 773,000
Land Application System Expansion	1	LS	$2,371,000	$ 2,371,000
Existing Lagoon Biosolids Removal	1	LS	$1,710,000	$ 1,710,000
Total Treatment Plant Construction Cost				$ 16,407,000
Soft Costs				
Construction Contingencies	10%	LS	$1,641,000	$ 1,641,000
Engineering, Legal, & Admin	20%	LS	$3,281,000	$ 3,281,000
Permitting	2%	LS	$328,000	$ 328,000
Total Project Budget				**$ 21,657,000**

Aumsville Facilities Plan

WWTP Alternative 1 - Sequencing Batch Reactor
Influent Pump Station & Headworks Improvements

Item	Qty	Unit	Unit Cost	Total Cost
Mobilization (percentage of total)	8.0%	LS	$20,800	$20,800
New Influent Pump Station Pumps	3	EA	$40,000	$120,000
New Influent Pump Station Control System	1	EA	$90,000	$90,000
Overhaul Headworks Screen	1	EA	$50,000	$50,000
Construction Total				**$281,000**

Aumsville Facilities Plan

WWTP Alternative 1 - Sequencing Batch Reactors
New Grit Chamber & Transfer Pump Station

Item	Qty	Unit	Unit Cost	Total Cost
Mobilization (percentage of total)	8.0%	LS	$65,200	$65,200
General Excavation and Subgrade Preparatio	40	CY	$35	$1,400
Wetwell Excavation	1	LS	$20,000	$20,000
Base Rock	15	CY	$45	$700
Imported Fill	400	CY	$45	$18,000
Concrete				
Foundation & Footings	32	CY	$500	$16,000
Grit Hopper	5	CY	$1,000	$5,000
Walls	12	CY	$750	$9,000
Slabs on Grade	10	CY	$500	$5,000
Wetwell Top Slab	5	CY	$1,500	$7,500
Precast Wetwell Barrel Sections	1	LS	$30,000	$30,000
Pump Station Valve Vault & Piping	1	LS	$100,000	$100,000
Wet Well Hatch	1	LS	$10,000	$10,000
Slide Gates	2	EA	$3,000	$6,000
Valved Connection to Existing HDPE Piping	1	LS	$20,000	$20,000
Misc. Mechanical	1	LS	$25,000	$25,000
Stairs	1	EA	$5,000	$5,000
Handrails	40	LF	$85	$3,400
Grating & Frame	90	SF	$80	$7,200
Equipment				
Grit System incl. Classifier	1	LS	$100,000	$100,000
Transfer Pumps, Controls, and Shelter	1	LS	$225,000	$225,000
Equipment Installation (20% of Equip. Cost)	1	LS	$65,000	$65,000
Electrical & Controls (20% of Total Cost)	1	LS	$136,000	$136,000
Construction Total				**$880,000**

Aumsville Facilities Plan

WWTP Alternative 1 - Sequencing Batch Reactors
SBR Complex (all basins)

Item	Quantity	Unit	Unit Cost	Total Cost
Mobilization (percentage of total)	8.0%	LS	$243,000	$243,000
Excavation & Subgrade Preparation	6700	CY	$35	$234,500
Base Rock	1000	CY	$45	$45,000
Concrete				
Bottom Slab	875	CY	$500	$437,500
Walls	790	CY	$750	$592,500
Walkways & Elevated Concrete Structural Flanges	90	CY	$1,500	$135,000
Structural Backfill	1000	CY	$45	$45,000
Handrailing	1,280	LF	$85	$108,800
Grating	100	SF	$80	$8,000
Sluice Gates	4	EA	$7,500	$30,000
Underslab Drain Piping	170	LF	$60	$10,200
Mud Valves	4	EA	$2,500	$10,000
Influent Pipes	40	LF	$250	$10,000
Air Header Pipes	100	LF	$250	$25,000
WAS Piping	100	LF	$100	$10,000
WAS Valves & Flow Meters	1	LS	$20,000	$20,000
Stairs	1	LS	$20,000	$20,000
Misc Mechanical	1	LS	$50,000	$50,000
SBR Equipment	1	LS	$620,000	$620,000
Equipment Installation (20% of Equip Cost)	1	LS	$124,000	$124,000
Electrical & Controls (20% of Total Cost)	1	LS	$507,000	$507,000
Construction Total				**$3,286,000**

Notes:

Aumsville Facilities Plan

WWTP Alternative 1 - Sequencing Batch Reactors
EQ Basin

Item	Quantity	Unit	Unit Cost	Total Cost
Mobilization (percentage of total)	8.0%	LS	$42,000	$42,000
Excavation & Subgrade Preparation	1400	CY	$35	$49,000
Baserock	225	CY	$45	$10,125
Concrete				
Bottom Slab	250	CY	$500	$125,000
Walls	125	CY	$750	$93,800
Structural Backfill	300	CY	$45	$13,500
Handrailing	50	LF	$75	$3,750
Grating	160	SF	$60	$9,600
Underslab Drain Piping	50	LF	$60	$3,000
Sluice Gates	2	EA	$7,500	$15,000
Misc Mechanical	1	LS	$25,000	$25,000
Effluent Control Valves & Piping	1	LS	$75,000	$75,000
Stairway	1	LS	$10,000	$10,000
Electrical & Controls (20% of Total Cost)	1	LS	$87,000	$87,000
Construction Total				**$562,000**

Notes:

Aumsville Facilities Plan

WWTP Alternative 1 - Sequencing Batch Reactors
Aerobic Digesters

Item	**Quantity**	**Unit**	**Unit Cost**	**Total Cost**
Mobilization (percentage of total)	8.0%	LS	$75,000	$75,000
Excavation and Subgrade Preparation	1900	CY	$35	$66,500
Baserock	230	CY	$45	$10,350
Concrete				
Bottom Slab	210	CY	$500	$105,000
Walls	300	CY	$750	$225,000
Elevated Walkway	50	CY	$1,500	$75,000
Handrailing	530	LF	$85	$45,050
Sluice Gate	2	LS	$7,500	$15,000
Underslab Drain Piping	30	LF	$60	$1,800
Misc Mechanical	1	LS	$25,000	$25,000
Mud Valves	2	EA	$2,500	$5,000
Telesoping Valves	2	EA	$3,000	$6,000
Aeration System & Blowers	1	LS	$75,000	$75,000
Mixers & Appurtenances	2	EA	$25,000	$50,000
Air Piping	1	LS	$15,000	$15,000
Sludge Pumps	1	LS	$15,000	$15,000
Sludge Piping	1	LS	$20,000	$20,000
Stairway	1	LS	$25,000	$25,000
Electrical & Controls (20% of Total Cost)	1	LS	$156,000	$156,000
Construction Total				**$1,011,000**
Notes:				

Aumsville Facilities Plan

WWTP Alternative 1 - Sequencing Batch Reactors
Existing Lagoon Modifications

Item	**Quantity**	**Unit**	**Unit Cost**	**Total Cost**
Mobilization (percentage of total)	8.0%	LS	$24,000	$24,000
New Flow Control Piping & Valves	4	Each	$75,000	$300,000
Construction Total				**$324,000**
Notes:				

Aumsville Facilities Plan

WWTP Alternative 1 - Sequencing Batch Reactors
Blower & Electrical Building

Item	Qty	Unit	Unit Cost	Total Cost
Mobilization (percentage of total)	8.0%	LS	$69,000	$69,000
Air Piping & Valves	1	LS	$35,000	$35,000
Misc Mechanical	1	LS	$25,000	$25,000
HVAC	1	LS	$35,000	$35,000
Building Structure	1,100	SF	$300	$330,000
Building Specialties				
Overhead Door	1	LS	$10,000	$10,000
Intake and Exhaust Louvers	1	LS	$30,000	$30,000
Bridge Crane	1	LS	$20,000	$20,000
Power Service Modifications	1	LS	$75,000	$75,000
Miscellaneous Electrical Equipment	1	LS	$100,000	$100,000
Electrical & Controls (30% of Total Cost)	1	LS	$198,000	$198,000
Construction Total				**$927,000**

Aumsville Facilities Plan

WWTP Alternative 1 - Sequencing Batch Reactors
Auxiliary Power System

Item	Qty	Unit	Unit Cost	Total Cost
Mobilization (percentage of total)	8.0%	LS	$29,000	$29,000
Generator Fuel Lines and Exhaust Piping	1	LS	$25,000	$25,000
Base Slab	35	CY	$500	$17,500
Auxiliary Power Generator, Enclosure, & Accessories	1	EA	$200,000	$200,000
Generator Installation (20% of Equip Cost)	1	LS	$40,000	$40,000
Exterior Fuel Tank	1	LS	$40,000	$40,000
Exterior Fuel Tank Concrete Slab	18	CY	$500	$9,000
Electrical & Controls (10% of Total Cost)	1	LS	$33,000	$33,000
Construction Total				**$394,000**

Aumsville Facilities Plan

WWTP Alternative 1 - Sequencing Batch Reactors
Civil Site Work, Lab, & Office Space

Item	Qty	Unit	Unit Cost	Total Cost
Mobilization (percentage of total)	8.0%	LS	$143,200	$143,200
Silt Fence	800	LF	$2	$1,600
Stabilized Construction Entrance	1	EA	$2,000	$2,000
Erosion Control Maintenance	1	LS	$2,000	$2,000
Clear & Grub	1	LS	$2,500	$2,500
Fine Grade Site	4800	SY	$1	$4,800
Gravel Surfacing	850	CY	$45	$38,300
Bollards	20	EA	$750	$15,000
Drain Pump Station	1	LS	$450,000	$450,000
Yard Piping				
RS Line to Headworks	1200	LF	$100	$120,000
SE & SBR and EQ Basin Bypass Lines	1350	LF	$100	$135,000
SE Flow Meter & Vault	1	LS	$35,000	$35,000
Auger Bore Under Beaver Creek	100	LF	$800	$80,000
EQ Basin Overflow Pipe	60	LF	$100	$6,000
Air Piping	250	LF	$80	$20,000
Digested Sludge Lines	300	LF	$60	$18,000
Drain Lines	1200	LF	$60	$72,000
Grit Classifier Discharge Line	95	LF	$60	$5,700
Manholes	5	EA	$6,000	$30,000
2" Washdown Water Lines	1000	LF	$25	$25,000
Potable Water Lines to Buildings	200	LF	$25	$5,000
Yard Hydrant / 50' Hose / Rack	5	EA	$2,000	$10,000
SD Pipelines	400	LF	$65	$26,000
SD Catch Basins	4	EA	$2,000	$8,000
Lab/Office Building				
Lab/Office Space	1,500	SF	$300	$450,000
Building Specialties				
Lab Equipment	1	LS	$50,000	$50,000
Fume Hood & Mechanical	1	LS	$15,000	$15,000
Electrical & Controls (10% of Total Cost)	1	LS	$163,000	$163,000
Construction Total				**$1,933,000**

Aumsville Facilities Plan

WWTP Alternative 1 - Sequencing Batch Reactors
Packaged DAF & Filter System for Lagoon Effluent

Item	Quantity	Unit	Unit Cost	Total Cost
Mobilization (percentage of total)	8.0%	LS	$82,000	$82,000
Fill in Cell 4	1600	CY	$45	$72,000
Preload Fill and Removal	420	CY	$45	$18,900
Baserock	50	CY	$45	$2,250
Concrete				
Bottom Slab	30	CY	$500	$15,000
Canopy	900	SF	$40	$36,000
Convert Small Irrigation Pump to DAF Feed Pump	1	LS	$20,000	$20,000
Sludge Pump Station	1	LS	$100,000	$100,000
DAF Inlet Piping	50	LF	$100	$5,000
DAF Outlet Piping	120	LF	$75	$9,000
DAF Sludge Waste Piping	300	LF	$75	$22,500
Miscellaneous Chemical Feed Equipment	1	LS	$10,000	$10,000
Miscellaneous Mechanical	1	LS	$15,000	$15,000
Packaged DAF Clarifier System	1	LS	$700,000	$700,000
Electrical & Controls (10% of Total Cost)	1	LS	$93,000	$93,000
Construction Total				**$1,201,000**

Notes:

Aumsville Facilities Plan

WWTP Alternative 1 - Sequencing Batch Reactors
Effluent Pump Station and Chlorine Feed System Improvements

Item	Qty	Unit	Unit Cost	Total Cost
Mobilization (percentage of total)	8.0%	LS	$55,900	$55,900
Retaining Wall	1	LS	$20,000	$20,000
Modify 16 inch Pump Suction Header	1	LS	$10,000	$10,000
New Water Supply Line from Shops Area	475	LF	$50	$23,800
Miscellaneous Civil Improvements	1	LS	$45,000	$45,000
New Pump Cans	2	EA	$15,000	$30,000
New Effluent Pumps & Appurtenances	2	EA	$40,000	$80,000
Effluent Pump Discharge Piping & Valves	2	EA	$25,000	$50,000
Strainer Piping Modifications	1	LS	$15,000	$15,000
New Strainers & Appurtenances	2	EA	$25,000	$50,000
Building Addition	288	SF	$325	$93,600
Chemical Feed System Improvements	1	LS	$75,000	$75,000
Tempered Safety Shower & Eyewash System	1	LS	$25,000	$25,000
Power Service Improvements	1	LS	$20,000	$20,000
Electrical & Controls (30% of Total Cost)	1	LS	$161,000	$161,000
Construction Total				**$754,000**

Aumsville Facilities Plan

WWTP Alternative 1 - Sequencing Batch Reactors
Chlorine Contact Chamber, Dechlorination System, & Outfall Imps

Item	Quantity	Unit	Unit Cost	Total Cost
Mobilization (percentage of total)	8.0%	LS	$57,000	$57,000
Excavation & Subgrade Preparation	1250	CY	$35	$43,750
Demolish Existing Contact Chamber	1	LS	$10,000	$10,000
Base Rock	125	CY	$45	$5,625
Miscellaneous Civil Improvements	1	LS	$40,000	$40,000
Concrete				
Bottom Slab	180	CY	$500	$90,000
Walls	220	CY	$750	$165,000
Structural Backfill	1250	150	$45	$56,250
Handrailing	145	LF	$85	$12,325
Retaining Wall	1	LS	$15,000	$15,000
Piping Connections	1	LS	$10,000	$10,000
Miscellaneous Mechanical Improvements	1	LS	$10,000	$10,000
Effluent Flow Measurement Weir	1	LS	$2,500	$2,500
Chemical Distribution Piping	1	LS	$20,000	$20,000
Carrier Water Feed System	1	LS	$10,000	$10,000
Drain Pump, Discharge Piping & Appurtenances	1	LS	$15,000	$15,000
Effluent Flow Meter	1	LS	$6,000	$6,000
Rain Gauge	1	LS	$6,000	$6,000
Washdown Water System	1	LS	$6,250	$6,250
Compliance Manhole	1	LS	$15,000	$15,000
Wastewater Sampler	1	LS	$8,500	$8,500
Outfall Pipe	240	LF	$120	$28,800
Outfall Check Valve	1	LS	$3,000	$3,000
Dechlorination Building Expansion	144	SF	$325	$46,800
Chemical Feed System Improvements	1	LS	$25,000	$25,000
Electrical & Controls (10% of Total Cost)	1	LS	$65,000	$65,000
Construction Total				**$773,000**
Notes:				

Aumsville Facilities Plan

WWTP Alternative 1 - Sequencing Batch Reactors
Land Application System Expansion

Item	Qty	Unit	Unit Cost	Total Cost
Mobilization (percentage of total)	8.0%	LS	$175,600	$175,600
Connection to Existing Piping	1	LS	$5,000	$5,000
New Irrigation Pipe In County Right of Way	8200	LF	$250	$2,050,000
Air/Vacuum Release Stations	3	Each	$20,000	$60,000
Auger Bore Casing Installations	100	LF	$800	$80,000
Construction Total				**$2,371,000**

Aumsville Facilities Plan

WWTP Alternative 1 - Sequencing Batch Reactors
Lagoon Biosolids Removal

Construction Costs				
Item	**Qty**	**Unit**	**Unit Cost**	**Total Cost**
Dredge, Dewater, Haul, & Dispose of Biosolids	1900	Dry Tons	$900	$1,710,000
Construction Total				$1,710,000

Aumsville Facilities Plan

WWTP Alternative 1 - Sequencing Batch Reactors
Estimated Additional Maintenance & Chemical Costs [1]

Process Equipment Major Maintenance Costs

Item	Units	Service Interval (years)	Cost per Service per Unit	Total Cost per Service	Annualized Cost
Influent Pump Station	NA - No additional costs with new facilities. O&M costs already included in City's O&M budget				$0.00
Headworks Screen	NA - No additional costs with new facilities. O&M costs already included in City's O&M budget				$0.00
Overhaul Transfer Pumps	3	15	$15,000.00	$45,000.00	$3,000.00
Overhaul Blowers	NA - These costs should already be included in the City's budget for maintenance of the existing aerators				$0.00
Replace Aeration Membranes	2	10	$20,000.00	$40,000.00	$4,000.00
Overhaul Decanter Drives	2	15	$7,500.00	$15,000.00	$1,000.00
Overhaul SBR Mixers	2	15	$10,000.00	$20,000.00	$1,333.33
Overhaul WAS Pumps	2	15	$7,500.00	$15,000.00	$1,000.00
Overhaul EQ Basin Control Valve	1	15	$10,000.00	$10,000.00	$666.67
Overhaul Irrigation Pump 3	1	15	$10,000.00	$10,000.00	$666.67
Irrigation Pump 1 & 2	NA - No additional costs with new facilities. O&M costs already included in City's O&M budget				$0.00
Chorination and Dechlorination Equipment	NA - No additional costs with new facilities. O&M costs already included in City's O&M budget				$0.00
Overhaul Packaged Lagoon Polishing System	1	20	$100,000.00	$100,000.00	$5,000.00
Remove Biosolids from Pond 1	1	10	$800,000.00	$800,000.00	$80,000.00
Total Annualized Maintenance Costs					**$96,666.67**

Routine Operation and Maintenance Costs

Analysis does not include general costs such as vehicles, vehicle fuel & maintenance, lab equipment, landscaping equipment, HVAC repair, etc.

Hourly Labor Rate: $60.00

Item	Units	Hrs Per Unit Per Year	Annual Labor Cost	Estimated Annual Material Cost Per Unit	Annual Material Cost	Total Annual Cost
Influent Pump Station	NA - No additional costs with new facilities. O&M costs already included in City's O&M budget					
Headworks Screen	NA - No additional costs with new facilities. O&M costs already included in City's O&M budget					
Grit Removal System	1	50	$3,000.00	$250.00	$250.00	$3,250.00
Transfer Pump Maintenance	3	40	$7,200.00	$100.00	$300.00	$7,500.00
Blower Maintenance	NA - These costs should already be included in the City's budget for maintenance of the existing aerators					$0.00
Decanter Maintenance	2	20	$2,400.00	$100.00	$200.00	$2,600.00
WAS Pump Maintenance	2	20	$2,400.00	$100.00	$200.00	$2,600.00
EQ Basin Control Valve Maintenance	1	20	$1,200.00	$50.00	$50.00	$1,250.00
Irrigation Pump 3 Maintenance	1	20	$1,200.00	$100.00	$100.00	$1,300.00
Irrigation Pump 1 & 2	NA - No additional costs with new facilities. O&M costs already included in City's O&M budget					$0.00
Chorination and Dechlorination Equipment	NA - No additional costs with new facilities. O&M costs already included in City's O&M budget					$0.00
Packaged Lagoon Polishing System Maintenance	1	120	$7,200.00	$100.00	$100.00	$7,300.00
Chemicals for Lagoon Polishing System	Not Used					$7,500.00
Process Monitoring and Operation	1	1560	$93,600.00	$0.00	$0.00	$93,600.00
Total Annual Labor Hours		**1850**				
Total Annual Routine Maintenace and Operation Cost						**$126,900.00**

Notes:

(1) These are operation and maintenance costs that are in excess of the existing operation and maintenance costs for the existing treatment facilities.

Aumsville Facilities Plan

WWTP Alternative 1 - Sequencing Batch Reactors
Estimated Additional Power Costs [1]

Process Power Consumption Does not include lighting, HVAC, chem feed pumps, and other small motor loads

Power Cost ($/Kw-hr) 0.09

Equipment Item	Units	Duty Hp	On Time (hrs/day/unit)	Hp Hours Per Day	Kw Hrs Per Day	Total Daily Cost	Operation Days Per Year	Annual Power Costs
Influent Pump Station	NA - No additional costs with new facilities. O&M costs already included in City's O&M budget							$0.00
Influent Screen & Conveyor	NA - No additional costs with new facilities. O&M costs already included in City's O&M budget							$0.00
Grit Pump & Classifier	1	3	6	18	13.4	$1.21	365	$441.11
Transfer Pump (Grit Chamber to SBR)	1	20	24	480	358.1	$32.23	365	$11,762.93
SBR Aeration Air - Additional [2]	1	10	20	200	149.2	$13.43	365	$4,901.22
SBR Mixers	2	8	4	64	47.7	$4.30	365	$1,568.39
SBR Decanter Drives	2	0.4	5	4	3.0	$0.27	365	$98.02
Air Valves	2	0.33	1	0.66	0.5	$0.04	365	$16.17
WAS Pumps	2	2	1.2	4.8	3.6	$0.32	365	$117.63
Digester Aeration	2	30	12	720	537.1	$48.34	365	$17,644.39
Chlorination & Dechlorination	NA - No additional costs with new facilities. O&M costs already included in City's O&M budget							$0.00
Irrigation Pump Station	NA - No additional costs with new facilities. O&M costs already included in City's O&M budget							$0.00
Packaged Lagoon Water Polishing System	1	20	24	480	358.1	$32.23	184	$5,929.80
Total Additional Annual Power Cost								**$42,480**

Notes:

(1) These are power costs that are in excess of the existing operation and maintenance costs for the existing treatment facilities.

(2) This is the estimated additional power required to aerate the SBR basins. This power equals aeration basin power requirements minus the exisitng lagoon aeration power

TREATMENT PLANT ALTERNATIVE 2 COST ESTIMATE

Aumsville Facilities Plan

WWTP Alternative 2 - Aerated Lagoons with MBBR
Cost Estimate Summary

Component	Qty	Unit	Unit Cost	Total Cost
Influent Pump Station & Headworks Improvements	1	LS	$281,000	$ 281,000
Lagoon Aeration System	1	LS	$1,858,000	$ 1,858,000
Convert Effluent Pump Station to Transfer Pump Station	1	LS	$368,000	$ 368,000
MBBRs	1	LS	$1,945,000	$ 1,945,000
Existing Lagoon Modifications	1	LS	$651,000	$ 651,000
Blower & Electrical Building	1	LS	$1,105,000	$ 1,105,000
Auxiliary Power System	1	LS	$394,000	$ 394,000
Civil Site Work, Lab, & Office Space	1	LS	$1,778,000	$ 1,778,000
Effluent Pump Station & Chemical Feed Building	1	LS	$1,248,000	$ 1,248,000
Chlorine Contact Chamber	1	LS	$527,000	$ 527,000
Land Application System Expansion	1	LS	$2,371,000	$ 2,371,000
Existing Lagoon Biosolids Removal	1	LS	$1,710,000	$ 1,710,000
Total Treatment Plant Construction Cost				$ 14,236,000
Soft Costs				
Construction Contingencies	10%	LS	$1,424,000	$ 1,424,000
Engineering, Legal, & Admin	20%	LS	$2,847,000	$ 2,847,000
Permitting	2%	LS	$285,000	$ 285,000
Total Project Budget				**$ 18,792,000**

Aumsville Facilities Plan

WWTP Alternative 2 - Aerated Lagoons with MBBR
Influent Pump Station & Headworks Improvements

Item	Qty	Unit	Unit Cost	Total Cost
Mobilization (percentage of total)	8.0%	LS	$20,800	$20,800
New Influent Pump Station Pumps	3	EA	$40,000	$120,000
New Influent Pump Station Control System	1	EA	$90,000	$90,000
Overhaul Headworks Screen	1	EA	$50,000	$50,000
Construction Total				**$281,000**

Aumsville Facilities Plan

WWTP Alternative 2 - Aerated Lagoons with MBBR
Lagoon Aeration System

Item	**Quantity**	**Unit**	**Unit Cost**	**Total Cost**
Mobilization (percentage of total)	8.0%	LS	$138,000	$138,000
Burried Air Distribution Piping				
16 Inch	965	LF	$120	$115,800
12 Inch	385	LF	$100	$38,500
8 Inch	990	LF	$75	$74,250
Air Lateral Connections	18	EA	$4,000	$72,000
Floating Air Headers				
6 Inch	3,900	LF	$25	$97,500
4 Inch	4,000	LF	$20	$80,000
3 Inch	600	LF	$20	$12,000
Lateral Cable Support System	18	EA	$5,000	$90,000
Aeration Equipment and Blowers	1	LS	$800,000	$800,000
Aeration Equipment Installation	1	LS	$150,000	$150,000
Ramps for Service Pontoon Boat	4	EA	$15,000	$60,000
Pontoon Boat & Trailer	1	LS	$30,000	$30,000
Disolved Oxygen Instruments and Telemetry	1	LS	$50,000	$50,000
Miscellaneous	1	LS	$50,000	$50,000
Construction Total				**$1,858,000**

Notes:

Aumsville Facilities Plan

WWTP Alternative 2 - Aerated Lagoons with MBBR
Convert Effluent Pump Station to Transfer Pump Station

Item	Qty	Unit	Unit Cost	Total Cost
Mobilization (percentage of total)	8.0%	LS	$27,200	$27,200
Retaining Wall	1	LS	$15,000	$15,000
Modify 16 inch Pump Suction Header	1	LS	$10,000	$10,000
New Water Supply Line from Shops Area	475	LF	$50	$23,800
Miscellaneous Civil Improvements	1	LS	$45,000	$45,000
New Pump Can	1	EA	$15,000	$15,000
New Effluent Pumps & Appurtenances	1	EA	$40,000	$40,000
Effluent Pump Discharge Piping & Valves	1	EA	$25,000	$25,000
Strainer Piping Modifications	1	LS	$15,000	$15,000
Building Addition	144	SF	$325	$46,800
Miscellanenous Mechanical Improvements	1	LS	$20,000	$20,000
Power Service Improvements	1	LS	$20,000	$20,000
Electrical & Controls (30% of Total Cost)	1	LS	$65,000	$65,000
Construction Total				**$368,000**

Aumsville Facilities Plan

WWTP Alternative 2 - Aerated Lagoons with MBBR MBBRs

Item	Quantity	Unit	Unit Cost	Total Cost
Mobilization (percentage of total)	8.0%	LS	$144,000	$144,000
Excavation & Subgrade Preparation	2400	CY	$35	$84,000
Base Rock	220	CY	$45	$9,900
Concrete				
Bottom Slab	250	CY	$500	$125,000
Walls	340	CY	$750	$255,000
Walkways & Elevated Concrete Structural Flanges	50	CY	$1,500	$75,000
Structural Backfill	1000	CY	$45	$45,000
Handrailing	350	LF	$85	$29,750
Grating	50	SF	$80	$4,000
Sluice Gates	3	EA	$7,500	$22,500
Underslab Drain Piping	170	LF	$60	$10,200
Mud Valves	3	EA	$2,500	$7,500
Air Header Pipes	220	LF	$200	$44,000
Stairs	1	LS	$20,000	$20,000
Misc Mechanical	1	LS	$25,000	$25,000
MBBR Equipment, Media, & Blowers	1	LS	$620,000	$620,000
Equipment Installation (20% of Equip Cost)	1	LS	$124,000	$124,000
Electrical & Controls (20% of Total Cost)	1	LS	$300,000	$300,000
Construction Total				**$1,945,000**
Notes:				

Aumsville Facilities Plan

WWTP Alternative 2 - Aerated Lagoons with MBBR
Existing Lagoon Modifications

Item	Quantity	Unit	Unit Cost	Total Cost
Mobilization (percentage of total)	8.0%	LS	$33,000	$33,000
New Flow Control Piping & Valves Cells 1, 2, 3	4	EA	$50,000	$200,000
Cell 1 to Cell 2 Transfer Pipe	750	LF	$200	$150,000
Coffer Dams for Breaching Lagoon Dikes	3	EA	$20,000	$60,000
Cell 2 to Cell 3 Transfer Pipe	320	LF	$150	$48,000
Auger Bore Beaver Creek	100	LF	$800	$80,000
New Gravel Road Surfaces	2000	CY	$40	$80,000
Construction Total				**$651,000**

Notes:

Aumsville Facilities Plan

WWTP Alternative 2 - Aerated Lagoons with MBBR
Blower & Electrical Building

Item	Qty	Unit	Unit Cost	Total Cost
Mobilization (percentage of total)	8.0%	LS	$81,000	$81,000
Excavation and Baserock	1	LS	$10,000	$10,000
Air Piping & Valves	1	LS	$35,000	$35,000
Misc Mechanical	1	LS	$25,000	$25,000
HVAC	1	LS	$35,000	$35,000
Building Structure	1,500	SF	$300	$450,000
Building Specialties				
Overhead Door	1	LS	$10,000	$10,000
Intake and Exhaust Louvers	1	LS	$30,000	$30,000
Bridge Crane	1	LS	$20,000	$20,000
Power Service Modifications	1	LS	$75,000	$75,000
Miscellaneous Electrical Equipment	1	LS	$100,000	$100,000
Electrical & Controls (30% of Total Cost)	1	LS	$234,000	$234,000
Construction Total				**$1,105,000**

Aumsville Facilities Plan

WWTP Alternative 2 - Aerated Lagoons with MBBR
Auxiliary Power System

Item	Qty	Unit	Unit Cost	Total Cost
Mobilization (percentage of total)	8.0%	LS	$29,000	$29,000
Generator Fuel Lines and Exhaust Piping	1	LS	$25,000	$25,000
Base Slab	35	CY	$500	$17,500
Auxiliary Power Generator, Enclosure, & Accessories	1	EA	$200,000	$200,000
Generator Installation (20% of Equip Cost)	1	LS	$40,000	$40,000
Exterior Fuel Tank	1	LS	$40,000	$40,000
Exterior Fuel Tank Concrete Slab	18	CY	$500	$9,000
Electrical & Controls (10% of Total Cost)	1	LS	$33,000	$33,000
Construction Total				**$394,000**

Aumsville Facilities Plan

WWTP Alternative 2 - Aerated Lagoons with MBBR
Civil Site Work, Lab, & Office Space

Item	Qty	Unit	Unit Cost	Total Cost
Mobilization (percentage of total)	8.0%	LS	$131,700	$131,700
Silt Fence	600	LF	$2	$1,200
Stabilized Construction Entrance	1	EA	$2,000	$2,000
Erosion Control Maintenance	1	LS	$2,000	$2,000
Clear & Grub	1	LS	$5,000	$5,000
Fine Grade Site	3500	SY	$1	$3,500
Gravel Surfacing	1000	CY	$45	$45,000
Bollards	20	EA	$750	$15,000
Drain Pump Station	1	LS	$450,000	$450,000
Yard Piping				
Connections to Existing Piping	2	EA	$5,000	$10,000
SE Lines	35	LF	$100	$3,500
SE Flow Meter & Vault	1	LS	$35,000	$35,000
Tertiary Effluent Lines	350	LF	$100	$35,000
Final Effluent Lines	240	LF	$100	$24,000
New Beaver Creek Outfall Diffuser	1	LS	$40,000	$40,000
New Reciculation Line	240	LF	$100	$24,000
New Irrigation Line	425	LF	$100	$42,500
Drain Pump Station Forcemain	120	LF	$100	$12,000
Gravity Drainage Lines	450	LF	$200	$90,000
Underground Chemical Piping	200	LF	$100	$20,000
Manholes	8	EA	$6,000	$48,000
2" Washdown Water Lines	1000	LF	$25	$25,000
Potable Water Lines to Buildings	200	LF	$25	$5,000
Yard Hydrant / 50' Hose / Rack	5	EA	$2,000	$10,000
SD Pipelines	400	LF	$65	$26,000
SD Catch Basins	4	EA	$2,000	$8,000
Lab/Office Building				
Lab/Office Space	1,500	SF	$300	$450,000
Building Specialties				
Lab Equipment	1	LS	$50,000	$50,000
Fume Hood & Mechanical	1	LS	$15,000	$15,000
Electrical & Controls (10% of Total Cost)	1	LS	$150,000	$150,000
Construction Total				**$1,778,000**

Aumsville Facilities Plan

WWTP Alternative 2 - Aerated Lagoons with MBBR
Effluent Pump Station and Chemical Feed Building

Item	Qty	Unit	Unit Cost	Total Cost
Mobilization (percentage of total)	8.0%	LS	$88,300	$88,300
Excavation and Baserock	1	LS	$10,000	$10,000
Wetwell Excavation and Backfill	1	LS	$20,000	$20,000
Miscellaneous Civil Improvements	1	LS	$25,000	$25,000
Wetwell Structure	1	LS	$60,000	$60,000
Irrigation Pumps	2	Each	$50,000	$100,000
Recycle Pumps	2	Each	$40,000	$80,000
Pump Discharge Piping & Valves	4	EA	$25,000	$100,000
Irrigation Flow Meter & Vault	1	LS	$30,000	$30,000
New Strainers & Appurtenances	2	EA	$25,000	$50,000
Building Structure	1050	SF	$325	$341,300
Chemical Feed System Improvements	1	LS	$100,000	$100,000
Tempered Safety Shower & Eyewash System	1	LS	$25,000	$25,000
Miscellaneous Mechanical Improvements	1	LS	$25,001	$25,001
Electrical & Controls (20% of Total Cost)	1	LS	$193,000	$193,000
Construction Total				**$1,248,000**

Aumsville Facilities Plan

WWTP Alternative 2 - Aerated Lagoons with MBBR
Chlorine Contact Chamber

Item	**Quantity**	**Unit**	**Unit Cost**	**Total Cost**
Mobilization (percentage of total)	8.0%	LS	$39,000	$39,000
Excavation & Subgrade Preparation	1850	CY	$35	$64,750
Demolish Existing Contact Chamber	1	LS	$10,000	$10,000
Base Rock	180	CY	$45	$8,100
Miscellaneous Civil Improvements	1	LS	$15,000	$15,000
Concrete				
Bottom Slab	144	CY	$500	$72,000
Walls	150	CY	$750	$112,500
Structural Backfill	1000	150	$45	$45,000
Handrailing	190	LF	$85	$16,150
Piping Connections	1	LS	$10,000	$10,000
Sluice Gates	2	Each	$6,500	$13,000
Miscellaneous Mechanical Improvements	1	LS	$10,000	$10,000
Effluent Flow Measurement Weir	1	LS	$2,500	$2,500
Miscellaneous Mechanical Improvements	1	LS	$20,000	$20,000
Carrier Water Feed System	1	LS	$10,000	$10,000
Rain Gauge	1	LS	$6,000	$6,000
Washdown Water System	1	LS	$5,000	$5,000
Compliance Manhole	1	LS	$15,000	$15,000
Wastewater Sampler	1	LS	$8,500	$8,500
Electrical & Controls (10% of Total Cost)	1	LS	$44,000	$44,000
Construction Total				**$527,000**

Notes:

Aumsville Facilities Plan

WWTP Alternative 2 - Aerated Lagoons with MBBR
Land Application System Expansion

Item	Qty	Unit	Unit Cost	Total Cost
Mobilization (percentage of total)	8.0%	LS	$175,600	$175,600
Connection to Existing Piping	1	LS	$5,000	$5,000
New Irrigation Pipe In County Right of Way	8200	LF	$250	$2,050,000
Air/Vacuum Release Stations	3	Each	$20,000	$60,000
Auger Bore Casing Installations	100	LF	$800	$80,000
Construction Total				**$2,371,000**

Aumsville Facilities Plan

WWTP Alternative 2 - Aerated Lagoons with MBBR
Lagoon Biosolids Removal

Construction Costs				
Item	**Qty**	**Unit**	**Unit Cost**	**Total Cost**
Dredge, Dewater, Haul, & Dispose of Biosolids	1900	Dry Tons	$900	$1,710,000
Construction Total				$1,710,000

Aumsville Facilities Plan

WWTP Alternative 2 - Aerated Lagoons with MBBR
Estimated Additional Power Costs [1]

Process Power Consumption Does not include lighting, HVAC, chem feed pumps, and other small motor loads

Power Cost ($/Kw-hr) 0.09

Equipment Item	Units	Duty Hp	On Time (hrs/day/unit)	Hp Hours Per Day	Kw Hrs Per Day	Total Daily Cost	Operation Days Per Year	Annual Power Costs
Influent Pump Station	NA - No additional costs with new facilities. O&M costs already included in City's O&M budget							$0.00
Influent Screen & Conveyor	NA - No additional costs with new facilities. O&M costs already included in City's O&M budget							$0.00
Lagoon Aeration Air - Additional[2]	1	10	24	240	179.0	$16.11	365	$5,881.46
Transfer Pump (Cell 4 to MBBR)	1	20	24	480	358.1	$32.23	365	$11,762.93
MBBR Aeration Air	1	26.6	24	638.4	476.2	$42.86	365	$15,644.69
MBBR Heating	Not Used				8700.0	$783.00	30	$23,490.00
Transfer Pump (Effluent Pump Station to Cell 1)	1	20	24	480	358.1	$32.23	60	$1,933.63
Chlorination & Dechlorination	NA - No additional costs with new facilities. O&M costs already included in City's O&M budget							$0.00
Irrigation Pump Station	NA - No additional costs with new facilities. O&M costs already included in City's O&M budget							$0.00
Total Additional Annual Power Cost								**$58,713**

Notes:

(1) These are power costs that are in excess of the existing operation and maintenance costs for the existing treatment facilities.

(2) This is the estimated additional power required to aerate the improved lagoon aeration system. This power equals power requirements for the improved lagoon aeration system minus the power requirements for the exisitng lagoon aeration power requirements. The existing lagoon aeration power requirements are already included in the City's existing O&M budget.

Aumsville Facilities Plan

WWTP Alternative 2 - Aerated Lagoons with MBBR
Estimated Additional Maintenance & Chemical Costs (1)

Process Equipment Major Maintenance Costs

Item	Units	Service Interval (years)	Cost per Service per Unit	Total Cost per Service	Annualized Cost
Influent Pump Station	NA - No additional costs with new facilities. O&M costs already included in City's O&M budget				$0.00
Headworks Screen	NA - No additional costs with new facilities. O&M costs already included in City's O&M budget				$0.00
Overhaul Blowers	NA - These costs should already be included in the City's budget for maintenance of the existing aerators				$0.00
Replace Aeration Membranes	1	15	$33,000.00	$33,000.00	$2,200.00
Overhaul Transfer Pumps (Cell 4 to MBBR)	3	15	$15,000.00	$45,000.00	$3,000.00
Overhaul MBBR Heating System	1	15	$25,000.00	$25,000.00	$1,666.67
Overhaul Transfer Pumps (Effluent PS to Cell 1)	2	30	$15,000.00	$30,000.00	$1,000.00
Overhaul Irrigation Pump 3	1	15	$10,000.00	$10,000.00	$666.67
Irrigation Pump 1 & 2	NA - No additional costs with new facilities. O&M costs already included in City's O&M budget				$0.00
Chorination and Dechlorination Equipment	NA - No additional costs with new facilities. O&M costs already included in City's O&M budget				$0.00
Biosolids Removal	1	30	$1,330,000.00	$1,330,000.00	$44,333.33
Total Annualized Maintenance Costs					**$52,866.67**

Routine Operation and Maintenance Costs — Analysis does not include general costs such as vehicles, vehicle fuel & maintenance, lab equipment, landscaping equipment, HVAC repair, etc.

Hourly Labor Rate: $60.00

Item	Units	Hrs Per Unit Per Year	Annual Labor Cost	Estimated Annual Material Cost Per Unit	Annual Material Cost	Total Annual Cost
Influent Pump Station	NA - No additional costs with new facilities. O&M costs already included in City's O&M budget					
Headworks Screen	NA - No additional costs with new facilities. O&M costs already included in City's O&M budget					
Blower Maintenance	NA - These costs should already be included in the City's budget for maintenance of the existing aerators					$0.00
Transfer Pump Maintenance (Cell 4 to MBBR)	3	40	$7,200.00	$100.00	$300.00	$7,500.00
MBBR Heating System Maintenance	1	40	$2,400.00	$100.00	$100.00	$2,500.00
Transfer Pump Maintenance (Eff PS to Cell 1)	2	10	$1,200.00	$100.00	$200.00	$1,400.00
Irrigation Pump 3 Maintenance	1	20	$1,200.00	$100.00	$100.00	$1,300.00
Irrigation Pump 1 & 2	NA - No additional costs with new facilities. O&M costs already included in City's O&M budget					$0.00
Chorination and Dechlorination Equipment	NA - No additional costs with new facilities. O&M costs already included in City's O&M budget					$0.00
Process Monitoring and Operation	1	1040	$62,400.00	$0.00	$0.00	$62,400.00
Total Annual Labor Hours		**1150**				
Total Annual Routine Maintenace and Operation Cost						**$75,100.00**

Notes:

(1) These are operation and maintenance costs that are in excess of the existing operation and maintenance costs for the existing treatment facilities.

TREATMENT PLANT ALTERNATIVE 3 COST ESTIMATE

Aumsville Facilities Plan				
WWTP Alternative 3 - Pump To Salem				
Cost Estimate Summary				
Component	**Qty**	**Unit**	**Unit Cost**	**Total Cost**
Influent Pump Station & Headworks Improvements	1	LS	$281,000	$ 281,000
Salem Pump Station	1	LS	$1,814,000	$ 1,814,000
Salem Forcemain	1	LS	$9,963,000	$ 9,963,000
Lagoon Improvements and Treatment Plant Decomissioni	1	LS	$570,000	$ 570,000
Existing Lagoon Biosolids Removal	1	LS	$1,710,000	$ 1,710,000
Total Treatment Plant Construction Cost				$ 14,338,000
Soft Costs				
Construction Contingencies	10%	LS	$1,434,000	$ 1,434,000
Engineering, Legal, & Admin	20%	LS	$2,868,000	$ 2,868,000
Easement Acquisition	1	LS	$150,000	$ 150,000
Permitting	3%	LS	$430,000	$ 430,000
Total Project Budget				**$ 19,220,000**

Aumsville Facilities Plan

WWTP Alternative 3 - Pump To Salem
Influent Pump Station & Headworks Improvements

Item	Qty	Unit	Unit Cost	Total Cost
Mobilization (percentage of total)	8.0%	LS	$20,800	$20,800
New Influent Pump Station Pumps	3	EA	$40,000	$120,000
New Influent Pump Station Control System	1	EA	$90,000	$90,000
Overhaul Headworks Screen	1	EA	$50,000	$50,000
Construction Total				**$281,000**

Aumsville Facilities Plan

WWTP Alternative 3 - Pump To Salem
Salem Pump Station

Item	Qty	Unit	Unit Cost	Total Cost
Mobilization (percentage of total)	8.0%	LS	$134,400	$134,400
Civil Sitework	1	LS	$150,000	$150,000
Wetwell & Appurtenances	1	LS	$100,000	$100,000
Yard Piping	1	LS	$50,000	$50,000
Miscellaneous Civil Improvements	1	LS	$25,000	$25,000
Pumps & Appurtenances	1	LS	$300,000	$300,000
Pump Station Building	1	LS	$250,000	$250,000
Pump Discharge Piping & Valves	1	LS	$150,000	$150,000
Hydraulic Transient Control System	1	LS	$100,000	$100,000
Calcium Nitrate Feed System	1	LS	$70,000	$70,000
Miscellanenous Mechanical Improvements	1	LS	$100,000	$100,000
Auxilliary Power System	1	LS	$100,000	$100,000
Power Service Improvements	1	LS	$35,000	$35,000
Electrical & Controls (30% of Total Cost)	1	LS	$250,000	$250,000
Construction Total				**$1,814,000**

Aumsville Facilities Plan

WWTP Alternative 3 - Pump To Salem
Forcemain to Salem

Item	Qty	Unit	Unit Cost	Total Cost
Mobilization (percentage of total)	8.0%	LS	$738,000	$738,000
Forcemain Urban Area	5500	LF	$250	$1,375,000
Forcemain Rural Area	34000	LF	$200	$6,800,000
Air/Vacuum Release Stations	10	EA	$25,000	$250,000
Railroad, Highway, Interstate 5, and Creek Crossings	800	LF	$1,000	$800,000
Construction Total				**$9,963,000**

Aumsville Facilities Plan

WWTP Alternative 3 - Pump To Salem
Lagoon Improvements and Treatment Plant Decomissioning

Item	Qty	Unit	Unit Cost	Total Cost
Mobilization (percentage of total)	8.0%	LS	$42,200	$42,200
Silt Fence	300	LF	$2	$600
Erosion Control Maintenance	1	LS	$2,000	$2,000
Gravel Surfacing	1000	CY	$45	$45,000
RS Lines Salem PS to Lagoons	200	LF	$250	$50,000
Miscellaneous Civil Improvements	1	LS	$100,000	$100,000
Overhaul Mechanical Floating Aeration System	1	LS	$150,000	$150,000
Decomission Cell 3 & Cell 4	1	LS	$100,000	$100,000
Decomission Chemical Feed Systems	1	LS	$10,000	$10,000
Decommission Chlorine Contact Chamber	1	LS	$20,000	$20,000
Decomission Irrigation Pump Station	1	LS	$15,000	$15,000
Decomission Effluent Reuse Site	1	LS	$15,000	$15,000
Miscellaneous Decomissioning	1	LS	$20,000	$20,000
Construction Total				**$570,000**

Aumsville Facilities Plan

WWTP Alternative 3 - Pump To Salem
Lagoon Biosolids Removal

Construction Costs

Item	Qty	Unit	Unit Cost	Total Cost
Dredge, Dewater, Haul, & Dispose of Biosolids	1900	Dry Tons	$900	$1,710,000
Construction Total				$1,710,000

Aumsville Facilities Plan

WWTP Alternative 3 - Pump To Salem
Estimated Additional Power Costs [1]

Process Power Consumption Does not include lighting, HVAC, chem feed pumps, and other small motor loads

Power Cost ($/Kw-hr) 0.09

Equipment Item	Units	Duty Hp	On Time (hrs/day/unit)	Hp Hours Per Day	Kw Hrs Per Day	Total Daily Cost	Operation Days Per Year	Annual Power Costs
Influent Pump Station	NA - No additional costs with new facilities. O&M costs already included in City's O&M budget							$0.00
Influent Screen & Conveyor	NA - No additional costs with new facilities. O&M costs already included in City's O&M budget							$0.00
Salem Pump Station	1	50	24	1200	895.2	$80.57	365	$29,407.32
Lagoon Aeration Air Savings	-7	5	24	-840	-626.6	-$56.40	365	-$20,585.12
Irrigation Pump Savings	-1	20	24	-480	-358.1	-$32.23	75	-$2,417.04
Chlorination & Dechlorination	NA - Savings from eliminating chlorination & dechlorination facilities is offset by added costs for sulfur dioxide control chemical							$0.00
Total Additional Annual Power Cost								**$6,405**

Notes:
(1) These are power costs that are in excess of the existing operation and maintenance costs for the existing treatment facilities.

Aumsville Facilities Plan

WWTP Alternative 3 - Pump To Salem
Estimated Additional Maintenance & Chemical Costs (1)

Process Equipment Major Maintenance Costs

Item	Units	Service Interval (years)	Cost per Service per Unit	Total Cost per Service	Annualized Cost
Influent Pump Station	NA - No additional costs with new facilities. O&M costs already included in City's O&M budget				$0.00
Headworks Screen	NA - No additional costs with new facilities. O&M costs already included in City's O&M budget				$0.00
Salem Pump Station Pumps	4	15	$15,000.00	$60,000.00	$4,000.00
Savings from Eliminating Blower Maintenance	-7	1	$1,500.00	-$10,500.00	-$10,500.00
Savings from Eliminating Irrigation Pumps	-2	15	$15,000.00	-$30,000.00	-$2,000.00
Savings from Eliminating Chorination and Dechlorination Equipment	NA - Savings from eliminating chlorination & dechlorination facilities is offset by added costs for sulfur dioxide control system				$0.00
Biosolids Removal	1	50	$750,000.00	$750,000.00	$15,000.00
Total Annualized Maintenance Costs					**$6,500.00**

Routine Operation and Maintenance Costs — Analysis does not include general costs such as vehicles, vehicle fuel & maintenance, lab equipment, landscaping equipment, HVAC repair, etc.

Hourly Labor Rate: $60.00

Item	Units	Hrs Per Unit Per Year	Annual Labor Cost	Estimated Annual Material Cost Per Unit	Annual Material Cost	Total Annual Cost
Influent Pump Station	NA - No additional costs with new facilities. O&M costs already included in City's O&M budget					
Headworks Screen	NA - No additional costs with new facilities. O&M costs already included in City's O&M budget					
Salem Pump Station Pumps	4	40	$9,600.00	$100.00	$400.00	$10,000.00
Savings from Eliminating Blower Maintenance	7	-16	-$6,720.00	$101.00	$707.00	-$6,013.00
Savings from Eliminating Irrigation Pumps	2	-16	-$1,920.00	$100.00	$200.00	-$1,720.00
Savings from Eliminating Chorination and Dechlorination Equipment	NA - Savings from eliminating chlorination & dechlorination facilities is offset by added costs for sulfur dioxide control system					$0.00
Savings from Eliminating Process Monitoring and Operation	1	-1040	-$62,400.00	$0.00	$0.00	-$62,400.00
Total Annual Labor Hours		**-1072**				
Total Annual Routine Maintenace and Operation Cost						**-$70,133.00**

Notes:

(1) These are operation and maintenance costs that are in excess of the existing operation and maintenance costs for the existing treatment facilities. Negative values are savings associated with the proposed improvements.