City of Independence

WASTEWATER SYSTEM FACILITIES PLAN

Adopted March 8, 2022 – Ordinance No. 1595

Westech Engineering, Inc.
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WASTEWATER SYSTEM FACILITIES PLAN

City of Independence, Oregon

March 2022

Prepared for
City of Independence, Oregon
555 S Main Street
Independence, OR 97351

REGISTERED PROFESSIONAL ENGINEER
56473PE
OREGON
JANUARY 14, 2003
CHRISTOPHER J. BRUGATO
RENEWS: 12/31/2023

Prepared by
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BEFORE THE CITY COUNCIL OF THE CITY OF INDEPENDENCE
FOR THE COUNTY OF POLK, STATE OF OREGON

An Ordinance Amending the Independence Comprehensive Plan and Adopting the Wastewater Facilities Plan	)))	Council Bill #2022-03

ORDINANCE NO. 1595

WHEREAS, the City of Independence has been engaged in a lengthy and involved process with the public and worked with a consultant in reviewing and updating the City's Wastewater Facilities Plan (WWFP); and

WHEREAS, on February 7, 2022, the Independence Planning Commission conducted a properly noticed public hearing and determined that an updated WWFP with amendments to the Independence Comprehensive Plan and the Independence Development Code (IDC) are necessary not only for compliance with State of Oregon Department of Environmental Quality (DEQ) regulations, but also to reflect changing conditions in the City of Independence; and

WHEREAS, on March 8, 2022, the Independence City Council conducted a properly noticed public hearing giving the general public an additional opportunity to be heard, and reviewed the record and the recommendations of the Planning Commission and staff, NOW THEREFORE,

THE CITY OF INDEPENDENCE DOES ORDAIN AS FOLLOWS:

Section 1. Findings. The City Council of the City of Independence does hereby adopt findings in support of amendments to the Independence Comprehensive Plan, as contained in the Staff Report, attached hereto as Exhibit "A", and by this reference incorporated herein.

Section 2. The Independence Comprehensive Plan is hereby amended to replace the current Public Facilities Element with a new Public Facilities Element reflecting the 2022 City of Independence Wastewater Facilities Plan, as set forth on as the attached Exhibit "B".

Section 3. All unamended provisions within the Comprehensive Plan shall continue in full force and effect.

Section 4. The 2022 Wastewater Facilities Plan attached as Exhibit C is hereby adopted and incorporated herein by this reference.

Section 5. The 2022 Wastewater Facilities Plan supersedes and replaces all previous forms, editions and versions of the City of Independence's Wastewater System Master Plan.

Section 6. Effective Date. The Ordinance shall become effective 30 days after passage by the Council and signature of the Mayor.

First Reading to the Council, this 8th day of March, 2022
Second Reading to the Council, this 8th day of March, 2022.
Adopted, this 8th day of March, 2022.
Signed by the Mayor this 8th day of March, 2022.

JOHN McARDLE, MAYOR

ATTEST:
Karin Johnson
Karin Johnson, MMC
City Recorder

Oregon
Kate Brown, Governor

Department of Environmental Quality
Western Region Salem Office
4026 Fairview Industrial Dr SE
Salem, OR 97302-1142
Office: (503) 378-8240
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TTY: 711

February 11, 2022

Gerald Fisher, Public Works Director
City of Independence
PO Box 7
Independence, OR 97351

RE: WQ-**City of Independence Sewage Treatment Plant**
File No. 41513
Polk County
Approval – Facility Plan, Sewage Collection and Treatment Facilities

Dear Ms. Fisher:

DEQ received the final facilities plan for the City of Independence sewage collection system and treatment facility on January 31, 2022. The document reflects comments and questions that were addressed by the city's consulting engineer, Chris Brugato on February 11, 2022. The City of Independence Facilities Plan is hereby approved.

The next step for this project is to complete a Predesign Report for the overall project. Please submit a draft report to DEQ for our review. DEQ will review the draft promptly and provide comments for inclusion in the final report.

If you have any questions regarding this letter of approval, please contact me at (503) 378-4995.

Sincerely,

Timothy C. McFetridge, P.E.
Senior Environmental Engineer
Western Region-Salem Office

cc: Alexis Cooley, DEQ, Eugene

Chris Brugato, P.E
Westech Engineering
3841 Fairview Industrial Drive SE
Salem, OR 97302

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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
BOD	biochemical oxygen demand
CFS	cubic feet per second
CIP	capital improvement plan
CMU	concrete masonry units
DEQ	Oregon Department of Environmental Quality
DO	dissolved oxygen
EPA	US Environmental Protection Agency
FEMA	Federal Emergency Management Agency
FPS	feet per second
GPD	gallons per day
HDPE	high density polyethylene
HP	horsepower
IGA	intergovernmental agreement
KW	kilowatt
MAO	mutual agreement and order
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
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	Supervisory Control and Data Acquisition
SCFM	standard cubic feet per minute
SDC	system development charge
SF	square feet
TDH	total dynamic head
TSS	total suspended solids
UGB	urban growth boundary
USGS	United States Geological Survey
UV	ultraviolet light
VFD	variable frequency drive
WWTP	wastewater treatment plant

EXECUTIVE SUMMARY

Summary Outline

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, analyses, and recommendations in each chapter of the study. A summary of the recommended capital improvement costs is 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 municipalities, the City of Independence 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 Independence is located in the mid-Willamette Valley in Polk County, Oregon. The City is roughly ten miles southwest of the City of Salem, as shown in Figure 2-1. State highways 99W, 22, and 51 provide primary access to the City. Independence is located on the western bank of the Willamette River. Most of the City's topography and sanitary sewers drain according to the Ash Creek basin, which bisects the City east to west. The City has a defined Urban Growth Boundary (UGB) and City Limits. The UGB encompasses approximately 2,300 acres. Of this area, approximately 1,900 acres is currently within the City Limits. The City's wastewater system currently serves 3,570 connections and a population of roughly 10,000 people.

The City owns and operates the wastewater utility serving the area. The City's facilities are regulated by Oregon Department of Environmental Quality (DEQ) under a National Pollutant Discharge Elimination System (NPDES) permit. The City's system consists of a conventional gravity collection system with thirteen pump stations and a facultative lagoon treatment plant. Treated effluent is discharged to the Willamette River during winter months and to irrigated fields during summer months. The treatment plant is located in the central part of the City.

Over the past several years, the City has had several NPDES permit violations for treated effluent quality. These violations are the direct result of inadequate capacity of the wastewater treatment plant. This Facilities Plan describes these violations and makes specific recommendations for addressing the violations. The City's previous facilities plan was completed in 2015. This plan will replace the previous plan entirely and will serve as the City's primary planning document for the next planning period.

Additional background and introductory information is presented in Chapter 1 of this document.

STUDY AREA AND PLANNING CONSIDERATIONS

The study area of this report is the entire area within the City of Independence's Urban Growth Boundary (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. The City expanded the UGB in 2008 to include a relatively large area southwest of the City, known as the "Southwest Area" or Basin C. This document provides specific recommendations for sewer service in this area.

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. 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. 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 DEQ mandates the use of County coordinated growth rates and population projections. Therefore, the growth rates and population projections used in this plan are based on figures developed by the Portland State Population Research Center. Using these projected growth rates, the projected municipal population of Independence in the year 2045 is expected to be approximately 16,300 (see Section 5). Wastewater flow and load projections are detailed in Chapter 5. Some of the projects will not be constructed until several years after this document is adopted. As such, the designers for these projects will need to make new flow and loading projections that utilize current flow data and are based on 20-year projections from the date that construction is completed for each project.

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 a strategic plan. 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 City currently operates the wastewater utility under a NPDES permit issued by DEQ, included in Appendix A. All future facilities must be developed and maintained to ensure that the City can remain in compliance with the NPDES permit. 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's existing wastewater facilities consist of a conventional gravity collection system comprised of five basins and fifteen sub-basins. Each sub-basin is served by a pump station. Five main pump stations convey water from each basin directly to the wastewater treatment plant. For some sub-basins, wastewater is pumped two to three times in order to reach the treatment plant. The collection system is comprised of approximately 163,000 feet of gravity sewer mainline piping. Figure 4-1 is a schematic of the sewer flows from sub-basins to the treatment plant. Figure 4-2 is a map of the sewer basins. As a part of this plan, the City's sewer utility maps were updated and are included in Appendix B.

The City's wastewater treatment plant (WWTP) consists of a headworks with influent flow measurement & sampling, four facultative lagoon cells, effluent flow measurement, a chlorine disinfection system, and a sulfur dioxide dechlorination system. Winter discharge facilities include a river outfall to the Willamette River that is common to the City of Monmouth. Summer discharge facilities include an irrigation pump station, pipeline, and irrigation sprinkler systems at a privately-owned farm north of the City. The City has an effluent reuse agreement in place with the landowner. Recycled water irrigation from the treatment plant began in spring of 2021.

Detailed descriptions of the existing facilities are included in Chapter 4, including descriptions of each pump station, components of the wastewater treatment facility and plant performance.

The City's existing NPDES permit requires the treatment plant to produce effluent quality for biological oxygen demand (BOD) and total suspended solids (TSS) below 30 mg/L and 50 mg/L, respectively, during the winter discharge season (on an average monthly basis). The existing plant is not able to reliably meet these concentration limits, as shown in Table 4-10. The City has additionally violated the permit's maximum allowed weekly BOD and TSS concentrations on occasion.

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. The existing permit allows for the discharge of 500 pounds per day of BOD and 830 pounds per day of TSS on a monthly average basis during the winter discharge season. Average monthly effluent BOD and TSS mass loads are listed in Table 4-11 for the last two years. This table indicates that the existing plant is not able to consistently produce an effluent quality that allows the City to meet the permitted effluent mass loads for BOD and TSS. In addition to monthly mass load limits, the City's permit also has limits for weekly and daily effluent mass loads. This data is not shown in Table 4-11, but violations of these limits have also occurred.

Overall, this study indicates that the existing plant is overloaded and improvements are needed early in the planning period. Specific projects to address these issues are developed & recommended in Chapter 7 and are listed at the end of this section.

WASTEWATER FLOWS AND LOADS

Chapter 5 of the plan includes an analysis of the existing wastewater flows and loading rates to the treatment plant. Population projections are used to estimate future design flows and loads. Estimation of future flows and loads are based on a few key assumptions related to planning and development, listed below. All of the assumptions used to estimate future flows & loads are listed in Chapter 5.

- Population growth will occur in accordance with the study's projections.
- There will be no addition of "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.
- All growth will occur in conformance with current land use policies as outlined in the City's Comprehensive Plan.

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. Like many Cities in Western Oregon, a substantial portion of the City's flows are a result of infiltration and inflow (I/I). This is due to leaky sewers or due to stormwater inflows to the sanitary sewer system.

Portland State University Population Research Center forecasts an average annual growth rate between 1.4% and 2.2% for the Independence UGB. The projected population in 2045 is 16,276. The projected wastewater flows and loads during the planning period are included in Table ES-1 and Table ES-2.

Table ES-1 | Projected Population & Wastewater Flows

		Projected Wastewater Flows (MGD)						
Year	*Population*	*ADWF*	*AAF*	*AWWF*	*MMDWF*	*MMWWF*	*PDF*	*PHF*
2025	11,355	1.0	1.6	2.2	2.1	3.1	5.9	9.7
2030	12,578	1.2	1.8	2.4	2.3	3.4	6.3	10.2
2035	13,803	1.3	2.0	2.6	2.5	3.7	6.8	10.8
2040	15,032	1.4	2.1	2.9	2.8	4.1	7.2	11.3
2045	16,276	1.5	2.3	3.1	3.0	4.4	7.7	11.9

Table ES-2 | Projected Wastewater Loads

Year		BOD (ppd)		TSS (ppd)	
	Population	Avg. Annual	Peak Month	Avg. Annual	Peak Month
2025	11,355	2,498	2,998	1,817	2,180
2030	12,578	2,767	3,320	2,044	2,453
2035	13,803	3,037	3,644	2,264	2,717
2040	15,032	3,307	3,968	2,485	2,982
2045	16,276	3,581	4,297	2,706	3,247

COLLECTION SYSTEM DEFICIENCIES AND RECOMMENDED IMPROVEMENTS

Chapter 6 presents an analysis of the wastewater collection system and recommended projects (bolded herein). Current operation and maintenance (O&M) practices are first reviewed. Overall, the City's current O&M practices are inadequate to address the entire collection system due to lack of personnel assigned specifically to sewer collections. Two recurring programs and two projects are recommended to improve operation and maintenance. These are aimed at increasing consistent preventative maintenance practices, which reduce the need for costly emergency repairs due to issues such as blockage and overflow.

Program-1 is a sewer cleaning and inspection program, which systematically addresses regular maintenance of existing sewers. The goal of **Program-1** is to improve the overall reliability of the collection piping by cleaning and inspecting each sewer every two to ten years. It is recommended that the entire collection system be inspected and cleaned in the first five years of the planning period. Some parts of the City's collection system have not been inspected or cleaned in 20 or more years. The recommended budget for this program is $66,000 per year for the duration of the planning period.

Program-2 is a sewer rehabilitation and replacement program, which addresses regular repair or replacement failing and leaky sewers. Much of the City's gravity collection system will require increased attention during the planning period to keep groundwater infiltration and stormwater inflow from becoming a problem. This will require regular manhole rehabilitation, spot repairs, mainline rehabilitation, and service lateral rehabilitation. The recommended budget for this program is $100,000 per year for the duration of the planning period. It is recommended that this budget be adjusted once more information about the City's collection system has been gathered. This information would be gathered as a part of **Program-1** and the two O&M projects.

Project M-1 is a comprehensive mapping effort to fill in missing information in the City's collection system maps over a five-year period. The City's existing maps of the sewer system lack key information, such as pipe size and material. This information should be gathered during **Program-1** and then used to update the maps. An additional component of this project is to collect a data set on the existing sewers in the form of a spreadsheet. This dataset could be used to determine where to allocate funding for rehabilitation and to track maintenance schedules for sewers. The recommended budget for this project is $10,000 per year for five years.

Project M-2 is a comprehensive I/I study and evaluation of the collection system over a four-year period. These projects are described in detail in Section 6.2. Information from these two projects would be used to prioritize areas of the collection system to rehabilitate or replace (**Program-2**). The recommended budget for this project varies year-to-year and averages $46,000 per year.

Project M-3 recommends an update to the City's Wastewater Facilities Plan at 10-year intervals through the planning period. The budget for this project is $300,000. This will ensure that the plan's recommendations and assumptions are adjusted to account for changes to the City's needs and to the regulatory environment over time.

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 some key gravity sewers do not have the capacity to convey existing or peak flows. **Projects G-1, G-2, G-3, G-4 and G-11** are recommended upgrades to these sewers and are described in detail in Chapter 6.

In addition to capacity issues, Chapter 6, also identifies a number of improvements that are needed to address infrastructure that has already or will likely reach the end of its useful life during the planning period. For example, **Projects G-5, G-6, G-7 and G-8** are projects to replace specific gravity sewers with regular clogging issues.

Projects P-3 through P-11 and P-15 are recommended improvements for pump stations that address aging electrical components. These components are anticipated to need to be replaced at some point during the 20-year planning period. These projects also address station reliability by adding generators.

The Maple Drive Pump Station was originally constructed over 40 years ago. It is recommended to have overall improvements for civil, structural, mechanical, and electrical components early in the planning period. These are included in **Projects P-5 and F-2.**

The 9th Street Pump Station is recommended to serve a larger area of the City's collection system for Basin C. This pump station is already operating at its pumping capacity during peak flow events. The 9th Street Pump Station is recommended to be upgraded over three phases: **Projects P-1, F-1, and P-2. Project-P-1** consists of upgrades to the existing pump station. It is recommended to be completed early in the planning period in order to prevent an overflow at this station and to serve growth in Basin C. **Project F-1** is an additional forcemain that would be shared with the Lagoon Pump Station. Overall, **Project P-2** consists of a new wetwell with an additional set of pumps at the 9th Street Pump Station.

Several other projects are identified that facilitate sewer service for Basin C. Two new pump stations and forcemains are proposed as a part of **Projects P-12, P-13, F-3, and F-4.** These new pump stations are recommended to be used to replace two existing pump stations by constructing two gravity sewer projects (**Projects G-9 and G-10)**. An additional pump station and forcemain are proposed to serve an area of Sub-basin C2 (**Project P-14**).

The Mt. Fir Pump Station and the sewer through Mt. Fir Park are recommended to be upgraded to serve development in Sub-basin C5 in Basin C (**Projects P-10 and G-11**). The trunk sewer along 9th Street is also recommended to be upgraded (**Project G-1**). These projects are needed to serve development in Basin C.

Several areas of the UGB are not currently developed or are served by private septic systems. These areas are typically outside of the City Limits or were recently added to the City Limits. **Projects G-12 through G-20** are gravity sewer projects that provide service to these areas. These projects are anticipated to be paid for by developers of these areas.

In addition to the 9th Street and Mt. Fir Pump Stations, five pump stations are anticipated to need upgrades to increase pumping capacity. These are the Oak Street, North Main, Maple, Lagoon, and Stryker Road Pump Stations. **Projects P-3, P-4, P-5, P-6 and P-11** are the recommended improvements to these pump stations.

The previously mentioned deficiencies, programs, and projects are described in more detail in Chapter 6. These are listed at the end of this section and are prioritized in Chapter 8.

TREATMENT SYSTEM DEFICIENCIES AND RECOMMENDED IMPROVEMENTS

Chapter 7 includes an analysis of the City's treatment system and recommended improvements. Each component of the wastewater treatment facility was evaluated for its capacity, age, and condition. Several deficiencies were identified in Table 7-1. Projects were identified to address these deficiencies based on alternatives analysis.

As previously described, the existing wastewater treatment plant does not have the capacity to treat the existing flows and loads for suspended solids and BOD. The City has violated the conditions of the NPDES permit in recent years and has been fined by the DEQ for these violations. As such, improvements to the treatment facility are needed early in the planning period. Various treatment systems were considered including additional facultative lagoons, aerated lagoons, and activated sludge. Ultimately the analysis determined that the most cost-effective solution is an aerated lagoon system. Conceptual designs and cost estimates for two alternative aeration systems were compared. These included diffused aeration and floating mechanical aerator systems. Both systems would meet the needs of the City. Diffused aeration has a higher capital cost than floating mechanical aerators. However, a diffused aeration system has a lower O&M cost than a floating mechanical aerator system. The plan ultimately recommends a diffused aeration system due to lower lifecycle costs over the life of the facility. That said, the floating mechanical aeration system is about $1 million less in initial capital costs. Therefore, if initial funding is a problem, the City could choose to install a floating mechanical aeration system with the understanding that it will have higher annual O&M costs. More detail on the treatment alternative evaluation and the lagoon aeration project (**Project T-3)** is included in Section 7.5. In addition to lagoon aeration, **Project T-3** also includes upgrades to other miscellaneous infrastructure at the treatment plant including transfer piping, valves, and a transfer pump station to convey water between the lagoon cells. These components are reaching the end of their useful life and need to be upgraded as a part of the larger aeration project.

The treatment capacity of the lagoons is being impacted negatively by the accumulation of sludge in the lagoons. Over time, solid material, or sludge, accumulate in the lagoons and must be periodically removed. Sludge has never been removed from the lagoons since they were constructed over forty years ago. It is recommended that biosolids be removed early in the planning period and prior to installing the aeration system. **Project T-2** can be referenced for more information.

The existing headworks was evaluated for its ability to handle the projected flows at build-out of the system. The projected flows will exceed the capacity of the headworks, therefore, improvements are needed during the planning period. In addition to capacity issues, the existing headworks also lacks screening facilities that remove rags and other large solids. These materials clog and interfere with the aeration equipment. Therefore, screening equipment must be installed at the headworks prior to **Project T-3**. **Project T-1** includes the construction of a new headworks with adequate hydraulic capacity and screening facilities compatible with the proposed aeration equipment.

The existing concrete chlorine contact chamber was evaluated for its ability to disinfect the projected flows. This structure was originally built in 1978 and is too small to adequately treat the projected flows at the end of the planning period. Therefore, **Project T-4** includes the construction of an additional chlorine contact chamber.

In addition to improvements at the treatment plant, some upgrades will be needed during the planning period to expand the irrigated fields. **Projects T-5** and **T-6** would expand the land application system over two phases. The total area that is currently irrigated is about 230 acres. An additional 80 acres would be irrigated after **Project T-5** by covering more area with the existing sprinkler systems. **Project T-6** includes further expansion of the land application system by installing additional buried pipe and irrigation sprinklers at new fields north of Rogers Road. The total irrigated acreage after **Project T-6** would be 425 acres.

The existing river outfall pipes underneath lagoon cells #1 and #4 were video inspected and evaluated for improvements. The pipes appear to be in relatively good condition. However, given their age and location, it is recommended that they be reinforced with a liner during the planning period. **Project T-7** proposes cured-in-place pipe liners be installed underneath lagoon cells #1 and #4. It is recommended that this project be completed jointly with the City of Monmouth.

A list of the recommended treatment system projects is included in Chapter 7. These improvements are later prioritized in Chapter 8 to develop the recommended Capital Improvement Plan.

RECOMMENDED CAPITAL IMPROVEMENT PLAN

This 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.

The improvement projects were ranked by priority on a 1 to 3 scale. Projects that address known existing deficiencies and address NPDES compliance were given the highest priority (priority 1). The list of projects and ranks are included in Table ES-3 below. Priority 1 projects are considered to be needed immediately. They have been developed to resolve existing or near-term system deficiencies. It is recommended that Priority 1 improvements are undertaken as soon as practical. Priority 2 projects will be needed beyond the near term of the Priority 1 projects to improve the quality of service throughout the City. Although not critical at this time, they will likely be required at some point during the planning period (eventually become priority 1 projects). 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.

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 these improvements will be constructed as part of future development and that individual developers will construct and pay for the Priority 3 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-3 | Recommended Capital Improvement Projects

Project Code [1]	Project	Priority	Total Estimated Project Cost [2]
T-1	Headworks and Cell 1 Distribution Pipe Improvements	1	$1,382,000
T-2	Lagoon Biosolids Removal	1	$4,140,000
T-3	Lagoon Aeration and Conveyance Piping Improvements	1	$5,989,000
G-2	Basin E Trunk Sewer	1	$557,000
G-5	C Street Clay Tile Sewer Replacement	1	$720,000
G-6	H Street from 3rd Street to Main Street Replacement	1	$331,000
G-7	Spruce Court to Briar Road Replacement	1	$304,000
G-8	E Street from 12th Street to 13th Street Replacement	1	$157,000
P-1	9th Street Pump Station Capacity Upgrade - Phase 1	1	$966,000
P-5	Maple Drive Pump Station Upgrade	1	$508,000
F-2	Maple Drive Pump Station Forcemain	1	$53,000
		Subtotal Priority 1	**$ 15,107,000**
G-3	Lagoon Pump Station Trunk Sewer	2	$692,000
G-4	12th Street Sewer Improvements	2	$319,000
P-3	Oak Street Pump Station Capacity Upgrade & Improvements	2	$786,000
P-4	North Main Pump Station Capacity Upgrade & Improvements	2	$309,000
P-6	Lagoon Pump Station Capacity Upgrade & Improvements	2	$411,000
P-7	Albert Street Pump Station Electrical Systems Upgrade	2	$244,000
P-8	Briar Road Pump Station Electrical Systems Upgrade	2	$155,000
P-9	13th Street Pump Station Electrical Systems Upgrade	2	$253,000
P-11	Stryker Road Pump Station Electrical Systems Upgrade	2	$364,000
P-15	Williams Street Pump Station Generator Upgrade	2	$60,000
T-4	Chlorine Contact Chamber Improvements	2	$858,000
T-5	Land Application System Expansion Phase I	2	$241,000
T-6	Land Application System Expansion Phase II	2	$1,526,000
T-7	Outfall Improvements	2	$1,054,000
M-3	Wastewater System Facilities Plan Update	2	$300,000
		Subtotal Priority 2	**$ 7,572,000**
G-1	9th Street Trunk Sewer	3	$447,000
G-9	13th Street Pump Station Sewer to Sub-basin C3	3	$347,000
G-10	Briar Road Pump Station Sewer to Sub-basin C5	3	$138,000
G-11	Mt. Fir Park Sewer Upgrade	3	$480,000
G-12	Sub-basin C3 Trunk Sewer to Undeveloped Area	3	$1,007,000
G-13	Sub-basin C4 Trunk Sewer to Undeveloped Area	3	$903,000
G-14	Sub-basin C5 Trunk Sewer to Undeveloped Area	3	$990,000
G-15	Hoffmann Road Sewer to Undeveloped Area	3	$351,000

Table ES-3 | Recommended Capital Improvement Projects

Project Code [1]	Project	Priority	Total Estimated Project Cost [2]
G-16	Gun Club Road Sewer to Undeveloped Area	3	$1,597,000
G-17	Corvallis Road Sewer to Unsewered Area	3	$578,000
G-18	16th Street Sewer	3	$182,000
G-19	Talmadge Road Sewer	3	$608,000
G-20	Sub-basin C2 Sewer	3	$675,000
P-2	9th Street Pump Station Capacity Upgrade - Phase 3	3	$928,000
P-10	Mt. Fir Pump Station Capacity & Electrical Systems Upgrade	3	$256,000
P-12	New Ash Creek Pump Station	3	$865,000
P-13	New Corvallis Road Pump Station	3	$887,000
P-14	New Talmadge Road Pump Station & Forcemain	3	$605,000
F-1	Common Forcemain for the 9th Street and Lagoon Pump Stations	3	$806,000
F-3	New Ash Creek Pump Station Forcemain	3	$728,000
F-4	New Corvallis Road Pump Station Forcemain	3	$413,000
		Subtotal Priority 3	**$ 13,791,000**
		TOTAL	**$ 36,470,000**
Operation & Maintenance Programs and Projects			
Program-1	Sewer Cleaning and Inspection Program – Annual recurring program		$66,000 per year
Program-2	Sewer Rehabilitation & Replacement Program – Annual recurring program		$100,000 per year
M-1	Comprehensive Map Update – Annual project for five years		$10,000 per year
M-2	Sewer System Evaluation Study – Annual project for four years		Average $46,000 per year
	Subtotal Recurring Annual Programs / Projects Years 1 - 4		**$222,000**
	Subtotal Recurring Annual Programs / Projects Year 5		**$176,000**
	Subtotal Recurring Annual Programs Years 6- 20		**$166,000**

[1] Project Code Legend:
G = Gravity Sewer T = Treatment P = Pump Station F= Forcemain Program = O&M Program
M = Miscellaneous Project
[2] See Section 8.3 for basis of project cost estimates

CHAPTER 1
INTRODUCTION

Chapter Outline

INTRODUCTION

CHAPTER 1

1.1 INTRODUCTION

The City of Independence is located in Polk County approximately ten miles southwest of Salem, Oregon. The City provides sanitary sewer service to the residents within the City Limits. The City has a comprehensive plan for the area within the City Limits and the Urban Growth Boundary (UGB). These boundaries serve as the study area for this report.

The UGB encompasses approximately 2,300 acres. Of this area, approximately 1,900 acres is currently within the City Limits. The City currently serves 3,570 sewer connections. The overall population of the City is approximately 10,000 people.

The City owns and operates the wastewater utility serving the area. The City's facilities are regulated by Oregon Department of Environmental Quality (DEQ) under a National Pollutant Discharge Elimination System (NPDES) permit. The City's system consists of a conventional gravity collection system with thirteen pump stations and a facultative lagoon treatment plant. Treated effluent is discharged to the Willamette River during the wet weather season. Treated effluent is also discharged to irrigated agricultural fields north of the City during the dry weather season. The treatment plant is located in the north and central part of the City.

The City's existing pump stations and treatment plant are aging and will need substantial improvements over the next decades. In recent years, the City has been unable to consistently meet the limits set forth in the NPDES permit. The treatment plant is currently unable to consistently comply with the organic treatment limits listed in the permit. Additionally, the City is preparing for substantial development and growth in the southwest area of the City over the planning period. Therefore, a new facilities plan is prudent at this time. This plan will replace the current plan entirely and will serve as the City's primary planning document for the next twenty years.

1.2 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 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.

1.3 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 included both physical and socioeconomic conditions. Existing population and land use are examined and projected into the future.

The existing wastewater system is investigated. 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's 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. Flows projections are made for both dry period and wet period conditions, and unit design values are established.

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 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. Alternatives for system administration are also identified and evaluated.

Nonviable options are eliminated, and a limited number of selected alternatives are established and evaluated in detail. Finally, a recommended 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.

1.4 PREVIOUS STUDIES AND REPORTS

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

- *Construction Drawings, Wastewater Treatment Expansion,* Independence, Oregon, Clark & Groff Engineering, February, 1978.
- *Sanitary Sewerage System Facilities Plan*, City of Independence, Oregon, GHD, April 2015.
- *Recycled Water Use Plan – City of Independence,* Cascade Earth Sciences, 2015.
- *Construction Drawings, Recycled Water Use Facility & Williams Street Pump Station,* Independence, Oregon, Westech Engineering Inc., March 2020.
- *Guidelines for Making Wet-Weather and Peak Flow Projections for Sewage Treatment in Western Oregon*, State of Oregon, Department of Environmental Quality, 1996.
- *Southwest Independence Concept Plan,* Independence, Oregon. Angelo Planning Group. June 2012.

1.5 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.

- <u>Aerobic</u> - Microorganisms living in the presence of free oxygen, or biological treatment processes that occur in the presence of oxygen.
- <u>Anaerobic</u> - 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. This process is also known as anaerobic denitrification.
- 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 – Treated sludge that is removed from a treatment facility for beneficial reuse or 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.
- 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

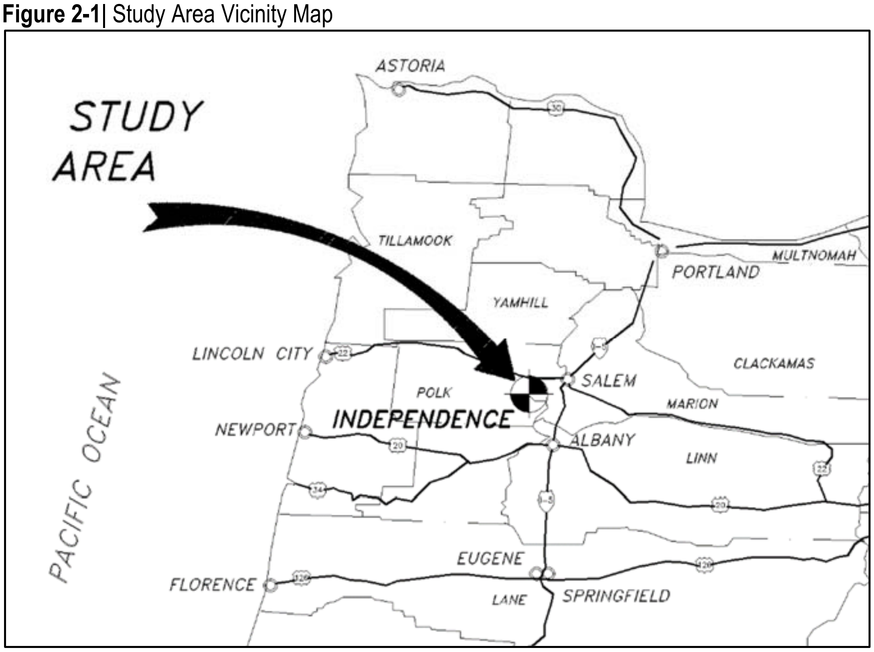
STUDY AREA AND PLANNING CONSIDERATIONS

2.1 INTRODUCTION

The City of Independence is located in the mid-Willamette Valley in Polk County, Oregon. The City is roughly ten miles southwest of the City of Salem, as shown in Figure 2-1. State highways 99W, 22, and 51 provide primary access to the City. Independence is located on the western bank of the Willamette River. Most of the City's topography and sanitary sewers drain according to Ash Creek, which bisects the City east to west.

The City has a defined Urban Growth Boundary (UGB) and City Limits. The UGB encompasses approximately 2,300 acres. Of this area, approximately 1,900 acres is currently within the City Limits. Eventually all of the City's UGB will be within the City Limits. Figure 2-3, presented at the end of this chapter, is a map depicting these features.

Figure 2-1| Study Area Vicinity Map



2.2 STUDY AREA

The study area of this report is the entire area within the City's 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.

The City's development code establishes zoning and land use restrictions for certain areas within the City. Figure 2-4 depicts these features, which is presented at the end of this chapter.

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 UGB 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 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

The study area is located in the central part of the Willamette Valley. The climate in Independence 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 winter months to 30-50 percent during summer months. 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 likely occurred in

1996 when most Willamette Valley weather stations recorded over 70 inches of precipitation. Approximately 82% percent of the annual precipitation occurs between November 1 and May 30. The City measures daily precipitation at the wastewater treatment plant.

Based on the isopluvials of 24-hour precipitation from the NOAA Atlas 2, Volume X (Oregon), Figure 26, the 5-year 24-hour rainfall for the study area is approximately 3.5 inches, while Figure 27 shows that the 10-year 24-hour rainfall is approximately 4.0 inches. An isopluvial is a line on a map connecting all points of equal precipitation, and is read similar to elevation contour lines (also called isohyetal lines).

The other two rainfall statistics applicable to the facilities planning are from NOAA climatography data sets. Data from Hyslop field near Corvallis is assumed to be a reasonably close representation of the climate in Independence. The monthly precipitation amount for May with a 10% probability of exceedance is 4.12”. The monthly precipitation amount for December with a 20% probability of exceedance is 10.46”. The 10% probability of exceedance corresponds with a 10 year return interval, while the 20% probability of exceedance corresponds with a 5 year return interval.

2.4.2 Topography

The City of Independence is located along the banks of the Willamette River and Ash Creek, which puts parts of the City within floodways. The topography of the city is relatively flat except for the creek and river banks throughout town. The main downtown area is located on the banks of the Willamette River, which have smaller drainages and river terraces. The landscape generally drains from west to east. Ash Creek, a tributary of the Willamette River separates the northern and southern halves of the City. The lowest elevations in the City are roughly 140 feet high at the confluence of Ash Creek and the Willamette River. The highest elevations are roughly 180 feet high in the northwest and southwest edges of the UGB.

2.4.3 Soils

The soils in Independence are derived from two main parent materials: glacial flood deposits and from alluvial sediments. Most of the soil properties exhibited can be attributed to these parent materials.

The glacial flood deposits from the ancient Missoula floods result in the fine silt and clay-dominated soils in the central and eastern portion of the City. These soils tend to have high water holding capacity and low infiltration. These also result in high groundwater areas and seasonal areas of flooding. USDA soil types exhibiting these characteristics include Amity, Concord, and Dayton.

Soils derived from alluvial sediments are found on the east side of the City, near the Willamette River and along Ash Creek. The waterways transport sediment from higher in the basin and deposit them in the flood plains. Over time they result in sandy and silty soils generally with good infiltration. USDA soil types exhibiting these characteristics include Newberg, Coburg, and Malabon.

Several different soil types have been identified and mapped with the study area (see Figure 2-5 at the end of this section). Overall, soil types do not generally place limitations on development of the sanitary sewer system.

2.4.4 Geologic Hazards

Known geologic hazards within the study area include high seasonal groundwater, seismic concerns, and flooding.

2.4.4.1 High Groundwater

Seasonal high groundwater is a common occurrence within the study area, and is a primary cause for the observed high levels of infiltration and inflow. The high groundwater problems are caused primarily by perched water tables due to soil saturation and lack of local drainage.

2.4.4.2 Seismic

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.

2.4.4.3 Flooding

As previously mentioned, the Willamette River is the primary stream within the study area, with Ash Creek being the only major tributary within the study area. Ash Creek enters the Willamette River near downtown Independence at approximately river mile 95. The Willamette River has a streamflow pattern typified by high flows during the winter and low flows during the summer months.

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.

During a 100-year flood (as defined by the Federal Emergency Management Association, FEMA), the Willamette River and Ash Creek rise out of their normal channels creating a large floodplain. Flood profiles and maps for those portions of the waterways adjacent to the study area are included in the Flood Insurance Study prepared for the City as follows.

- FIRM panel 41053C0402F (panel 402 of 575), December 19, 2006
- FIRM panel 41053C0404F (panel 404 of 575), December 19, 2006
- FIRM panel 41053C0410F (panel 410 of 575), December 19, 2006

It should be noted that the Floodplain and Floodway boundaries shown on the FEMA flood maps are based on flood elevations, and as such the actual boundaries may vary slightly from the location shown. Final determinations of whether property is within the floodway or floodplain must be determined based on a topographic survey of the property in question.

The wastewater treatment plant and some of the sewage lift stations are located adjacent to the banks of Ash Creek and the Willamette River. FEMA’s Flood Insurance Rate Map (FIRM) panels indicate the base (100-year) flood elevations and flood plains for this area. The wastewater treatment plant has areas that border Ash Creek within the FIRM 100-year flood plain that are approximately 163 to 165 feet in elevation. The Oak Street Pump Station lies within the 100-year flood plain. The Riverview and 9th Street Pump Stations lie near the 100-year flood plain boundaries.

2.4.5 Public Health Hazards

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

2.4.6 Energy Production and Consumption

Electricity is provided to the community by Pacific Power. Natural gas service is available in the City. There are no known power generation facilities within the City.

2.4.7 Water Resources

Water resources within the study area include freshwater streams and ground water. Specific water quality regulations related to the treatment and disposal of wastewater are summarized in Chapter 3 of this report. Section 303(d) of the Clean Water Act (CWA) requires that states identify waters that do not meet state water quality standards. Portions of both Ash Creek and the Willamette River are on the 303(d) list for various contaminants.

2.4.7.1 Surface Water Resources

Surface water quality protection is subject to extensive regulation by the State of Oregon. There are two significant streams with drainage channels that cross through the City boundaries: the Willamette River and Ash Creek. The Willamette River comprises the eastern boundary of the City and is near the City's downtown. Ash Creek runs east into the Willamette River and bisects the City.

The City discharges treated effluent to the Willamette River in strict accordance with the City's NPDES permit. Therefore, potential impacts to surface water streams within the City are limited to overflows from pump stations or sewer manholes. Recommendations for minimizing the likelihood of such overflows are contained in this study.

2.4.7.2 Groundwater

Groundwater protection is important from the standpoint of both natural resource protection and public health protection. Typically, the primary groundwater concern relating to wastewater collection and disposal systems is the potential for contamination of drinking water wells from sewage or treated effluent.

2.4.8 Native Vegetation and Wildlife

Within the City boundaries there exists riparian habitat with native vegetation and wildlife. This ecosystem exists in the flood plains of the Willamette River and Ash Creek. These streambanks are periodically flooded and consistently moist throughout the year, leading to the diverse array of plants and animals that live there. Common tree species in this habitat include Bigleaf maple, Black cottonwood, Oregon ash, Oregon white oak, Red alder, and White alder. Common shrubs within the habitat include Douglas spirea, snowberry, red-osier dogwood, and willows.

These vegetation types support a variety of animals, including aquatic mammals, birds, and fish. Beaver can be commonly seen diving in and out of the stream banks. Packs of otters will roam the banks and dine on crayfish and small fish, such as smallmouth bass. Osprey and bald eagles frequently patrol the rivers and dive in for a catch.

In addition to the riparian wildlife, a variety of other species are found throughout the study area. Wildlife in the area includes squirrels, skunks, raccoons, nutrias, coyotes, opossum, deer, and a variety of reptiles and amphibians.

2.4.9 Air Quality and Noise

Air quality in the study area is generally good. Significant non-natural noise sources within the study area are limited to traffic on local streets and Monmouth-Independence Highway, and construction.

2.4.10 Environmentally Sensitive Areas

The riparian areas and wetlands adjacent to the various natural waterways that run through the study area are considered to be environmentally sensitive areas. Figure 2-7 included at the end of this chapter shows the locations of designated wetlands within the study area. Not all wetland areas within the study area are shown in this figure and detailed wetland investigations may be required prior to the implementation of the recommended improvements.

2.4.11 Historic and Archeological Sites

There are no known archaeological sites that will be disturbed or impacted by the proposed improvements. However, since the mouths and banks of rivers are well known to have been centers of Native American life. It should be noted that archaeological or cultural deposits including artifact middens, burial sites, village sites, etc. could be located within the project boundaries. As such, a detailed archaeological assessment may need to be performed prior to implementation of the recommended improvements.

2.4.12 Threatened or Endangered Species

A comprehensive inventory for threatened or endangered species under the Endangered Species Act (ESA) within the study area has not been completed. However, the Oregon Department of Fish and Wildlife maintains an inventory of both state and federally-listed threatened and endangered species. Project specific biological assessments may be required for those capital improvements that include work in existing undeveloped areas.

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

Economics in Independence has historically been based around manufacturing, natural resources, quarrying and mining, and agriculture. In the past decade, substantial employment has been gained from retail, and healthcare. With the redevelopment of the downtown area, the new hotel, and expansion of residential development, economic activity is expected to be further supported by retail and tourism.

The Urban Growth Boundary (UGB) was last modified in 2008 when the City added area to the southwestern and northwestern parts of town. Most of this new area is intended for residential development, but some is zoned industrial. Independence is home to several manufacturers that provide numerous jobs to citizens. Many residents of Independence are employed in the neighboring Salem-Keizer metropolitan area.

2.5.2 Population and Growth Projections

Between 2000 and 2010, the population within the Independence UGB grew at an average annual rate of 3.4%, which was a relatively high growth rate compared to Polk County overall. During this same period, the number of housing units in Independence increased by 45% (1,003 units), the largest increase of any UGB in Polk County. This growth slowed after the 2008 recession. However, recent years have shown a pickup in development in Independence from new subdivisions and redevelopment to the expanded downtown.

In June of 2017, population projections for Polk County were prepared by the Portland State University Population Research Center[1]. Independence's population in 2017 was estimated to be approximately 9,326[2]. The Portland State University Population Forecast Center (PSU) forecasts that from 2017 through 2035 population within the Independence UGB will grow at a rate of 2.2%. PSU forecasts that from 2035 through 2067 population within the UGB will grow at a rate of 1.4%. Polk County is expected to grow more slowly during these same time periods at rates of 1.5% and 1.l% respectively.

Based on these projections, the estimated 2035 population within the Independence UGB will be about 13,803. This value is known as the "county coordinated population projection" and will be used for planning purposes in order to conform to state-wide planning goals. As noted elsewhere in this document, the study period ends in 2045. Therefore, the 2045 population was extrapolated for the preparation of this document. The coordinated population projections are based on an average annual growth rate of 2.2% from 2017 to 2035 and 1.4% from 2036 through 2067. These growth rates were applied to the 2017 population of 9,326 to estimate the 2045 population of roughly 16,300.

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 includes an urban growth boundary (UGB) that encompasses approximately 2,300 acres with approximately 1,900 acres within the current City Limits.

Eventually the entire area within the UGB will be part of Independence and will be served by the City's utility systems. The planning area is made up of land in two general categories, namely land inside of City limits and land outside of the City limits, all of which is inside the Urban Growth Boundary. Land use zoning in Independence is comprised primarily of residential uses, although the Comprehensive Plan sets aside large areas for industrial and commercial development. Total areas under each zoning designation are listed in Table 2-1 and ranked in Figure 2-2. A map showing the UGB, City limits and land use zoning areas appears on Figure 2-4 at the end of this chapter.

The majority of the land within the City limits is currently developed or partially developed. All of the land inside the UGB, but outside the City limits, is undeveloped.

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

[2] Portland State University, Population Research Center

Table 2-1 | Approximate Areas by Land Use Zone within Current City Limits

Land Use Zone		Area (acres)	Area (% of Total)
Low-Density Residential	RS	298	17%
Medium-Density Residential	RM	313	18%
High-Density Residential	RH	106	6%
Residential Single-Family Airpark Overlay	RSA	109	6%
Mixed Residential	MX	143	8%
Mixed-Use Pedestrian Friendly Commercial	MUPC	81	5%
Downtown Riverfront Zone	DRZ	10	1%
Light Industrial	IL	107	6%
Heavy Industrial	IH	125	7%
Industrial Park	IP	44	3%
Airport District	AD	101	6%
Agricultural	AG	20	1%
Public Service	PS	284	16%
	Total	1,741	100%

Figure 2-2 | **Ranked Land Uses**

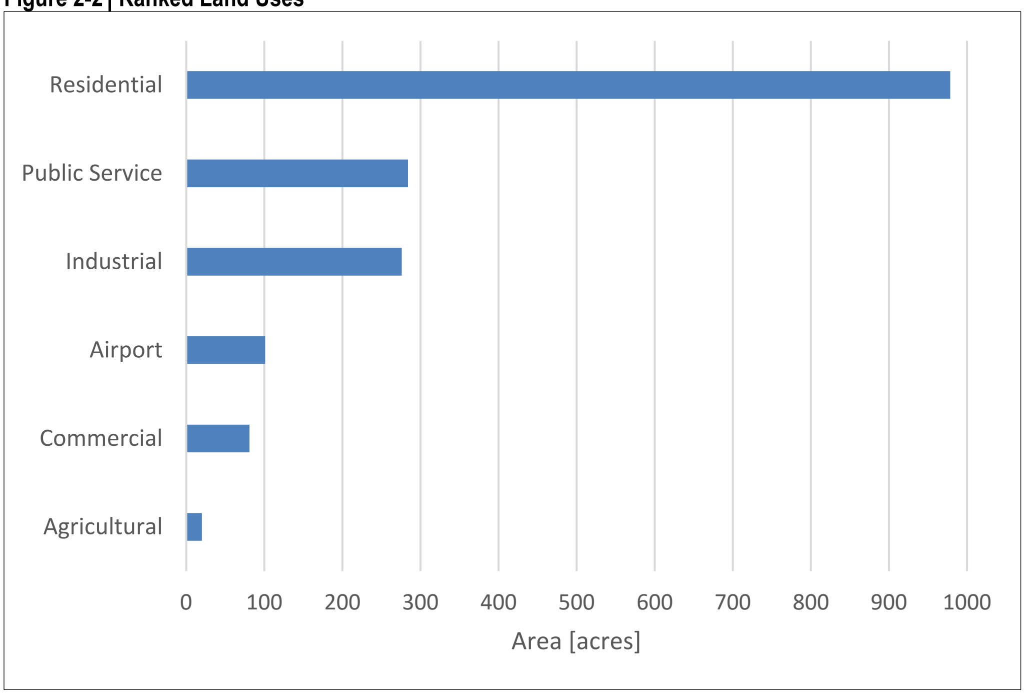


Figure 2-3 | Study Area

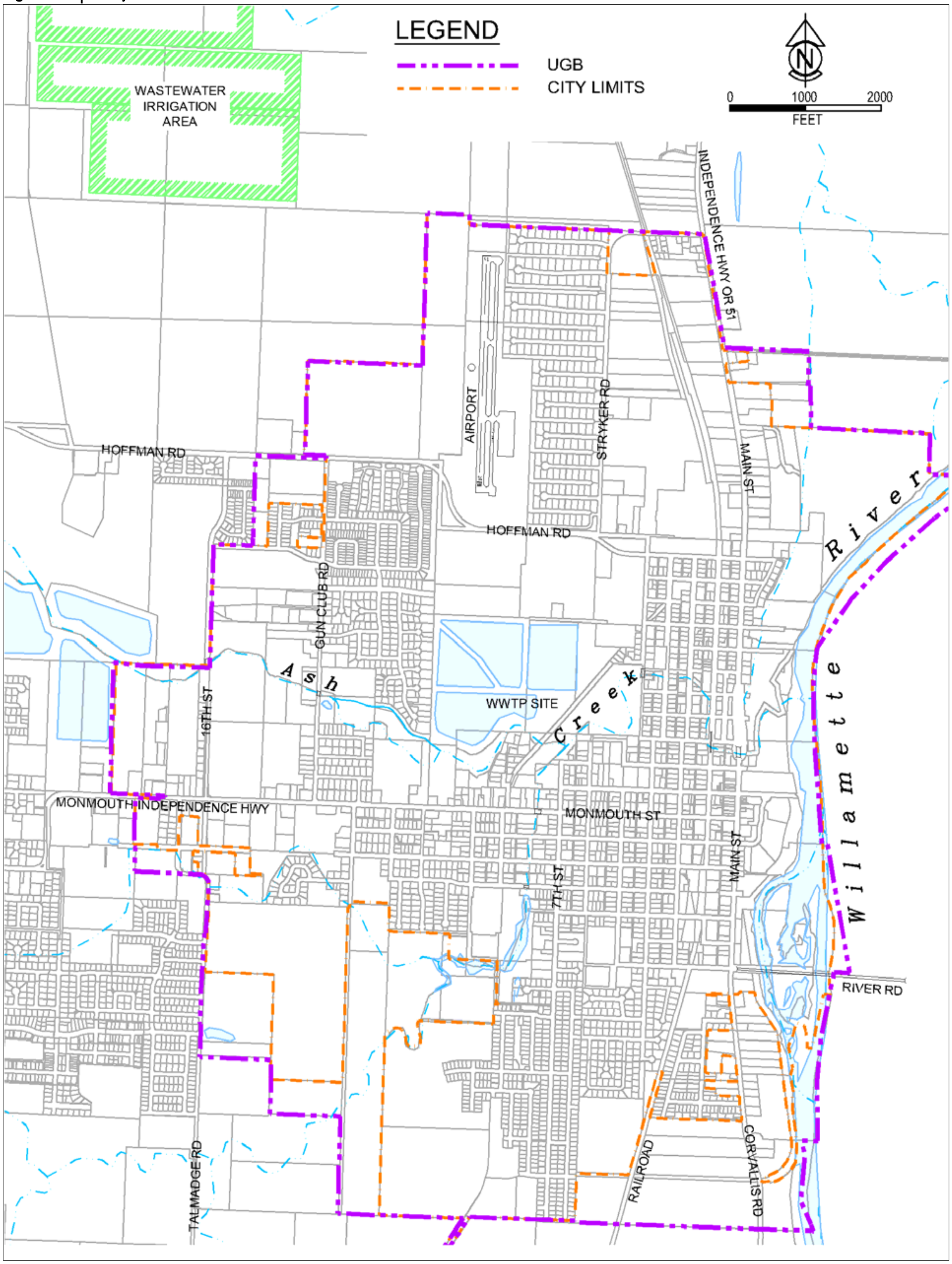


Figure 2-4 | Comprehensive Plan Designations

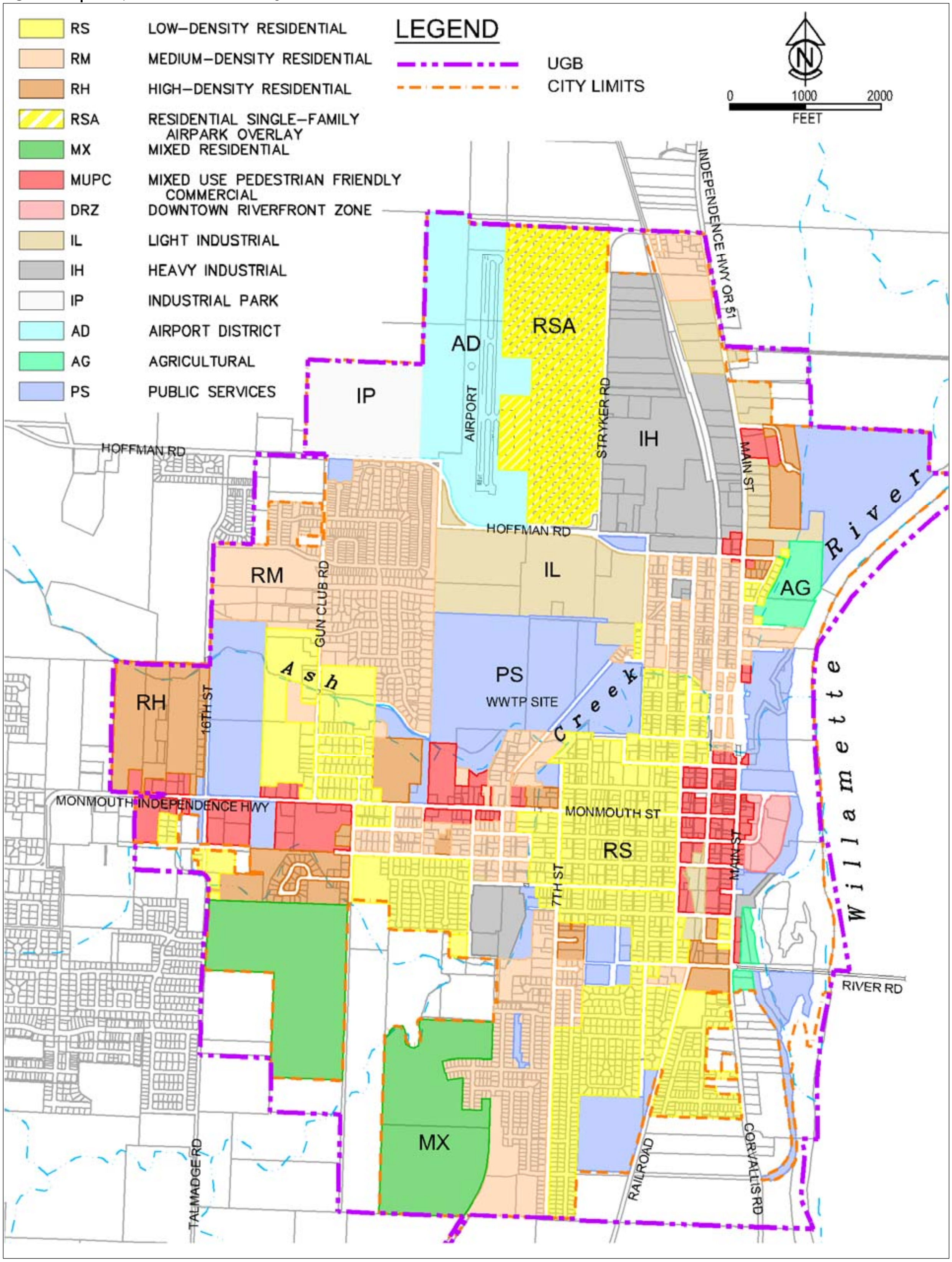


Figure 2-5 | Soils Map

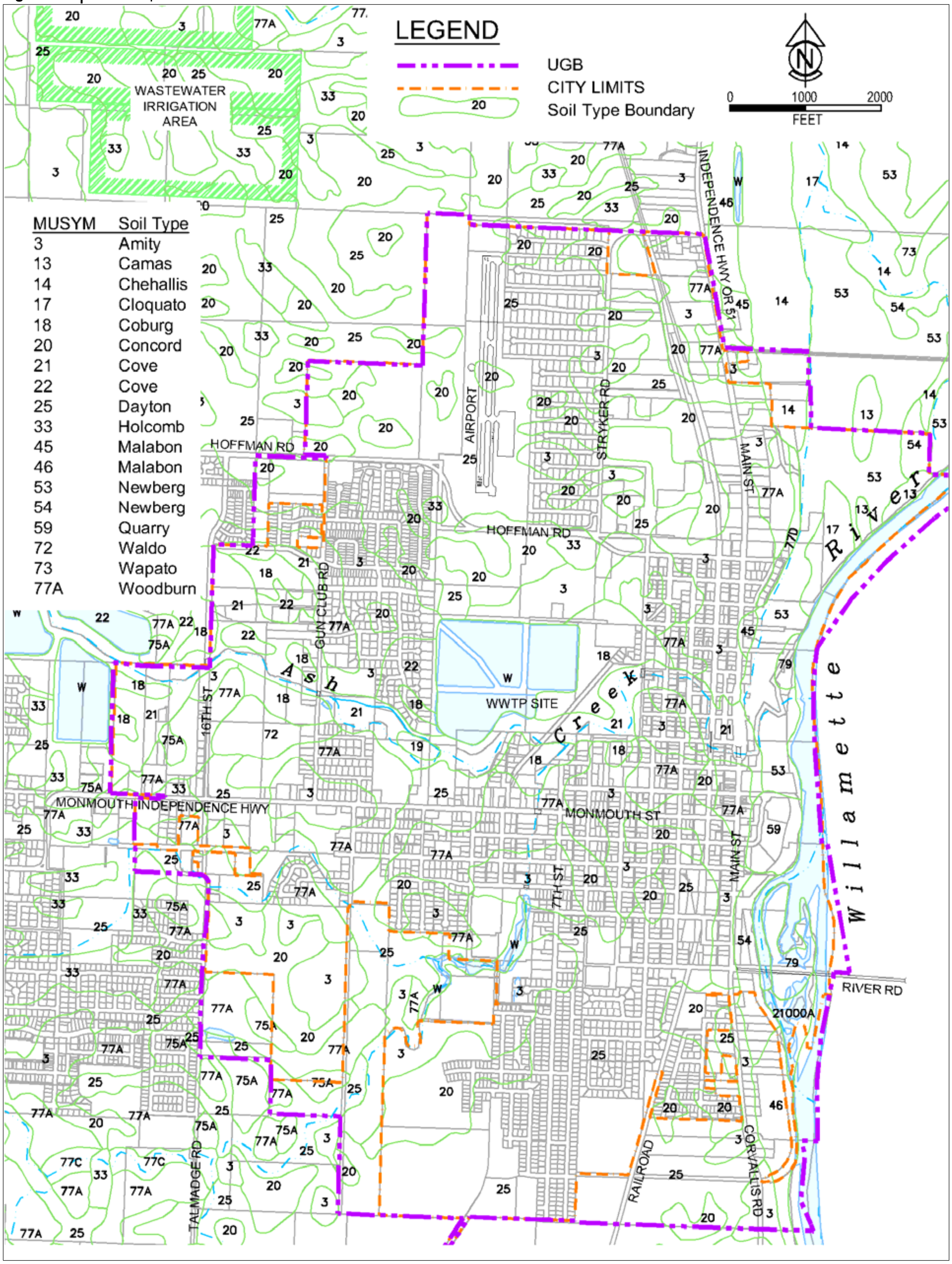


Figure 2-6 | 100- Year Floodplain

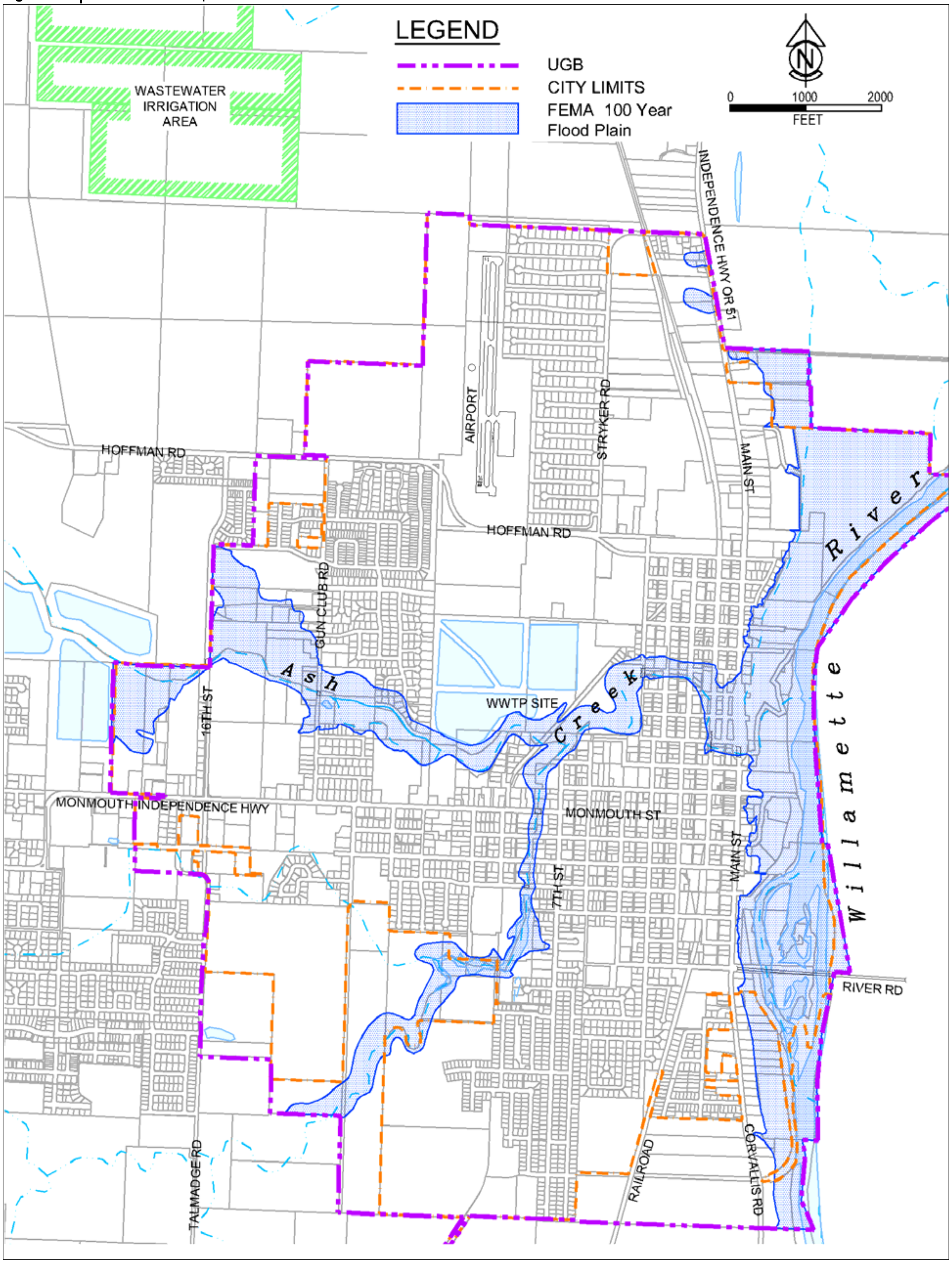
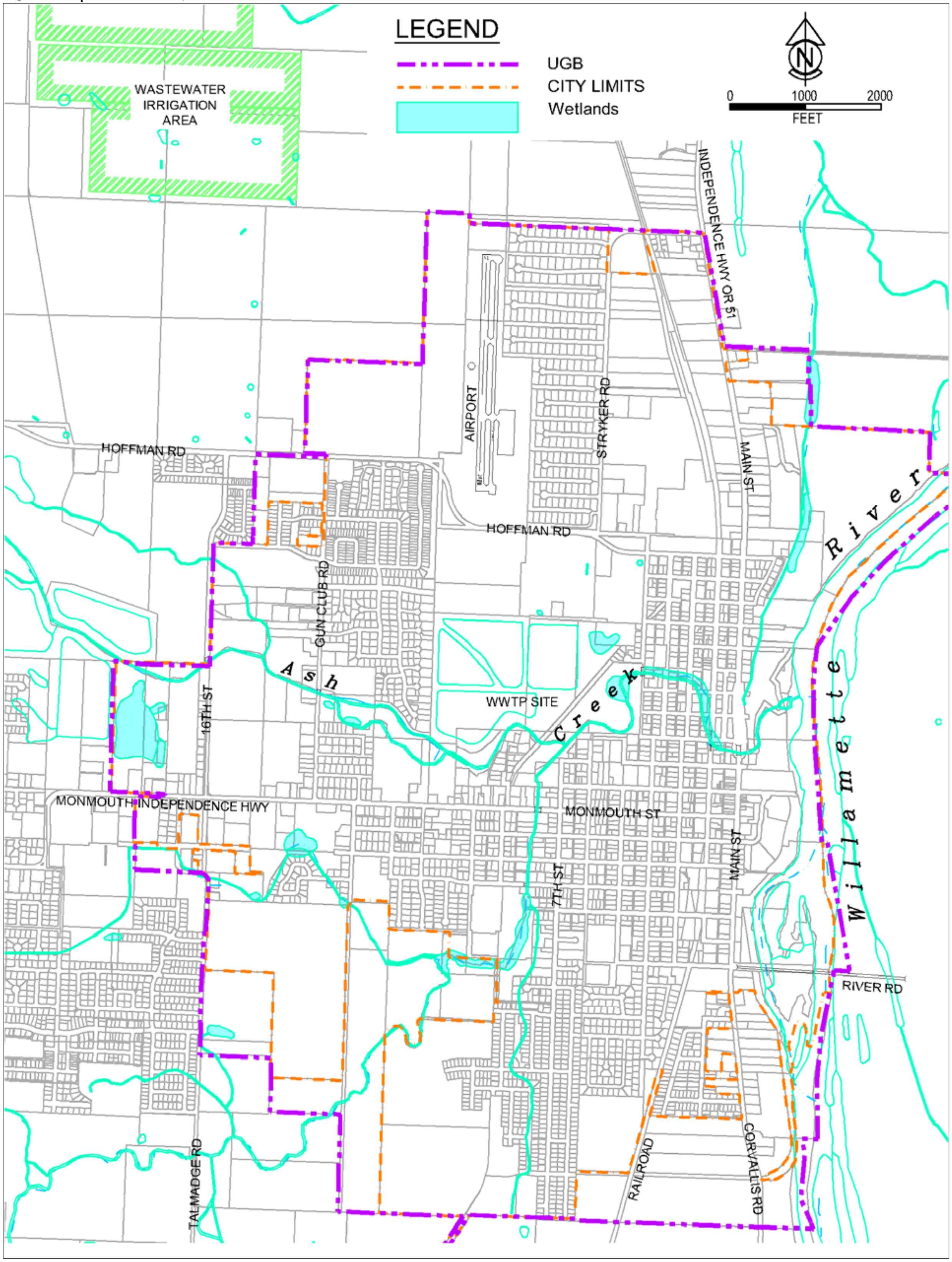


Figure 2-7 | Wetlands Map



CHAPTER 3
BASIS OF PLANNING

Chapter Outline

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 Oregon Department of Fish and Wildlife, 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 has been in effect since June 9, 2016 and expires on April 30, 2021. The City has submitted a timely renewal application, and a new permit should be issued in 2021 or early 2022.

The City is currently permitted to discharge treated effluent to the Willamette River on a seasonal basis. The NPDES permit includes several limitations with respect to seasonality, effluent quality and quantity (Table 3-1 and Table 3-2). The NPDES permit also establishes a mixing zone at the outfall location. The mixing zone is defined as that portion of the Willamette River contained within a band 50 feet upstream of the outfall, 50 feet east from the outfall, and 300 feet downstream from the outfall.

Table 3-1 | NPDES Permit Requirements- Winter Discharge

Discharge Season	**November 1 – May 31**				
Outfall	001 – Treated Wastewater				
Effluent Quality	Avg. Effluent Concentration (mg/L)		Avg. Effluent Mass Loads (ppd)		
Parameter	*Monthly*	*Weekly*	*Monthly*	*Weekly*	*Daily*
BOD_5	30	45	500	750	1,000
TSS	50	80	830	1,200	1,700
BOD_5 Removal Efficiency	Greater than or equal to **85%** of monthly average				
TSS Removal Efficiency	Greater than or equal to **65%** of monthly average				
pH Range	6.1 - 9.0				
E. Coli	Monthly Log(Geometric) Mean		126 organisms per 100 mL		
	Maximum Single Sample		406 per 100 mL		
Chlorine Residual	Monthly Average		0.070 mg/L		
	Daily Maximum		0.12 mg/L		

Table 3-2 | NPDES Permit Requirements- Recycled Water

Discharge Season	**June 1 – October 31**	
Outfall	002 – Recycled Water Reuse Fields	
Effluent Quality	Class C or Class D per OAR 340-0055 Recycled Water Use	
Irrigation Rate	Agronomic rates to match crop uptake of water and nutrients in accordance with DEQ approved recycled water use plan.	
Disinfection	*Class C*	*Class D*
	Total Coliform is no greater than **23** organisms per 100 mL (7-day median)	Total E. coli is no greater than **126** organisms per 100 mL (30-day geometric mean)
	Total Coliform is no greater than **240** organisms per 100 mL (two consecutive samples)	Total E. coli is no greater than **406** organisms per 100 mL (any sample)

3.4 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. All groundwater in the state is protected from pollution. Oregon's groundwater protection rules are described in OAR 340-040. With respect to the City's wastewater utility, the facultative lagoons and the land application facilities have the highest potential to impact groundwater quality.

The two original lagoon cells were constructed in the mid 1960's. Two more lagoons were constructed in 1978. It is unknown whether the lagoons were constructed with a liner or compacted native soils to minimize seepage loss. The lagoons were tested for seepage in 2021 as a part of this Facilities Plan.

These tests showed that leakage from all four lagoon cells was less than 1/8 – inch per day. This indicates that the lagoons are not leaking in excess of DEQ's guidelines. In addition, the City's NPDES permit does not require any further evaluation of groundwater impacts. There is no evidence to suggest the City's existing lagoons impact ground water quality. Therefore, improvements to the lagoon liner system are not likely to be needed during the planning period.

Land application of recycled water is performed in accordance with the DEQ approved recycled water use plan. In accordance with the recycled water use plan, the application rate of recycled water is matched to agronomic uptake rates. As such, the potential for recycled water to impact groundwater quality is low.

3.5 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 uses recycled water for irrigation of agricultural fields north 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 3-3 and Table 3-4.

Table 3-3 | 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 3-4 | 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

3.6 SLUDGE STABILIZATION REQUIREMENTS

As discussed in Chapter 7, the sludge that accumulates in the facultative sludge lagoons will need to be removed during the planning period. As such, the regulations regarding sludge stabilization and disposal are summarized in this subsection. Sludge that is not stabilized may be disposed at a landfill. However, most other disposal methods require that the sludge be stabilized in accordance with the requirements described 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.

3.6.1 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.

3.6.2 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.

3.6.3 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.

3.6.4 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.

3.6.5 Biosolids Use

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

Table 3-5 | Biosolids Use Restrictions Based on Quality Rating

Biosolids Quality Rating by Category			
Pathogens	Vector Attraction	Trace Elements	Use Restrictions
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

3.6.6 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 3-4 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 3-6 | 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

3.7 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 3-5 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 3-7 | 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.

3.8 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 the City's design standards and DEQ guidelines. The City has 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's design standards require collection system piping 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, Appendix A and DEQ design guidelines. Table 3-6 includes a list of the minimum allowable slope based on mainline pipe sizes.

Table 3-8 | 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

3.9 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 3-7 below summarizes design criteria assumed for new pump stations or the upgrades of the existing pump stations.

Table 3-9 | 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 start or variable frequency drive if required by City or utility company
Flow Measurement	• Magnetic flow meter in vault downstream of valve.
Auxiliary Power	
Type	• Permanent diesel generator w/ATS
Location	• Pad-mounted or in control building adjacent to P.S.
Fuel Supply	• Sub-base tank, 24 hour minimum or as required by City
Enclosure	• Critical grade sound-attenuating and insulated
Telemetry	
Type	• Match City system, programmed per City direction
Alarms	• Remote alarms as required by City

CHAPTER 4
EXISTING WASTEWATER FACILITIES

Chapter Outline

EXISTING WASTEWATER FACILITIES

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 and pumped collection system that conveys wastewater to the treatment plant. The collection system includes thirteen pump stations. Four main pump stations deliver all of the wastewater directly to the headworks of the wastewater treatment plant. Nine smaller pump stations collect wastewater from Sub-basins and convey it to the primary pump stations.

The City's treatment facility is located in the northern and central part of the City at 490 Ash Street. The plant is accessed from a gravel road west of Ash Street. Raw sewage treatment facilities consist of a headworks with Parshall flume, four facultative lagoon cells, and structures for conveying sewage between lagoons. There exists a small pump station to transfer wastewater from lagoon cell 1 to 2. The headworks does not have facilities for screening or grit removal.

Final effluent is processed by a Parshall flume, chlorine contact chamber, and sulfur dioxide dechlorination. Final effluent can be processed specifically for recycled water reuse, which is discharged from the plant by an irrigation pump station. The treatment plant has a control and chemical feed building at the effluent handling facilities of the treatment plant. The Lagoon Pump Station is located near the control building. A diesel-powered auxiliary power generator provides on demand backup power for the final effluent processing facilities and the Lagoon Pump Station.

Disinfected and dechlorinated final effluent is discharged in the winter discharge season by gravity in a 24" and 36" diameter sewer. This sewer is shared with the City of Monmouth. It discharges finished effluent to the Willamette River.

Detailed maps of the collection system are included in Appendix B. An overall schematic of the wastewater system is shown in Figure 4-1. Detailed descriptions of the major components of the wastewater system are included below.

4.3 HISTORY AND DEVELOPMENT OF THE WASTEWATER SYSTEM

The City's original sewer collection system was installed in the 1920's. The City's first wastewater treatment plant was constructed in the 1950's as a shared system with the City of Monmouth. The original treatment plant was located near the current location of the Riverview Pump Station at the confluence of Ash Creek and the Willamette River. By the 1960's the treatment plant was becoming overloaded by growing populations in the cities. In 1963, the cities constructed separate lagoon treatment plants. The existing treatment plant was demolished and converted to the Riverview Pump Station to deliver wastewater to the new plant at its existing location.

In 1978 the City constructed two additional lagoon cells, replaced the chlorination building and the chlorine contact basin, and installed an effluent Parshall flume. The outfall pipe from the original two lagoons was repurposed as a lagoon bypass sewer that is still in partial use today. At this time, the 24" outfall pipe for the City of Monmouth and the shared 36" outfall pipe was constructed underneath what is now lagoon cells 4 and 1. According to the 1978 WWTP drawings, there was not yet a shared outfall in use by the Cities. It is likely that these plants originally discharged disinfected effluent to Ash Creek.

In 1998 the City made systematic improvements to the collection system that were focused on reducing infiltration and inflow. Several pump stations, forcemains, and interceptors were constructed. Roof drains were disconnected from the sanitary sewer. Numerous sewer laterals were repaired. Additionally, the existing headworks and influent Parshall flume were constructed at the treatment plant

Over the years, the collection system was extended to serve new development projects. In the late 1990's and early 2000's the southern part of town developed substantially. This included construction of the Mt. Fir Estates and Freedom Estates subdivisions. The Mt. Fir and Briar Road Pump Stations were constructed as a part of these subdivisions. During this time the Ash Creek Subdivision and 13th Street Pump Station were constructed in the western part of town.

In 2019 the City upgraded the Riverview Pump Station. This work included upsizing the pumps, replacing the valve vault, electrical systems, and improving the forcemain crossing underneath Ash Creek with ductile iron pipe.

In 2019 and 2020 the City made substantial improvements to the treatment plant allowing the plant to reclaim water for beneficial use per the requirements of the NPDES permit. An irrigation pump station and forcemain were constructed allowing the City to discharge recycled water to irrigated crop land north of the City. At this time the City also upgraded the chemical feed building and chemical feed equipment, installed an auxiliary power generator, and replaced the lagoon cell four outlet control structure and effluent flow control system.

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 April 2020, the City's system served approximately 3,600 user connections. A breakdown of the connections by user type is presented below (Table 4-1). The majority of the connections are single family residential. There are several light industrial users connected to the City's collection system. These include various types of manufacturers that are not water-intensive industries.

Table 4-1 | Sewer User Summary

User Classification	Number of Connections
Residential	3,370
Commercial	174
Public Services	26
Total	3,570

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 five main basins as shown in Figure 4-2. These main basins are comprised of fifteen sub-basins. Two basins do not have any development in the City Limits or sewer service: sub-basins C3 and C5.

The approximate area within each of the basins is listed in Table 4-2. The routing of the existing system is shown schematically in Figure 4-1.

Table 4-2 | Sewer Drainage Basin Areas

Basin	Sub-basin	Total Area (Acres)	Potentially Buildable Area (Acres)
A	A1	162.6	62.4
	A2	84.0	5.7
B	B1	263.3	14.0
	B2	3.9	0.5
	B3	43.7	1.2
	B4	9.8	0.0
C	C1	172.6	30.6
	C2	95.2	48.3
	C3	103.7	84.0
	C4	190.0	71.9
	C5	128.0	68.5
D	D1	284.4	56.4
	D2	134.7	101.4
E	E1	228.9	57.7
	E2	66.8	22.6
	Total	1,971.6	624.9

Figure 4-1 | Existing Wastewater System Schematic

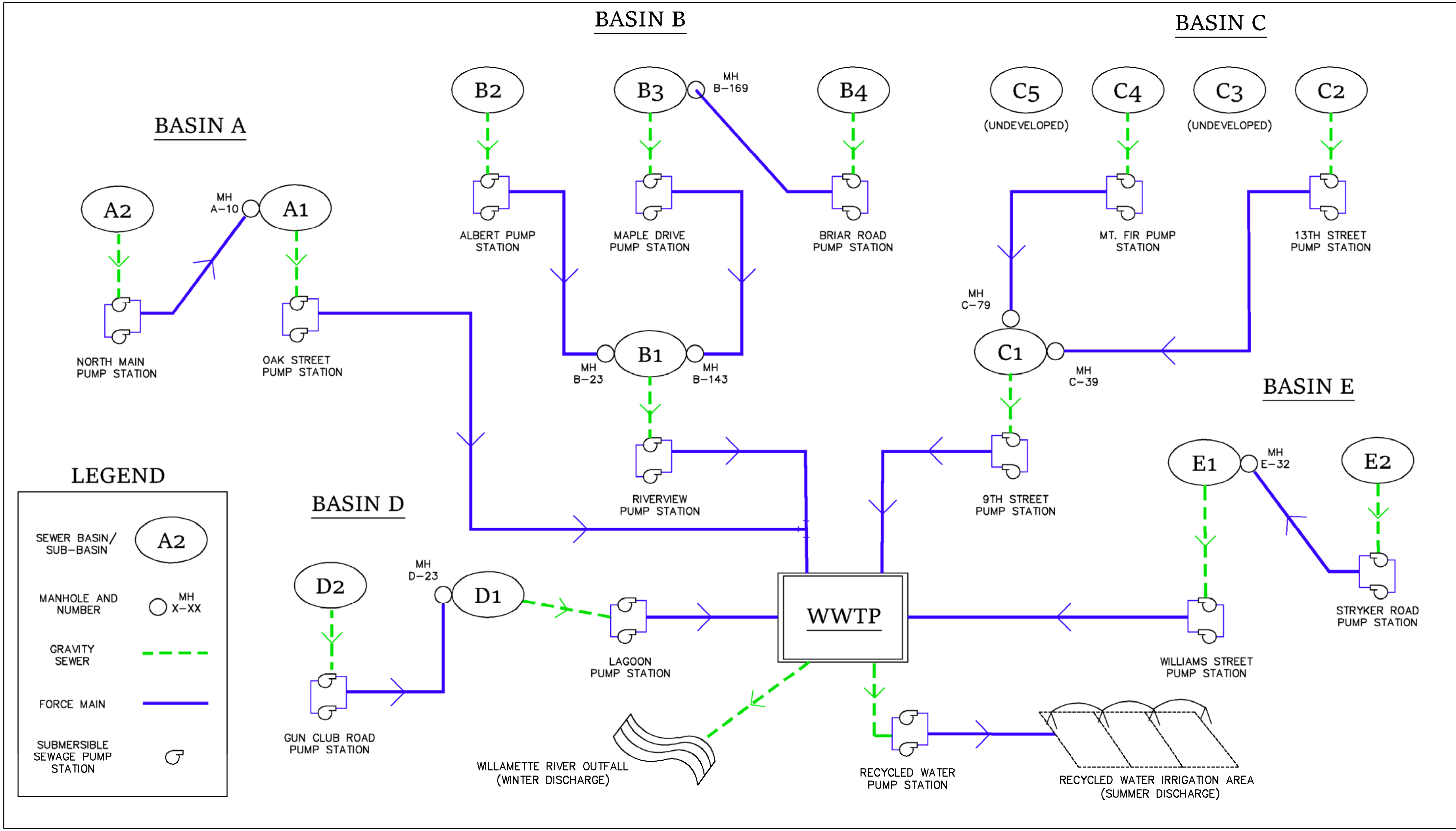
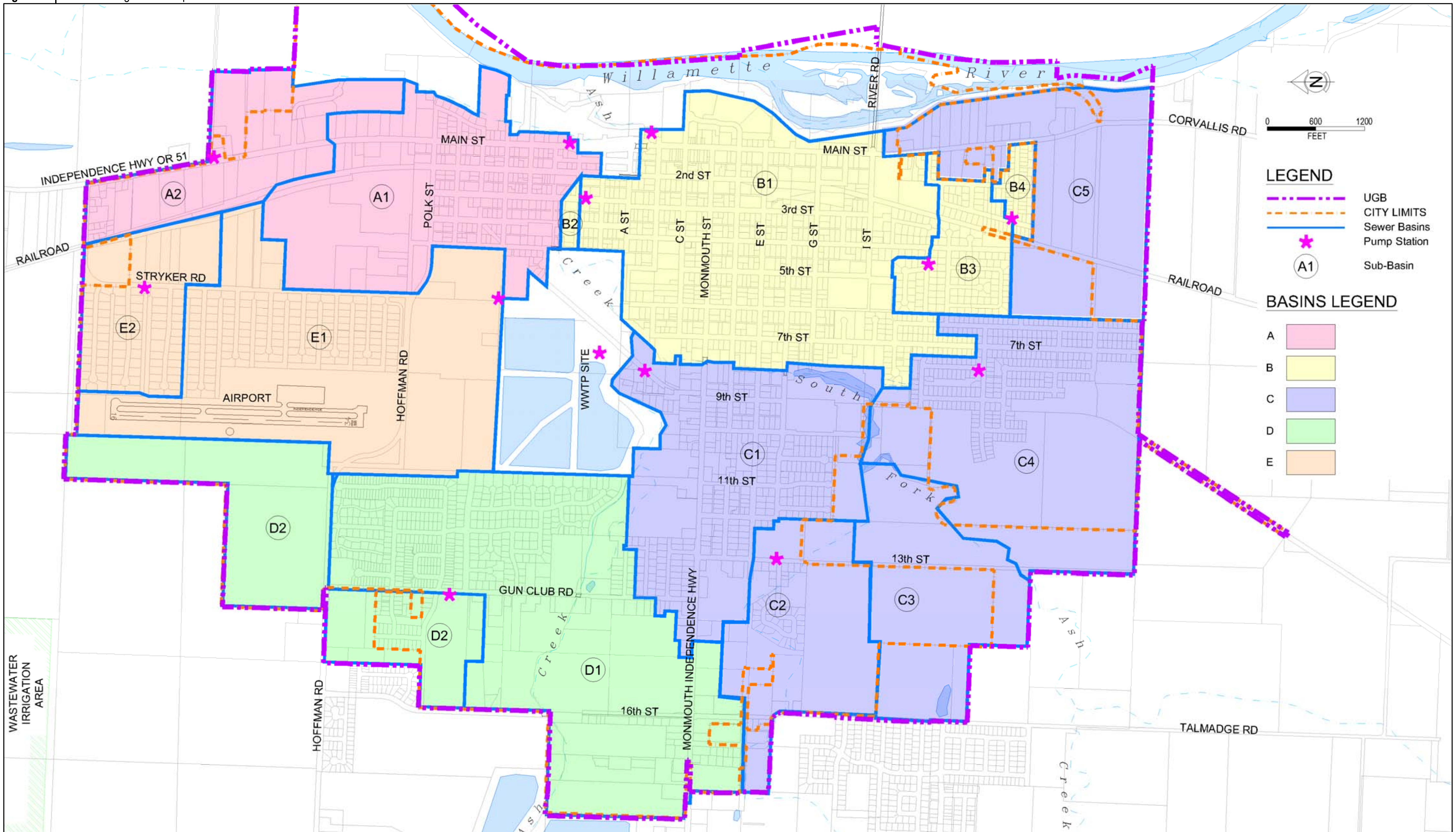


Figure 4-2 | Sewer Drainage Basin Map



4.4.3 Gravity Collection System

The collection system serving Independence includes approximately 163,000 feet of mainline pipe with approximately 3,600 connections. Gravity sewer pipe sizes range from 8-inch to 21-inch diameter, with the vast majority of the pipe being 8-inch. The collection system includes thirteen pump stations, and approximately 16,300 feet of pressure forcemain piping. The pump stations and forcemain piping are described in greater detail below. The original collection system was built in the 1920's. It is unknown how much of this piping remains in service. The original collection system has been extended over the years and most new extensions have been with concrete or PVC pipe. Therefore, most of the pipe within the City is PVC and concrete. However, a majority of the pipes in the City's collection system are of an unknown diameter and material.

Table 4-3 | Manholes by Basin

Basin	Manholes	Percent of Total
A	64	12.0 %
B	182	34.1 %
C	126	23.6 %
D	115	21.5 %
E	47	8.8 %
TOTAL	534	100.0 %

4.4.4 Known Gravity Collection System Problems

The following bullet points list major collection system problems that are known at the present time. These areas require regular jet-cleaning and maintenance by operators to clear debris and prevent backup. These problems should be fixed during the planning period.

- Main Street from H Street to B Street. During heavy rains the sewer along Main Street near downtown has regularly surcharged. This line had a known overflow event in January of 2012. This line is 15-inch, 12-inch, and 8-inch pipe. Risk of surcharging and overflow has likely been lessened since the Riverview Pump Station upgrade project in 2019. However, this line is expected to further surcharge in the planning period as flows increase.
- H Street from 3rd Street to Main Street. There is a belly in the line near the railroad track crossing that causes surcharging, debris accumulation, and maintenance problems. Manholes in this area that are regularly clogged include S9-4.2, S9-2B, S9-1. The manholes immediately west of the railroad have a sewer with reverse grade.
- Spruce Court Cul-de-sac to Briar Road. There is a belly in the line near the Spruce Court cul-de-sac that causes surcharging, debris accumulation, and maintenance problems. Manhole S9-2.15 is regularly clogged and has to be jet-cleaned to clear debris and prevent backup.
- Monmouth Independence Highway at Gun Club Road. Manhole M15-4A, north of the Chevron gas station, is regularly clogged. The specific cause for the backup is unknown at this time.

- Manholes near 16th Street. Manholes W-18 and W-18-4.1 are regularly clogged and cause backups. The specific cause for the backup is unknown at this time.
- Manholes on 12th and 13th Streets. Manhole W9-9.2 at the corner of Picture & N 13th Street and manhole W9-5 at the corner of Wildfang and N 12th Street are regularly clogged and cause backups. The specific cause for the backup is unknown at this time.
- Manhole at 7th Street & F Street. Manhole M12-3 is regularly clogged and causes backups. The specific cause for the backup is unknown at this time.
- Manhole at Main Street & Williams Street. Manhole N9 is regularly clogged and causes backups. The specific cause for the backup is unknown at this time.
- E Street Grade Issues from 13th Street to 12th Street. Sewer lines and manholes along this line are relatively flat and do not fully drain.
- C Street Clay Tile Line. The entire sewer line along C Street from the alley between 6th and 7th Streets to Monmouth Street is clay tile. This pipe is brittle, has reached the end of its useful life, and needs to be replaced. City Staff are not able to regularly maintain and clean the line due to risk of failure.

4.4.5 Pump Stations

The existing wastewater collection system serving the City includes thirteen pump stations. Table 4-4 through Table 4-7 below contain a summary of some of the important characteristics of each of the pump stations. This information is based on as-built drawings, field observations, specifications, O&M manuals and topographic survey. A more detailed description of each of the stations is presented in the following sections.

Table 4-4 | Summary of Existing Pump Stations

	Oak Street	North Main	Riverview	Briar Road
General				
▪ Basins served	A1, A2	A2	B1, B2, B3, B4	B4
▪ Construction date(s)	1998	2005	1998 / 2019	2002
▪ Type	Submersible	Submersible	Submersible	Submersible
Firm Capacity (1)	-Oak Only: 1,060 gpm @ 45 ft TDH -Oak/ Riverview: 600 gpm @ 65 ft TDH (2)	250 gpm @ 29 ft TDH	-Riverview Only: 3,100 gpm @ 77 ft TDH (2) -Riverview/ Oak: 2,900 gpm @ 80 ft TDH (2)	200 gpm @ 22 ft TDH
Wetwell				
▪ Type	Circular Concrete	Circular Concrete	Circular Concrete	Circular Concrete
▪ Size	8' diameter	6' diameter	12' diameter	6' diameter
▪ Rim Elevation	160.5 ft.	± 160.5 ft.	167 ft.	170.5 ft.
▪ Influent Invert Elev.	145.9 ft.	± 145 ft.	147.7 ft.	161 ft.
▪ Bottom Elev.	139.4 ft.	± 140 ft.	144 ft.	158 ft.
▪ Depth (Rim to Bottom)	21 ft.	± 20 ft.	23 ft.	12 ft.
Pumps				
▪ Type	Submersible	Submersible	Submersible	Submersible
▪ Number	2	2	2	2
▪ Manufacturer & Model	Flygt CP 3152/432-MT	Flygt NP 3102/464	Flygt NP 3301/ 634 MT	Flygt NP3085.092-462
▪ Motor Size & Speed	20 HP 1750 RPM	5 HP 1755 RPM	85 HP 1185 RPM	3 HP 1750 RPM
▪ Power Supply	460-Volt 3-Phase	240-Volt 3-Phase	480-Volt 3-Phase	230-Volt 1-Phase
▪ Motor Speed Control	On/Off	On/Off	Variable	Variable
Force Main				
▪ Size	8" and 16"	6"	12"/ 14"/16"	4"
▪ Type	C-900 PVC / DIP	PVC	C-905 PVC/ DIP	C-900 PVC
▪ Length	±3,660 ft	±1,700	4,638' PVC, 180' DIP	40 ft.
▪ FM Discharge	WWTP Headworks	MH A-10	WWTP Headworks	MH B-169
▪ FM Discharge Elev.	± 185 ft.	Unknown	± 185	± 167.75
Hydrogen Sulfide Control	None	None	None	None
Auxiliary Power				
▪ Type & Location	60 kW Fixed Gen	20 kW Portable Gen	150 KW Fixed Gen	20 kW Portable Gen
▪ Fuel Supply	Diesel	Diesel	Diesel	Diesel
▪ Transfer Switch	Automatic	Manual	Automatic	Manual
Telemetry	SCADA System	SCADA System	SCADA System	SCADA System
Overflow	MH A-45/ A-40	MH A-15/ A-16	MH B-175	MH B-169

(1) Firm capacities based on the largest single pump out of service at each station.
(2) Capacity estimated based on hydraulic model and pump performance data available from as-builts.

Table 4-5 | Summary of Existing Pump Stations (continued)

Category	Albert Street	Maple Drive	9th Street	Mt. Fir
General				
▪ Basins served	B3	B2	C1, C2, C3	C3
▪ Construction date(s)	1998	1971 & 2002	1998	1998
▪ Type	Submersible	Submersible	Submersible	Submersible
Firm Capacity (1)	147 gpm @ 22 ft TDH	200 gpm @ 18 ft TDH (2)	900 gpm @ 51 ft TDH	1 pump: 568 gpm @ 20 ft TDH 2 pumps: 700 gpm @ 32 ft TDH (3)
Wetwell				
▪ Type	Circular Fiberglass	Circular Concrete	Circular Concrete	Circular Concrete
▪ Size	6' diameter	6' diameter	8' diameter	8' diameter
▪ Rim Elevation	161.5 ft.	±170 (drywell floor)	165.8 ft.	172 ft.
▪ Influent Invert Elev(s)	148.1 ft.	±163.5 / ±163.0	154.9 ft. (21")	157.4 ft.
▪ Bottom Elev.	145.1 ft.	±159.0	146.4 ft.	151 ft.
▪ Depth (Rim to Bottom)	16.4 ft.	±14.0 ft.	19.3 ft.	21 ft.
Pumps				
▪ Type	Submersible	Submersible	Submersible	Submersible
▪ Number	2	2	2	2 (Space for 3)
▪ Manufacturer & Model	Hydronix S4MVX, 8.5"	Flygt 3085 / 463	Flygt CP-3152/432-MT (1) 3153 (1)	Flygt MT 3127-434
▪ Motor Size & Speed	5 HP 1150 RPM	3 HP 1700 RPM	20 HP 1750 RPM	7.5 HP 1750 RPM
▪ Power Supply	480-Volt 3-Phase	230-Volt 3-Phase	460-Volt 3-Phase	230-Volt 3-Phase
▪ Motor Speed Control	On/Off	On/Off	On/Off	On/Off
Force Main				
▪ Size & Type	4" PVC C-900	4" SC 40 Steel	10" C-900 PVC/DIP	8" C-900 PVC
▪ Length	350 ft	200 ft	2,200 ft.	1900 ft.
▪ FM Discharge	MH B-23	MH B-143	WWTP Headworks	MH C-79
▪ FM Discharge Elev.	163.5 ft	Unknown	± 185	± 165
Hydrogen Sulfide Control	None	None	None	None
Auxiliary Power				
▪ Type & Location	20 KW Portable Gen	20 KW Portable Gen	60 kW Fixed Gen	40 kW Fixed Gen
▪ Fuel Supply	Diesel	Diesel	Diesel	Diesel
▪ Transfer Switch	Manual	Manual	Automatic	Automatic
Telemetry	SCADA System	SCADA System	SCADA System	SCADA System
Overflow	MH B-25	B-179 or B-182 (TBD)	MH C-2	MH C-108 and C-94

(1) Firm capacities based on single largest pump out of service at each station, except as noted for Mt. Fir.
(2) Firm capacity listed is based on estimated duty point and pump performance data. Pump nameplate referenced to determine pump performance data.
(3) Existing pump station has room for the installation of a third pump. Capacity referenced from design criteria.

Table 4-6 | Summary of Existing Pump Stations

	13th Street	Lagoon	Gun Club Road	Williams Street
General				
▪ Basins served	C2	D1, D2	D2	E1, E2
▪ Construction date(s)	2001	1999	2008	2020
▪ Type	Submersible	Submersible	Submersible	Submersible
Firm Capacity (1)	150 gpm @ 23.5 ft TDH	1,500 gpm @ 65 ft TDH	525 gpm @ 74 ft TDH	1,180 gpm @ 78.8 ft TDH
Wetwell				
▪ Type	Circular Concrete	Rectangular Conc.	Circular Concrete	Circular Concrete
▪ Size	6' diameter	12' x 10'	7' diameter	7' diameter
▪ Rim Elevation	172.0 ft.	164 ft.	175 ft.	170.25 ft.
▪ Influent Invert Elev.	159.0 ft.	151.75 ft.	152 ft.	153.50 ft.
▪ Bottom Elev.	151.60 ft.	150.5 ft.	146 ft.	147.75 ft.
▪ Depth (Rim to Bottom)	20.4 ft.	14 ft.	29 ft.	22.5 ft.
Pumps				
▪ Type	Submersible	Submersible	Submersible	Submersible
▪ Number	2	2	2	2
▪ Manufacturer & Model	Flygt CP3085.092-462 MT	Flygt CP 3201/639 MT	Flygt NP 3153.091	Flygt NP 3171-433
▪ Motor Size & Speed	3 HP 1700 RPM	40 HP 1185 RPM	20 HP 1750 RPM	34 HP 1750 RPM
▪ Power Supply	460-Volt 3-Phase	460-Volt 3-Phase	460-Volt 3-Phase	480-Volt 3-Phase
▪ Motor Speed Control	On/Off	On/Off	Variable	Variable
Force Main				
▪ Size & Type	4" PVC C-900	10" C-900 PVC	6" PVC	10" IPS HDPE
▪ Length	420 ft	1,500 ft.	1,950 ft.	940 ft
▪ FM Discharge	MH C-39	WWTP Headworks	MH D-23	WWTP Headworks
▪ FM Discharge Elev.	Unknown	± 185 ft.	Unknown	± 185 ft.
Hydrogen Sulfide Control	None	None	None	None
Auxiliary Power				
▪ Type & Location	20 kW Portable Gen	200 kW Fixed Gen	50 kW Fixed Gen	125 kW Fixed Gen
▪ Fuel Supply	Diesel	Diesel	Diesel	Diesel
▪ Transfer Switch	Manual	Automatic	Automatic	Automatic
▪ Note	-	Shared use with WWTP Building		
Telemetry	SCADA System	SCADA System	SCADA System	SCADA System
Overflow	MH C-41.1	MH D-12	MH D-107 and D-112	MH E-3

(1) Firm capacities based on the single largest pump out of service at each station.

Table 4-7 | Summary of Existing Pump Stations

	Stryker Road
General	
▪ Basins served	E2
▪ Construction date(s)	1993
▪ Type	Wetwell w/ dry-pit pumps
Firm Capacity [(1)]	155 gpm @ 20 ft TDH
Wetwell	
▪ Type	Circular Fiberglass
▪ Size	6' diameter
▪ Rim Elevation	169 ft.
▪ Influent Invert Elev.	± 156 ft.
▪ Bottom Elev.	151 ft.
▪ Depth (Rim to Bottom)	18 ft.
Pumps	
▪ Type	End-suction centrifugal
▪ Number	2
▪ Manufacturer & Model	Hydronix Hydromatic 40 MPV
▪ Motor Size & Speed	3 HP 950 RPM
▪ Power Supply	230-Volt 1-Phase
▪ Motor Speed Control	On/Off
Force Main	
▪ Size & Type	4" PVC
▪ Length	320 ft.
▪ FM Discharge	MH E-32
▪ FM Discharge Elev.	Unknown
Hydrogen Sulfide Control	Air injection system (not in use)
Auxiliary Power	
▪ Type & Location	20 kW Portable Gen
▪ Fuel Supply	Diesel
▪ Transfer Switch	Manual
Telemetry	SCADA System
Overflow	MH upstream of pump station

(1) Firm capacities based on the single largest pump out of service at each station.

4.4.5.1 Oak Street Pump Station


Figure 4-3 | Oak Street Pump Station

Overview: The Oak Street Pump Station was constructed in 1998 as a part of city-wide improvements to the sanitary sewer system. This station collects wastewater from the entirety of Basin A (the northern and eastern parts of the city). This pump station discharges wastewater directly to the wastewater treatment plant headworks via a common forcemain with the Riverview Pump Station. The main pump station components are a control building, concrete wetwell with submersible pumps, valve vault, forcemain, and auxiliary power generator.

Location: The pump station is located two hundred feet southeast of the intersection of Main Street and Oak Street on the east side of Main Street (OR Highway 51).

Site Improvements: The site has gravel surfacing and a gravel driveway. The site is separated from the highway by a guardrail. The station is surrounded by a barbed wire security fence with privacy slats. Gates to the pump station are locked at all times. Vacuum trucks and crane trucks are able to access the site to complete repairs and maintenance. The site also has an overhead light.

Control Building: The control building is a slab-on-grade and stick-framed structure. It provides shelter for the pump station power, control and telemetry equipment. It also provides shelter for irrigation water treatment equipment used for irrigating city parks and soccer fields.

Wetwell & Sewers: Wastewater is conveyed to the pump station wetwell via a 18” PVC influent sewer. The pump station has an 8-foot diameter concrete wetwell with cast-in-place top and bottom slabs. The station does not have a dedicated overflow pipe. In the event of an overflow, wastewater will flow through the top of the lowest upstream manholes. These manholes are at the intersection of Williams and Log Cabin Streets (MH A-40 and A-45).

Pumps & Discharge Piping: Two 20-horsepower Flygt submersible pumps discharge wastewater from the wetwell via 8-inch ductile iron piping. The design criteria and performance data for the pumps and equipment are outlined above (Table 4-4). The valve vault contains three isolation valves, two check valves, and pressure gauges.

Forcemain: There is approximately 50 feet of 8-inch PVC C-900 forcemain within the pump station site. This connects to the 16-inch PVC C-905 common forcemain at an 8-inch by 16-inch mechanical joint tee. Wastewater is then conveyed approximately 3,600 feet to the WWTP headworks. Four of the common forcemain’s sewage air release and vacuum break valves were replaced in 2019 as a part of the Riverview Pump Station improvement project. The station does not include provisions for hydrogen sulfide control in the forcemain.

Power & Control Systems: The pump station is supplied with 460-volt 3-phase power. The station also utilizes an onsite auxiliary power generator to provide backup power. In the event of a blackout, an automatic transfer switch automatically directs power to the pump station from the generator instead of the grid. The generator with sub-base fuel tank is mounted on a concrete pad outside of the control building. The fuel tank provides 24-hours of fuel at 100% load.

The pumps operate at a single speed without soft starters. The pump station alternates running each pump to balance usage.

The pump station is equipped with an automatic level control system. The primary level control element is a Flygt multilevel probe mounted in the wetwell. This multiprobe is also used to signal a high-level alarm. The station does not have a redundant level control sensor or a dedicated overflow sensor.

The pump station utilizes the original power distribution and control equipment that was installed in 1998. Due to their age, it is expected that these systems will need to be entirely replaced and upgraded during the planning period. It is recommended that a redundant level control system and dedicated overflow sensor also be installed at this time.

<u>SCADA:</u> The station is monitored remotely using the City's SCADA system. The station's PLC communicates with the City's SCADA system by radio telemetry. The PLC communicates alarm conditions to the SCADA system.

<u>Summary:</u> As noted above, this pump station shares a forcemain with the Riverview Pump Station. When pumps at both of these stations are running simultaneously, the pumps have to deliver more pressure and flow rate is subsequently reduced. In 2020 the Riverview Pump Station was retrofit with larger pumps. This change reduced the capacity of the Oak Street Pump Station from 740 gpm to an estimated 600 gpm when both stations have one pump running. The pump station is expected to need an upgrade for pumping capacity during the planning period.

Considering that the pump station was constructed in 1998, some components are expected to reach the end of their useful lifespan's during the planning period. It is anticipated that the station's power & control equipment and instruments will need to be entirely replaced and upgraded.

Other than improvements for capacity and electrical equipment, the pump station is expected to serve the City's needs with regular repairs and maintenance. Typical repair and maintenance activities include building maintenance, normal pump maintenance, generator maintenance, and periodic work on the power, control and telemetry systems. These activities should be funded under normal operation and maintenance budgets. A capital improvement project for the capacity upgrade and electrical improvements is included in Chapter 6.

4.4.5.2 North Main Pump Station


Figure 4-4 | North Main Pump Station

Overview: The North Main Pump Station was constructed in 2005 to serve the farthest northern and eastern part of the City. This station collects wastewater from Sub-basin A2. This pump station discharges to manhole A-10 in Sub-basin A1. The main pump station components are a disconnect/control panel, concrete wetwell with submersible pumps, valve vault, and forcemain.

Location: The pump station is located on the southeast corner of Main Street (OR Highway 51) and Hanna Road.

Site Improvements: The site has gravel surfacing. The paved driveway is shared with the adjacent business. The pump station has bollards around the control panels and concrete barriers around the wetwell to protect it from vehicles. The site is not fenced. Electrical enclosures and hatches are locked at all times to prevent tampering. Vacuum trucks and crane trucks are able to access the site to complete repairs and maintenance. The site also has an overhead light.

Control Shelter: Outdoor-rated electrical enclosures provide shelter for the pump station's power, control and telemetry equipment.

Wetwell & Sewers: Wastewater is conveyed to the pump station wetwell via an 8" PVC influent sewer. The pump station has a 6-foot diameter concrete wetwell with cast-in-place top and bottom slabs. The station does not have a dedicated overflow pipe. In the event of an overflow, wastewater will flow through the top of the lowest upstream manholes. These are the manholes at the intersection of Main Street and Hanna Road (MH A-15/ A-16).

Pumps & Discharge Piping: Two 5 horsepower Flygt submersible pumps discharge wastewater from the wetwell via 4-inch diameter ductile iron piping. The design criteria for the pumps and equipment are outlined above (Table 4-4). Each pump is fitted with an isolation valve and a check valve in the valve vault.

Forcemain: There is approximately 600 feet of 4-inch PVC C-900 forcemain between the pump station and its discharge point. The forcemain discharges at the sanitary sewer manhole approximately 600 feet south of the pump station in Highway 51. The station does not include provisions for hydrogen sulfide control in the forcemain.

Power & Control Systems: The pump station is supplied with 240-volt 3-phase power. The station does not have an auxiliary power generator. In the event of a power outage, the PLC and radio telemetry are powered by an uninterruptible power supply and alarms are sent to the City's SCADA system. Operators bring a trailer-mounted generator to the pump station. There is a manual transfer switch that directs power to the pump station from the generator instead of the grid.

The pump control panel is a Flygt Multirode. The pumps operate at a single speed. The pump station alternates running each pump to balance usage.

The pump station is equipped with an automatic level control system. The primary level control element is a Flygt multisensor probe mounted in the wetwell. The station does not have a redundant pump control probe. A Flygt probe detects high level conditions and initiates an alarm.

The pump station utilizes the original power and control equipment that was installed in 2005. It is expected that the control system will need to be entirely replaced and upgraded during the planning period. It is recommended that a generator, redundant level control system and dedicated overflow sensor also be installed. The power service and power distribution equipment are not expected to need improvements during the planning period.

SCADA: The station is monitored remotely using the City's SCADA system. The station's PLC communicates with the City's SCADA system by radio telemetry. The PLC communicates alarm conditions to the SCADA system.

Summary: Considering that the pump station was constructed in 2005, it is anticipated that the station's power & control equipment will need to be entirely replaced and upgraded within the planning period. It is also recommended that a generator be installed at the pump station. Otherwise the rest of the station is in relatively good condition.

4.4.5.3 Riverview Pump Station

Overview: Riverview Pump Station was constructed in its current location in 1998. It was originally located lower in the flood plain at the former location of the City's wastewater treatment facility. In 2019 the City upgraded the pumps, piping, and power & control systems. The Riverview Pump Station has the largest capacity of any sewage lift station in the City. This station collects wastewater from the entirety of Basin B (the southern and central parts of the City). The pump station discharges wastewater directly to the wastewater treatment plant headworks via a common forcemain with the Oak Street Pump Station. The main pump station components are a control building, concrete wetwell with submersible pumps, valve vault, forcemain, auxiliary power generator, and outdoor fuel tank.

Figure 4-5 | Riverview Pump Station

Location: The pump station is located two hundred feet northeast of the intersection of Main Street and B Street. Based on conversations with City staff, the influent sewer and driveway are located within an easement that is also used by the adjacent business.

Site Improvements: The site has gravel surfacing and a gravel driveway. The station is surrounded by a barbed wire security fence with privacy slats. Gates to the pump station are locked at all times. Crane trucks are able to access the site. It is very difficult for Public Works to access the site with a vacuum truck due to the narrow driveway, retaining wall, and approach from the park. The site also has an overhead light.

Control Building: The masonry building provides shelter for the pump station power, control and telemetry equipment. It also provides shelter for the auxiliary power generator in a separate room.

Wetwell & Sewers: Wastewater is conveyed to the pump station wetwell via an 18” PVC influent sewer with HDPE baffle. The pump station has a 12-foot diameter concrete wetwell with cast-in-place top and bottom slabs.

The station does not have a dedicated overflow pipe. In the event of an overflow, wastewater will overflow through the top of an upstream manhole. The lowest upstream manhole has its lid bolted down (manhole B-174). Therefore, an overflow would also overtop the second lowest manhole which is immediately south of the Riverview Park Amphitheatre (manhole B-175).

Pumps & Discharge Piping: Two 85-horsepower Flygt submersible pumps discharge wastewater from the wetwell via 12-inch diameter ductile iron piping. The design criteria for the pumps and equipment are outlined above (Table 4-4). The valve vault contains three isolation valves, two check valves, dismantling joints, pressure gauges and an air release and vacuum break valve (ARV). The ARV vents sewer gas in to the valve vault, which is a hazard. Sewer gas contains hydrogen sulfide, which is toxic and flammable. The vent piping should be rerouted outside of the confined work space to open air. Adjacent to the valve vault there is a bypass pump port.

Forcemain: There is approximately 40 feet of 12-inch ductile iron forcemain within the pump station site that was installed in 2019. This connects to 140 feet of 14-inch ductile iron forcemain that passes through 22-inch diameter steel casing underneath Ash Creek. 1,027 feet of 14-inch diameter PVC C-905 then conveys wastewater to the manifold with the Oak Street Pump Station. Wastewater is then conveyed by approximately 3,600 feet of 16-inch PVC C-905 forcemain to the WWTP headworks. The forcemain’s sewage air release and vacuum break valves were replaced in 2019. The station does not include provisions for hydrogen sulfide control in the forcemain.

Power & Control Systems: The pump station is supplied with 480-volt 3-phase power. The station also utilizes an onsite auxiliary power generator to provide backup power. In the event of a power outage, an automatic transfer switch automatically directs power to the pump station from the generator instead of the grid. The generator is installed in the building. The fuel tank is installed on a concrete pad outside of the control building. There is a concrete wall surrounding the tank for protection and spill containment. The fuel tank provides 24-hours of fuel at 100% load.

The pumps are run with variable frequency drives. The pump control panel is a Flygt MultiSmart. The pump station alternates running each pump to balance usage.

The pump station is equipped with an automatic level control system. The primary level control element is a pressure transducer mounted in the wetwell. In addition to the primary level control system, the station includes a backup level control system that consists of float switches. The highest float switch detects overflow conditions and initiates an alarm condition.

SCADA: The station is monitored remotely using the City’s SCADA system. The station’s PLC communicates with the City’s SCADA system by radio telemetry. The PLC communicates alarm conditions to the SCADA system.

Summary: The Riverview Pump Station was upgraded in 2019. As such, it is expected to serve the City well throughout the planning period with normal maintenance activities. Typical maintenance activities include building maintenance, normal pump maintenance, generator maintenance, periodic upgrades to the telemetry equipment, etc. One small but important improvement is to modify the ARV piping to vent outside of the valve vault. These activities should be funded under normal operation and maintenance budgets and are not included as capital improvement projects in this document. No major capital improvements are anticipated during the planning period.

4.4.5.4 Briar Road Pump Station

Overview: The Briar Road Pump Station was constructed in 2002 to serve the Freedom Estates subdivision. This station collects wastewater from services along Independence Way, River Oak Road and Briar Road (Sub-basin B4). This pump station discharges wastewater to Sub-basin B2 (served by the Maple Pump Station). The main pump station components are a concrete wetwell with submersible pumps, valve vault, forcemain, and electrical enclosures. The pump station is a packaged Flygt unit.

Figure 4-6 | Briar Road Pump Station

Location: The pump station is located on the northeast corner of the intersection of Briar Road and Independence Way.

Site Improvements: The site has landscaped surfacing immediately around the pump station. There is a curb, a sidewalk, and landscaping between the pump station and the asphalt roadway. Vacuum trucks and crane trucks are able to access the site to complete repairs and maintenance, but have to temporarily block the sidewalk to do so. The vault hatches and the electrical enclosures are typically locked at all times.

Control Shelter: The pump station has outdoor-rated electrical enclosures that house the pump station's power, control and telemetry equipment. The pump station also has a roofed shelter that provides protection from excess sun, wind, and rain.

Wetwell & Sewers: Wastewater is conveyed to the pump station wetwell by a single 8-inch influent sewer. The pump station has a 6-foot diameter concrete wetwell with cast-in-place top & bottom slabs. The station has a dedicated overflow pipe that discharges to the same manhole as the forcemain (MH B-169). This manhole is 30 feet northwest of the wetwell. In some high flow events, water in the downstream sewer backs up in to the wetwell through the overflow pipe. In this situation the station is pumping in a circle. It is recommended that a check valve be installed in the overflow pipe to prevent this.

Pumps & Discharge Piping: Two 3-horsepower Flygt submersible pumps discharge wastewater from the wetwell via 4-inch ductile iron piping. The design criteria for the pumps and equipment are outlined above (Table 4-4). Each pump is fit with an isolation valve and a check valve in the valve vault.

Forcemain: There is approximately 40 feet of 4-inch PVC C-900 forcemain between the pump station and its discharge point. The forcemain discharges at the sanitary sewer manhole northwest of the intersection of Briar Road and Independence Way. The station does not include provisions for hydrogen sulfide control in the forcemain.

Power & Control Systems: The pump station is supplied with 240-volt single-phase power. The station does not have an auxiliary power generator. In the event of a power outage, the PLC and radio telemetry are powered by an uninterruptible power supply and alarms are sent to the City's SCADA system.

Operators bring a trailer-mounted generator to the pump station. There is a manual transfer switch that directs power to the pump station from the generator instead of the grid.

The pump control panel is a Flygt Multirode. The pumps operate at variable speeds using variable frequency drives. The pump station alternates running each pump to balance usage.

The pump station is equipped with an automatic level control system. The primary level control element is a Flygt multisensor probe mounted in the wetwell. In addition to the primary level control system, the station has a backup level Flygt single sensor probe that detects high level conditions and initiates an alarm.

SCADA: The station is monitored remotely using the City's SCADA system. The station's PLC communicates with the City's SCADA system by radio telemetry. The PLC communicates alarm conditions to the SCADA system.

Summary: Considering that the pump station was constructed in 2002, it is anticipated that the station's power distribution & control equipment will need to be entirely replaced and upgraded within the planning period. The recommended capital improvement plan includes a project for this.

4.4.5.5 Albert Street Pump Station

Overview: The Albert Street Pump Station was constructed in 1998 as a part of city-wide improvements to the sanitary sewer system. This station collects wastewater from a small Sub-basin consisting of two City blocks (Sub-basin B3). This pump station discharges wastewater to Sub-basin B1, which is served by the Riverview Pump Station. The main pump station components are a fiberglass wetwell with submersible pumps, fiberglass valve vault, forcemain, and electrical enclosures. The pump station is a packaged unit manufactured by Hydronix.

Figure 4-7 | Albert Street Pump Station

Location: The pump station is located 180 feet north of the intersection of Butler Street and Log Cabin Street.

Site Improvements: The site has gravel surfacing and a gravel driveway. The station is surrounded by a barbed wire security fence with privacy slats. Gates to the pump station are locked at all times. Vacuum trucks and crane trucks are able to access the site to complete repairs and maintenance. The site also has an overhead light.

Control Shelter: Outdoor-rated electrical enclosures provide shelter for the pump station's power, control and telemetry equipment.

Wetwell & Sewers: Wastewater is conveyed to the pump station wetwell by two 8-inch influent sewers. The pump station has a 6-foot diameter fiberglass wetwell with cast-in-place bottom slab. The station does not have a dedicated overflow pipe. In the event of an overflow, wastewater will flow through the top of the lowest upstream manhole. This manhole is 20 feet north of the wetwell (manhole B-25).

Pumps & Discharge Piping: Two 5-horsepower Hydronix submersible pumps discharge wastewater from the wetwell via 4-inch ductile iron piping. The design criteria for the pumps and equipment are outlined above (Table 4-5). Each pump is fitted with an isolation plug valve, a check valve, and a pressure gauge. There is a pneumatic pinch valve in the valve vault that is not in use. It was originally intended for draining the forcemain to control hydrogen sulfide corrosion.

Forcemain: There is approximately 340 feet of 4-inch PVC C-900 forcemain between the pump station and its discharge point. The forcemain discharges at the sanitary sewer manhole between Log Cabin Street and Walnut Street on Butler Street. The station does not include provisions for hydrogen sulfide control in the forcemain.

Power & Control Systems: The pump station is supplied with 480-volt 3-phase power. The pump station was upgraded with the addition of a PLC and radio telemetry in 2008. The station does not have an auxiliary power generator. In the event of a power outage, the PLC and radio telemetry are powered by an uninterruptible power supply and alarms are sent to the City's SCADA system. Operators bring a trailer-mounted generator to the pump station. There is a manual transfer switch that directs power to the pump station from the generator instead of the grid.

The pumps operate at a single speed. The pump station alternates running each pump to balance usage.

The pump station is equipped with an automatic level control system. The level control element is a set of four float switches mounted in the wetwell. The highest float switch detects overflow conditions and initiates an alarm condition.

The pump station utilizes the original power distribution and control equipment that was installed in 1998. Due to their age, it is expected that these systems will need to be entirely replaced and upgraded during the planning period. It is recommended that a redundant level control system, onsite generator, and dedicated overflow sensor also be installed. The power service to the station is not expected to need any improvements during the planning period.

SCADA: The station is monitored remotely using the City's SCADA system. The station's PLC communicates with the City's SCADA system by radio telemetry. The PLC communicates alarm conditions to the SCADA system.

Summary: Considering that the pump station and forcemain were constructed in 1998, some components are expected to reach the end of their useful lifespan's during the planning period. It is anticipated that the station's power distribution & control systems and instruments will need to be replaced and upgraded. The recommended capital improvement plan includes this work.

4.4.5.6 Maple Drive Pump Station

Figure 4-8 | Maple Drive Pump Station

Overview: The Maple Drive Pump Station was originally constructed in 1971. It was upgraded in 2002 when the Freedom Estates subdivision and Briar Road Pump Station were constructed. Maple Drive Pump Station collects wastewater from services in the southeastern part of the City (Sub-basin B2), including discharge from the Briar Road Pump Station. This pump station discharges wastewater to Sub-basin B1, which is served by the Riverview Pump Station. The main pump station components are a concrete wetwell with submersible pumps, drywell with valves and piping, forcemain, and electrical enclosures.

Location: The pump station is located at the intersection of Maple Drive and Maple Court. As shown in the above figure, the pump station is located between the curb and sidewalk.

Site Improvements: The site has landscaped surfacing immediately around the pump station. Vacuum trucks and crane trucks are able to access the site to complete repairs and maintenance. The drywell hatch and the electrical enclosures are typically locked at all times.

Control Shelter: Outdoor-rated electrical enclosures provide shelter for the pump station's power, control and telemetry equipment.

Wetwell & Sewers: Wastewater is conveyed to the pump station wetwell by two 8-inch influent sewers. The pump station has a 6-foot diameter concrete wetwell with a fiberglass drywell on top. The station does not have a dedicated overflow pipe. In the event of an overflow, wastewater will overflow through the top of the lowest upstream manhole. The lowest manhole is to be determined. It is expected to be on Maple Drive, which is either manhole B-179 or B-182.

Pumps & Discharge Piping: Two 3-horsepower Flygt submersible pumps discharge wastewater from the wetwell via 4-inch ductile iron piping. Piping is flanged between the forcemain the pumps. It is difficult to service the pumps in this configuration. The design criteria for the pumps and equipment are outlined above (Table 4-5). Each pump is fit with an isolation valve and a check valve in the drywell.

Forcemain: There is 170 feet of 4-inch schedule 40 steel forcemain between the pump station and its discharge point. The forcemain discharges at the sanitary sewer manhole east of the pump station at the intersection of 4th Street and Maple Drive. The station does not include provisions for hydrogen sulfide control in the forcemain. The forcemain is recommended to be replaced due to corrosive soil conditions and age.

Power & Control Systems: The pump station is supplied with 240-volt power. The station does not have an auxiliary power generator. In the event of a blackout, the PLC and radio telemetry are powered by an uninterruptible power supply and alarms are sent to the City's SCADA system. Operators bring a trailer-mounted generator to the pump station. There is a manual transfer switch that directs power to the pump station from the generator instead of the grid.

The pumps operate at a single speed. Soft starters are used to ramp up the motors when they are turned on. The pump station alternates running each pump to balance usage.

The pump station is equipped with an automatic level control system. The level control element is a set of four float switches mounted in the wetwell. The highest float switch detects overflow conditions and initiates an alarm condition.

The pump station utilizes the original power distribution and control equipment that was installed in 2002. Due to their age, it is expected that these systems will need to be entirely replaced and upgraded during the planning period. It is recommended that a redundant level control system, onsite generator, and dedicated overflow sensor also be installed. The power service to the station is not expected to need any improvements.

SCADA: The station is monitored remotely using the City's SCADA system. The station's PLC communicates with the City's SCADA system by radio telemetry. The PLC communicates alarm conditions to the SCADA system.

Summary: With over 50 years of service since it was originally constructed, the Maple Drive Pump Station is the oldest of the City's pump stations still in use. The pump station and forcemain are recommended to be replaced early in the planning period. Evaluation of the pumping and forcemain capacities are addressed in Chapter 6: Collection System Evaluation.

4.4.5.7 9th Street Pump Station

Overview: The 9th Street Pump Station was first constructed in 1999 as a part of system-wide improvements to the City's sanitary sewers. This station collects wastewater from the entirety of Basin C, the south and southwestern part of the City. The pump station discharges wastewater directly to the treatment plant headworks. The pump station's main components are a masonry control building, concrete wetwell with submersible pumps, valve vault, forcemain, and auxiliary power generator.

Figure 4-9 | 9th Street Pump Station

The 9th Street Pump Station has been identified as a high priority facility for improvements. The facility regularly experiences wet-weather flows in excess of its firm capacity where two pumps run simultaneously. Construction documents have been prepared for increasing the size of the pumps and associated improvements.

Location: The pump station is located in an abandoned railroad grade north of the intersection of 9th Street and Main Street. The pump station site is owned by the City.

Site Improvements: The site has gravel surfacing and a gravel driveway. The station is surrounded by a barbed wire chain link fence. Gates to the pump station are locked at all times. Vacuum trucks and crane trucks are able to access the site to complete repairs and maintenance.

Control Building: The masonry building provides shelter for the pump station power, control and telemetry equipment.

Wetwell & Sewers: Wastewater is conveyed to the pump station wetwell via a 21” diameter PVC sewer and an 8” diameter PVC sewer. The pump station has an 8-foot diameter concrete wetwell with cast-in-place top and bottom slabs. The station does not have a dedicated overflow pipe. In the event of an overflow, wastewater will overflow through the top of the lowest upstream manhole. This manhole is at the north end of 9th street in the cul-de-sac (manhole C-2).

Pumps & Discharge Piping: Two 20-horsepower Flygt submersible pumps discharge wastewater from the wetwell. There is 8-inch diameter ductile-iron piping within the wetwell and valve vault. The design criteria for the pumps and equipment are outlined above (Table 4-5). Each pump is fitted with a check valve and isolation valve in the valve vault originating from the 1999 construction.

Forcemain: There is approximately 2,100 feet of 10-inch PVC C-900 forcemain that conveys wastewater from the pump station to the treatment plant headworks. There is one ARV on the forcemain in a manhole that was installed roughly in 2010. The station does not include provisions for hydrogen sulfide control in the forcemain.

Power & Control Systems: The pump station is supplied with 460-volt 3-phase power. This power service was installed in 1999. The station also utilizes an onsite auxiliary power generator to provide backup power. In the event of a blackout, an automatic transfer switch (ATS) automatically directs power to the pump station from the generator instead of the grid. The generator with sub-base fuel tank are mounted on a concrete pad inside of the control building. The fuel tank is sized to provide 24 hours of runtime for one pump running at 100% load.

The pumps operate at a single speed without soft starters. The pump station alternates running each pump to balance usage. The pump station is equipped with an automatic level control system.

SCADA: The station is monitored remotely using the City’s SCADA system. The station’s PLC communicates with the City’s SCADA system by radio telemetry. The PLC communicates alarm conditions to the SCADA system.

Summary: As previously discussed, the pump station is in need of immediate upgrades to increase the capacity for sewer flows. Additionally, a substantial amount of development is anticipated in Basin C, which would further increase flows to the station. The project to improve the pump station is discussed in more detail in Chapter 8.

4.4.5.8 Mt. Fir Pump Station

Overview: The Mt. Fir Pump Station was constructed in 1998 to serve the Mountain Fir Estates subdivision. This station collects wastewater from Sub-basin C3. This pump station discharges wastewater to a sewer in Sub-basin C1. The discharged wastewater then flows by gravity to the 9th Street Pump Station. Mt. Fir's main pump station components are a masonry control building, concrete wetwell with submersible pumps, valve vault, forcemain, and auxiliary power generator.

Figure 4-10 | Mt. Fir Pump Station

Location: The pump station is located on the northwest corner of Chestnut Street and S 8th Street.

Site Improvements: The site has asphalt surfacing and a driveway. The station is surrounded by a chainlink fence with privacy slats. Gates to the pump station are locked at all times. Vacuum trucks and crane trucks are able to access the site to complete repairs and maintenance.

Control Building: The small masonry building provides shelter for the pump station power, control and telemetry equipment.

Wetwell & Sewers: Wastewater is conveyed to the pump station wetwell via a single 12" PVC influent sewer. The pump station has an 8-foot diameter concrete wetwell with cast-in-place top and bottom slabs. The station has an overflow pipe, but it is no longer operational. The overflow used to daylight at a wetland nearby. The outfall area has since been developed for homes. In the event of an overflow, wastewater will overflow through the top of the lowest upstream manholes. These area the manholes at the intersection of Maple and S 9th Streets (MH C-108 and C-94).

Pumps & Discharge Piping: Two 7.5-horsepower Flygt submersible pumps discharge wastewater from the wetwell via 6-inch diameter ductile iron piping. The design criteria for the pumps and equipment are outlined above (Table 4-5). The wetwell has space and piping to accommodate a third pump. Each pump is fit with a check valve and isolation valve that are in the valve vault. An 8-inch diameter ductile iron manifold is in the valve vault along with the original air injection piping.

Forcemain: There is approximately 1,500 feet of 8-inch PVC C-900 forcemain that conveys wastewater to manhole C-79, northwest of Cedar Court. The station originally had an operational hydrogen sulfide mitigation system, but it is no longer in use.

Power & Control Systems: The pump station is supplied with 230-volt 3-phase power. The station also utilizes an onsite auxiliary power generator to provide backup power. In the event of a blackout, an automatic transfer switch automatically directs power to the pump station from the generator instead of the grid. The generator with sub-base fuel tank is mounted on a concrete pad outside of the control building. The fuel tank is sized to provide 24 hours of runtime for three pumps running at 100% load.

The pump control panel is a Flygt Multirode. The pumps operate at a single speed. The pumps do not utilize soft start controls. The pump station alternates running each pump to balance usage.

The pump station is equipped with an automatic level control system. The primary level control element is a Flygt multilevel probe mounted in the wetwell. This multiprobe is also used to signal a high level alarm. The station does not have a redundant level control sensor or a dedicated overflow sensor.

The pump station utilizes the original power distribution and control equipment that was installed in 1998. Due to their age, it is expected that these systems will need to be entirely replaced and upgraded during the planning period. It is recommended that a redundant level control system, and dedicated overflow sensor also be installed. The power service to the station is not expected to need any improvements.

SCADA: The station is monitored remotely using the City's SCADA system. The station's PLC communicates with the City's SCADA system by radio telemetry. The PLC communicates alarm conditions to the SCADA system.

Summary: Considering that the pump station and forcemain were constructed in 1998 some components are expected to reach the end of their useful lifespan's during the planning period. It is anticipated that the station's power distribution & control equipment will need to be entirely replaced and upgraded. The recommended capital improvement plan includes this work.

Evaluation of the pumping and forcemain capacities are addressed in Chapter 6: Collection System Evaluation.

4.4.5.9 13th Street Pump Station

Overview: The 13th Street Pump Station was constructed in 2001 to serve the Falcon Loop Subdivision. This station collects wastewater from Falcon Loop, F Street, and parts of Collins Road and S 13th Street (Sub-basin C2). This pump station discharges wastewater to Sub-basin C1 (served by the 9th Street Pump Station). The main pump station components are a concrete wetwell with submersible pumps, valve vault, forcemain, and electrical enclosures. The 13th Street Pump Station was originally located approximately 310 feet south of its existing location. At the time the Falcon Loop Subdivision was built, the existing pump station and influent sewers were built which entirely replaced the previous sewers and pump station.

Figure 4-11 | 13th Street Pump Station

Location: The pump station is located east of the intersection of S 13th Street and F Street. The pump station is located in the public right of way.

Site Improvements: The site has gravel surfacing immediately around the pump station. Bollards separate the pump station from the asphalt roadway. Vacuum trucks and crane trucks are able to access the site to complete repairs and maintenance. The vault hatches and the electrical enclosures are typically locked at all times.

Control Shelter: Outdoor-rated electrical enclosures provide shelter for the pump station's power, control and telemetry equipment.

Wetwell & Sewers: Wastewater is conveyed to the pump station wetwell by a single 8-inch influent sewer. The pump station has a 6-foot diameter concrete wetwell with cast-in-place top & bottom slabs. The station does not have a dedicated overflow pipe. In the event of an overflow, wastewater will overflow through the top of the lowest upstream manhole. This manhole is 310 feet south of the wetwell near the former location of the pump station (MH C-41.1). The wetwell is poorly vented; and sewer gas accumulates in the wetwell.

Pumps & Discharge Piping: Two 3-horsepower Flygt submersible pumps discharge wastewater from the wetwell via 4-inch ductile iron piping. The design criteria for the pumps and equipment are outlined above (Table 4-6). Each pump is fit with an isolation valve and a check valve in the valve vault. There is a pneumatic pinch valve in the valve vault that is not in use. It was originally intended for draining the forcemain to control hydrogen sulfide corrosion.

Forcemain: There is approximately 320 feet of 4-inch PVC C-900 forcemain between the pump station and its discharge point. The forcemain discharges at the sanitary sewer manhole in the intersection of S 13th Street and E Street. The station does not include provisions for hydrogen sulfide control in the forcemain.

Power & Control Systems: The pump station is supplied with 240-volt 3-phase power. The station does not have an auxiliary power generator. In the event of a blackout, the PLC and autodialer are powered by an uninterruptible power supply and alarms are sent to the City's SCADA system. Operators bring a trailer-mounted generator to the pump station. There is a manual transfer switch that directs power to the pump station from the generator instead of the grid.

The pump control panel is a Flygt Multirode. The pumps operate at a single speed. The pump station alternates running each pump to balance usage.

The pump station is equipped with an automatic level control system. The primary level control element is a Flygt multilevel probe mounted in the wetwell. This multiprobe is also used to signal a high-level alarm. The station does not have a redundant level control sensor or a dedicated overflow sensor.

The pump station utilizes the original power distribution and control equipment that was installed in 2001. Due to their age, it is expected that these systems will need to be entirely replaced and upgraded during the planning period. It is recommended that a redundant level control system, onsite generator, and dedicated overflow sensor also be installed. The power service to the station is not expected to need any improvements during the planning period.

SCADA: The station is monitored remotely using the City's SCADA system. The station's PLC communicates with the City's SCADA system by radio telemetry. The PLC communicates alarm conditions to the SCADA system.

Summary: Considering that the pump station was constructed in 2001, some components are expected to reach the end of their useful lifespan's during the planning period. It is anticipated that the station's power distribution & control equipment will need to be entirely replaced and upgraded. The recommended capital improvement plan includes a project for this. However, depending on how development proceeds in the area, this project may not be necessary. There is a substantial amount of development that is anticipated to occur south of the 13th Street Pump Station in Basin C. The recommended capital improvement plan includes a new pump station and sewer that would allow the 13th Street Pump Station and forcemain to be decommissioned. It is not recommended that the City undertake capital improvement projects to upgrade the 13th Street Pump Station if they can be avoided by utilizing the new pump station.

The capital improvement plan includes both of these projects, but only one is likely to be needed during the planning period.

Evaluation of the pumping and forcemain capacities are addressed in Chapter 6: Collection System Evaluation.

4.4.5.10 Lagoon Pump Station

Overview: The Lagoon Pump Station collects wastewater from the entirety of Basin D and provides plant pumping. This pump station discharges wastewater directly to the treatment plant headworks. The main pump station components are a control building, concrete wetwell with submersible pumps, valve vault, and forcemain. The pump station was last upgraded in 1999. The pump station originally had dry-pit pumps, but was converted to a submersible configuration in 1999.

Figure 4-12 | Lagoon Pump Station

Location: The pump station is located at the City's wastewater treatment plant near the control building. The pump station site is owned by the City.

Site Improvements: The site has gravel surfacing and a gravel driveway. The station is surrounded by a barbed wire security fence. Gates to the pump station are locked at all times. Vacuum trucks are able to access the site to complete repairs and maintenance. The site also has a jib crane for pump removal.

Control Building: The control building is a masonry structure set on top of a cast in place drywell. It provides shelter for the pump station power, control and telemetry equipment.

Wetwell & Sewers: Wastewater is conveyed to the pump station wetwell via a single 15" PVC influent sewer. The pump station has an open-top concrete wetwell with cast-in-place walls and bottom slab. The wetwell is approximately 12 feet by 12 feet square. There is a guardrail around the wetwell. The station does not have a dedicated overflow pipe. In the event of an overflow, wastewater will overflow through the top of the upstream manhole with the lowest rim in the basin. This manhole is at the southwest corner of sewage lagoon cell 4 (manhole D-12).

Pumps & Discharge Piping: Two 40-horsepower Flygt submersible pumps discharge wastewater from the wetwell via 10-inch ductile iron piping. The design criteria for the pumps and equipment are outlined above (Table 4-6). The valve vault contains three isolation valves, two check valves, and pressure gauges. Each pump is fit with an isolation valve and a check valve. According to the 1998 construction drawings, there is space and piping to add a third pump.

Forcemain: There is approximately 1,500 feet of 10-inch PVC C-900 forcemain between the pump station and the WWTP headworks. The forcemain was constructed as a part of the system-wide improvements in 1999. The station does not include provisions for hydrogen sulfide control in the forcemain.

Power & Control Systems: The pump station is supplied with 480-volt 3-phase power. A new power service was installed in 2020 as a part of the Recycled Water Use Facility improvements. The station also utilizes an onsite auxiliary power generator to provide backup power. This generator also provided backup power to the wastewater treatment plant control building. In the event of a power outage, an automatic transfer switch automatically directs power to the pump station from the generator instead of the grid. The generator with sub-base fuel tank are mounted on a concrete pad outside of the control building. The fuel tank provides the pump station at least 24-hours of fuel at 100% load.

The pumps operate at a single speed. Soft starters are used to ramp the pump speeds up and down during startup and shutdown respectively. The pump station alternates running each pump to balance usage.

The pump station is equipped with an automatic level control system. The primary level control element is a set of four floats mounted in the wetwell. The highest float switch is also used to signal a high-level alarm. The station does not have a redundant level control sensor or a dedicated overflow sensor.

The pump station utilizes the original power and control equipment that was installed in 1999. Due to their age, it is expected that these systems will need to be entirely replaced and upgraded during the planning period. It is recommended that a redundant level control system and dedicated overflow sensor also be installed. The power service to the station is not expected to need any improvements during the planning period.

SCADA: The station is monitored remotely using the City's SCADA system. The station's PLC communicates with the City's SCADA system by radio telemetry. The PLC communicates alarm conditions to the SCADA system.

Summary: Considering that the pump station was constructed in 1999 some components are expected to reach the end of their useful lifespan's during the planning period. It is anticipated that the station's power distribution & control systems and instruments will need to be entirely replaced and upgraded. The recommended capital improvement plan includes this work.

Evaluation of the pumping and forcemain capacities are addressed in Chapter 6: Collection System Evaluation.

4.4.5.11 Gun Club Road Pump Station

Overview: The Gun Club Road Pump Station was constructed in 2008 to serve the Legacy Oaks apartments. This station collects wastewater from Sub-basin D2. This pump station discharges wastewater to Sub-basin D1. The discharged wastewater then flows by gravity to the Lagoon Pump Station. The main pump station components are a masonry control building, concrete wetwell with submersible pumps, valve vault, forcemain, and auxiliary power generator.

Figure 4-13 | Gun Club Road Pump Station

Location: The pump station is located on the west side of Gun Club Road between Marigold Drive and Picture Street. The pump station site is owned by the City.

Site Improvements: The site has asphalt surfacing and a driveway. The pump station does not have fencing. The building and vault hatches are locked at all times. Vacuum trucks and crane trucks are able to access the site to complete repairs and maintenance.

Control Building: The small masonry building provides shelter for the pump station power, control and telemetry equipment. The building has two rooms, one for power and control equipment and one for the generator. The generator room has an insulated and enclosed attic space with a gable vent, and is therefore able to maintain a relatively consistent temperature. The control room has an attic space separate from the generator room with rafters and roof that are exposed to the control room. This exposure creates a hot environment in the control room during warm weather. It is recommended that improvements be made to maintain a more consistent and lower ambient temperature for the electrical equipment. A possible solution is to finish the control room with a standard insulated and vented attic space. This would consist of enclosing the ceiling with gypsum board, insulating the ceiling, and adding passive vents to the attic space. There is a gable-mounted exhaust fan in the attic space currently used to vent the control room. A ceiling-mounted vent and ducting to the gable fan should be installed to allow the control room to continue to be vented even after the ceiling is enclosed. These changes will help ensure the longevity of the power and control equipment.

Wetwell & Sewers: Wastewater is conveyed to the pump station wetwell via a single 8” PVC influent sewer. The pump station has a 7-foot diameter concrete wetwell with cast-in-place top and bottom slabs. The station does not have a dedicated overflow pipe. In the event of an overflow, wastewater will overflow through the top of two upstream manholes with the lowest rims in the basin. These manholes are adjacent to the Legacy Oaks Apartments (manholes D-107 and D-112).

Pumps & Discharge Piping: Two 20-horsepower Flygt submersible pumps discharge wastewater from the wetwell via 4 and 6-inch diameter ductile iron piping. The design criteria for the pumps and equipment are outlined above (Table 4-6). Each pump is fit with a check valve and an isolation valve in the valve vault.

Forcemain: There is approximately 1,950 feet of 6-inch PVC C-900 forcemain that conveys wastewater to manhole D-23 near the intersection of Gun Club Road and Rhoda Lane. There are two air vents on the forcemain where it crosses Ash Creek. The station does not include provisions for hydrogen sulfide control in the forcemain.

Power & Control Systems: The pump station is supplied with 460-volt 3-phase power. The station also utilizes an onsite auxiliary power generator to provide backup power. In the event of a blackout, an automatic transfer switch automatically directs power to the pump station from the generator instead of the grid. The generator with sub-base fuel tank is mounted inside the control building. The fuel tank is sized to provide at least 24 hours of runtime for one pump running at 100% load.

The pump control panel is a Flygt Multirode. The pumps operate at variable speed. The pump station alternates running each pump to balance usage.

The pump station is equipped with an automatic level control system. The primary level control element is a Flygt pressure transducer mounted in the wetwell. The station also includes a single sensor probe that detects high level alarm conditions.

The pump station utilizes the original power and control equipment that was installed in 2008. No improvements to these systems are anticipated during the planning period.

SCADA: The station is monitored remotely using the City's SCADA system. The station's PLC communicates with the City's SCADA system by radio telemetry. The PLC communicates alarm conditions to the SCADA system.

Summary:

Considering that the pump station and forcemain were constructed in 2008 some components are expected to reach the end of their useful lifespan's during the planning period. It is anticipated that the station's power & control systems and instruments will need to be entirely replaced and upgraded. The recommended capital improvement plan includes this work.

It is recommended that the attic be enclosed in the control room, as previously discussed. It is expected that an improvement of this nature would also be funded by normal operation and maintenance budgets.

Evaluation of the pumping and forcemain capacities are addressed in Chapter 6: Collection System Evaluation.

4.4.5.12 Williams Street Pump Station

Overview: The Williams Street Pump Station and forcemain was constructed in 2021 to serve Basin E. The original Williams Street Pump Station was entirely replaced at this time. The pump station discharges wastewater directly to the wastewater treatment plant headworks. The pump station's main components are a prefabricated fiberglass control shelter, concrete wetwell with submersible pumps, valve vault, ARV manhole and bypass pump port, HDPE forcemain, and auxiliary power generator.

Figure 4-14 | Williams Street Pump Station

Location: The pump station is located west of the intersection of Ash Street and Williams Street within the fenced area of the wastewater treatment plant. The pump station site is not owned by the City. The City has two easements that allow the City to operate and maintain the pump station.

Site Improvements: The site has gravel and asphalt surfacing. The driveway to the pump station is shared with the WWTP. The station is surrounded by a barbed wire chain link fence. Gates to the pump station and WWTP are locked at all times. Vacuum trucks and crane trucks are able to access the site to complete repairs and maintenance. There is an overhead light at the site.

Control Shelter: The small prefabricated fiberglass shelter provides shelter for the pump station power, control and telemetry equipment. The structure is mounted to a concrete slab.

Wetwell & Sewers: Wastewater is conveyed to the pump station wetwell via two PVC influent sewers. The main influent sewer is a 15" diameter pipe. The other influent sewer is an 8" diameter pipe that drains waste from the City's water treatment plant. The pump station has a 7-foot diameter concrete wetwell with cast-in-place top and bottom slabs. The wetwell has a fiberglass sump in the bottom that funnels waste to the pumps. The station has an overflow pipe that is connected to the Independence-Monmouth effluent outfall pipe. This pipe drains to the Willamette River.

Pumps & Discharge Piping: Two 34-horsepower Flygt submersible pumps discharge wastewater from the wetwell. The design criteria for the pumps and equipment are outlined above (Table 4-6). 6-inch diameter stainless steel piping within the wetwell connects to 6-inch and 8-inch diameter ductile iron piping in the valve vault an ARV manhole. The ARV piping also serves as a bypass pump port in the event of an emergency. Each pump is fit with a check valve and isolation valve in the valve vault. The pump station has an identical spare pump in the event that one pump must be removed for prolonged repair.

Forcemain: After the ARV manhole there is approximately 960 feet of 10-inch DR 13.5 HDPE forcemain that conveys wastewater to the plant headworks. The station does not include provisions for hydrogen sulfide control in the forcemain.

Power & Control Systems: The pump station is supplied with 480-volt 3-phase power. The station also utilizes an onsite auxiliary power generator to provide backup power. In the event of a blackout, an automatic transfer switch automatically directs power to the pump station from the generator instead of the grid. The generator with sub-base fuel tank is mounted on a concrete pad outside of the control building. The sub-base fuel tank is approximately 330 gallons. At 100% load the generator has a run time of approximately 36 hours. This generator was originally installed at the Lagoon Pump Station. It was moved to the Williams Street Pump Station in 2021 when the pump station was constructed.

The pump control panel is a Flygt Smartrun. The pumps operate with variable frequency drives. The pump station controls automatically balance usage of each pump. The pump station controls are capable of some notable features. These include forcemain cleaning cycles, operating the pumps in reverse to clear debris, and drawing down the wetwell to extra low levels in order to evacuate debris.

The pump station is equipped with an automatic level control system. The primary level control element is a submerged pressure transducer. In addition to the primary level control system, the station includes a backup level control system that consists of a Flygt multisensor probe mounted in the wetwell. If liquid level rises above normal operating ranges and submerges the sensors on the redundant level probe, both pumps will start. An additional single sensor probe detects overflow conditions and initiates an alarm condition.

SCADA: The station is monitored remotely using the City's SCADA system. The station's PLC communicates with the City's SCADA system by radio telemetry. The PLC communicates alarm conditions to the SCADA system.

Summary: The pump station and forcemain were constructed in 2021. It is expected to serve the City's needs through the planning period without any major improvements, assuming that regular repairs and maintenance are performed.

During the planning period, it is recommended that the generator be evaluated for replacement since it was roughly 20 years old at the time it was installed at this location. A project is included as a placeholder for this, which may not be needed during the planning period.

4.4.5.13 Stryker Road Pump Station

Overview: The Stryker Road Pump Station was constructed in 1998 to serve the northern part of the Independence Air Park and the surrounding area. This station collects wastewater from Corsair Drive, Skyraider Drive, and part of Stryker Road (Sub-basin E2). This pump station discharges wastewater to Sub-basin E1 (served by the Williams Street Pump Station). The main pump station components are a fiberglass wetwell, fiberglass drywell with end-suction pumps, valves, forcemain, and electrical enclosures. The station is a packaged unit manufactured by Hydronix.

Figure 4-15 | Stryker Road Pump Station

Location: The pump station is located south of the intersection of Skyraider Drive and Stryker Road.

Site Improvements: The site has gravel surfacing immediately around the pump station. There is a curb and a sidewalk between the pump station and the asphalt roadway. Vacuum trucks and crane trucks are able to access the site to complete repairs and maintenance, but have to temporarily block the sidewalk to do so. The vault hatches and the electrical enclosures are typically locked at all times.

Control Shelter: Outdoor-rated electrical enclosures provide shelter for the pump station's power, control and telemetry equipment.

Wetwell & Sewers: Wastewater is conveyed to the pump station wetwell by a single 8-inch influent sewer. The pump station collects influent in a 6-foot diameter concrete manhole with precast lid and bottom slab. The station does not have a dedicated overflow pipe. In the event of an overflow, wastewater will overflow through the top of the lowest upstream manhole. This is the manhole at the intersection of Skyraider and Stryker Roads (manhole E-40).

Pumps & Discharge Piping: Two 3-horsepower Hydronix end-suction pumps discharge wastewater from the wetwell via 4-inch ductile iron piping. The design criteria for the pumps and equipment are outlined above (Table 4-7). The end-suction pumps sometimes require manual priming, which is very troublesome for operators. The fiberglass dry well also serves as a valve vault. The dry well has a secure and rain proof lid. Each pump is fit with isolation valves on the inlet and discharge sides of the pumps. Each pump has a wafer style check valve. There is an air injection system that is not in use. This was originally intended to control hydrogen sulfide corrosion in the forcemain. A sump pump provides drainage for the dry well in case the lid leaks.

Forcemain: There is approximately 320 feet of 4-inch PVC C-900 forcemain between the pump station and its discharge point. The forcemain discharges at the sanitary sewer manhole in the intersection of Stryker Road and Stearman Street. The station does not include active provisions for hydrogen sulfide control in the forcemain.

Power & Control Systems: The pump station is supplied with 240-volt single-phase power. The station does not have an auxiliary power generator. In the event of a blackout, the PLC and radio telemetry are powered by an uninterruptible power supply and alarms are sent to the City's SCADA system. Operators bring a trailer-mounted generator to the pump station. There is a manual transfer switch that directs power to the pump station from the generator instead of the grid.

The pumps operate at a single speed. The pump station alternates running each pump to balance usage.

The pump station is equipped with an automatic level control system. The primary level control element is a set of four float switches mounted in the wetwell. The highest float switch detects overflow conditions and initiates an alarm.

The pump station utilizes the original power and control equipment that was installed in 1998. Due to their age, it is expected that these systems may need to be entirely replaced and upgraded during the planning period. The power service is not anticipated to need any improvements.

SCADA: The station is monitored remotely using the City's SCADA system. The station's PLC communicates with the City's SCADA system by radio telemetry. The PLC communicates alarm conditions to the SCADA system.

Summary: Considering that the pump station and forcemain were constructed in 1998, some components are expected to reach the end of their useful lifespan's during the planning period. It is anticipated that the station's power distribution & control systems and instruments will need to be replaced and upgraded. The recommended capital improvement plan includes this work.

As previously discussed, the end-suction pumps sometimes require manual priming, which is time-consuming for operators. When the pumps in the station need to be upgraded, it is recommended that the station be converted to submersible pumps installed in the manhole. It is not anticipated that this will occur during the planning period. Evaluation of the pumping and forcemain capacities are addressed in Chapter 6: Collection System Evaluation.

4.4.6 Infiltration & Inflow

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). As discussed in Chapter 5, though the wastewater influent flow measurements at the treatment plant are not considered to be accurate, they can be used to make some general observations regarding seasonal flow patterns. Plant inflows in the City are strongly influenced by precipitation. Therefore consistent I/I correction work is recommended during the planning period.

The City does not have television inspection equipment and has not inspected most of the mainline pipes and manholes in the last five years. If the City is similar to most communities in Western Oregon, service lateral piping likely contributes a significant amount of I/I, perhaps more than the mainline pipes or manholes.

The City currently allocates approximately $10,000 per year for I/I corrective work. In recent years, the City has rehabilitated manholes, lined pipes, raised cleanouts, and performed mainline repairs using these funds. The City last performed smoke testing over 15 years ago to identify inflow sources. As such, smoke testing should be performed early in the planning period. Faults and connections to storm drainage facilities can be identified by smoke testing and these inflow sources are often the most cost-effective to remove.

As the City's collection system continues to age and deteriorate, groundwater infiltration rates are likely to increase. As such, the City should continue to implement I/I corrective improvements indefinitely. Alternatives for I/I correction are considered in Chapter 6.

4.4.7 Known Collection System Non-Compliance Issues

The City received a letter from the Oregon DEQ summarizing a compliance inspection conducted in March, 2020. This letter identified two sanitary sewer overflows (SSOs) that occurred in 2018. The first was the result of a blocked sewer near 12th and E Street. According to City operators, this area of the sewer system is relatively flat and shallow, so it is subject to blockage. The City consistently makes an effort to clear blockages with jet cleaning and vacuuming from known problem areas before they overflow.

The second overflow was the result of a computer malfunction at the 9th Street Pump Station. A backup alarm has been installed to prevent this issue from happening again. Additionally, the recommended improvements to the 9th Street Pump Station address this problem and are described in Chapter 6.

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.

4.4.8 Collection System Deficiencies

Problems with the Collection System were identified from meetings and discussions with City staff and from field investigations.

The deficiencies in the existing system can generally be divided into three categories: inadequate capacity, end of useful life, and high I/I. 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.

- <u>Inadequate Capacity-</u> Certain components of the existing sanitary sewer system do not provide for current or projected flows. The correction of these types of problems requires replacement or reconstruction of the existing system.
- <u>End of Useful Life</u>- 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 and severe hydrogen sulfide corrosion. The correction of these types of problems requires replacement or reconstruction of the existing system.
- <u>High Infiltration/Inflow</u>- 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.

Table 4-8 outlines the major known problem areas, as well as the category that the problem falls under.

Table 4-8 | Known Collection System Deficiencies

Location	Deficiency Category
H & 3rd Street alley near railroad crossing	Inadequate capacity due to flat grade
9th Street Pump Station discharge rate	Inadequate capacity during high flow events

4.5 EXISTING WASTEWATER TREATMENT AND DISPOSAL SYSTEM

The City owns, operates and maintains the wastewater treatment plant (WWTP) serving the study area. The WWTP is located west of 490 Ash Street in Independence, in the north central part of the City. The WWTP is accessed from a gravel driveway owned by the City on the west side of the intersection of Ash and Williams Streets.

The WWTP consists of a headworks, four facultative lagoon cells, a chlorine contact basin, a chemical feed and control building, an irrigation pump station, an effluent outfall sewer, and an irrigation water distribution system.

The wastewater facilities are schematically presented in Figure 4-16. The layout of the treatment facilities is shown in Figure 4-17. A summary of the design data for the facilities is presented in Table 4-9 The following subsections provide an evaluation of the performance of the existing plant as well as a brief description of each of the individual unit processes that comprise the treatment facility.

Table 4-9 | Existing Treatment Plant Design Data

Headworks & Flow Measurement				
• Screening & Grit Removal	• None			
• Primary Device	• Parshall Flume			
• Throat Width	• 12-inch			
• Flume Invert	• 180.0 feet			
• Maximum Capacity	• 7.4 MGD @ 2 feet of water depth			
• Flow Measurement	• Ultrasonic level transducer			
• Influent Sampler	• Refrigerated automatic composite sampler			
Lagoon	Cell 1	Cell 2	Cell 3	Cell 4
• Type	• Facultative	• Facultative	• Facultative	• Facultative
• Surface Area at Mid-Depth	• 13.8 acres	• 14.0 acres	• 8.0 acres	• 15.1 acres
• Top of Dike Elevation	• 177.0 ft	• 181.0 ft	• 175.0 ft	• 174.0 ft
• Bottom Elevation	• 166.25	• 171.25	• 165.0	• 165.1 ft
• Min. Depth/ Elevation	• 2 ft / 168.25 ft	• 2 ft / 173.25 ft	• 2 ft / 167.0 ft	• 2 ft / 167.1 ft
• Max. Depth/ Elevation	• 8.75 ft /175.0 ft	• 7.75 ft /179.0 ft	• 8 ft / 173.0 ft	• 6.9 ft / 172.0 ft
• Minimum Freeboard	• 2 ft	• 2 ft	• 2 ft	• 2 ft
• Est. Usable Storage Volume	• 93.2 ac –ft	• 80.5 ac -ft	• 48.0 ac -ft	• 74.0 ac -ft
• Total Plant Storage Volume	• 295.7 ac –ft			
Disinfection Facilities				
• Type	• Gas Chlorine			
• Chemical Delivery	• Ton Cylinders			
• Typical Feed Concentration	• 1.5 mg/L (winter), 3-7 mg/L (summer)			
• Average Winter Chlorine Use	• 25 ppd			
• Average Summer Chlorine Use	• 80 ppd			
• Chlorinator Rotameter Capacity	• 200 ppd			
• Total Storage Capacity	• Three 1-ton cylinders			
• Typical Chlorine Delivery	• Twice per year			
• Control System	• Manual On/Off with flow proportional dosing			
• Injection Point	• Cell 4 outlet control valve vault			
• Chemical Mixing	• Natural turbulence			
• Contact Chamber, Primary				
- Type	- Baffled concrete tank (winter/ summer)			
- Geometry	- 40:1 Minimum Length to Width Ratio			
- Volume	- 90,000 gallons			
- Contact Time	- 45 minutes @ 3 mgd, typical discharge rate - 32 minutes @ 4 mgd, peak discharge rate			
• Contact Chamber, Secondary				
- Type	- Buried Irrigation Pipeline (summer only), subject to DEQ approval			
- Material	- HDPE, butt-fused, DR 13.5			
- Diameter	- 20” O.D., 16.859” I.D.			
- Length, Conveyance Only	- 9,500 ft. from pump station to first irrigation riser (no intermediate outlets)			
- Volume	- 110,000 gal, 11.6 gal/ft.			
- Contact Time	- 209 minutes @ 525 gpm, typical irrigation rate - 68 minutes @ 1,600 gpm, peak irrigation rate			

Table 4-9 | Existing Treatment Plant Design Data

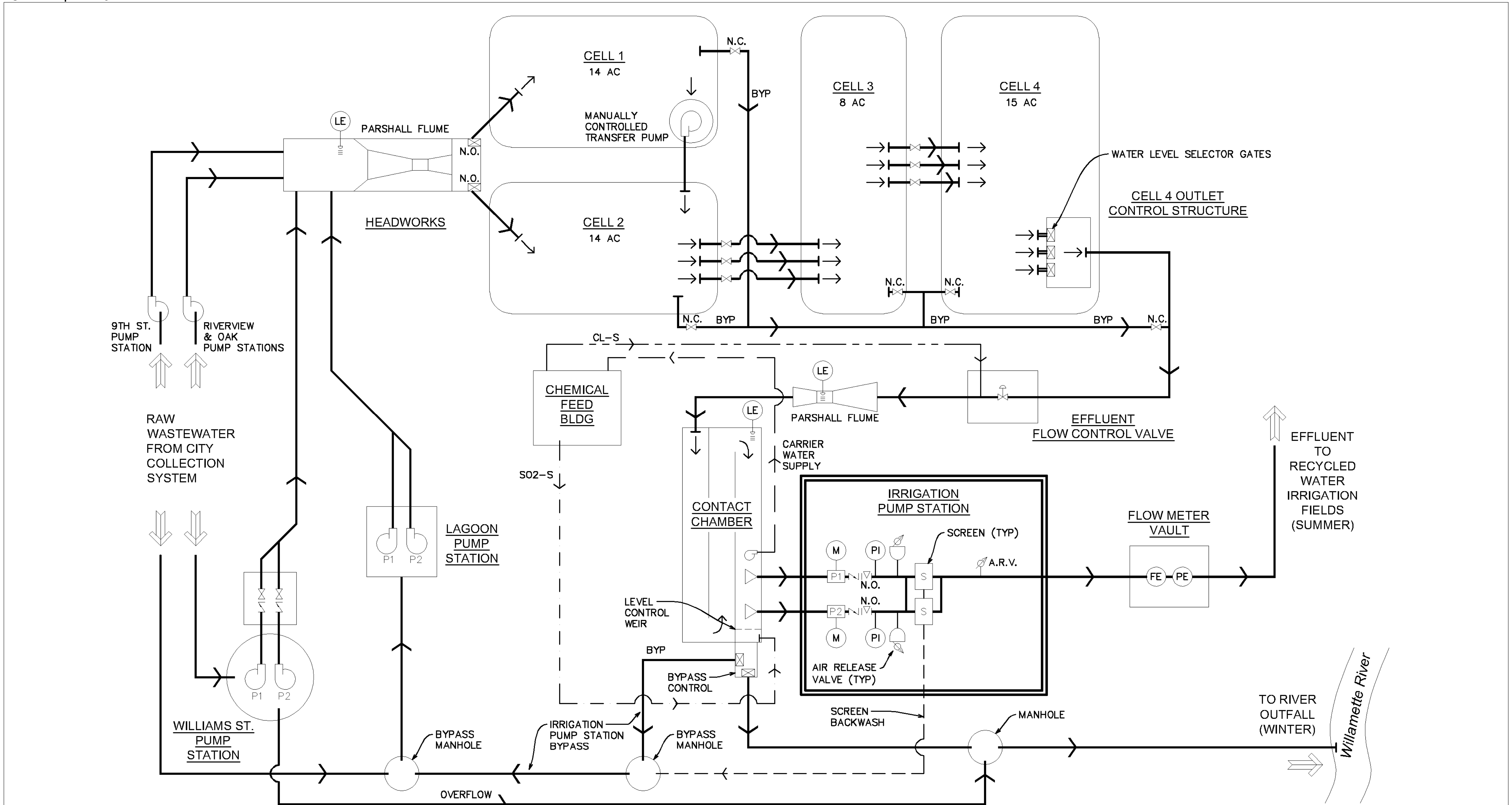
Dechlorination Facilities	
• Type	• Sulfur Dioxide Gas
• Chemical Delivery	• 150-pound cylinders
• Typical Feed Concentration	• 0.75 mg/L
• Typical Usage Rate	• 19 ppd
• Rotameter Capacity	• 50 ppd
• Total Storage Capacity	• 10 150-pound cylinders
• Typical SO2 Gas Delivery	• Once every 2 months
• Control System	• Manual On/Off with manual dosing
• Injection Point	• Downstream end of contact chamber
• Chemical Mixing	• Natural turbulence from contact chamber outlet weir
Final Lagoon Effluent Flow Control	
Structure	• Lagoon cell 4 outlet control structure
Lagoon Outlet	• 24” sluice gates at three levels for variable depth draw-off
Outflow Pipe	• 16” Ductile Iron
Flow control	• Valve vault with actuated plug valve
Auxiliary Power	
Type	Standby diesel generator
Rating	200 kW, 480-volt, 3-phase
Location	Lagoon Pump Station (WWTP)
Fuel Supply	24-hour, full-load
Enclosure	Outdoor-rated, sound-attenuating
Transfer Switch	Automatic
Exerciser	Automatic
Winter Effluent Flow Measurement & Sampling	
• Primary Device	• 9-inch Parshall Flume
• Device Location	• Upstream end of contact chamber
• Measurement Range	• 0.06 – 5.7 mgd
• Flow Meter	• Ultrasonic level transducer
• Effluent Sampler	• Refrigerated automatic composite sampler
• Sample Location	• Downstream end of concrete contact chamber
Willamette River Outfall Shared with City of Monmouth (winter discharge)	
• Type	• Open pipe discharge, typically submerged in summer months
• Material	• Concrete pipe
• Size	• 24-inch and 36-inch

Table 4-9 | Existing Treatment Plant Design Data

Irrigation Pump Station	
• Purpose	• Dry season discharge to irrigation sites
Pumps	• 2 Vertical Turbine, Variable Speed
• Pump Type & Number	• 75 HP each
• Pump Size	
• Operating Capacity	• 1,200 gpm @ 86 psi (1 pump running)
(Min. 65 psi in irrigation mainline)	• 2,190 gpm @ 96 psi (2 pumps running)
• Pump Control	• VFD - Pump speed adjusted to maintain pressure set-point
Wet Well	
• Type	• Concrete chlorine contact chamber
• Level Control	• Pressure transducer
Irrigation Flow Meter	
• Type	• Magnetic
• Location	• Vault near control building and pump station
• Size	• 10 inch
Irrigation Pressure Transducer	
• Type	• Digital sensor/transducer mounted on an isolation ring
• Location	• Vault near control building and pump station
• Size	• 10-inch isolation ring

Irrigation Fields	North	Middle	South	TOTAL
• Irrigated Area	• 96.7 acres	• 57.9 acres	• 74.8 acres	• 229.4 acres
• Sprinkler Type	• Linear	• Linear	• Linear	
• Application Rate	• 624 gpm	• 388 gpm	• 565 gpm	• 1,577 gpm

Figure 4-16 | Existing Wastewater Treatment Plant Schematic



PROCESS DIAGRAM LEGEND

LINE LEGEND
- PRIMARY PROCESS PIPING
- XX SECONDARY PROCESS PIPING (FLUID NOTED)

VALVE SYMBOLS
- CHECK VALVE
- BUTTERFLY VALVE
- GATE VALVE
- BALL VALVE
- PLUG VALVE
- WATER CONTROL GATE
- CONTROL VALVE (FUNCTION NOTED)
- END SUCTION CENTRIFUGAL PUMP

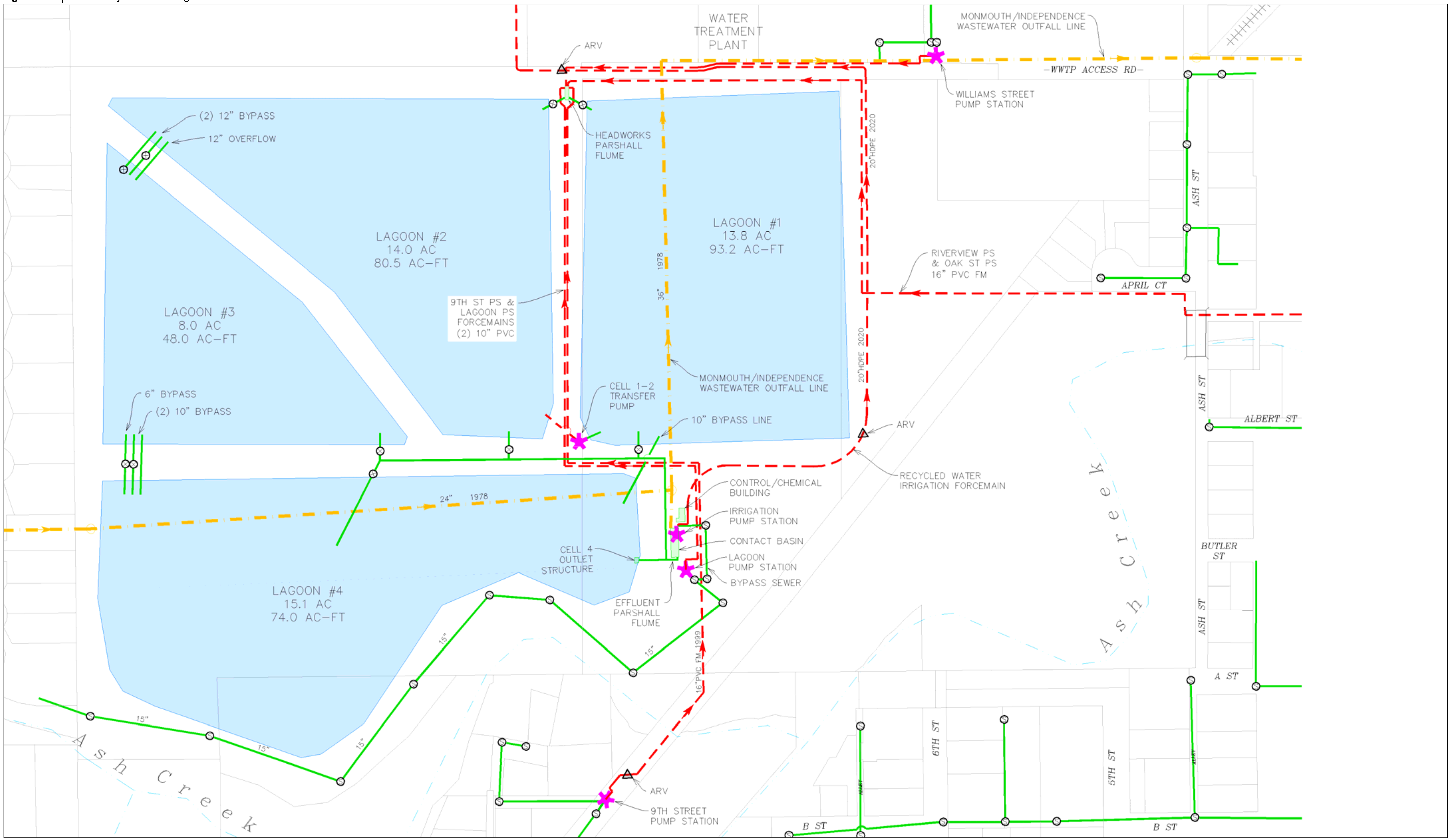
PUMP & INSTRUMENT SYMBOLS
- M P# VERTICAL TURBINE PUMP
- XX INSTRUMENT

XX	INSTRUMENT
FE	FLOW ELEMENT (METER)
LE	LEVEL ELEMENT
PI	PRESSURE INDICATOR (GAUGE)
PE	PRESSURE ELEMENT (TRANSDUCER)
M	MOTOR
S	SCREEN

ABBREVIATIONS

N.O.	NORMALLY OPEN
N.C.	NORMALLY CLOSED
P#	PUMP NUMBER
CL-S	CHLORINE SOLUTION
SO2-S	SULFUR DIOXIDE SOLUTION
BYP	BYPASS

Figure 4-17 | Overall Layout of Existing Wastewater Treatment Plant



4.5.1 Plant Performance

The City's existing effluent permit requires the production of effluent BOD and TSS concentrations below 30 mg/L and 50 mg/L during the winter discharge season on an average monthly basis. Average monthly effluent BOD and TSS concentrations are listed in Table 4-10 for the last two years. As demonstrated in Table 4-10 (note the values in bold text), the existing plant is not capable of reliably meeting the effluent BOD and TSS concentration limits under existing loading conditions. Though not shown on the table, the City has also violated the maximum allowed weekly BOD and TSS concentrations on occasion. This suggests that the existing plant is overloaded and that improvements are needed during the planning period.

In past years, the City did not have enough lagoon volume to store wastewater during June through October and was not yet able to irrigate. In these instances, the City discharged to the river in October to prevent overflow of the lagoons, which were permit violations. In 2021, the City completed the construction of the effluent irrigation system. This enabled the City to discharge during June through October as defined by the City's Recycled Water Use Plan. This system should eliminate the need for out-of-season discharges moving forward.

Table 4-10 | Existing Treatment Plant Average Monthly Effluent BOD and TSS Concentrations (mg/L)

Year	2019		2020		Average	
Month	BOD	TSS	BOD	TSS	BOD	TSS
January	12.9	28.2	10.9	15.3	11.9	21.7
February	11.2	26.5	12.8	15.5	12.0	21.0
March	14.9	21.7	16.3	11.7	15.6	16.7
April	20.5	19.3	23.2	22.3	21.9	20.8
May	22.2	25.9	23.0	43.8	22.6	34.8
October	**65.7**	**64.0**	**22.8**	29.5	**44.3**	**46.8**
November	**34.6**	38.0	**42.2**	36.7	**38.4**	37.3
December	23.9	26.9	NA	NA	23.9	26.9
Average	21.0	27.6	19.9	24.8	20.5	26.4

Note: Existing effluent BOD permit limit is 30 mg/L. Existing TSS permit limit is 50 mg/L. Values in **bold** text exceed these limits.

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 500 pounds per day of BOD and 830 pounds per day of TSS on a monthly average basis during the winter discharge season. The existing permit does not allow for any discharge to surface waters during the summer months. Average monthly effluent BOD and TSS mass loads are listed in Table 4-11 for the last two years.

It is clear from an examination of Table 4-11, that the existing plant is not able to consistently produce an effluent quality that allows the City to meet the permitted effluent mass loads for BOD and TSS (note values in bold text). In addition to monthly mass load limits, the City's permit also has limits for weekly and daily effluent mass loads. This data is not shown in Table 4-11, but violations of these limits have also occurred. As noted above, these violations are evidence that the treatment facilities are overloaded and that improvements will be needed during the planning period.

Table 4-11 | Existing Treatment Plant Average Monthly Effluent BOD and TSS Mass Loads (pounds per day)

Year	2019		2020		Average	
Month	BOD	TSS	BOD	TSS	BOD	TSS
January	183	386	138	194	161	290
February	144	328	210	239	177	284
March	227	331	264	190	246	261
April	281	299	272	259	276	279
May	254	298	336	617	295	458
October	**2196**	**2139**	**729**	**954**	**1462**	**1546**
November	**553**	601	**1121**	**909**	**837**	**755**
December	243	325	NA	NA	243	325
Average	320	417	370	433	341	26.4

Note: Existing effluent BOD and TSS mass load limits are 500 and 830 pounds per day respectively. Values in **bold** text exceed these limits.

4.5.2 Headworks

Raw wastewater enters the plant through four forcemains that discharge directly to the headworks. These forcemains are from the primary basin pump stations. The pipe diameters are 10-inch from the Williams Street Pump Station, 10-inch from the Lagoon Pump Station, 16-inch from the Oak and Riverview Pump Stations, and 10-inch from the 9th Street Pump Station.

Figure 4-18 | Wastewater Treatment Plant Headworks

The headworks includes a Parshall flume for flow measurement and an automatic refrigerated wastewater sampler for collecting influent samples. Flow measurement is accomplished in a 12-inch Parshall flume outfitted with an ultrasonic level sensor.

On the downstream end of the headworks, flow is directed to two 18-inch ductile-iron pipes, one each to lagoon cells 1 and 2. The existing headworks does not include screening or grit removal equipment. All solids that pass through the headworks remain in the waste stream and pass into the lagoons. The headworks was constructed in 1998. Overall, the structure is in relatively good condition and should serve the City for many years as long as it remains compatible with the improvements recommended in Chapter 7. The City's NPDES permit requires annual flow meter calibrations which the City has traditionally performed.

4.5.3 Facultative Lagoons

Four facultative lagoons provide sedimentation, biological treatment, and sludge digestion. The lagoons also provide storage for non-discharging periods. The wastewater treatment plant was expanded to four lagoons in 1978. The lagoon cells are identified as 1, 2, 3, and 4. The interior dike slopes are covered with riprap to protect the dikes from erosive wave action.

Water flows through the lagoons in semi-sequential manner. Water from the headworks is split and directed to the north ends of cells 1 and 2. Water is then pumped from the south end of cell 1 in to cell 2. Water then flows from cells 2 to 3 to 4 by gravity. The discharge from cell 2 passes through 2, 12-inch pipes with valves. Cell 2 also has a 12-inch overflow pipe to cell 3. The discharge from cell 3 passes through 2, 10-inch and 1, 6-inch pipes with valves. Water can be bypassed from each lagoon directly to cell 4 using a 10-inch bypass line and valves. The plant piping is intended to allow for the temporary isolation of each of the lagoon cells. Lagoon cells 1, 2, and 3 have catwalks with handrails to the outlet control pipes. According to operators, the outlet pipes can be closed, but no longer allow for discharge from a selected level in the lagoon. Each of these catwalks is severely deteriorated. For lagoons 1, 2 and 3, it is recommended that the outlet control structures and catwalks be replaced during the planning period. The outlet control structure for lagoon 4 was recently replaced, which is shown in Figure 4-19.

Based on discussions with operators, several of the valves used for lagoon bypass at the treatment plant no longer open or do not close completely. These valves were installed as a part of the original construction of the lagoons in the 1970's. One of these valves near the chlorine contact basin was replaced as a part of the 2020 treatment plant improvement project. In addition to the outlet controls structures, is also recommended that these valves and piping be repaired during the planning period in conjunction with a larger treatment plant project.

Effluent from cell 4 is collected at a lagoon outlet control structure at the east end of the lagoon (Figure 4-19). This cast-in-place concrete structure was built in 2020. Under normal operating conditions, plant discharge is routed to the chlorine contact chamber from the cell 4 outlet structure. This structure is designed with three inlets set at different elevations. This gives operators the ability to draw water from various elevations in the water column. In general, most algae growth occurs in the upper layers of the lagoons. Therefore, it can be useful to draw water from below the algae layer in order to optimize the quality of effluent discharged from the lagoons.

Downstream of the cell 4 outlet structure is a plug valve with an electric actuator. This valve is used to automatically control the flow from the lagoon either for winter discharge activities or to meet varying irrigation demands during summer discharge. Flow from the valve is directed to the 9-inch effluent Parshall flume.

The City is not permitted to discharge effluent to the Willamette River between June 1st and October 31st. In 2020 the wastewater treatment plant was first able to discharge effluent using the recycle water use facility for irrigation of cropland. There will be periods in the early or late part of the irrigation season when the farmer will not be able irrigate, either due to weather or agronomic reasons. During this time, influent will have to be stored in the lagoons.

Figure 4-19 | Lagoon Cell 4 Outlet Control Structure

Biosolids have accumulated in the lagoons since they were built. Biosolids profiling was completed in 2019 for all four lagoons. The report indicated the values for average biosolids depths shown in Table 4-12.

Table 4-12 | Biosolids Profile Results

Lagoon Cell	Average Biosolids Depth (inches)	Average Water Depth (inches)	Percent of Average Water Depth
1	17	65	26%
2	16	59	27%
3	12	60	20%
4	8.5	53	16%

These results indicate that roughly one quarter of the water column is dominated by biosolids in the cells. Biosolids removal is recommended to be completed early in the planning period.

4.5.4 Disinfection System

Chlorine gas is used to disinfect the treated effluent prior to discharge. The chemical feed equipment is located in the chemical building and control room. Chlorine gas is delivered to the plant in one-ton cylinders and is stored in the chemical storage room. The gas feed equipment consists of cylinder valves that automatically switch to a full cylinder when one cylinder is emptied. The cylinder valves will also close automatically if a chlorine leak is detected. The gas feed system is a vacuum system. Gas is removed from the cylinders under a vacuum and routed to a gas chlorinator. The chlorinator is used to mix the gas with carrier water to create a chlorine solution. This solution is injected into the

Figure 4-20 | Chlorine Contact Chamber & Parshall Flume

effluent stream. Water is supplied to the injector from the chlorine contact chamber. Chlorine solution is added to the effluent stream at the actuated valve vault immediately before the chlorine contact chamber.

Chlorine contact time is provided by the chlorine contact chamber. The contact chamber is a baffled concrete structure with parallel flow channels. Additional contact time for summer effluent is provided by 9,500 feet of the irrigation forcemain before it reaches the irrigation distribution piping.

The discharge rate from the plant is controlled using the control panel in the chemical feed building. The main plant PLC automatically controls the flow control valve to maintain a constant flow rate or to maintain a constant level in the contact basin for the irrigation pumps. Water level in the contact basin is measured by an ultrasonic level transducer.

During the winter discharge season, residual chlorine is removed from the effluent stream at the downstream end of the contact basin just after the water level control weir. A sulfur dioxide gas feed system is used for dichlorination. The sulfur dioxide feed equipment is similar to the chlorine gas feed equipment. Sulfur dioxide is delivered to the plant in 150-pound bottles. Cylinder valves are used to control the flow of gas from the bottles to the sulfur dioxide gas injector. The sulfur dioxide gas injector mixes the gas with a carrier water stream in a similar fashion as the chlorinator. Mixing energy for the dechlorination reaction is provided in the turbulence below the weir. The sulfur dioxide dosing rate is set manually by the operator.

Plant discharge, flows by gravity from the contact basin to the Willamette River in 24-inch and 36-inch concrete pipes. The effluent compliance samples are taken immediately downstream of the weir in the contact basin. An automatic wastewater sampler is used to collect composite effluent samples.

Downstream of the contact basin there is a concrete structure with sluice gates that allows operators to direct effluent either to the river or to the Lagoon Pump Station. Effluent is allowed to flow to the Lagoon Pump Station in order to prepare the basin for irrigation and to maintain disinfection in between periods of irrigation demand.

The chlorination equipment allows for flow-paced dosing. During the winter discharge season, the flow signal from the effluent Parshall flume is used to pace the chlorine dosage. During the summer irrigation season, the flow signal from the effluent parshall flume meter is used to pace chlorine dosage.

4.5.5 Chemical Feed & Control Building

Adjacent to the chlorine contact chamber is a building used for chemical feed and electrical equipment. The building was originally built in 1978 for chemical feed and storage. In 2020, the building was doubled in size to add a separate chemical storage room. This facilitated the current storage room to be re-purposed for chemical feed equipment, electrical equipment, and storage of some laboratory equipment. This control/chemical feed room is the location the main plant PLC.

The building houses the chlorination and dechlorination chemical feed and storage equipment. The gas cylinders are stored in the north room and the chemical injection and electrical equipment is located in the southern room. The chemical storage room is equipped with gas leak detection equipment. Alarm conditions are monitored using the City’s SCADA system. Alarm lights are also located on the building exterior to indicate a chlorine or sulfur dioxide leak alarm. A chain hoist and monorail are used to off-load cylinders from delivery trucks and transport them in to the storage room.

The entire building was retrofited in 2020 as a part of the treatment plant improvements. It is anticipated with regular repair and maintenance the building should serve the City for the remainder of the planning period.

Figure 4-21 | WWTP Chemical Feed & Control Building

4.5.6 Surface Water Outfall

During the wet weather months (November 1 – May 31), treated effluent flows by gravity through a 24-inch and 36-inch pipeline to the Willamette River. The pipeline and outfall are shared with the City of Monmouth. The 36-inch pipeline discharges directly in to the Willamette River below normal low-water levels (See Figure 4-22). There is no diffuser or grating on the end of the 36-inch pipe.

Figure 4-22 | Willamette River Common Outfall

The current NPDES permit provides for a regulatory mixing zone in the Willamette River where federal regulations and Oregon Administrative Rules allow the DEQ to suspend all or part of the water quality standards in small designated areas. For Independence, this area is defined as a band along the west bank of the river that is fifty feet wide, extends fifty feet upstream of the outfall and extends 300 feet downstream of the outfall. The permit also defines a zone of immediate dilution (ZID) as that portion of the allowable mixing zone that is within 30 feet of the point of discharge.

The City prepared a mixing zone study in 2015 as a part of the update to their NPDES permit. This study was prepared in accordance with the Level II mixing zone study requirements. This study evaluated sensitive environmental receptors within the vicinity of the outfall and evaluated estimated dilution characteristics of the outfall. The study did not find sensitive receptors or habitats in the discharge area.

The study estimated dilution at the edge of the zone of initial dilution, ZID, (for acute conditions) and at the edge of the regulatory mixing zone (for chronic and human health conditions). Centerline dilution factors for acute, chronic, and human health conditions were estimated for the outfall to be 6.3, 11.1, and 12, respectively. The report indicates that these values are "the most reasonably conservative results" that the engineer was able to model and that "the mixing at the actual regulatory mixing zone is probably much higher". The report's results indicated that the plume dimensions are within the regulatory mixing zone for all conditions.

4.5.7 Irrigation Pump Station & Distribution Piping

The purpose of the irrigation pump station is to deliver water at a suitable pressure to the irrigation sprinkler systems approximately two miles from the treatment plant.

Figure 4-23 | Irrigation Pump Station

The irrigation pumps and piping are mounted to a cast-in-place concrete slab on top of the chlorine contact chamber. Two vertical turbine pumps draw water from the downstream end of the basin. The pumps are automatically controlled to adjust the pumping speed as needed to maintain a constant discharge pressure in the irrigation forcemain. A magnetic flow meter and pressure transducer are located in a vault outside of station. As irrigation demand changes, the pump speed is adjusted to maintain a constant pressure. The actuated flow control valve on the cell 4 outlet pipe modulates to maintain a constant level in the contact basin. The pump discharge piping is fitted with isolation valves, check valves, and air release valves. Strainers are also installed in-line to prevent clogging of the sprinkler systems. The pump control panel and variable frequency drives are located in the chemical feed building. The pump station has provisions to install a third pump in the future.

For short durations (i.e., hours – days) events during the summer months when irrigation not actively occurring, the pumps will stop and disinfected water will flow through the contact basin to the Lagoon Pump Station. This system prevents the operators from having to shut-down and restart the disinfection when irrigation is stopped for short durations. The irrigation pump station is monitored using the City's SCADA system. An auto-dialer located in the City's Public Works Shops is used to call out alarm conditions.

The City's recycled water distribution piping consists of butt-fused HDPE totaling approximately 18,200 feet (3.45 miles). This consists of roughly 14,100 feet of 20-inch, 3,100 feet of 12-inch, and 1,000 feet of 10-inch O.D. piping (nominal sizing). Approximately 8,600 feet of this piping is used to distribute water to irrigation risers. The remaining 9,500 feet is a pipeline that conveys water from the treatment plant to the irrigation fields. Air and vacuum release valves are installed along the pipeline in manholes at terminations and relative high points. A large portion of this pipe is installed on the west side of the Independence Airport. The piping and pump station are sized to allow expansion of the City's recycled water use fields at the edges of the distribution network.

The irrigation pump station and distribution piping were constructed in 2019 and 2020. Therefore, they are new, in good condition, and with normal maintenance will serve the City for the remainder of the planning period.

4.5.8 Recycled Water Irrigation Systems

During the dry weather months (May – October), treated effluent is pumped from the irrigation pump station to irrigation sites located northwest of the City. These sites are on private property owned by a local farmer. The total area that can be irrigated is approximately 229.4 acres.

Figure 4-24 | Linear Irrigation Sprinkler at Reuse Field

Effluent is irrigated on the fields using three linear irrigation sprinklers. The City has an agreement with the owner who manages the agricultural activities at these sites. The sites are currently used for growing grass seed crops. Underground piping with vertical risers is in place to distribute recycled water to the irrigation sites.

The City prepared a recycled water use plan in 2015. The plan includes the eventual irrigation of up to 66 additional acres adjacent to the current fields. Additional acreage is available adjacent to the current fields that may be possible to be irrigated with recycled water if the recycled water use plan was amended. Depending on the location of these fields, the existing distribution piping and, or the linear sprinklers may be able to be used.

4.5.9 SCADA System

Much of the equipment at the treatment plant is monitored remotely by the City's SCADA system. The SCADA terminal is located at the City's Public Works Shops on Main Street, which serves as the primary office for operations staff. The SCADA terminal includes custom designed screens for some of the unit processes at the plant. The SCADA system is used primarily for monitoring purposes with limited control capabilities. Alarms are dialed out to the operations staff using an auto-dialer located at the water treatment plant.

4.5.10 Water Supply System

A 2-inch water service serves the headworks area, the chemical feed building, and the Lagoon Pump Station. This water is used for potable water in the building, the emergency eyewash/shower, and for washdown purposes.

4.5.11 Access Roads

Vehicular access to the treatment plant is along a gravel driveway that extends from the intersection of Ash and Williams Street west approximately 900 feet to the treatment plant site. Vehicular access around the plant is by gravel roadways constructed on the top of the lagoon dikes. For the most part, vehicular access is good. The lagoon dike roads are in relatively good condition. Potholes and isolated rutting sometimes occur on the main entrance road. The City periodically repairs the potholes and rutting as part of normal routine maintenance practices.

4.5.12 Wastewater Treatment Plant Operational Problems

Some of the components of the treatment plant have degraded to the point of no longer functioning. These components include some of the original structures installed in the 1970's. These include the valves that isolate flow between lagoons. Additionally, the catwalks that access some of the valves are deteriorated and no longer safe for personnel. Since the treatment plant was upgraded in 2020, some of the operational issues were addressed at that time. Several of these issues still remain and are recommended to be addressed during the planning period.

4.5.13 Summary of Wastewater 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 consistently meet the concentration and mass load limits required by the NPDES permit for effluent BOD and TSS.
- The existing catwalks, piping, valves, and pumps used to convey water from lagoon Cell 1 to Cell 4 are old and antiquated and should be replaced during the planning period.
- Sludge accumulation in the lagoons is becoming significant, and the City should plan to remove sludge during the planning period.

4.6 WASTEWATER SYSTEM OPERATOR CERTIFICATION

The City's wastewater collection system currently requires an operator with a Level II certification. The treatment system requires an operator with a Level II certification. It is unlikely that these will change during the planning period.

4.7 WASTEWATER SYSTEM FUNDING MECHANISMS

Funding for the City's wastewater system comes from user fees and system development charges (SDC's). The City also utilizes loans to fund capital improvement projects.

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. At the time of this writing, the City's wastewater user fee schedule was established by Resolution No. 20-1543 with an effective date of January 1, 2021.

The City charges a base monthly fee depending on the user classification (Table 4-13). Commercial users are charged an additional fee if their potable water usage is in excess of 1 equivalent residential unit (ERU). The City defines an ERU as 9.6 units of water per month. A unit of water is equal to 750 gallons. Therefore an ERU is equal to 7,200 gallons. Commercial users that use greater than 1 ERU are charged the base sewer fee plus the additional rate per unit of water used in excess of the 1 ERU.

The anticipated revenue from sewer billings for the fiscal year 2020/21 was budgeted to be $2,272,550.

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.

Table 4-13 | Current Wastewater User Fees

User Classification	*Monthly User Charge*
Residential	$54.12
Residential, Outside City Limits	$108.24
Commercial[1]	$54.12

[1] An additional rate of $2.42 is applied per unit of water used in excess of 1 equivalent residential unit (ERU).

4.7.2 System Development Charges

System development charges (SDC's) provide funds for sewer system capital improvement projects. A SDC is a fee collected by the City as each piece of property is developed. SDC's are used to finance necessary capital improvements and municipal services required by the development. SDC's 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 SDC fee system was most recently revised by Resolution Number 20-1543. The City charges different SDC fees for various types of connections. The current fee structure is listed in Table 4-14.

Table 4-14 | Current SDC Fees

Water	
Residential	
Single Family Unit	$2,786.00
Multi-Family Unit	$2,226.00
Commercial Building	
¾ - Inch Water Meter	$2,226.00
1- Inch Water Meter	$3,961.00
1 ½ - Inch Water Meter	$8,906.00
2 - Inch Water Meter	$15,833.00
3- Inch Water Meter	$39,667.00
4- Inch Water Meter	$63,501.00
Wastewater	
Residential	
Single Family Unit	$4,070.00
Multi-Family Unit	$3,353.00
Commercial Building	
¾ - Inch Water Meter	$3,353.00
1- Inch Water Meter	$5,972.00
1 ½ - Inch Water Meter	$13,411.00
2 - Inch Water Meter	$23,840.00
3- Inch Water Meter	$59,599.00
4- Inch Water Meter	$95,358.00
Stormwater	
Single Family Unit	$937.00
Multi-Family Unit	$590.00
Commercial Building	$472.00 per 1,000 sqft of impervious area
Transportation	
Single Family Unit	$3,680.00
Multi-Family Unit	$2,503.00
Commercial Building	$11,664.00
Industrial Building	$2,462.00 per 1,000 sqft of office area
Parks	
Single Family Unit	$4,372.00
Multi-Family Unit	$4,076.00
SDC Total	
Single Family Unit	$15,845.00
Multi-Family Unit	$12,748.00

4.7.3 Annual Sewer System Costs & Existing Debt Service

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 (uses) as listed below (Table 4-15). The total sewer operating fund expenditures for the fiscal year are $8,418,506.

Table 4-15 | Sewer Operating Fund Budgeted Expenditures 2020/2021 Fiscal Year

Item	Budget
Personnel Services	$ 437,000
Materials and Services	$ 745,050
Capital Expense	$5,001,000
Transfers, Debt Service and Contingency	$ 2,235,456
TOTAL EXPENDITURES (USES)	**$ 8,418,506**

The City currently has two outstanding loans for the sewer system. In 2013, the City issued $2,900,000 in sewer system revenue bonds to refund the City's DEQ Clean Water State Revolving Fund Loan (CWSRF), repay existing sewer bonds issued to the US Department of Agriculture Rural Utilities Service, and to pay for administrative costs for the bonds. Net income from sewer user fees is pledged to pay debt service. Interest of the bonds is payable semiannually in June and December of each year. The average debt payment through 2025 is approximately $147,000 per year. The interest rate is 3% and bond maturity is 2040. Total sewer bond principal and interest starting fiscal year 2021 was $2,105,000 and $798,750, respectively.

In 2017, the City obtained a DEQ CWSRF loan for $5,966,930. These funds are for several wastewater collection and treatment improvement projects. These projects include upgrades to the Riverview Pump Station, a new Recycled Water Use Facility, a new Williams Street Pump Station, and upgrades to the 9th Street Pump Station. These funds are to be repaid semi-annually with interest over 30 years. The annual interest rate is 1.42%. Income from sewer user fees is pledged to pay debt service for the loan. Based on the loan terms, the City pays roughly $149,000 twice per year in principal and interest. This payment is anticipated to last the duration of the planning period.

4.7.4 Sewer SDC Fund

The City currently has one fund that is used to save money for sewer capital improvements. The balance at the beginning of the 2020/21 fiscal year was $2,000,197. SDC fund revenue is dependent upon growth in the City and can be somewhat erratic. The City's 2020/21 budget lists the anticipated SDC revenue at $130,000. In addition to the SDC fees, SDC installments, investment interest and interfund loans and repayments are sources for the Sewer SDC Fund. The total sources for the SDC Fund were budgeted for the 2020/21 fiscal year to be $265,198.

CHAPTER 5

WASTEWATER FLOWS AND LOADS

Chapter Outline

5.1 INTRODUCTION

In order to select and size both collection and treatment facilities for the planning period, projected wastewater flows and organic loadings must be determined. The projected flows and organic 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 and load projections. Much of the challenge in projecting system growth relates to the difficulty in accurately tracking or projecting actual populations.

At the time this facilities plan was prepared, there were no known large residential, commercial, or industrial developments planned in the City. Therefore, the future flows and loads are based solely on municipal population growth within the City.

5.2.1 Historic and Future Population

Population histories provide a tool for determining the future growth rate of the municipal wastewater system. According to the U.S. Census Bureau, the population in Independence has steadily increased from approximately 4,425 people in 1990 to 9,828 in 2020. Figure 5-1 shows the population trends in Independence from 1990 to the present.

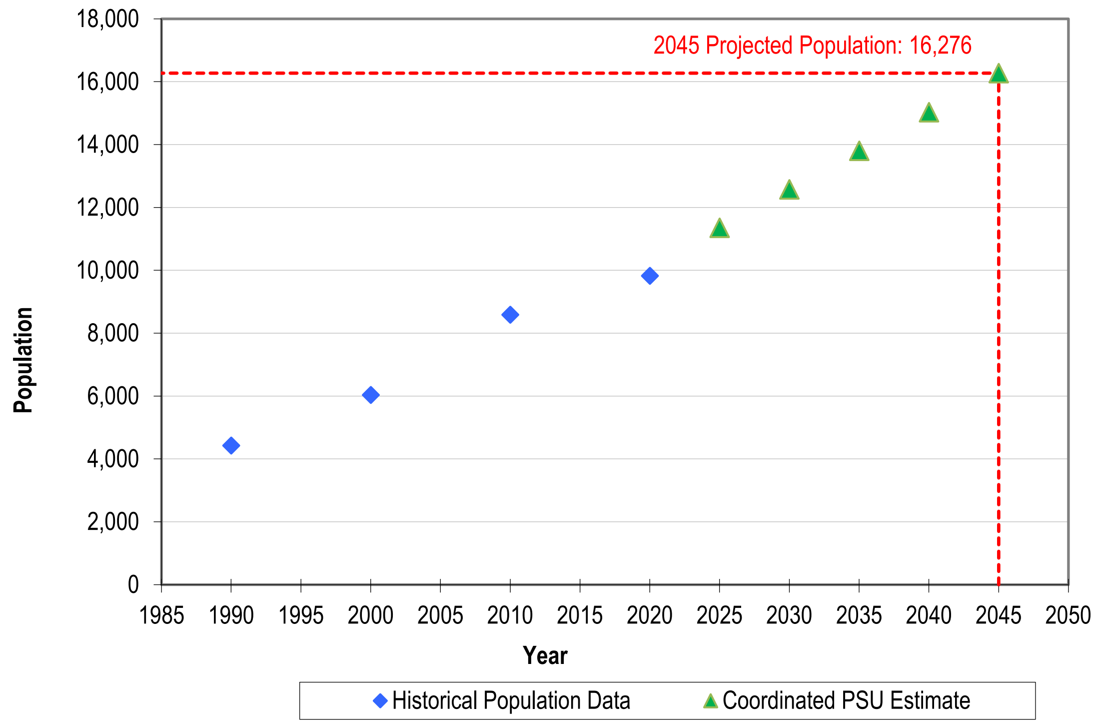
In the review of Facilities Plans, the DEQ relies on the County population allocations as the 'coordinated number' for evaluating population projections. This number has been agreed to by the Department of Land Conservation and Development (DLCD), the Office of the State Economist, and Polk County and is based on documented population trends. DEQ has indicated that the City is obligated under ORS 195.036 to conform to the County population allocation in order for the Department to approve the Facilities Plan. Therefore, the Polk County population projections for Independence will be used for facilities planning purposes.

In June of 2017, population projections for Polk County were prepared by the Portland State University Population Research Center. The population forecasts are based on average annual growth rates of 2.2% from 2017 to 2035 and 1.4% from 2035 to 2067. The 2045 population forecast for Independence was projected at 16,276. The County Coordinated population estimates are plotted together with historical population trends in Figure 5-1. Based on these projections the population of Independence is expected to reach 16,276 by 2045. The projected population estimates are listed by year in Table 5-1.

Table 5-1 | Independence Population Projections

Year	*Population*
2025	11,355
2030	12,578
2035	13,803
2040	15,032
2045	16,276

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

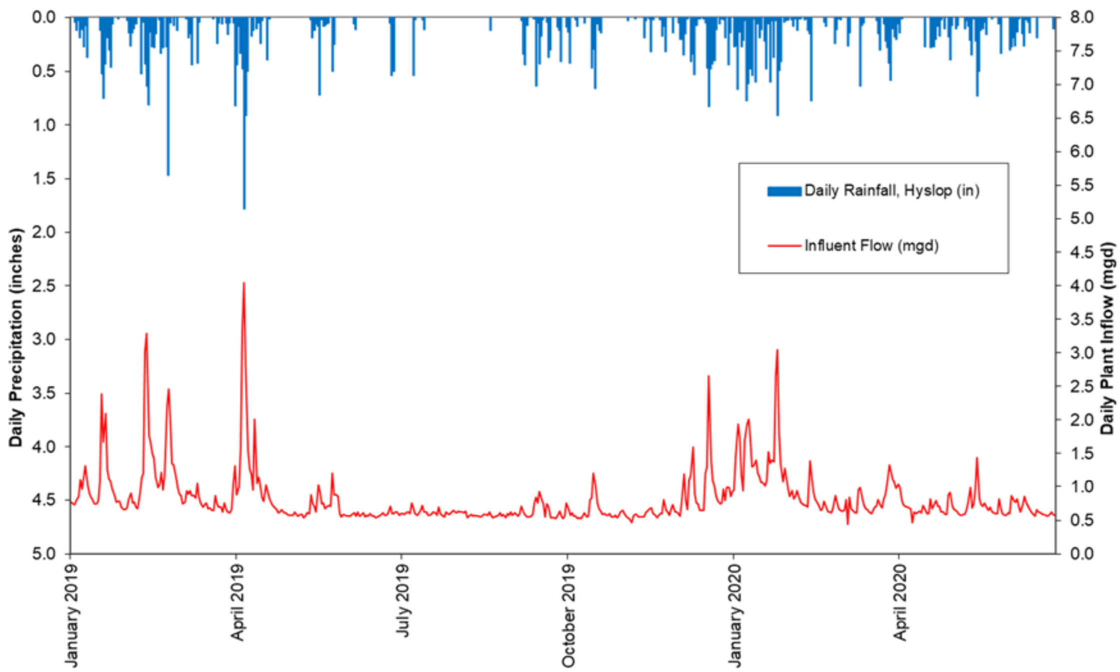
The City's treatment plant Discharge Monitoring Reports (DMRs) filed with the DEQ for the period from January 2015 through June 2020 were evaluated as part of this planning effort. Overall, there appears to be problems with the flow measurements. The existing flow measurements appear to be too low for a City the size of Independence. The current population of the City is estimated to be approximately 10,096 people. During the dry weather months of May through October, wastewater production rates for Cities in the Willamette Valley tend to be between 80-100 gallons per person per day. During the dry weather months of 2019 and 2020, the average dry weather wastewater flow in Independence was about 0.64 mgd, which is equivalent to about 63 gallons per person per day. This value is simply too low to be considered a reliable measurement. The City's potable water production records were also reviewed to determine water production rates. Potable water production rates during the winter months when there is no lawn watering are typically about the same as the wastewater production rates during the dry weather months. Table 5-2, includes a comparison of potable water production rates to the wastewater flow rates for the City. During the last two winter seasons, the average water production for the City was about 0.81 mgd which corresponds to a per capita production rate of 80 gallons per person per day. As shown in Table 5-2, the average dry weather wastewater flow during this period averaged about 66 gallons per person per day. These discrepancies are unusual and not typically seen in other Cities. For this reason, none of the existing wastewater flow data was used for this study. In the Spring of 2021, the City replaced the influent flow meter at the wastewater treatment plant. During the preliminary design phase for the improvements recommended in this plan, the City should review the latest data collected with the new meter to verify the accuracy of the flow measurements and the sizing recommendations presented in this report.

Table 5-2 | Wet Weather Potable Water Production and Dry Weather Wastewater Flow

Potable Water Production (mgd)		Wastewater Flows (mgd)	
December 2018 – February 2019	0.82	May 2019 – October 2019	0.66
December 2019 – February 2020	0.79	May 2020 – October 2020	0.62
Average	**0.81**	**Average**	**0.64**

Though the wastewater influent flow measurements at the treatment plant are not considered to be accurate, they can be used to make some general observations regarding seasonal flow patterns. Plant inflows in the City are strongly influenced by precipitation. The flows increase in the winter in response to winter storms (Figure 5-2). Again, it is important to note that the flow values show in Figure 5-2 are not likely to be accurate, but they do demonstrate the seasonal increase in flow during the winter months in response to stormwater inflow and groundwater infiltration (I/I). This seasonal increase is common for wastewater collection systems in the 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).

Figure 5-2 | Precipitation Effects on Plant Influent Flow



5.3.2 Existing Wastewater System Flow Estimates

For a typical planning effort, wastewater flows would be estimated using influent flow data measured at the wastewater treatment plant. As illustrated in the previous subsection, the existing flow measurements are not considered to be accurate and an alternative means for estimating flows must be used for this study. Average dry weather flows were estimated by assuming a per capita flow of 90 gallons per person per day. This value may be slightly higher than the actual value, but is considered a conservative estimate that is useful for planning purposes. In order to estimate the existing peak wet weather flow values, a series of peaking factors are used. Peaking factors are the ratio of a particular wet weather flow component to the average dry weather flow. For example, the peak hour flow is greater than the peak day flow, so the ratio of peak hour flow to average dry weather flow will be higher than the ratio of peak day flow to average dry weather flow. The average dry weather flow is multiplied by the peaking factor for a particular wet weather flow component to estimate the actual flow during the wet weather event.

Peaking factors for this plan are assumed based on typical flows in a small city in the Willamette Valley with a gravity collection system of similar age as Independence. The peaking factors are listed in Table 5-3.

Table 5-3 | Wet Weather Flow Peaking Factors

Wet Weather Flow Ratio	Average
AWWF / ADWF	2.2
MMDWF / ADWF	2.0
MMWWF / ADWF	3.0
PDF / ADWF	6.0
PHF / ADWF	10.0

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 City's where large amounts of I/I enter the collection piping and manholes, 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 that 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. The DEQ methodology for estimating peak wet weather flows requires accurate flow measurement data at the treatment plant. Since the data for Independence is not considered to be accurate (see above), the DEQ method cannot be applied to this study.

Assuming a current population of 10,096, a dry weather wastewater flow of 90 gallons per capita per day, and the peaking factors listed in Table 5-3, the existing flow estimates shown in Table 5-4 were calculated. 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 5-4 | Summary of Existing Flow Estimates

Flow	Value (MGD)
ADWF	0.91
AAF	1.43
AWWF	1.96
MMDWF	1.85
MMWWF	2.72
PDF	5.42
PHF	9.09

5.3.3 Wastewater Flow Projections

This section builds on the discussions of population projections in Section 5.2 and the existing flow estimates listed in Table 5-4. 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. It is important to note that the flow projections listed below include the existing peak flow estimates listed in Table 5-4. These flow estimates are theoretical estimates of wastewater flow that might occur in the absence of surcharging (Section 5.3.2). These flows are likely to be significantly higher than the measured flows. 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 growth.
- 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 addition of “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 will continue to implement infiltration and inflow reduction measures that 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 wet weather flow components during the planning period will be equal to the following ratios. It is important to note that these ratios are lower than the peaking factors used to estimate the existing flows. This is because the newly developed areas will utilize modern sewer materials and will have less I/I than the existing system
    - The increase in the AWWF over the planning period is equal to twice (2x) the increase in the ADWF.
    - The increase in the MMDWF over the planning period is equal to twice (2x) the increase in the ADWF.
    - The increase in the MMWWF over the planning period is equal to three (3x) times the increase in the ADWF.
    - The increase in the PDF over the planning period is equal to four (4x) times the increase in the ADWF.
    - The increase in the PHF over the planning period is equal to five (5x) times the increase in the ADWF.

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

Table 5-5 | Future Wastewater Flow Projections

Year	Population	*Projected Wastewater Flows (MGD)*						
		ADWF	*AAF*	*AWWF*	*MMDWF*	*MMWWF*	*PDF*	*PHF*
2025	11,355	1.0	1.6	2.2	2.1	3.1	5.9	9.7
2030	12,578	1.2	1.8	2.4	2.3	3.4	6.3	10.2
2035	13,803	1.3	2.0	2.6	2.5	3.7	6.8	10.8
2040	15,032	1.4	2.1	2.9	2.8	4.1	7.2	11.3
2045	16,276	1.5	2.3	3.1	3.0	4.4	7.7	11.9

5.3.4 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 build-out conditions are used for sizing purposes because trunk sewers are not suited for incremental expansion. In relatively small Cities like Independence, it is generally more cost effective to install a sewer line sized for complete development of the upstream service area. This is because 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 build-out 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 estimated in the previous sections 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 on the areas within each basin that are comprised of new and old construction materials. Estimates of existing I/I within each basin was further supported by the length of mainline within each basin and sewer pump station runtime trends during storm events.

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 from the existing collection system is anticipated to remain relatively constant due to the recommended rehabilitation and replacement program described in Section 6.2.3.

Table 5-6 | Rates Used for Estimates of Flow from Undeveloped Areas

Land use	Flow (gallons/acre/day)
Commercial	1,500
Industrial	1,500
Low-density Residential	1,500
Medium-density Residential	2,500
High-density Residential	3,000

The existing peak flows and the projected peak flows at build-out are listed for each collection system basin in Table 5-7.

Table 5-7 | Projected Drainage Basin Service Area Flows at Build-out of the System

Basin	Sub-basin	Total Area (Acres)	Sewered Area (Acres)	Existing ADWF (MGD)	Existing Peak Hour I/I (MGD)	Existing PHF (MGD)	Future Additional ADWF (MGD)	Future Additional I/I (MGD)	Build-out PHF (MGD)
A	A1	162.6	93.2	0.08	0.97	1.2	0.10	0.10	1.6
	A2	84.0	78.3	0.06	0.37	0.56	0.01	0.01	0.61
B	B1	263.3	234.4	0.19	2.5	3.1	0.04	0.02	3.2
	B2	3.9	3.4	0.01	0.04	0.04	-	-	0.05
	B3	43.7	42.6	0.04	0.29	0.40	-	-	0.40
	B4	9.8	9.8	0.01	0.09	0.12	-	-	0.12
C	C1	172.6	142	0.12	0.60	0.95	0.05	0.05	1.2
	C2	95.2	15.8	0.01	0.16	0.17	0.09	0.08	0.6
	C3	103.7	-	-	-	-	0.15	0.13	0.6
	C4	190.0	65.0	0.05	0.37	0.54	0.13	0.11	1.0
	C5	128.0	-	-	-	-	0.12	0.11	0.46
D	D1	284.4	219.0	0.18	1.5	2.0	0.13	0.09	2.4
	D2	134.7	33.3	0.03	0.05	0.14	0.16	0.16	0.79
E	E1	228.9	114.2	0.09	0.65	0.93	0.09	0.09	1.3
	E2	66.8	44.2	0.04	0.16	0.27	0.03	0.04	0.41

Table 5-8 | Projected Flows to Pump Stations at Build-out

	Existing Sewer Routing		Future Sewer Routing at Build-out	
Pump Station	Sub-basins Collected	Existing PHF (MGD)	Sub-basins Collected	Build-out PHF (MGD)
Oak Street	A1, A2	1.8	A1, A2	2.2
North Main	A2	0.56	A2	0.61
Riverview	B1, B2, B3, B4	3.6	B1, B2, B3	3.6[1]
Albert	B2	0.04	B2	0.05
Maple	B3, B4	0.51	B3	0.40[1]
Briar Road	B4	0.12	-	- [1]
9th Street	C1, C2, C4	1.76	C1, C2, C3, C4, C5 B4	4.0[1]
13th Street	C2	0.17	-	- [1]
Ash Creek [2]	-	-	C2, C3	1.2
Talmadge Road [2]	-	-	C2 (partial)	0.4
Mt. Fir	C4	0.6	C4, C5, B4	1.6
Corvallis Road [2]	-	-	C5, B4	0.6
Lagoon	D1, D2	2.2	D1, D2	3.2
Gun Club	D2	0.14	D2	0.80
Williams Street	E1, E2	1.2	E1, E2	1.7
Stryker Road	E2	0.27	E2	0.41

(1) Future PHF to Riverview and 9th Street Pump Stations account for changes in flow routing that direct water from Sub-basins B4 to the 9th Street Pump Station (away from the Riverview Pump Station). The Briar Road and 13th Street Pump Stations are recommended in Chapter 6 to be decommissioned.
(2) Ash Creek, Talmadge Road, and Corvallis Road Pump Stations are recommended future pump stations.

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) 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 Wastewater Treatment Plant Load Records

Organic and solids loading to the treatment plant are calculated by multiplying the flow values by the BOD and TSS concentration measurements from composite samples. As described above (Section 5.3.1), the treatment plant flow measurements are not considered to be accurate. Since these flow values are used to calculate the loading to the treatment plant, the influent loading data reported on the City's DMRs is also not accurate. The BOD and TSS concentrations should be accurate, but the actual loading numbers listed on the DMRs are not. The average monthly BOD and TSS measurements for the 2019 and 2020 calendar years are listed in Table 5-9.

Table 5-9 | Average Monthly Influent BOD and TSS Concentrations (mg/L)

Year	2019		2020	
Month	**BOD**	**TSS**	**BOD**	**TSS**
January	200	161	67	63
February	125	82	178	136
March	232	240	199	147
April	162	141	228	179
May	207	171	189	150
June	292	250	287	212
July	319	284	326	168
August	219	175	309	211
September	228	200	355	231
October	307	271	212	119
November	234	202	203	131
December	194	167	140	79
Average	**227**	**196**	**224**	**152**

During the dry weather months of May through October, the BOD and TSS values average about 271 mg/L and 203 mg/L respectively. Assuming a population of 9,700 and a dry weather flow of 0.91 mgd (see Table 5-4) the per capita BOD and TSS loading rates are about 0.21 and 0.16 pounds per person per day respectively. Based on the engineering literature[3], typical BOD values in domestic wastewater fall in the range of 0.11 – 0.26 pounds per capita per day. TSS values are typically in the range of 0.13 – 0.33 pounds per capita per day. The BOD and TSS loading rates for the City fall within these ranges. This demonstrates that the wastewater is, more or less, a typical municipal strength wastewater and does not show any evidence of high industrial loading. Therefore, typical municipal strength loading rates will be used for this planning effort. For planning purposes, a value of 0.22 pounds per person per day will be used to estimate BOD loading rates and a value of 0.18 pounds per person per day will be used to estimate TSS loading rates. These values are slightly higher than the observed rate, but are considered reasonable for planning purposes. Based on these assumptions, the existing BOD, and TSS loading rates are summarized in Table 5-10. These values are determined by multiplying the per capita loading rates by the estimated population of 9,700.

Table 5-10 | Existing BOD and TSS Loading Rates

	BOD Loading	TSS Loading
Average Annual (ppd)	2,130	1,750
Maximum Month (ppd) (1)	2,560	2,100

(1) Based on a peaking factor of 1.2 (Metcalf & Eddy, 2003)

[3] Metcalf & Eddy. 2003

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 5-10. 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 and TSS loading rates will increase in proportion to population increase.
- All growth will occur in conformance with current land use policies as outlined in the City's Comprehensive Plan.
- The per capita BOD loading rate for new population growth will be 0.22 pounds per person per day.
- The per capita TSS loading rate for new population growth will be 0.18 pounds per person per day.
- The ratio of peak monthly BOD and TSS loads to average loads is 1.2.

Based on these assumptions, the future estimates of influent wastewater loads listed in Table 5-11 were prepared.

Table 5-11 | Future Wastewater Load Projections

Year		BOD (ppd)		TSS (ppd)	
	Population	Average Annual	Peak Month	Average Annual	Peak Month
2025	11,355	2,498	2,998	1,817	2,180
2030	12,578	2,767	3,320	2,044	2,453
2035	13,803	3,037	3,644	2,264	2,717
2040	15,032	3,307	3,968	2,485	2,982
2045	16,276	3,581	4,297	2,706	3,247

5.5 RECOMMENDATIONS

The intent of this chapter is to identify existing flows and loads that must be conveyed and treated by the wastewater pumping and treatment system. Subsequent chapters of this report include more detailed evaluations of each component of the wastewater system. However, this chapter does include the following recommendations.

The existing influent flow measurements collected at the treatment plant headworks do not seem to be accurate (Section 5.3.2), and may not be useful. As a first step to try and solve the problem, the City replaced the influent flow meter in the Spring of 2021. During the rest of the 2021 calendar year, the City should review the data collected with the new flow meter to determine if the new flow meter solved the problem. If not, the City should continue to investigate this matter to determine the cause of the low measurements.

CHAPTER 6

COLLECTION SYSTEM EVALUATION

Chapter Outline

COLLECTION SYSTEM EVALUATION

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 preventative 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. For these reasons, this section provides some suggestions to improve the City's operation and maintenance practices.

Collection system maintenance can be separated into two types: preventative and corrective.

Preventative 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, preventative maintenance reduces the amount of corrective maintenance needed.

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; the jurisdiction will typically pay a premium to have this work performed.

6.2.2 Evaluation of Present Operations & Maintenance Practices

The City's current collection system maintenance program consists of regular activities and a dedicated equipment set to address collection system problems. At the present time, the City can regularly address all of the corrective maintenance issues and the most critical preventative maintenance tasks. City Staff have been working diligently over the years to maintain the sewers with the resources available. However, more dedicated sewer labor and regular maintenance programs are needed to provide adequate operation & maintenance of the City's collection system.

Examples of current maintenance activities done by City staff include jet cleaning, epoxy-coating manholes, cured-in-place pipe lining, and high-velocity forcemain cleaning (double-pumping). City staff also monitor pipe crossings at creeks for scour and monitor & clear the outfall sewer. City staff also perform miscellaneous activities, such as regular communication with users of grease traps, checking control systems (PLC's), and noting observations for updates to utility maps.

There is a substantial amount of additional preventative maintenance activities that need to be done on a regular basis in order to maintain the collection system. As previously discussed, preventative maintenance generally reduces the amount of corrective maintenance needed and reduces the overall cost of maintaining the system. The current preventative maintenance program only addresses the critical "hot-spots" in the collection system that have been identified in past years.

Ideally the City would clean and inspect every sewer mainline at 5-year intervals. Based on conversations with Public Works Staff, there are pipes in the collection system that have neither been inspected nor cleaned in the past 20 years due to shortages in available resources. Only the areas of the collection system that frequently cause backups, clogs or other problems are regularly maintained. This is resulting in a backlog of overdue inspection that is needed to identify developing problems and to allocate resources. This is also resulting in a backlog of maintenance needed to address existing problems and prevent future ones.

The City recently acquired a service truck with sewer vacuum and water jet-cleaning equipment (vac-truck). This is an important piece of equipment for maintaining the collection system. The City has a push camera that can be used to take photos of sewers over 175 feet of distance, but this is very limited in its ability to efficiently monitor long stretches of sewer. As a result, operators are jet cleaning sewers without fully knowing the current condition or the results of the maintenance activities. Typically a vac-truck is used in conjunction with TV monitoring equipment to inspect sewers before and after cleaning activities. This may be a piece of equipment that the City should consider acquiring, which could perhaps be cost-shared with the City of Monmouth.

The City's current operations budget spends approximately $10,000 per year on sewer replacement and rehabilitation work. This budget does not adequately support the extent of maintenance activities needed to effectively maintain the collection system. An adequate budget would also need to include maintenance and replacement costs for the cleaning and television inspection equipment (if purchased). Recommendations for operations and maintenance programs and projects are described in the following paragraphs.

6.2.3 Operations, Planning & Preventative Maintenance Recommendations

The following paragraphs outline some recommendations for implementing preventive maintenance programs and miscellaneous projects for maintaining the collection system. These include the following:

- **Program-1 - Sewer Cleaning and Inspection Program**
- **Program-2 - Sewer Rehabilitation & Replacement Program**
- **Project M-1 - Comprehensive Map Update**
- **Project M-2 - Sewer System Evaluation Study**
- **Project M-3 - Wastewater System Facilities Plan Update**

- **Program-1 - Sewer Cleaning and Inspection Program**

It is important that a systematic program for the cleaning and inspection of manholes and gravity sewers be established. Regular cleaning is necessary to prevent blockages, grease accumulation and sediment buildup in sewer lines. Normally, sanitary sewers laid at steep grades require less frequent cleaning than those laid at flat grades. Sewers at flat grades can experience sedimentation and grease buildup problems and will require more frequent cleaning and maintenance. Since nearly all of the sewers in Independence are laid at relatively flat grades, routine cleaning is especially important.

As part of the cleaning program, it is important that the City continue to keep records, including conditions encountered such as pipe failures, grease and solids buildup, and other problems. These records are useful in scheduling corrective work and to establish a long-term cleaning frequency schedule for different sewers. As the database is established, a schedule for subsequent cleaning can be tailored to the physical character of each line, the area served, and its performance history. Additional specific problem areas requiring more frequent cleaning can be incorporated into this program.

The inspection component of the program should include both above-ground and internal inspection of the sewer system. Above ground inspection is performed by inspecting right-of-ways, easements and noting evidence of structural failure, flooding, manhole covers above or below the present level of streets, or other problems. Additionally, it is especially useful to observe the sewers for surcharging during large rain events, which can indicate specific problem areas.

The two common methods of internal inspection are TV inspection performed in conjunction with the cleaning activities, and smoke testing. TV inspection of a sewer system utilizes a specially designed television camera and equipment to view the interior of the piping system. A video file and record of the inspection is generated and retained by the City. Leaking sewer service connections, debris or root buildup, structural failures, leaking joints and other problems can be easily identified and documented. TV inspection of sewers requires that the sewers be cleaned immediately prior to the inspection. TV inspection of sewers is typically performed during the winter months so that sources of I/I can more easily be noted and identified. Smoke testing is recommended as a part of **Project-2**, described below.

Given the large backlog of inspection and cleaning, it is expected that the collection system will be inspected and cleaned in a series of batches, perhaps one basin each year for 5 years. This will provide a comprehensive data set that can be used for allocating maintenance resources and for updating the utility maps.

The City's sewer utility maps were updated as a part of this study. However, as noted in Chapter 4, the maps do not include information for diameter, material, age or condition for a majority of the system. The recommended project list includes a project for gathering data on existing sewers and incorporating this in the utility maps that is described below in more detail (**Project M-1**). The data gathered from the inspection program should be used to determine pipe diameter, material and relative age or condition. In summary, it is recommended that inspections from **Program-1** provide data for **Project M-1** (the comprehensive mapping work).

The total length of the City's mainline collection system piping is approximately 163,000 feet. The City has a dedicated sewer vacuum and jet cleaning truck, but, as previously mentioned, does not own the equipment needed to perform TV inspections. Additionally, the City may not be able to allocate enough labor to this regular activity. Therefore, for planning purposes this work is expected to be performed by a contractor. A contractor will typically clean and TV inspect a particular line segment at the same time. The City may opt to have a contractor only provide the inspection services and to perform the jet cleaning in-house.

It is recommended that the program be funded with the goal of cleaning and inspecting every line in the City at 5-year intervals. The costs for this work performed by a contractor are about $2.00 per foot of mainline pipe. Inspection of the entire system over a 5-year period will require approximately 33,000 feet of mainline to be cleaned and inspected annually at a cost of about $66,000. As such, the City should consider allocating $66,000 per year to clean and inspect the entire collection system. Once the initial round of work is completed, the City should use the data to determine which segments need to be inspected more frequently and which segments can be inspected less frequently. Every pipe segment in the system should be placed on an inspection schedule that may vary between once every two years and once every ten years. In no case, should a line be inspected less frequently than once every ten years. With this goal in mind, the $66,000 annual budget should be allocated indefinitely and adjusted as needed.

- **Program-2 - Sewer Rehabilitation & Replacement Program**

The City's existing collection system is similar to other systems in Oregon in that it collects large amounts of I/I. The system is showing signs of aging and will continue to deteriorate. As such, it is important for the City to continue to rehabilitate the system during the planning period. Failure to continue with rehabilitation efforts will lead to major system failures that may need to be repaired under emergency circumstances. Periodic emergency repairs are likely to be more costly to the City in the long-run when compared to a more systematic rehabilitation program implemented on an annual basis.

A sewer rehabilitation and replacement program should include mainline, manhole, and service lateral rehabilitation or replacement. This type of sewer rehabilitation program may also be referred to as an I/I reduction program. It is especially important that any rehabilitation program address service laterals as they are a significant portion of the collection system piping and contribute significant amounts of I/I.

As noted above, the City currently spends approximately $10,000 per year on sewer rehabilitation projects. This amount is insufficient for a City the size of Independence. Similar sized municipalities in the Willamette Valley that have consistently maintained sewer systems typically allocate $30,000 to $100,000 per year to sewer rehabilitation measures.

To determine the appropriate funding rate for an I/I reduction program in Independence, the scope of the rehabilitation effort must be defined, including the amount of mainlines, manholes, and service laterals that are to be addressed. Based on this scope, an estimate can be developed for the total cost of rehabilitating these facilities and a schedule can be defined for the number of years over which the rehabilitation should occur. As previously discussed, information on sewer installation date, material and diameter is not available for a majority of town. Therefore, a comprehensive mapping update is recommended as a part of **Project M-1**. Additionally, this plan recommends a formal I/I study be performed to evaluate the amount of I/I that can be attributed to different parts of the collection system, further described below. This analysis will allow the City to compare the relative amount of I/I from each part of the collection system and to prioritize where I/I reduction efforts will be most effective.

As previously discussed, this program's activities and its annual recurring budget can be better defined once **Projects M-1 and M-2** are completed. These projects are recommended to be completed in years 1 through 5 of the planning period. These projects will be used to define the scope of the sewer rehabilitation and replacement work (**Program-2**). At this time, an annual recurring budget of $100,000 for sewer rehabilitation and replacement is recommended. This figure should be revisited and updated as more data becomes available and as construction costs increase over time.

Typical unit costs for this type of work are included in Table 6-1. To account for soft costs, engineering can be assumed to be 15% of the construction cost. Legal, permitting, and administration costs can be assumed to be 5% of the construction cost. A construction contingency of 5% is also recommended. Therefore, the total soft costs are assumed to be 25% of the construction costs.

Table 6-1 | Sewer Rehabilitation Program Unit Costs

Item	Unit Cost
Sewer Mainline	$110 / ft (1)
Sewer Manholes	$5,000 / each (2)
Service Laterals	$60 / ft
Total Rehabilitation Construction Cost	

Notes:
(1) Average unit cost based on a typical mix of CIPP, pipe bursting, and open cut reconstruction.
(2) Average unit cost base on a typical mix of replacement and rehabilitation.

- **Project M-1 - Comprehensive Map Update**

As a part of this planning effort, the City's sewer system maps were updated from 2013 to include new sewers, manholes, clean outs and pipelines. Background data was also updated, such as taxlots and roads. All available information from as-constructed record drawings were also included in the plans. Even after this effort, the vast majority of the collection system map lacks information such as pipe size and material. The minimum additional information needed is pipe material, diameter, and approximate year of installation for each mainline. As previously discussed, effective planning and maintenance efforts are hindered by this missing information. For example, if there was data on the overall age and material of sewers in the City, then resources for I/I reduction could be budgeted and allocated more efficiently (**Program-2**). Due to the importance of this program, this plan recommends a dedicated mapping project be completed in the first five years of the planning period.

As previously discussed, **Program-1** involves a widespread and ongoing TV inspection effort. This data would be the main source for the missing map information. **Project M-1** would compile data from the TV inspections and add it to the City's sewer system maps. An additional goal should be to create a spreadsheet (database) that lists sewers and identifies their attributes. For example, each sewer mainline would be identified with start/end manhole numbers, length, diameter, pipe material, sub-basin, installation year, number of service laterals, debris accumulation history, cleaning schedule, etc. This data set could be used to make informed management and planning decisions. For example, for planning I/I reduction, one could create a list of all of concrete pipe with mortar joints and determine their total length in each basin. This could be used to prioritize which basin ranks highest for I/I reduction measures, estimate material & labor costs and plan the improvement work.

There are approximately 163,000 feet of sanitary sewer pipe and 530 manholes in the City's collection system. As previously discussed, a vast majority of the system is not characterized for diameter, material or year of installation. Assuming data for the maps on these characteristics is collected and organized by **Program-1,** then this project will only require interpretation of the data and inputting it to the map file. It's estimated that this effort will require approximately $10,000 per year for five years if data interpretation and entry is completed by a consultant. This cost could be reduced if the City can provide the edits to the maps, i.e. "redlines", based on inspection data.

- **Project M-2 - Sewer System Evaluation Study**

A sewer system evaluation study is comprehensive analysis of a collection system performed by a consultant to evaluate infiltration & inflow problems. This study is used to determine areas of the City that contribute the most I/I to the system. This study allows for effective planning and design of I/I reduction measures. It is recommended that a project for this include both flow monitoring and smoke testing.

For flow monitoring, sensors or flow meters are installed at strategic locations in the collection system. Both the quantity of flow and the behavior of the data can provide useful insight to the I/I problems. For example, sharper spikes in flow data indicate inflows, while slowly increasing peaks generally indicate groundwater infiltration. Generally, short duration monitoring is installed during the wet weather months. Longer duration studies monitor both the dry and wet season months, which allows baseline sanitary flows to be compared to peaks associated with infiltration and inflow. Additionally, monitors can be installed in sewers both before and after rehabilitation activities to evaluate I/I reduction efforts.

Smoke testing indicates inflow locations, such as connections of downspouts to the sanitary sewer system. Smoke testing is conducted by blowing harmless nontoxic smoke into the sewer system and observing the points at which it escapes. Smoke testing is typically performed during the summer months so that groundwater does not interfere with the smoke. Smoke testing can be used to identify potential leaks into the system caused by broken pipes, bad joints, manhole failures, and similar deficiencies. Smoke testing is also very effective for locating storm sewer cross connections and illegal connections such as roof and foundation drains. As the City continues to implement I/I corrective work, smoke testing will be a useful tool for prioritizing problem areas.

Overall, a study for I/I is recommended to be completed over a four-year period for the entire collection system. It is recommended to install flow meters in fourteen locations in the collection system and to monitor wastewater flows from December through February. Fourteen monitoring installations are estimated to cost $85,000 for a single wet weather season. Weather patterns vary year to year, so it is recommended that all of the monitors be installed during the same year of the program. This will allow flow data to be compared across basins. In the subsequent three years, the work should include smoke testing of the entire collection system. The costs for smoke testing are about $0.50 per foot of mainline pipe, which would roughly cost $82,000 for the entire collection system. The final year of the program should include data analysis and the development of a recommended correction plan. This work is estimated to cost roughly $15,000. Therefore, the total recommended budget for this program over four years averages $46,000 per year. If cash flow becomes a problem, the smoke testing work could be extended over a longer period of time (e.g. 5 years rather than 3).

- **Project M-3 - Wastewater System Facilities Plan Update**

The planning assumptions used as the basis for this study are subject to change over the years. As such, the City should update this document at approximately 10-year intervals. To facilitate this, a project is included in the recommended capital improvement plan. The budget for this work is $300,000.

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 Existing 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 survey data. 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 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 5-7) 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 peak hour flow estimates were simulated in the main trunk lines. These flows were input at the manholes 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.

The modeling results indicated several surcharging problems in the existing collection system either when existing peak flows or future peak flows were introduced. Therefore, the existing collection system piping is not adequately sized to convey peak flows for the foreseeable future and there is a need to increase existing pipe sizes or reroute flows during the planning period.

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, approximately 4 feet of pipe surcharging was allowed. 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 noted above, the flows used for this analysis are the existing and build-out peak drainage basin service area flows (Table 5-7). The hydraulic model predicts surcharging throughout the City in some key trunk lines. However, this surcharging is generally the result of increases in peak flow due to development. The model predicts surface flooding at the following locations.

- Basin C 12-inch trunk sewer along 9th Street from Monmouth Street south to F Street
- Basin C Mt. Fir Park 12-inch sewer from Mt Fir Pump Station Forcemain
- Basin D 10-inch trunk sewer along 12th St from Ash Creek to Wildfang Drive
- Basin D trunk sewer to the Lagoon Pump Station within the wastewater treatment plant
- Basin E 10-inch trunk sewer north from the Williams Street Pump Station along Stryker Road

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 will need to be installed to serve underdeveloped or underserved areas as they develop. In some cases pump stations may be needed to convey wastewater to the existing system. Current City regulations require that mainlines serving these areas are to 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.

6.3.3 Pump Station Capacity Analysis

There are a total of thirteen wastewater pump stations in the City's collection system. The firm capacity of each station (Table 4-3) was compared against the peak flow to the station at buildout (Table 5-7). This analysis indicated that the **9th Street Pump Station** lacks the ability to convey the existing peak flows from the upstream collection system. This analysis also showed that other pump stations may lack the ability to convey existing peak flows from the upstream collection system early in the planning period, including **Oak Street, North Main, and Maple Drive**. The pump station run times for Oak Street, North Main and Maple Drive were reviewed for the last three years during the wet weather months. Based on the data and the observations of City operators, there is no evidence that indicates a need to upgrade the capacity of the Oak Street and North Main stations early in the planning period. Due to other issues, the Maple Drive Pump Station is recommended to be upgraded early in the planning period. If long pump run times and high levels start to be observed at these stations, then improvement projects for these stations can be moved to a higher priority. Improvement projects for these stations are included in the recommended projects and are described in more detail in Section 6.6.

In addition to the previously mentioned pump stations, this analysis showed that the peak flows at buildout are expected to exceed the capacities of the **9th Street, 13th Street. Mt. Fir, Lagoon Pump Station, and Stryker Road Pump Stations**. Improvement projects for these stations are included in the recommended projects and are described in more detail in Section 6.6.

Sewer flow from new development in Sub-basin C2 associated with Phase 1 of the Southwest Crossing Subdivision is planned to be routed to the 13th Street Pump Station. Capacity exists at this pump station to handle flows associated only with this phase of development. Additional development in Sub-basin C2 will require construction of the Ash Creek Pump Station & Forcemain and sewer **Project G-9** to direct flows from the 13th Street Pump Station to Sub-basin C3 and to decommission the 13th Street Pump Station.

Based on the analysis herein, the remaining stations have adequate capacity to convey peak flows at buildout of the upstream basins, including **Riverview, Albert Street, Briar Road, Gun Club Road, and Williams Street**.

6.3.4 Forcemain Capacity Analysis

Each of the pump stations convey water through pressure forcemain pipes to the discharge locations. Each of these pipelines was analyzed with respect to their ability to convey peak flows at buildout of the upstream basin (Table 5-7), as well as their overall age and ability to reliably serve the City for the remainder of the planning period. Pipe friction losses become problematic for pump station design when pipe velocities exceed about seven feet per second. At these pipe velocities, the power requirements to overcome the friction losses drive operating costs above acceptable levels. These pipe velocities also cause mechanical problems due to hydraulic pressure transients and excessive wear on valves and other similar pipe appurtenances. As such, the flow in each pipe segment that corresponds to a velocity of seven feet per second was considered to be the maximum capacity of each pipe segment.

Based on the analysis, the **9th Street Pump Station's** 10-inch forcemain is inadequate to convey the peak hour flows at build-out. As Basin C builds-out, several sub-basins will be routed to this pump station. As such a second forcemain is recommended to be installed as a part of the second phase upgrade of the pump station. This project is described in more detail in Section 6.6.

Based on the analysis, the **13th Street Pump Station's** 4-inch forcemain is inadequate to convey the peak hour flows at build-out. Recommended improvements to decommission this pump station are described in Section 6.6.

Additionally, the capacity of the **Lagoon Pump Station's** 10-inch forcemain is expected to be exceeded within the planning period. This station will need additional forcemain capacity. As previously discussed, a second forcemain is needed for the 9th Street Pump Station. It is recommended that this forcemain be designed as a common forcemain for the Lagoon Pump Station. This project is described in more detail in Section 6.6.

The **Maple Drive** forcemain is 4-inch steel pipe that is approximately 50 years old. It is expected that this forcemain will reach the end of its useful life during the planning period due to its age. A replacement for this forcemain is recommended as a part of the pump station replacement project.

6.3.5 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 are listed below (Table 6-1).

Table 6-2 | Summary of Collection System Deficiencies

Location	Problem Category
Main Street Sewer from H Street to B Street	May reach end of useful life during planning period
H Street Sewer from 3rd Street to Main Street	End of useful life
C Street Clay Tile Sewer	End of useful life
9th Street Trunk Sewer from Monmouth Street to F Street (Basin C)	Lacks capacity to convey peak flows at buildout of the upstream basin
Mt. Fir Trunk Sewer	Lacks capacity to convey peak flows at buildout of the upstream basin
Basin E Trunk Sewer to Williams Street Pump Station	Lacks capacity to convey peak flows at buildout of the upstream basin
Basin D Trunk Sewer to Lagoon Pump Station	Lacks capacity to convey peak flows at buildout of the upstream basin
Basin D Trunk Sewer along 12th Street	Lacks capacity to convey peak flows at buildout of the upstream basin
9th Street Pump Station & Forcemain	Lacks capacity to convey existing and future peak flows
13th Street Pump Station & Forcemain	Lacks capacity to convey future peak flows
Oak Street Pump Station	Lacks capacity to convey peak flows at buildout of the upstream basin
North Main Pump Station	Lacks capacity to convey peak flows at buildout of the upstream basin
Maple Drive Pump Station & Forcemain	Lacks capacity to convey peak flows at buildout of the upstream basin. End of useful life.
Lagoon Pump Station & Forcemain	Lacks capacity to convey peak flows at buildout of the upstream basin
Gravity collection system	Infiltration and Inflow
Undeveloped Areas	No Sewer Service

6.4 COLLECTION SYSTEM ALTERNATIVES

The shortcomings identified in Table 6-1, will need to be addressed by making improvements to the system. 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 proposes and evaluates 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 only 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 alternative, 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.

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 the recommended sewer collection system maintenance program (i.e., Program-2) will prevent increases in the amount of I/I that enters the existing collection system. In other words, no reduction in existing I/I flows is assumed. 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 forcemains 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 station where topographical limitations require. Septic tank effluent pumping (STEP) or Septic tank effluent gravity (STEG) collection systems were not considered practical given the City's reliance on a conventional gravity system and the potential deterioration of concrete components in the existing system from hydrogen sulfide present in STEP and STEG effluents.

6.5 Recommended Gravity Collection System Improvements

To address the I/I problems in the collection system, the I/I reduction plan (i.e., Program-2) is recommended. This program is discussed in greater detail above. As described above, some parts of the existing collection system piping are inadequately sized to convey the peak flows at buildout of the study area. Additionally, there are recommended improvements to the existing collection system that are needed to address structural problems such as sewer lines with grade issues.

To provide service to areas that are currently undeveloped, future pump station locations, trunk sewer sizes, and conceptual 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.

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

The recommended sewer pipeline improvements are described in the following subsections. The recommended improvements to the existing system are shown graphically in Figure 6-1, Figure 6-2 and Figure 6-3.

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.

To address the capacity problems listed in Table 6-2, it is recommended that some of these sewer segments be replaced with larger diameter lines. There are essentially no opportunities to reroute sewage through other nearby lines and the only practical alternative is to replace these lines. When these lines are replaced, it is also recommended that the manholes and service laterals either be replaced or rehabilitated to help control I/I.

6.5.1 Recommended Improvements to the Existing Gravity Collection System

- 9th Street Trunk Sewer- Manhole C-7 to C-74 (Project G-1)

  The 9th Street Trunk Sewer conveys flows from Sub-basins C1 and C4. In order to serve development in the remainder of Basin C, this sewer will need to additionally convey flows from Sub-basins C3 and C5. It is anticipated that this sewer will need to be upsized once flows from C3 and C5 are connected. Therefore, this project is considered to be development driven. Additionally, flows from Sub-basins C2 and B4 would be routed to this trunk sewer as a result of projects that decommission Briar Road and 13th Street Pump Stations (**Projects G-9 and G-10**).

  The proposed project is to increase the size of approximately 1,200 feet of 12-inch PVC mainline to 15-inch PVC mainline. This sewer is in 8th Street between Monmouth Street and F Street. As a part of the project, six manholes would be rehabilitated. The project would cross an ODOT right-of-way, which increases construction, administration and engineering costs. The total recommended budget for this project is $447,000. The detailed estimate of this budget is included in Appendix C.

  It should be noted that this project must be built prior to **Project G-11,** the upgrade to the Mt. Fir Park Sewer. **Project G-11** is necessitated by development in Sub-basin C5 and extends this 15-inch sewer an additional 1,400 feet to the Mt. Fir Pump Station forcemain. A phased approach to these two projects would allow infrastructure to be upsized as development progresses in Basin C. Depending on how development occurs, it may be most cost-effective to build **Project G-1** at the same time as **Project G-11**.

- Basin E Trunk Sewer- Manhole E-2 to E-18 (Project G-2)

  The trunk sewer north of the Williams Street Pump Station is ten inches in diameter and drains Basin E. This sewer was installed several years ago at approximately 0.15% slope, which does not provide enough capacity to convey peak hour flows. This sewer is anticipated to surcharge to an unacceptable level or overflow early in the planning period. It is recommended that this sewer be inspected and observed for overflows during high flow events. The proposed project is to increase approximately 2,000 feet of sewer from 10-inch to 15-inch diameter and to rehabilitate six manholes. The total recommended budget for this project is $557,000. The detailed estimate of this budget is included in Appendix C.

- Lagoon Pump Station Trunk Sewer- Manhole D-4 to D-14 (Project G-3)

  As flows increase in Basin D during the planning period, peak hour flows to the Lagoon Pump Station are expected to exceed the capacity of the 15-inch trunk sewer that runs along the south edge of the wastewater treatment lagoons. The proposed project is to upsize approximately 2,500 feet of 15-inch sewer to 18-inch sewer from the Lagoon Pump Station to the western edge of the wastewater treatment plant. This work would be mostly within the treatment plant adjacent to the lagoon dike slopes. Ten manholes would be rehabilitated as a part of the project. The total recommended budget for this project is $692,000. The detailed estimate of this budget is included in Appendix C.

- 12th Street Sewer- Manhole D-14 to D-55 (Project G-4)

  Flows from the northern part of Basin D are anticipated to exceed the capacity of the 10-inch sewer along 12th Street. The project proposes upsizing approximately 900 feet of sewer to 12-inch and rehabilitating six manholes. The total recommended budget for this project is $319,000. The detailed estimate of this budget is included in Appendix C.

- <u>C Street Clay Tile Sewer Replacement – Manhole B-5 to B-83 (Project G-5)</u>

  The proposed project is to replace a sewer that has reached the end of its useful life, as previously described. The proposed project is to replace 2,200 feet of sewer with 8-inch pipe. Seven manholes would be rehabilitated as a part of the work. It also includes boring approximately 100 feet under the railroad to replace the sewer line. The project would impact an ODOT right of way, which increases construction, administration and engineering costs. The total recommended budget for this project is $720,000. The detailed estimate of this budget is included in Appendix C.

- <u>H Street from 3rd Street to Main Street Replacement- Manhole B-12 to B-126 (Project G-6)</u>

  A belly has been observed in the sewer line near the railroad track crossing that causes surcharging, debris accumulation, and maintenance problems. Manholes in this area that are regularly clogged include B-133, B-126, and B-112. The manholes immediately west of the railroad have a sewer with reverse grade. This line crosses underneath the railroad, which may have caused settling over time.

  The proposed improvement project is to replace the faulty sewer in this area. For planning purposes, the extent of the proposed project is to replace the entire line and rehabilitate each manhole. This includes replacement of approximately 600 feet of 12-inch sewer line and rehabilitation of six manholes. It also includes boring approximately 100 feet under the railroad to replace the sewer line. It is possible that the project does not require this entire scope. The exact extent of the issue can be determined once this area is TV inspected (**Program-1**) and surveyed. The total recommended budget for this project is $331,000. The detailed estimate of this budget is included in Appendix C.

- <u>Spruce Court to Briar Road Replacement - Manhole B-159 to B-162 (Project G-7)</u>

  There is a belly in the line near the Spruce Court cul-de-sac that causes surcharging, debris accumulation, and maintenance problems. The upstream manhole (B-154) is regularly clogged and has to be jet-cleaned to clear debris and prevent backup.

  The proposed improvement project is to replace the faulty sewer in this area. For planning purposes, the extent of the proposed project is to replace the entire line and rehabilitate each manhole. This includes replacement of approximately 350 feet of 8-inch sewer line and rehabilitation of four manholes. It is possible that the project does not require this entire scope. The exact extent of the issue can be determined once this area is TV inspected (**Program-1**) and surveyed. The project also would include boring approximately 100 feet under the railroad to replace the sewer line. This sewer line goes between homes and through backyards. Due to the location of the sewer relative to the railroad and homes, auger bore insertion and receiving pits would disrupt private property. Surface restoration and landscaping on private property are expected to impact the cost of the project. The total recommended budget for this project is $304,000. The detailed estimate of this budget is included in Appendix C.

- <u>E Street from 12th Street to 13th Street Replacement - Manhole C-37 to C-39 (Project G-8)</u>

  Sewer lines and manholes along this line are relatively flat and do not fully drain. Based on field observations and grades, the problem appears to be located at the two manholes at the intersection of 12th and E Street.

The proposed improvement project is to replace the faulty sewer in this area. For planning purposes, the extent of the proposed project is to replace the entire line and rehabilitate each manhole. This includes replacement of approximately 550 feet of 8-inch sewer line and rehabilitation of three manholes. It is possible that the project does not require this entire scope. The exact extent of the issue can be determined once this area is TV inspected (**Program-1**) and surveyed. The total recommended budget for this project is $157,000. The detailed estimate of this budget is included in Appendix C.

- <u>13th Street Pump Station Sewer to Sub-basin C3 (Project G-9)</u>

  The proposed collection system for Sub-basin C3 includes a new pump station (the Ash Creek Pump Station). This pump station is planned to be southeast of the existing 13th Street Pump Station. The proposed project is to build a sewer from the 13th Street Pump Station to Sub-basin C3's trunk sewer that would allow the 13th Street Pump Station to be decommissioned. The 13th Street Pump Station's wetwell would be rehabilitated and converted to a flow-through manhole. The alignment of this sewer would be determined when the subdivision is built. For planning purposes, the length is expected to be approximately 1,400 feet of 8-inch pipe and require three manholes. The total recommended budget for this project is $347,000. The detailed estimate of this budget is included in Appendix C.

- <u>Briar Road Pump Station Sewer to Sub-basin C5 (Project G-10)</u>

  The proposed collection system for Sub-basin C5 includes a new pump station, the "Corvallis Road Pump Station". This pump station will be south of the existing Briar Road Pump Station. The proposed project is to build a sewer from the Briar Road Pump Station to the Corvallis Road Pump Station that would allow the Briar Road Pump Station to be decommissioned. The Briar Road Pump Station's wetwell would be rehabilitated and converted to a manhole. The alignment of this sewer would be determined when the subdivision is built in Sub-basin C5. For planning purposes, the length of sewer is expected to be approximately 500 feet of 8-inch pipe, require work on two manholes and require decommissioning of the existing pump station equipment. The total recommended budget for this project is $138,000. The detailed estimate of this budget is included in Appendix C.

  Project P-8 recommends electrical upgrades and various improvements be made to the Briar Road Pump Station during the planning period. These improvements are expected to be needed mid-way through the planning period, which is very likely to be prior to construction of the Corvallis Road Pump Station. **Project G-10** is still recommended if **Project P-8** is completed. **Project G-10** would substantially reduce O&M costs by eliminating a pump station.

- <u>Mt. Fir Park Sewer Upgrade (Project G-11)</u>

  This project is proposed to increase the capacity of the existing sewer that runs through the Mt. Fir Park. This improvement would allow flows from Sub-basin C5 to be conveyed from the Mt. Fir Pump Station to the 9th Street Trunk Sewer. The proposed project is to increase the size of approximately 1,400 feet of 12-inch PVC to 15-inch PVC mainline. As a part of the project, five manholes would be rehabilitated. The sewer would cross Ash Creek with roughly a 75-foot bore. The total recommended budget for this project is $480,000. The detailed estimate of this budget is included in Appendix C.

  It should be noted that this project must be built after to **Project G-1,** the upgrade to the 9th Street Trunk Sewer. A phased approach to these two projects would allow infrastructure to be upsized and paid for as development progresses in Basin C. Depending on how development occurs, it may be most cost-effective to build **Project G-1** at the same time as **Project G-11**.

6.5.2 Recommended Gravity Sewer Improvements 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. These relatively short extensions are not discussed in this section since the needed line extensions are relatively obvious. This section does identify several sewer extension projects that are needed to serve the larger parcels of undeveloped land within the study area. These projects are also shown on Figure 6-1 through Figure 6-3. It should be noted that the alignments shown in these figures are conceptual in nature and the final alignments, overall project lengths, and costs will depend upon the locations of future right of ways and similar development patterns. These improvements are included in this plan to illustrate how undeveloped areas of the City are to be connected to the existing system. In many cases, the specific connection points are necessary to ensure that downstream facilities are not overloaded. Any future changes to the connection points shown in this plan will need to be thoroughly analyzed to ensure that the downstream collection system has the required capacity. It is envisioned that most of these improvements will be built by developers as the larger portions of undeveloped land are annexed and developed.

- Sub-basin C3 Trunk Sewer (Project G-12)

  Sub-basin C3 does not have any development at the present time. This project is an 8-inch sewer to serve this area of Basin C to convey flows to the proposed new “Ash Creek Pump Station”. For planning purposes, the length is expected to be approximately 4,100 feet of 8-inch sewer and require twelve manholes. The total recommended budget for this project is $1,007,000. The detailed estimate of this budget is included in Appendix C.

- Sub-basin C4 Trunk Sewer (Project G-13)

  A substantial area of Sub-basin C4 is not yet served by gravity sewer. This project is comprised of 8-inch sewers to serve this area of Basin C to convey flows to the existing Mt. Fir Pump Station. For planning purposes, the length is expected to be approximately 4,000 feet of 8-inch sewer and require ten manholes. The total recommended budget for this project is $903,000. The detailed estimate of this budget is included in Appendix C.

- Sub-basin C5 Trunk Sewer (Project G-14)

  Sub-basin C5 does not have any development at the present time. This project would convey flows to the proposed new “Corvallis Road Pump Station”. For planning purposes, the length is expected to be approximately 3,900 feet of 8-inch sewer and require ten manholes. The sewer would cross the railroad tracks with roughly a 75-foot bore. The total recommended budget for this project is $990,000. The detailed estimate of this budget is included in Appendix C.

- Hoffmann Road Sewer to Undeveloped Area (Project G-15)

  North of the City’s wastewater treatment plant there is an undeveloped parcel. A new sewer would be required to serve this area of Basin E. For planning purposes, the length is expected to be approximately 1,500 feet of 8-inch sewer and require four manholes. The total recommended budget for this project is $351,000. The detailed estimate of this budget is included in Appendix C.

- Gun Club Road Sewer to Undeveloped Area (Project G-16)

  West of the airport there is approximately 85 acres of land that is undeveloped and zoned industrial in Sub-basin D2. It is most cost-effective for the Gun Club Pump Station to serve this area. For planning purposes, the length is estimated to be approximately 4,200 feet of 10-inch and 2,800 feet of 8-inch sewers to convey flows from this area to the lift station. Approximately 18 manholes would be required along the trunk sewer. The total recommended budget for this project is $1,597,000. The detailed estimate of this budget is included in Appendix C.

- Corvallis Road Sewer to Unsewered Area (Project G-17)

  Approximately twenty-two tax lots south of the River Road Bridge are outside of the city limits and are within the UGB. The developed tax lots in this area utilize septic systems. A new sewer along Corvallis Road would be required to serve this area of Sub-basin C5. These parcels are recommended to be served by the Corvallis Road Pump Station, as there is not enough vertical grade to serve this area by gravity to Basin B. This sewer would be approximately 2,300 feet of 8-inch pipe and require at least six manholes. The total recommended budget for this project is $578,000. The detailed estimate of this budget is included in Appendix C.

- 16th Street Sewer (Project G-18)

  A small area of Sub-basin D1 is not connected to the City's sewer system. This area is east and west of 16th Street, south of Monmouth Street and east of Talmadge Road (north of the Talmadge Road intersection with 16th Street). This project is an 8-inch sewer to serve this area to convey flows north to an existing sewer on Monmouth Street. For planning purposes, the length is expected to be approximately 600 feet of 8-inch sewer and require three manholes. The total recommended budget for this project is $182,000. The project would impact an ODOT right of way. The detailed estimate of this budget is included in Appendix C.

- Talmadge Road Sewer (Project G-19)

  An area in the northwest corner of Sub-basin C2 is undeveloped. This area is east and west of Talmadge Road and 16th Street (north and south of the intersection of Talmadge Road and 16th Street). This sewer additionally will serve some lots northwest of the existing Falcon Loop Subdivision. This project is an 8-inch sewer to serve this area to convey flows to the proposed new "Talmadge Road Pump Station". For planning purposes, the length is expected to be approximately 2,500 feet and require eight manholes. The total recommended budget for this project is $608,000. The detailed estimate of this budget is included in Appendix C.

- Sub-basin C2 Sewer (Project G-20)

  A large part of Sub-basin C2 does not have any development at the present time. Near-term development in this sub-basin is being directed to the 13th Street Pump Station as a temporary solution prior to building the Ash Creek Pump Station. This project includes 8-inch sewers to serve this area of Basin C to convey flows to the existing 13th Street Pump Station. For planning purposes, the length is expected to be approximately 2,800 feet of 8-inch sewer and require eight manholes. The total recommended budget for this project is $675,000. The detailed estimate of this budget is included in Appendix C.

6.6 RECOMMENDED PUMP STATION AND FORCEMAIN IMPROVEMENTS

This subsection includes a description of the recommended improvements to the City's existing pump stations and forcemain piping. Where appropriate the various improvement alternatives that were considered are discussed along with the reasons for the selection of the preferred alternative.

For projects that include increasing the pumping capacity of an existing pump station, and projects that include construction of an entirely new pump station, recommended design capacities are summarized in Table 5-8. These capacities are included for planning purposes only and should be re-evaluated for accuracy during the design phase of each project.

6.6.1 Improvements to the Existing Pump Stations and Forcemains

To address the long-term pump station capacity problems listed in Table 6-2, upgrades to several pump stations will be required. Some improvement projects listed in this subsection are intended to correct problems that are not related to capacity issues such as auxiliary power and power & control equipment that are likely to reach the end of their useful life during the planning period.

- 9th Street Pump Station Capacity Upgrade, Phases 1 & 3 (Projects P-1 & P-2)

  The proposed improvements to the 9th Street Pump Station are to substantially increase the pumping capacity over three phases. Phase 1 involves installing larger pumps in the existing wetwell. Phase 2 is the installation of a second forcemain (**Project F-1**). Phase 3 is the installation of a second wetwell, described below. Wet weather flows to the existing station currently exceed the maximum pumping capacity during large storms. Additional future flows from Basin C are planned to be directed to the 9th Street Pump Station. The Phase 1 improvements will increase the size of the pumps to the maximum extent feasible with the existing forcemain. The project will also rehabilitate the wetwell, install a new power service, install a new generator and upgrade the power and control systems. These improvements are **Project P-1**. The power service will be sized for the ultimate build-out of the station (Phases 1 through 3). The firm capacity of the pump station after Phase 1 will be 2.3 mgd. The total recommended budget for this project is $966,000. The detailed estimate of this budget is included in Appendix C.

  The Phase 3 improvements (**Project P-2**) include installing a second wetwell with two additional and identical pumps, a new valve vault, and a larger generator. Flow from the influent sewers would be split between the two wetwells. The firm capacity of the pump station after Phase 3 is anticipated to be approximately 6 mgd. The total recommended budget for this project is $928,000. The detailed estimate of this budget is included in Appendix C.

- Common Forcemain for the 9th Street and Lagoon Pump Stations (Project F-1)

  Due to the anticipated development in Basins C and D, the capacity of the 9th Street Pump Station's forcemain and the Lagoon Pump Station's forcemain are expected to be exceeded during the planning period. A new 12-inch forcemain common to these pump stations is proposed to be built. A common forcemain is proposed since both pump stations can use the same pipe alignment. Additionally, the forcemain will need to travel through a narrow dike road between lagoon cells 1 and 2, which is more effectively accomplished with a single pipe.

  The forcemain is proposed as Phase 2 of 3 phases to upgrade the capacity of the 9th Street Pump Station. The second forcemain is anticipated to increase the capacity of the 9th Street Pump Station after Phase 2 from 2.3 mgd to 2.9 mgd. However, this forcemain will need to be installed prior to or at the same time as **Project P-9**, the Lagoon Pump Station Capacity Upgrade. Depending upon how development is progressing in Basin C, it may be possible at this time to prolong building the portion of the new common forcemain between the Lagoon Pump Station and the 9th Street Pump Station.

The project would require approximately 2,300 feet of 12-inch forcemain pipe and 100 feet of boring underneath Ash Creek. A piping manifold would be installed at the 9th Street Pump Station to link the existing forcemain and the two new forcemains. A second manifold would be installed at the wastewater treatment plant to connect the two existing and one new forcemain. Approximately 1,300 feet of the piping will be installed in the lagoon dike slope, which requires extra materials and labor to install. The total recommended budget for this project is $806,000. The detailed estimate of this budget is included in Appendix C.

- <u>Oak Street Pump Station Capacity Upgrade & Improvements (Project P-3)</u>

  The Oak Street Pump Station shares a forcemain with Riverview Pump Station. The pumps at the Riverview Pump Station were upsized in 2019, which reduced the capacity of the Oak Street Pump Station (due to the shared forcemain). The proposed improvements for the Oak Street Pump Station are to install larger pumps that can meet the peak hour demands with the Riverview Pump Station running. The project would also rehabilitate the wetwell, upsize site piping, and replace the wetwell top slab & hatch to accommodate the larger pumps. The firm capacity of the upgraded pump station will need to be approximately 2.2 mgd.

  The Oak Street Pump Station utilizes the original power distribution and control equipment that was installed in 1998. Due to their age, it is recommended that these systems be upgraded during the planning period. The proposed project includes an upgraded power service, new variable frequency drives, a generator, and an upgraded control system. The upgraded control system would include a new control panel, level sensor, redundant level control probe and a dedicated overflow sensor. To install the new controls in the existing building, it is expected that temporary controls will need to be setup. It is expected that the existing generator would need to be upgraded in order to run the new pumps simultaneously.

  The Oak Street Pump Station's rim elevation was recently surveyed to be 163.72 ft. FEMA flood maps indicate a 100-year flood elevation of 162 ft at the site. Flooding is not expected to be an issue at this location. In the past, the City has not had issues with flooding at this pump station during major floods. However, flood maps may change in the future. It's recommended that current flood maps be referenced prior to designing new improvements at the station.

  The total recommended budget for this project is $786,000. The detailed estimate of this budget is included in Appendix C.

- <u>North Main Pump Station Capacity Upgrade & Improvements (Project P-4)</u>

  Peak hour flows to the North Main Pump Station are anticipated to exceed the firm capacity during the planning period. The proposed improvements are to install larger pumps in the existing wetwell. The wetwell and discharge piping appear to be in good condition, so rehabilitation of these is not anticipated to be necessary. The firm capacity of the upgraded pump station will need to be approximately 0.61 mgd.

  The pump station utilizes the original power and control equipment that was installed in 2005. This equipment will likely reach the end of its useful life during the planning period due to age. Therefore, the proposed project includes a generator, new variable frequency drives and an upgraded control system. The control system would include a new control panel, level sensor, redundant level control probe and a dedicated overflow sensor. It is recommended that the electrical improvements be constructed adjacent to the existing controls while the station is in service and then to switch-over the station to the new controls. The power service is not expected to need improvements to run the larger pumps.

The pump station is located on private property. The City does not have an easement for the site according to the City's records. Costs for easement acquisition are included in the cost estimate. The total recommended budget for this project is \$309,000. A detailed breakdown of this budget is included in Appendix C.

- Maple Drive Pump Station Upgrade & Forcemain (Projects P-5 and F-2)

Peak hour flows to the Maple Drive Pump Station are anticipated to exceed the firm capacity during the planning period. Additionally, the pump station is in need of substantial structural, mechanical and electrical upgrades. It is recommended that the pump station be substantially upgraded early in the planning period. This station has been identified by Public Works as the highest priority pump station to improve due to its age and condition. The proposed project is to retrofit the pump station in its current location and make some site improvements. Bypass pumping would be setup for the duration of construction to take the wetwell out of service. The pump station is located on private property. The City does not have an easement for the site according to the City's records. It is recommended that the City acquire an easement for the site. The recommended project budget includes cost for easement acquisition.

The existing pumps are relatively new and should serve the needs of the City for several years. These pumps are recommended to be salvaged and reinstalled. Larger pumps should be installed later in the planning period when flows increase. The firm capacity of the upgraded pump station will need to be approximately 0.4 mgd.

The proposed improvements include rehabilitating the existing concrete wetwell, installing a new top slab and hatch, adding a small valve vault, and upgrading power & control equipment. The wetwell would be retrofit with pump guide bars, which would facilitate maintenance of pumps. The sidewalk along Maple Drive is incomplete. It's recommended that the project also include improvements to complete the sidewalk. The pump station does not have space for an on-site generator. Operators would continue to use a trailer-mounted generator.

This project should be built in conjunction with the new recommended forcemain (**Project F-2**). These are separate projects in this document only for organizational purposes. The project would include approximate 250 feet of 6-inch pipe.

An alternative to this project was considered in order to decommission the pump station. The Mt. Fir Pump Station was evaluated for its capacity to serve Sub-basin B3 by constructing a new sewer, but there is not enough vertical grade.

The total recommended budget for both the pump station and forcemain projects is \$561,000. The detailed estimate of this budget is included in Appendix C.

- Lagoon Pump Station Capacity Upgrade & Improvements (Project P-6)

The pumping capacity of the Lagoon Pump Station is anticipated to be exceeded during the planning period due to development in Basin D. Additionally, this pump station is utilized for wastewater plant pumping. The pump station was last upgraded in 1999. The station has space and piping that can accommodate the addition of a third pump. The proposed project is to add a pump to the existing wetwell and other improvements that would retrofit the pump station. Recommended electrical improvements include new variable frequency drives, new wetwell instruments, and new control & telemetry panels. These electrical components are anticipated to reach the end of their useful life during the planning period. The existing building is not anticipated to be large enough to house the new electrical equipment. A building addition is recommended, which would also facilitate the installation of the new equipment while the existing equipment is still in service. Miscellaneous improvements are also recommended to modernize the station, including new handrails and a new floor in the control building over the dry well. The firm capacity of the upgraded pump station will need to be approximately 3.2 mgd for sewer flows.

The Lagoon Pump Station's 10-inch forcemain does not have substantial excess capacity to accommodate the larger pumps that will be installed as a part of **Project P-6**. **Project F-1**, the recommended common forcemain with the 9th Street Pump Station, should be completed prior to or at the same time as **Project P-6**. Depending upon how development is progressing in Basin C, it may be possible at this time to prolong building the portion of the new common forcemain that is between the Lagoon Pump Station and the 9th Street Pump Station. The total recommended budget for this project is $411,000. The detailed estimate of this budget is included in Appendix C.

- Albert Street Pump Station Electrical Systems Upgrade (Project P-7)

  The Albert Street Pump Station utilizes the original power distribution and control equipment that was installed in 1998. These systems will likely reach the end of their useful life during the planning period due to age. The proposed project includes the addition of a generator, variable frequency drives and an upgraded control system. The control system would include a new pump disconnect panel, pump control panel, level sensor, redundant level control probe and a dedicated overflow sensor. It is recommended that the electrical improvements be constructed adjacent to the existing controls while the station is in service and then to switch-over the station to the new controls. The power service is not expected to need improvements during the planning period. The total recommended budget for this project is $244,000. The detailed estimate of this budget is included in Appendix C.

- Briar Road Pump Station Electrical Systems Upgrade (Project P-8)

  The Briar Road Pump Station utilizes the original power distribution and control equipment that was installed in 2002. It is expected that the control system will need to be entirely replaced and upgraded during the planning period. The proposed project includes the addition of a generator and an upgraded control system. The control system would include a new control panel, level sensor, redundant level control probe and a dedicated overflow sensor. The power service is not expected to need improvements during the planning period.

  The pump station is located on private property. The City does not have an easement for the site according to the City's records. Costs for easement acquisition are included in the cost estimate. The total recommended budget for this project is $155,000. The detailed estimate of this budget is included in Appendix C.

- 13th Street Pump Station Electrical Systems Upgrade (Project P-9)

  The 13th Street Pump Station utilizes the original power distribution and control equipment that was installed in 2001. This equipment will likely reach the end of its useful life during the planning period due to age. Therefore, the proposed project also includes the addition of an auxiliary power generator and an upgraded control system. The control system would include a new control panel, level sensor, redundant level control probe and a dedicated overflow sensor. It is recommended that the electrical improvements be constructed adjacent to the existing controls while the station is in service and then to switch-over the station to the new controls. The power service is not expected to need improvements during the planning period. As a part of this project, it is recommended that a vent be installed in the wetwell top slab. Additionally, the former 13th Street Pump Station nearby was abandoned and needs to be demolished. That would be demolished as a part of this project.

The pump station is located on private property. The City does not have an easement for the site according to the City's records. Costs for easement acquisition are included in the cost estimate. The total recommended budget for this project is $253,000. The detailed estimate of this budget is included in Appendix C.

As previously discussed, this project may not be needed during the planning period depending upon how development proceeds in Basin C. This plan recommends that flows to the 13th Street Pump Station be directed to the new Ash Creek Pump Station using a new sewer (**Project G-9**). **Project G-9** would allow the 13th Street Pump Station to be decommissioned and to avoid retrofitting the electrical systems. An easement for the wetwell and sewers on private property will still be needed even if the pump station is decommissioned.

- <u>Mt. Fir Pump Station Capacity & Electrical Systems Upgrade (Project P-10)</u>

As a result of development in Sub-basin C5, flows to the Mt. Fir Pump Station are expected to exceed the pumping capacity during the planning period. The pump station has provisions for the addition of a third pump. The proposed project includes a third pump installed in the existing wetwell and improvements to the electrical systems. It is not expected that the flows to the pump station will exceed the pumping capacity until development occurs in Sub-basin C5. The firm capacity of the upgraded pump station will need to be approximately 1.6 mgd.

The pump station utilizes the original power distribution and control equipment that was installed in 1998. This equipment will likely reach the end of its useful life during the planning period due to age. Therefore, the proposed project includes the addition of variable frequency drives and an upgraded control system. The control system would include a new control panel, level sensor, redundant level control probe and a dedicated overflow sensor. To install the new controls in the existing building, it is expected that temporary controls will need to be setup. The power service is not expected to need improvements during the planning period. The total recommended budget for this project is $256,000. The detailed estimate of this budget is included in Appendix C.

- <u>Stryker Road Pump Station Upgrade (Project P-11)</u>

Peak hour flows to the Stryker Road Pump Station are anticipated to exceed the firm capacity during the planning period. The proposed improvements are to install larger pumps in the existing wetwell. The wetwell and discharge piping appear to be in good condition, so rehabilitation of these is not anticipated to be necessary. The firm capacity of the upgraded pump station will need to be approximately 0.41 mgd.

The Stryker Road Pump Station utilizes the original power distribution and control equipment that was installed in 1998. This equipment will likely reach the end of its useful life during the planning period due to age. Therefore, the proposed project includes the addition of a generator, variable frequency drives and an upgraded control system. The control system would include a new control panel, level sensor, redundant level control probe and a dedicated overflow sensor. It is recommended that the electrical improvements be constructed adjacent to the existing controls while the station is in service and then to switch-over the station to the new controls. The power service is not expected to need improvements during the planning period.

The pump station is located on private property. The City does not have an easement for the site according to the City's records. Costs for easement acquisition are included in the cost estimate. The total recommended budget for this project is $364,000. The detailed estimate of this budget is included in Appendix C.

- Williams Street Pump Station Generator Upgrade (Project P-15)

During the planning period, it is recommended that the generator at the Williams Street Pump Station be evaluated toward the end of the planning period for replacement. It was roughly 20 years old at the time it was installed at this location. If the generator is still in usable condition at this time, this project may not be needed. The total recommended budget for this project is $60,000.

6.6.2 Pump Station and Forcemain Improvements to Serve Undeveloped Areas

Sewer service is not currently available in some areas of the City. As such, new gravity sewers (see section 6.5.2), pump stations, and forcemain pipelines will be required to provide service to these areas. The recommended improvements are described below and shown graphically in Figure 6-1 through Figure 6-3. It should be noted that the pump station locations and forcemain alignments shown in the figures are conceptual in nature and the final alignments, overall project lengths, and costs will depend upon the locations of future right of ways and similar development patterns. It is envisioned that most of these improvements will be built by developers as the larger portions of undeveloped land are annexed and developed.

- New Ash Creek Pump Station and Forcemain (Projects P-12 & F-3)

A new pump station is proposed to serve Sub-basins C2 and C3, the "Ash Creek Pump Station". This pump station is assumed to be roughly located south of Sweet Cherry Lane. This location would facilitate the drainage of Sub-basin C3 with the existing slopes toward Ash Creek. The project would include a duplex pump configuration with a pre-cast wetwell and a pre-cast valve vault. Power and control systems would include VFD's, wetwell instruments and an on-site generator. A pre-fabricated control shelter is recommended to house equipment, similar to the one at the Williams Street Pump Station. The firm capacity of the new pump station is recommended to be 1.5 mgd. The associated forcemain is **Project F-3**. This 6-inch forcemain would convey flows approximately 2,800 feet from the pump station to the 9th Street gravity sewer at manhole C-74 (**Project G-1**). The forcemain would cross Ash Creek with roughly a 100-foot bore.

This new pump station is recommended to be located relatively near to the 13th Street Pump Station. This will facilitate the construction of a gravity sewer from the 13th Street Pump Station to Sub-basin C3, which will allow the 13th Street Pump Station to be decommissioned. This sewer is **Project G-9**. The depth of the new wetwell should be designed to allow the 13th Street Pump Station to be converted to a manhole. The total recommended budget for both the pump station and forcemain projects is $1,593,000. The detailed estimate of this budget is included in Appendix C.

- New Corvallis Road Pump Station & Forcemain (Project P-13 & F-4)

A new pump station is proposed to serve Sub-basins C5 and B4, the "Corvallis Road Pump Station". This pump station is assumed to be roughly located south of Briar Road. The project would include a duplex pump configuration with a pre-cast wetwell and a pre-cast valve vault. Power and control systems would include VFD's, wetwell instruments and an on-site generator. A pre-fabricated control shelter is recommended to house equipment, similar to the one at the Williams Street Pump Station. The firm capacity of the new pump station will need to be at least 0.6 mgd. The associated forcemain is **Project F-4**. The forcemain would cross the railroad with roughly a 100-foot bore. This 6-inch forcemain would convey flows approximately 1,300 feet from the pump station to the gravity sewer near 6th & Rose Street at manhole C-98. This sewer was built in 1999 and was intentionally upsized to convey flows from the nearby areas. This sewer flows to the Mt. Fir Pump Station, which ultimately conveys flow to the 9th Street Pump Station.

The nearby Briar Road Pump Station and Basin B were evaluated for their ability to receive flows from Sub-basin C5. It was determined that the Briar Road Pump Station and the surrounding sewers are several feet too shallow to receive gravity flows from Sub-basin C5. Therefore, a new and deeper pump station is needed for this area. It was determined that it is most cost-effective to convey flows from Sub-basin C5 to the treatment plant via Basin C, rather than to discharge it to Sub-basin B3 (Maple Drive P.S.) and subsequently Sub-basin B1 (Riverview P.S.). Discharging flows from the new pump station to Basin B would necessitate upsizing more existing gravity sewers and would be substantially more expensive. **Projects P-10, P-13, and F-4** are necessitated by the sewer flows associated with Sub-basin C5. It is expected that costs associated with these projects would be borne by the developers of this area.

This new pump station is recommended to be located relatively near to the Briar Road Pump Station. This will facilitate the construction of a gravity sewer from the Briar Road Pump Station to Sub-basin C5, which will allow the Briar Road Pump Station to be decommissioned. This sewer is **Project G-10**. The depth of the new wetwell should be designed such to allow the Briar Road Pump Station to be converted to a manhole. The total recommended budget for both the pump station and forcemain projects is $1,300,000. The detailed estimate of this budget is included in Appendix C.

- New Talmadge Road Pump Station & Forcemain (Project P-14)

A new pump station and forcemain are proposed to serve undeveloped lots in the northwestern corner of Sub-basin C2, the "Talmadge Road Pump Station". This pump station is needed to convey flows from lots along Talmadge Road and 16th Street that are west of the existing Falcon Loop Subdivision. Sewers described in **Project G-19** will convey flows to the pump station. Flows from this pump station would be discharged to a gravity sewer on the north edge of the Southwest Crossing Subdivision (at the planned Road C). The area to be served is zoned primarily as high-density residential. The approximate firm capacity of the pump station is recommended to be at least 0.5 mgd. The forcemain is expected to be relatively short. A separate project is not defined for the forcemain. This project would be built by a developer as a part of a subdivision. The total recommended budget for the project is $605,000. The detailed estimate of this budget is included in Appendix C.

Figure 6-1 | Recommended Improvements to the City's Existing Collection System - North

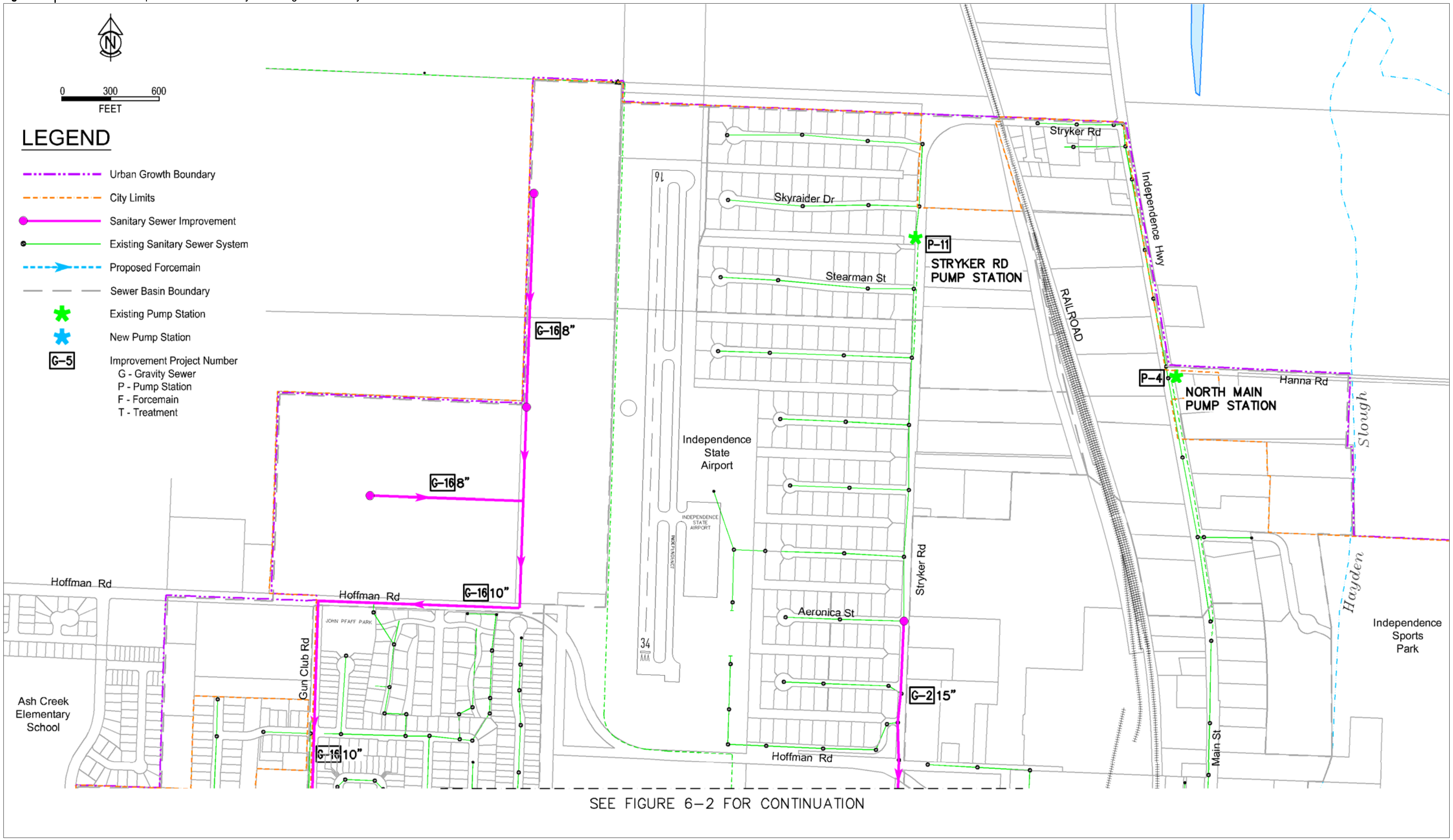


Figure 6-2 | Recommended Improvements to the City's Existing Collection System - Central

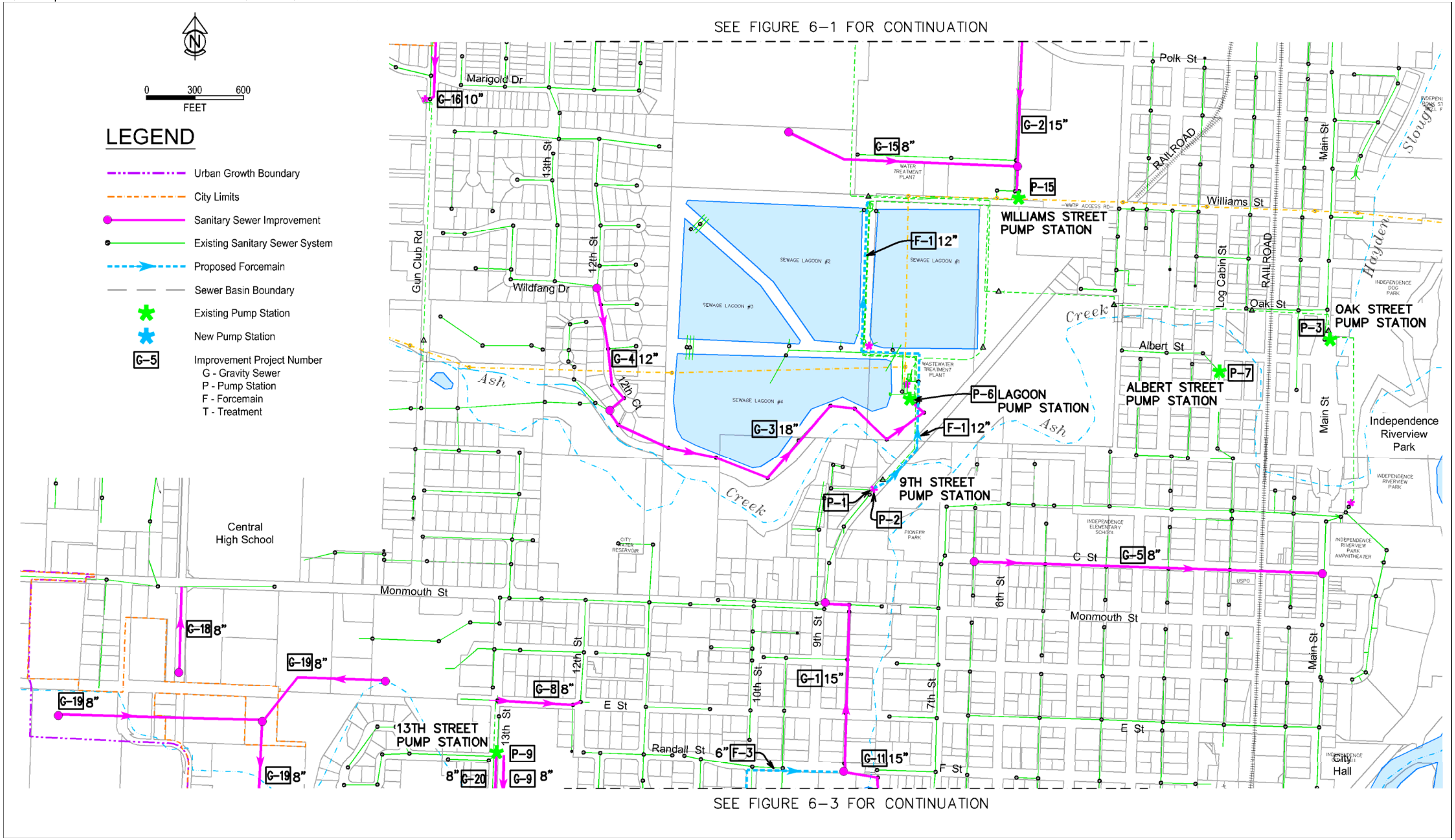
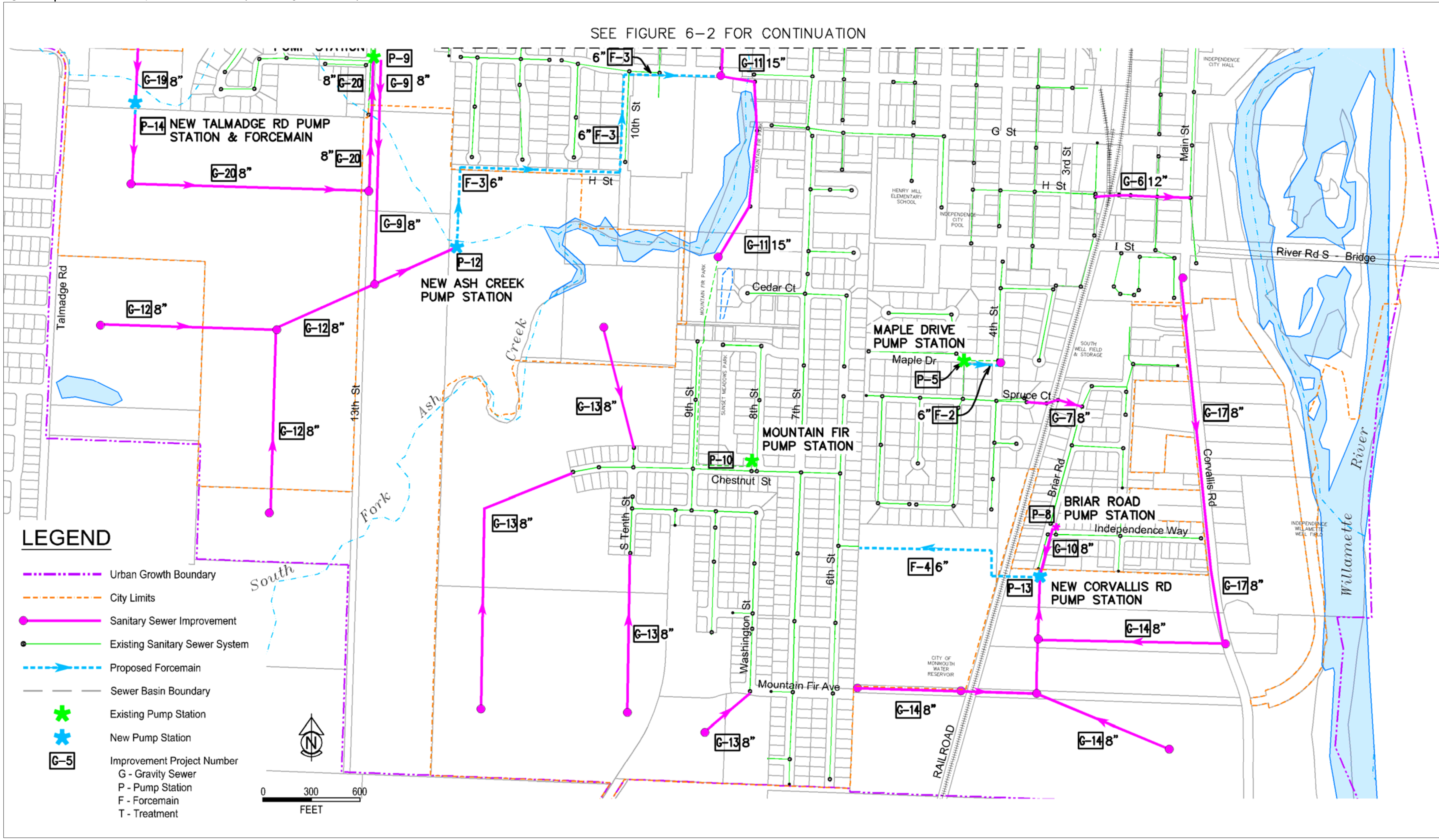


Figure 6-3 | Recommended Improvements to the City's Existing Collection System - South



6.7 Summary of Recommendations

The recommended improvements described above are summarized in Table 6-2 and are shown in the figures above. 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 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 service area limits or community growth boundaries 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 6-3 | Recommended Collection System Improvements

Project Code	Project Description	Diameter	Length	Project Cost
Gravity Collection System Improvements				
G-1	9th Street Trunk Sewer- Manhole C-7 to C-74	15	1,200	$447,000
G-2	Basin E Trunk Sewer- Manhole E-2 to E-6	15	1,400	$557,000
G-3	Lagoon Pump Station Trunk Sewer- Manhole D-4 to D-12	18	2,100	$692,000
G-4	12th Street Sewer- Manhole D-14 to D-55	12	900	$319,000
G-5	C Street Clay Tile Sewer Replacement – Manhole B-5 to B-83	8	2,200	$720,000
G-6	H Street from 3rd Street to Main Street Replacement- Manhole B-12 to B-126	12	600	$331,000
G-7	Spruce Court to Briar Road Replacement - Manhole B-159 to B-162	8	350	$304,000
G-8	E Street from 12th Street to 13th Street Replacement - Manhole C-37 to C-39	8	550	$157,000
G-9	13th Street Pump Station Sewer to Sub-basin C3	8	1,400	$347,000
G-10	Briar Road Pump Station Sewer to Sub-basin C5	8	500	$138,000
G-11	Mt. Fir Park Sewer Upgrade	15	1,400	$480,000
G-12	Sub-basin C3 Trunk Sewer to Undeveloped Area	8	4,100	$1,007,000
G-13	Sub-basin C4 Trunk Sewer to Undeveloped Area	8	4,000	$903,000
G-14	Sub-basin C5 Trunk Sewer to Undeveloped Area	8	3,900	$990,000
G-15	Hoffmann Road Sewer to Undeveloped Area	8	1,500	$351,000
G-16	Gun Club Road Sewer to Undeveloped Area	8 / 10	2,800 / 4,200	$1,597,000
G-17	Corvallis Road Sewer to Unsewered Area	8	2,300	$578,000
G-18	16th Street Sewer	8	600	$182,000
G-19	Talmadge Road Sewer	8	2,500	$608,000
G-20	Sub-basin C2 Sewer	8	2,800	$675,000
Pump Station and Forcemain Improvements				
P-1	9th Street Pump Station Capacity Upgrade - Phase 1	-	-	$966,000

Table 6-3 | Recommended Collection System Improvements

P-2	9th Street Pump Station Capacity Upgrade - Phase 3	-	-	$928,000
P-3	Oak Street Pump Station Capacity Upgrade & Improvements	-	-	$786,000
P-4	North Main Pump Station Capacity Upgrade & Improvements	-	-	$309,000
P-5	Maple Drive Pump Station Upgrade	-	-	$508,000
P-6	Lagoon Pump Station Capacity Upgrade & Improvements	-	-	$411,000
P-7	Albert Street Pump Station Electrical Systems Upgrade	-	-	$244,000
P-8	Briar Road Pump Station Electrical Systems Upgrade	-	-	$155,000
P-9	13th Street Pump Station Electrical Systems Upgrade	-	-	$253,000
P-10	Mt. Fir Pump Station Capacity & Electrical Systems Upgrade	-	-	$256,000
P-11	Stryker Road Pump Station Electrical Systems Upgrade	-	-	$364,000
P-12	New Ash Creek Pump Station	-	-	$865,000
P-13	New Corvallis Road Pump Station	-	-	$887,000
P-14	New Talmadge Road Pump Station & Forcemain	-	-	$605,000
P-15	Williams Street Pump Station Generator Upgrade	-	-	$60,000
F-1	Common Forcemain for the 9th Street and Lagoon Pump Stations	12	2,300	$806,000
F-2	Maple Drive Pump Station Forcemain	6	250	$53,000
F-3	New Ash Creek Pump Station Forcemain	6	2,800	$728,000
F-4	New Corvallis Road Pump Station Forcemain	6	1,300	$413,000
Operations, Planning & Preventative Maintenance Recommendations				
Program-1	Sewer Cleaning and Inspection Program – *Annual recurring program*	$66,000 per year		
Program-2	Sewer Rehabilitation & Replacement Program – *Annual recurring program*	$100,000 per year		
M-1	Comprehensive Map Update – *Annual project for five years*	$10,000 per year		
M-2	Sewer System Evaluation Study – *Annual project for four years*	Average $46,000 per year		
M-3	Wastewater Systems Facilities Plan Update	$300,000		

CHAPTER 7

TREATMENT SYSTEM EVALUATION

Chapter Outline

TREATMENT SYSTEM EVALUATION

7.1 INTRODUCTION

Chapter 4 includes a listing of existing treatment system deficiencies (Section 4.5.3). 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 an 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 consistently meet the concentration and mass load limits required by the NPDES permit for effluent BOD and TSS.
- The existing catwalks, piping, valves, and pumps used to convey water from lagoon Cell 1 to Cell 4 are old and antiquated and should be replaced during the planning period.
- Sludge accumulation in the lagoons is becoming significant, and the City should plan to remove sludge during the planning period.

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 Headworks

All wastewater from the collection system is discharged into the headworks where flow enters the plant. The headworks includes a 12-inch Parshall flume for flow measurement. An ultrasonic flow meter and an automatic sampler for collecting influent samples. The headworks does not include any screening or grit removal facilities which is fairly common for a facultative lagoon system. On the downstream end of the headworks, flow is directed to two 18-inch ductile-iron pipes, one each to lagoon cells 1 and 2. The headworks was constructed in 1998 and the structure is in good condition. The 12-inch Parshall flume has the capacity to measure flow up to about 7.4 MGD. This is quite a bit lower than the existing and projected peak hour flow from the collection system (Table 5-4 and Table 5-5) and it is very likely that the flume will need to be replaced during the planning period as the various pump stations that discharge into the headworks are improved with increased pumping capacities. As such, the City should plan to replace the structure during the planning period with a larger flume that is capable of measuring the projected peak flows.

7.3.2 Hydraulic Storage Capacity

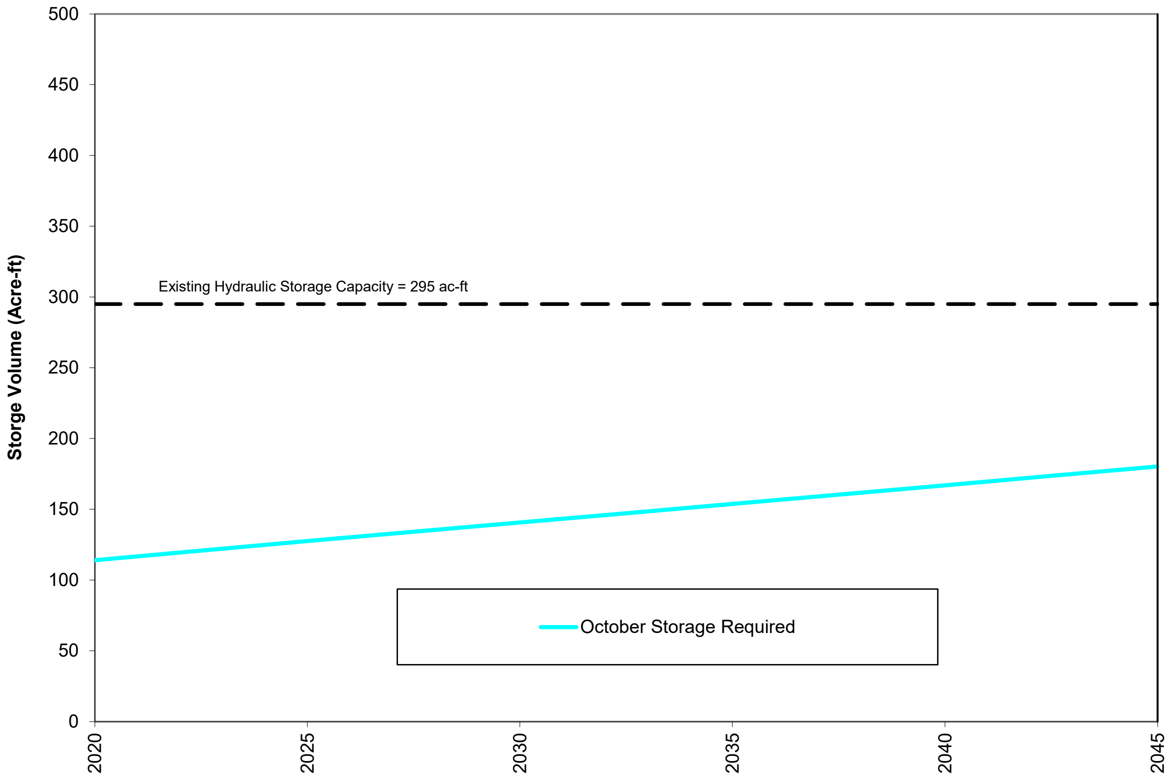
Throughout the year, there are two periods of time when the City is unable to discharge treated effluent from the lagoons and all wastewater that flows into the plant must be stored in the lagoons. The City's current discharge permit does not allow discharge to the receiving stream between June 1 and October 31. In early June, the irrigation sites can be too wet to be irrigated and all wastewater must be stored in the Lagoons. As fall rains start in October, the irrigation sites can also become too wet to receive irrigation water. The City is not permitted to discharge to the receiving stream until November 1. Therefore, during the month of October, all wastewater must also be stored in the lagoons.

When the lagoon water levels are drawn down to the minimum possible levels, the storage capacity provided by the lagoons is approximately 295 acre-feet (Table 4-9). To evaluate the adequacy of this volume, a water balance can be performed for the spring and fall storage periods. The water balance includes summing all the water inputs and outputs from the lagoons to estimate the total storage requirements. Water balances were performed at 5-year intervals during the planning period using the projected flows listed in Chapter 5. 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 storage period (i.e., October) are greater than the Spring storage period (i.e., June). Therefore, the Fall storage requirements control the sizing of the lagoons with respect to hydraulic storage. For the sake of clarity, the spring storage requirement line is not shown in Figure 7-1 since it is less than the storage requirement for Fall. The water balance calculations are based on the following assumptions.

- In an effort to be conservative with respect to the storage needs, the water balance calculations will be based on the assumption that no irrigation will occur during the month of June in the Spring and during the month of October in the Fall. This is a fairly conservative assumption since irrigation during these months is fairly common.
- The average influent flow to the lagoons during the June storage period and during the October storage period is approximately 25% higher than the average dry weather flow for the entire dry weather period. This assumption accounts for the fact that flows in the Spring and Fall can be higher than the middle of summer due to increased I/I.
- Zero wastewater outflow during the Spring and Fall storage periods.
- The monthly average pan evaporation is, 5.88 inches and 2.37 inches for June and October respectively [4]. Pan evaporation is multiplied by a pan coefficient of 0.745 to estimate the free surface evaporation from the lagoons.
- The monthly average rainfall is 1.23 inches and 3.17 inches for June and October respectively[4].

[4] Oregon State University Weather Station. Period of Record, 1890 through 2005

Figure 7-1 | Hydraulic Storage Requirements



The water balance calculations show the existing facilities provide more than enough storage to accommodate flows from the City for the entire planning period. Therefore, additional lagoon storage should not be needed during the planning period. The storage capacity of the existing plant (295 ac-feet) is based on complete drawdown of the lagoons to minimum water depths of two feet.

7.3.3 Organic Treatment Capacity

The facultative lagoons provide primary and secondary treatment. The organic treatment capacity of the lagoons is finite. If this capacity is exceeded, compliance problems will result. Flow from the headworks is typically split between Cell 1 and Cell 2. Water then flows in series from Cell 1 to Cell 2 to Cell 3 to Cell 4. In Western Oregon, a typical design approach is to size lagoons for an overall organic loading rate of 35 pounds of BOD per acre per day, with a maximum of 50 pounds of BOD per acre per day to the first cell on an average annual basis. When operated in series mode, the organic treatment capacity of the plant is controlled by the size of Cell 1. The combined surface area of Cell 1 and Cell 2 is about 27.8 acres. At 50 pounds per acre per day, the organic treatment capacity of the first two lagoon cells is about 1,390 pounds of BOD per day. The total surface area provided by all four lagoon cells is about 50.9 acres. At 35 pounds per acre pre day, the organic treatment capacity of the entire plant is about 1,780 pounds of BOD per day. The current BOD loading to the treatment plant is about 2,130 pounds per day on an average annual basis (Table 5-10). This value is significantly higher than the treatment capacity of the first two lagoon cells and the treatment capacity of the entire plant. Therefore, the treatment plant is overloaded and improvements are needed early in the planning period.

In addition to the overloading problem, the lagoons have accumulated a significant amount of sludge over the years (see Section 4.5.3). Sludge has never been removed from the lagoons since they were originally constructed. The accumulation is significant and is likely impacting the ability of the lagoons to provide adequate treatment. Therefore, the City should plan to remove the sludge during the planning period.

7.3.4 Discharge Facilities Capacity Evaluation

Once water enters the first lagoon cell, the flow rate through the plant is controlled by the discharge rate selected by the operator. During the winter months, the discharge rate is selected by the operator and the control system automatically adjusts the actuated valve on the Cell 4 outlet pipe to maintain the discharge rate selected by the operator. Water flows through the Cell 4 outlet pipe to the chlorine contact chamber and through the contact chambers to the outfall pipeline and ultimately to the Willamette River. Winter discharge occurs entirely by gravity. During the summer season, two vertical turbine pumps are used to convey water to the irrigation sites. The speed of the irrigation pumps is controlled to maintain a constant pressure in the irrigation distribution system. As more water is used for irrigation, the pressure in the irrigation piping drops and the speed of the irrigation pumps is increased to increase the pressure to the desired set point. The opposite sequence occurs as the amount of irrigation water being used decreases.

An analysis was completed of the various hydraulic facilities used to convey water from Cell 1 to the Willamette River as required during the winter discharge season. This analysis showed that all of the various transfer pipes and hydraulic structures used to convey water from the first lagoon cell to the Willamette River Outfall are adequately sized to convey at least 4 MGD. For the purposes of this study, the firm capacity of the winter discharge facilities will be taken as 4 MGD. During the summer discharge season (May – October) the irrigation pump station is used to discharge effluent at a maximum capacity of about 2,000 GPM or 2.9 MGD.

To determine the adequacy of the winter and summer discharge facilities, 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, flows 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 along with the summer irrigation capacity of the treatment plant in Figure 7-3. The water balance calculations are based on the following assumptions.

- The total winter discharge season is 200 days. The actual November 1 through May 31 discharge window is 212 days long. The shorter timeframe is used to be conservative and to account for equipment malfunctions and other similar events that may impact discharge operations.
- Summer discharge (i.e., irrigation) occurs over 45 days. This is equivalent to 6 to 7 weeks of irrigation. Based on grass seed crops currently grown at the irrigation sites. A conservative irrigation scheme is approximately 6 to 7 weeks of irrigation after the harvest.
- The average November – May rainfall depth is 34.08 inches[5].
- The average June – October rainfall depth is 6.73 inches[5].
- The average November – May pan evaporation is 11.84 inches[5]

[5] Western Regional Climate Center data for Corvallis State University

- The average June – October pan evaporation is 32.76 inches.
- Pan evaporation is multiplied by a pan coefficient of 0.745 to estimate the free surface evaporation from the lagoons.
- Zero lagoon seepage. This is conservative since some seepage from the lagoons will occur.
- 295 acre-feet of water stored in the lagoons must be discharged during the winter and summer discharge seasons.

As shown in Figure 7-2 the capacity of the piping and valves that are used to convey water through the plant during the winter months are adequate for most of the planning period. That said, much of the equipment used to convey water through the lagoons is old and will become antiquated during the planning period. The exception to this is the Cell 4 outlet structure and piping. These facilities were installed in 2020 and are adequate to serve the City for the remainder of the planning period. The remainder of the piping, pumps, and valves used to convey water from Cell 1 to Cell 4 should be replaced during the planning period to replace this old and outdated infrastructure.

As shown in Figure 7-3, the required summer discharge rate is less than the pumping capacity of the irrigation pump station. Therefore, the station should be adequate for the remainder of the planning period. This conclusion does not imply that the disposal capacity of the irrigation sites will be adequate for the remainder of the planning period. The pumping capacity of the station should be adequate, but the capacity of the irrigation sites is evaluated below (Section 7.3.7).

Figure 7-2 | Required Plant Winter Discharge Rate

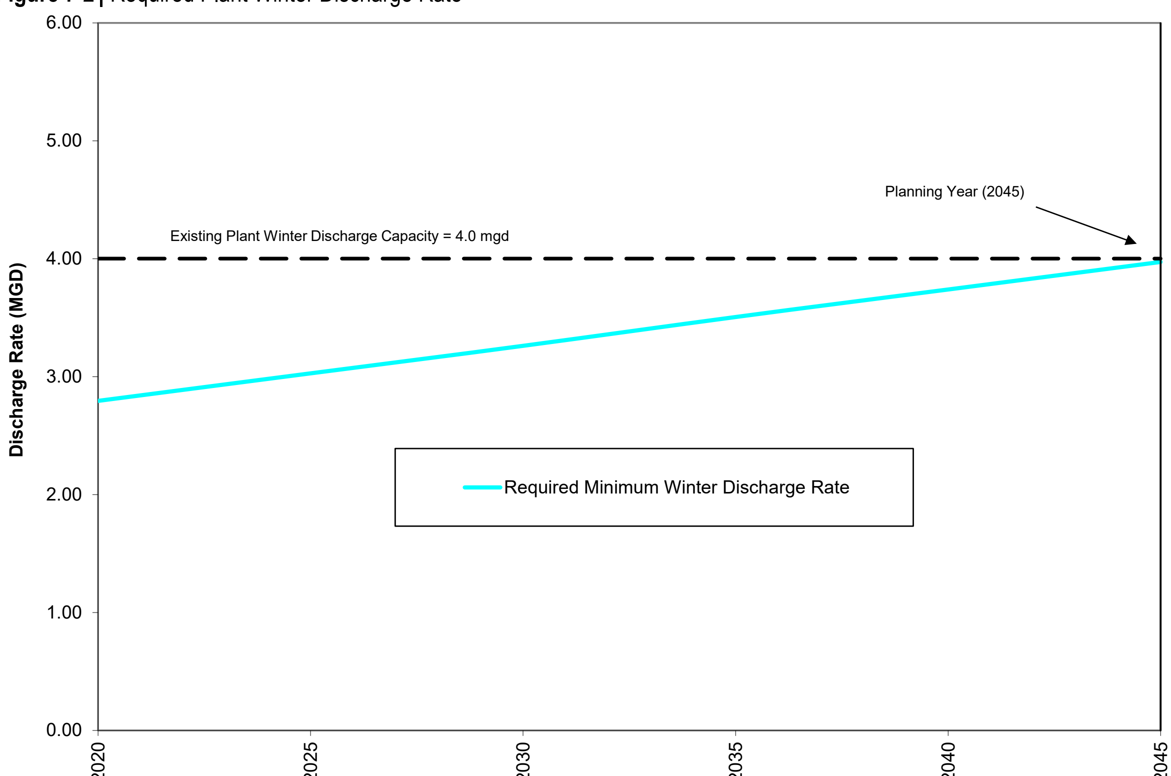
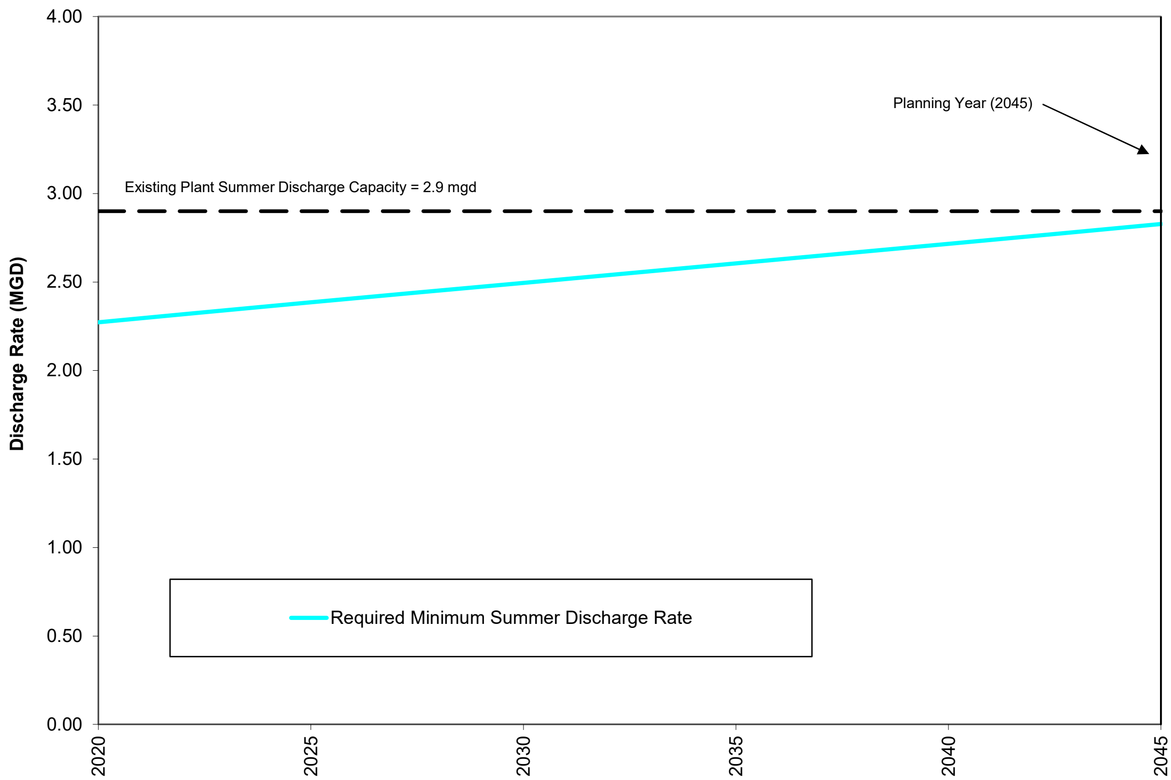


Figure 7-3 | Required Plant Summer Irrigation Rate



7.3.5 Disinfection System Capacity

Chlorine is added to disinfect the effluent prior to disposal. Disinfection by chlorine is not an instantaneous reaction. A fair amount of time is required in order for the chlorine to be effective. For this reason, facilities that use chlorine for disinfection have contact chamber that provides the time needed for effective chlorine disinfection. At the City's treatment plant, chlorine contact time is provided in a baffled concrete tank near the discharge from lagoon Cell 4. Water flows through the contact chamber to the outfall by gravity. The contact chamber provides about 90,000 gallons of contact volume. As show above (Figure 7-2), the City will need to discharge at an average rate of about 4.0 MGD at end of the planning period. At an average discharge rate of 4 MGD, the existing contact chamber provides about 32 minutes of contact time. Contact chambers are typically designed to provide about 60 minutes of contact time at average flow. Therefore, the existing contact chamber is undersized and a second contact chamber should be constructed during the planning period. The need for additional contact volume is fairly obvious since the original contact chamber was constructed in the late 1970s and the City has grown significantly since then.

The existing chlorine feed system is capable of feeding up to 200 pounds per day. This is sufficient to disinfect the anticipated effluent flows for the remainder of the planning period. A sulfur dioxide gas feed system is used to remove residual chlorine prior to disposal. The sulfur dioxide gas feed system is capable of feeding up to 50 pounds per day which should be adequate for the remainder of the planning period. Both the chlorine and sulfur equipment was installed in 2020. Therefore, the equipment is new, in good condition, and should serve the City well for the remainder of the planning period with normal maintenance.

7.3.6 Receiving Stream Capacity

Treated effluent is discharged to the Willamette River during the wet weather discharge season (November – May). 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 500 and 830 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 2.0 mgd (500 ppd ÷ 30 mg/L ÷ 8.34 = 2.0 mgd). The City routinely discharges at higher rates than 2.0 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. That said, the City has violated the mass load limits in recent years and DEQ has implemented enforcement actions as a result (see Section 4.5.13). As noted above (Section 7.3.3), the existing lagoons are overloaded from an organic treatment capacity standpoint. The lagoons also have a substantial amount of biosolids in the bottom that decreases the treatment capacity. As a result of these two factors, the lagoons do not always reduce effluent BOD and TSS concentrations low enough to comply with the City's NDPES permit. As the community continues to grow, this problem will worsen.

Water balance calculations (Figure 7-2) show that the City will need to discharge at average rate of approximately 4.0 mgd at the end of the planning period. In order to discharge at 4.0 mgd in compliance with the permitted mass loads, effluent BOD and TSS concentrations must be below 15 mg/L and 25 mg/L respectively. The existing treatment plant is not capable of consistently producing effluent of this quality. As such improvements will be needed during the planning period.

7.3.7 Capacity of Land Application Facilities

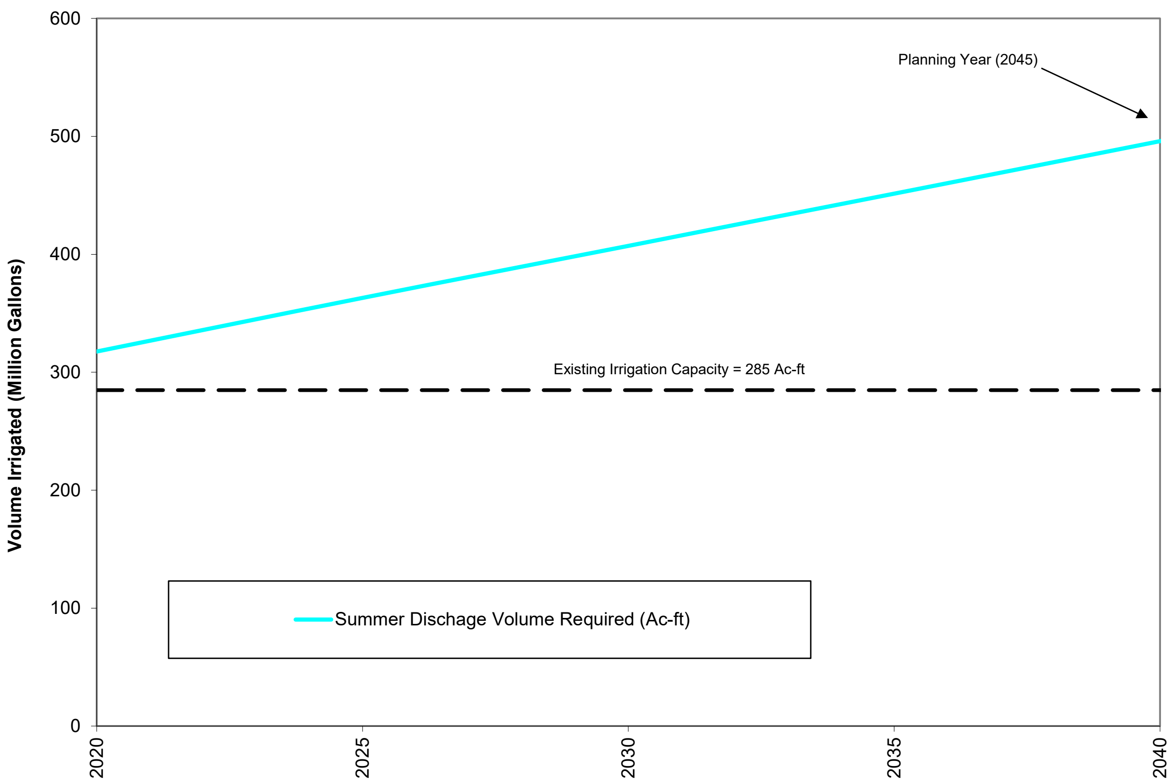
During the dry weather irrigation season (June – October), treated effluent is disposed by irrigating grass seed crops located about 2 miles northwest of the existing lagoons. These sites are owned by a private land owner and the City has an agreement with the land owner to irrigate the crops. The total area that is currently irrigated is approximately 230 acres. Effluent is distributed on three different fields using linear irrigation sprinklers. During the irrigation season (June-October), grass seed crops require approximately 17 inches of net irrigation[6] 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 17 inches. The City's current recycled water use plan lists the average gross irrigation rate at 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 (230 acres) and converting units results in a total irrigation capacity of 285 acre-feet. In other words, the existing land disposal system can accept approximately 285 acre-feet per year on average during the irrigation season.

In order to determine if 285 acre-feet per year is sufficient to dispose of effluent during the summer irrigation season, water balance calculations were performed for the June through October irrigation season. The minimum amount of water that must be irrigated is assumed to the amount of water that flows into the plant between June and October plus the water stored in the lagoons that must be discharged prior to the October storage season (section 7.3.2) plus rainfall minus evaporation. The assumptions used for the water balance calculations are generally the same as used above (section 7.3.4) with respect to rainfall and evaporation.

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

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 analysis shows that the existing irrigation sites lack disposal capacity under current conditions and that additional irrigation area will be needed early in the planning period. It should be noted that this analysis is based on several conservative assumptions. For example, the analysis is based on the assumption that there is no seepage from the lagoons. In reality, there will be some seepage which will decrease the amount of water that needs to be irrigated. This means that the City's existing irrigation sites will likely be adequate for several years more than show in Figure 7-4. However, for planning purposes, it is reasonable for the City to plan to increase the area of land that is irrigated during the planning period.

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 headworks lacks the capacity to convey the peak flows expected during the planning period.
D-2	The existing facultative lagoons lack the organic treatment capacity to treat the existing organic load under current conditions. The lagoons are overloaded from an organic loading standpoint and improvements are needed early in the planning period.
D-3	The lagoons have accumulated a significant amount of biosolids that is likely impacting the treatment capacity of the plant. Therefore, the biosolids should be removed during the planning period.
D-4	The existing catwalks, piping, valves, and pumps used to convey water from lagoon Cell 1 to Cell 4 are old and antiquated and should be replaced during the planning period.
D-5	The existing chlorine contact chamber lacks the capacity needed to provide adequate disinfection for the remainder of the planning period and additional contact volume is needed.
D-6	The existing irrigation sites lack the capacity needed to adequately dispose of the required quantities at the end of the planning period and the City should plan to increase the acreage under irrigation during the planning period.

7.5 TREATMENT PLANT IMPROVEMENT ALTERNATIVES ANALYSIS

To address the deficiencies described in Table 7-1, at a minimum, improvements to the headworks, the secondary treatment process, the disinfection system, and the dry-weather effluent disposal system will be needed during the planning period. This subsection presents the alternatives that were considered to develop the list of recommended treatment plant improvement projects.

7.5.1 Headworks/Secondary Treatment Process Alternatives Analysis

This subsection describes the alternatives that were considered to address deficiencies D-1 and D-2 in Table 7-1. These deficiencies include hydraulic capacity issues at the headworks, and secondary treatment capacity issues with the existing lagoons. The headworks improvements are considered together with the secondary treatment process improvements in this analysis because different secondary treatment processes often require different headworks components. For example, lagoon treatment systems typically do not include grit removal facilities at the headworks where activated sludge processes typically do. For this reason, the headworks and secondary treatment alternatives were considered together in this analysis.

All of the following alternatives include the construction of a new headworks structure that will replace the existing structure. As noted above (section 7.3.1), the existing Parshall flume lacks the capacity to convey peak flows. Therefore, a new flume or similar primary measurement device is needed. All of the proposed alternatives will include the installation of a mechanical screen. It is possible to construct screening facilities prior to the existing headworks, flow-splitting weirs and an additional flow-measurement flume next to the existing flume. However, the resulting facility will be somewhat cumbersome to operate and difficult to construct since the wastewater flow through the structure will need to be maintained during the construction phase. Abandoning the existing headworks in favor of a new headworks that is designed with an appropriately sized flume and the needed screening equipment will result in a more operator friendly installation that is easier to construct. For this reason, all of the alternatives described below include the construction of a completely new headworks structure.

7.5.1.1 Alternative 1: Facultative Lagoons

The City's existing treatment plant utilizes facultative stabilization lagoons to provide secondary treatment of the liquid wastewater stream. This technology is relatively simple, has low operations costs, and is well understood by City operations personnel. As such, some consideration was given to maintaining a treatment system that utilized facultative stabilization lagoons. Under this alternative, a new headworks would be constructed and new facultative lagoons would be constructed near the existing plant to increase the treatment capacity of the plant. Ultimately, this alternative was abandoned because facultative lagoons are not considered capable of reliably producing effluent with sufficiently low effluent BOD and TSS concentrations. As described above (section 7.3.6) the treatment plant must produce effluent with BOD and TSS concentrations below 15 mg/L and 25 mg/L respectively in order to comply with the mass load limits listed in the NPDES permit. Facultative lagoons cannot typically achieve this level of treatment on a consistent basis. Therefore, this alternative is not considered feasible and is eliminated from further consideration.

7.5.1.2 Alternative 2: Aerated Lagoons

Under this alternative a new headworks would be constructed with a mechanical screen, flow measurement equipment, and sampling equipment. Mechanical screening equipment is needed to remove rags and other debris that foul the aeration equipment. Air would be added to the existing lagoons to increase the organic treatment capacity of the plant. Air would be added to the lagoons using either a diffused aeration system or floating mechanical aerators. The resulting treatment facility would be similar in many respects to the City of Monmouth's facility. Aerated lagoons are common in Oregon and are relatively simple and well understood by the operations community. Based on a performance evaluation of other similar treatment facilities, aerated lagoons with properly designed aeration equipment, should be able to reliably meet the effluent mass load limits for BOD and TSS listed in the City's NPDES permit. For this reason, aerated lagoons are considered a feasible alternative that will be carried forward in this analysis.

7.5.1.3 Alternative 3: Activated Sludge

Under this alternative a new headworks would be constructed with a mechanical screen, grit removal equipment, flow measurement equipment, and sampling equipment. Water would flow from the headworks into an activated sludge treatment system. Several variations of the activated sludge process could be used including conventional activated sludge, an oxidation ditch, or sequencing batch reactors. The activated sludge process would provide most of the organic treatment and the existing lagoons would be used for storage during the non-discharge periods. This is a feasible alternative that is carried forward in this evaluation. However, as demonstrated below, this alternative is much more costly than the other alternatives from both a capital construction and operations standpoint.

7.5.1.4 Evaluation of Alternatives

Table 7-2 includes a comparison of the capital costs of each of the treatment alternatives described above. These costs include the costs of the headworks and the secondary treatment process. The costs for the other treatment plant improvement elements are listed in the following sections.

Alternative 2 has the lowest capital costs. In addition to capital costs, Alternative 2 will have the lowest operation and maintenance costs due to its relative simplicity. Alternative 3 will have higher operations and maintenance costs largely due to the need to manage solids within, and after, the activated sludge process. Activated sludge is generally more complicated than aerated lagoons. As such, it will require more labor and equipment to operate and maintain. Activated sludge will produce a higher quality effluent than the aerated lagoons. However, this level of treatment is not needed at this time and the additional costs for the facility are not considered to be a good use of public resources. For these reasons, Alternative 2 (Aerated Lagoons) is the preferred alternative to improve the secondary treatment capacity of the plant.

Table 7-2 | Headworks/Secondary Treatment Alternatives Cost Comparison

Alternative	Total Capital Costs
Alternative 1 Facultative Lagoons	NA – Not Feasible
Alternative 2 Aerated Lagoons	$4,000,000 to $6,000,000
Alternative 3 Activated Sludge	$15,000,000 to $25,000,000

7.5.2 Lagoon Aeration Alternatives

In the previous subsection (Section 7.5.1), aerated lagoons were shown to be the preferred alterative for improving the secondary treatment process. This subsection includes an evaluation of two types of aeration systems that are commonly used to add air to treatment lagoons. The first alterative includes the installation of floating mechanical aerators in the lagoons. Floating mechanical aerators are motorized devices that agitate the water surface and/or inject air into the water. The equipment is mounted on floating pontoons. Several aerators are typically installed in a grid-like pattern across the lagoons. The power to each aerator is supplied from cable that runs from the shore to each pontoon. The cables are supported using a stainless-steel cable mooring systems. Floating mechanical aerators are currently used by the City of Monmouth to add air to their lagoons. The other available aeration system uses submerged fine bubble diffusers that are mounted in a grid-like pattern across the lagoons. On-shore blowers are used to provide air for the system. A network of buried air piping is used to distribute the air from the blowers to floating air pipe headers. Floating air header pipes are mounted in the lagoons and the diffusers are fed from drop pipes connected to the floating header pipes. The submerged diffusers are not motorized and there is no moving machinery in the lagoons.

In general, floating mechanical aeration systems have lower capital installation costs than diffused aeration systems. However, since diffused aeration systems use fine bubble aeration with better oxygen transfer capabilities, they are generally more efficient and consume less power. Therefore, diffused aeration systems have lower O&M costs. To evaluate each system for Independence, conceptual designs for the two options were prepared. This included working with various manufacturers to size the facilities and determine the cost of the equipment needed for each system. Preliminary layouts and cost estimates were prepared for each alternative as well as estimates of the annual power consumption for each alternative. This information is presented in Table 7-3.

Table 7-3 | Lagoon Aeration Alternatives Cost Comparison

Lagoon Aeration Alternative	Estimated Capital Cost (1)	Maximum Power Requirement (Horsepower)	Average Power Requirement (2) (Horsepower)	Annual Power Costs (3)
Floating Mechanical Aerators	$3,500,000	420	273	$178,000
Diffused Aeration System	$4,900,000	175	114	$75,000

Notes
(1) Capital costs include construction costs and soft costs with soft costs estimated to be 20%, 10%, and 10% of the construction costs for engineering, administration costs, and construction contingency respectively.
(2) Aeration systems will have the ability to be turned down to match aeration feed rates to oxygen demand. This analysis is based on the assumption that the long-term average horsepower requirement will be 65% of the maximum.
(3) Annual power costs based on $0.10 per kilowatt hour.

For the comparison between floating aerators and a diffused aeration system, it is assumed that the labor and materials costs for operations and maintenance will be about the same between the two alternatives. Floating mechanical aerators consist of rotating machinery that requires routine seal maintenance, lubrication, and periodically replacement of wear items. Submerged diffused aerators do not have moving parts, but do have diffuser membranes that the must periodically be inspected, cleaned, and replaced. The labor and materials to complete these maintenance tasks is assumed to be approximately the same for both alternatives. Based on this assumption, the difference in operations cost between the two alternatives is mostly related to power consumption.

As shown in Table 7-3, the capital construction costs for the diffused aeration system is about $1,400,000 greater than the floating mechanical aeration system. However, the mechanical aeration system requires an additional $103,000 per year in power costs. Therefore, the payback period for the diffused aeration system is about 13 years. From a practical perspective, the payback period is probably in the 10-15 year range. Both systems are expected to have a minimum design life of 20-30 years. Therefore, over the life cycle of the facility, the diffused aeration alternative will have lower overall life cycle costs. For this reason, a diffused aeration system is recommended and the proposed project budgets presented below are based on the installation of a diffused aeration system. That said, if cash flow becomes a problem for the City, a floating mechanical aeration system is an acceptable alternative that will reduce the initial capital construction costs.

7.5.3 Disinfection System Alternatives Analysis

As described above, the existing chlorine contact chamber lacks the volume needed to provide adequate chlorine contact time at the end of the planning period (see Deficiency D-5, Table 7-2). As such, improvements are needed to ensure the City is able to comply with the disinfection requirements in the NPDES permit. The most common systems used for disinfection of wastewater are ultraviolet light and chlorine. Ultraviolet light is not a feasible option because the algae that may be present in the effluent from the aerated lagoons. This leaves chlorine disinfection as the best remaining option. In 2020, the City installed new gas chlorine feed equipment as well as sulfur dioxide feed equipment for dechlorination. This equipment was sized with future growth in mind and is adequate to serve the City for the remainder of the planning period (see section 7.3.5). Since this chemical feed equipment is new and adequately sized, there is no need to consider other chemical feed alternatives. Therefore, the recommended disinfection system improvements are relatively straight-forward and include the construction of a second chlorine contact chamber located immediately east of the existing chlorine contact chamber. These improvements are discussed in greater detail below.

7.5.4 Dry-Weather Effluent Disposal System Alternatives Analysis

During the summer months, the City disposes of treated effluent by irrigating cropland located at a reuse site north of the City. This system is adequately sized for current flows but will need to be expanded as the City grows (see deficiency D-6, Table 7-2). The existing dry-weather disposal system was installed in 2020 and is new and in good condition. The pump station and transmission pipe were designed for future expansion of the system, and the owner of the reuse site has several more fields near the existing site that can be used to expand the system. As such, the most cost-effective option for the City will be to expand the existing dry-weather disposal system when needed. The improvements will eventually include a third irrigation pump, additional distribution piping, and new irrigation equipment at fields owned by the same landowner that owns the existing reuse site. Therefore, other disposal alternatives such as park irrigation, subsurface disposal, or a new discharge to surface waters are not considered in this plan. Specific recommendations to expand the dry weather effluent disposal system are described below.

7.5.5 Ancillary Improvements Common to All Alternatives

Two ancillary improvements are needed for any of the alternatives under consideration. The first of these includes the removal of biosolids from the lagoons (see deficiency D-3, Table 7-2). The second are improvements to the existing piping, valves, and pumps used to convey water from lagoon Cell 1 to Cell 4 (see deficiency D-4, Table 7-2).

7.5.5.1 Lagoon Biosolids Removal

The amount of biosolids in the lagoons is impacting the treatment capacity (see deficiency D-3), Table 7-2) and the only real solution for this problem is to remove the biosolids. The biosolids are typically removed using a floating dredge. The solids can then be dewatered and hauled to a landfill or land applied. The quantity of biosolids is substantial and creates logistical challenges for land application. All of the nearby fields are used for grass seed crops that are typically harvested in July and replanted in the late summer or early fall. This leaves about a six-to-eight week window to apply the biosolids. Due to the quantities involved, it is unlikely that the biosolids can be removed from all four lagoons and distributed on fields during this relatively short timeframe. Therefore, land-application would need to be performed over multiple years and require multiple mobilizations of the dredging equipment. Fortunately, the City is located in close proximity to the Coffin Butte Landfill. This proximity makes landfilling a feasible option that could be performed with a single mobilization of the dredging equipment over a longer period of time. In 2011, the City of Monmouth removed biosolids, dewatered the material, and hauled it to Coffin Butte. This work required about 3 months to complete. Monmouth and Independence have roughly the same population and have similarly sized lagoons that were constructed at about the same time. Therefore, the City of Independence should anticipate a similar work effort (e.g., about 3 months) given that the quantities of biosolids will be similar. Another advantage of landfilling over land application is regarding presence of trash, plastics, and other debris that is contained in the biosolids. The treatment plant has never been equipped with a screen. Therefore, all rags, trash, plastic, and other solid debris that enters the plant accumulates in the lagoons. This trash should not be applied on agricultural fields and should be removed prior to doing so. Separating the trash from the biosolids requires an additional screening process prior to dewatering. This adds additional cost for land disposal. Therefore, land disposal is likely to be more costly than simply hauling to a landfill. Finally, hauling to a landfill requires a less extensive permitting process. Therefore, it is easier to implement. Based on lower costs, an easier permitting process, and fewer logistical challenges, the recommended disposal strategy includes hauling dewatered biosolids to Coffin Butte Landfill.

7.5.5.2 Lagoon Transfer Pump Station and Transfer Piping Improvements

All of the treatment alternatives considered in this plan include retaining the existing treatment lagoons. Therefore, the lagoons will remain in service and improvements to the Cell 1 transfer pump station and the piping and valves between the various lagoons will be needed during the planning period (see deficiency D-4, Table 7-2). It is envisioned that the Cell 1 transfer pump station and forcemain will be replaced by a new pump station designed to modern standards. The piping between the remaining lagoon cells will also be replaced. The specific improvements are discussed in greater detail below.

7.6 RECOMMENDED TREATMENT PLANT IMPROVEMENTS

This subsection includes a description of the recommended improvements to the City's wastewater treatment plant. These improvements are needed to address the deficiencies listed in above in Table 7-2. Cost estimates for these improvements are listed in Table 7-6 below. The improvements are prioritized in Chapter 8. That said, the projects are generally listed in the order in which they should logically be completed. Other sequences are acceptable depending on the City's goals and multiple projects can be grouped together into a lager project if desired for funding purposes.

- *Headworks and Cell 1 Distribution Pipe Improvements (Project T-1)*

The existing headworks lacks screening equipment. As a result, rags, plastics, and other debris, are not removed and accumulate in the lagoons. This has not traditionally been a problem because there is not mechanical equipment in the lagoons that can be fouled by these types of solid materials. However, the recommendations in the plan include installing aeration equipment in the pond. Aeration equipment can be fouled by rags, plastics, and other materials that are typically removed at the headworks using mechanical screening equipment. In addition to the lack of mechanical screening, the Parshall flume lacks the capacity to measure the peak flows projected at the end of the planning period. To address these problems, the recommended improvements include constructing a new headworks to replace the existing headworks (see section 7.5.1). The new headworks should be constructed east of the existing headworks (see Figure 7-5). It is envisioned that some fill will be constructed in cell 1 to create a building pad for the new headworks structure. The fill is considered necessary for constructability purposes. The new headworks must be completed before the existing headworks can be demolished. The proposed fill provides separation between the two structures that is necessary for construction access. The headworks should be designed with mechanical screening equipment with a screen size of 0.25 inches. The equipment should include a system for dewatering the screenings and a conveying and bagging system for depositing the screenings in a dumpster. After the screen, the water should pass through a new Parshall Flume for flow measurement. On the downstream side of the flume, sluice gates should be installed with piping to either cell 1 or cell 2. For normal operations all water will be routed to cell 1. The piping to cell 2 is recommended to allow cell 1 to be removed from service for maintenance purposes. In addition to the headworks structure, this project also includes the installation of a new influent distribution pipe in cell 1. This pipe will be used to convey influent from the headworks to the northeast corner of cell 1. This pipe will reduce short-circuiting within cell 1 and improve the overall treatment efficiency of the plant. Once the new headworks is completed, the old headworks can be demolished and that space can be used for vehicular traffic around the new headworks. The recommended design criteria for the new headworks is listed in Table 7-4. The total recommended budget for this project is $1,382,000. A detailed breakdown of this budget is included in Appendix C.

Table 7-4 | Recommended Design Criteria - Project T-1 Headworks and Cell 1 Distribution Pipe Improvements

Mechanical Screen Opening Size	6 mm
Screenings Disposal	Dewatered screenings conveyed to dumpster for pickup by solid waste company
Redundant Screening	Manual Bar Screen
Flow Measurement Primary Device	18-inch Parshall Flume
Flow Measurement Range	0.11 – 15.9 mgd
Influent Flow Meter	Ultrasonic level transducer
Influent Sampler	Automatic Refrigerated Composite
Sampler Pacing	Flow Proportional

- *Lagoon Biosolids Removal Project (Project T-2)*

At the Independence Wastewater Treatment Plant, sludge accumulates in the lagoon cells over time. Sludge has never been removed from the lagoons and the quantities of sludge accumulation are impacting the treatment process (see Section Table 4-12). Therefore, the City should plan to remove the sludge during the planning period. This should be completed prior to the installation of the aeration equipment (**Project T-3**). Since the treatment plant has never had influent screening facilities, the sludge will contain rags, plastics, and other debris that will foul the aeration equipment. Removing the sludge prior to the installation of the aeration equipment will avoid this problem. Processed sludge is often referred to as “biosolids” and the terms “sludge” and “biosolids” are used interchangeably in the remaining discussion.

In addition to sludge removal, Public Works would like to have the trash and debris removed that has accumulated along the interior dike slopes of lagoon cells 1 and 2. This is intermingled with riprap. This would require a separate clean-up process from the biosolids removal, perhaps using a vactor truck and hand labor. The estimated cost for a contractor to do this work is $50,000.

The first step in the biosolids removal project will be to measure the depth of the sludge in the lagoon to estimate the total quantity. Several samples will need to be collected in order to analyze and document the solids content and quantities of metals and other contaminates in the sludge. The City will then need to prepare contract documents for the biosolids removal work in accordance with DEQ requirements. Once the documents have been reviewed and approved by DEQ, the City can then advertise for bids and perform that work. It is anticipated that the sludge will be removed from the lagoons using a floating dredge. The dredged solids will need to be dewatered then hauled to Coffin Butte Landfill. There are a number firms in the Pacific Northwest that provide these services, and it is anticipated that the City will contract with one of these firms to perform the work. The landfill will require additional testing to verify that the solids have been sufficiently dewatered. As of the Summer of 2021, the tipping fees at Coffin Butte for the biosolids are $50 per dry ton plus an $18 environmental fee for each load. The total anticipated quantity of biosolids is about 4,000 dry tons. The total cost to dredge, dewater, haul, and dispose (including tipping fees) is estimated to be $850 per dry ton for a cost of $3,400,000. Including soft costs at 20%, the total recommended budget for this project, including the trash removal, is $4,140,000. Estimated soft costs total $680,000, which can be further broken down in to contingency, administrative and engineering costs. Contingency cost is estimated as 10% of construction cost at

$340,000. Administrative cost is estimated as 1.5% of construction cost at $51,000. Engineering cost is estimated as 8 to 9% of construction cost at $300,000. Since the biosolids are planned to be hauled to a sanitary landfill, no biosolids management plan is required by DEQ.

- *Lagoon Aeration and Conveyance Piping Improvements (Project T-3)*

As described above (Section 7.5.2), the installation of aeration equipment is recommended to improve the secondary treatment capacity of the plant. The installation of this equipment will require excavation work within the lagoon dikes to install the aeration piping and electrical power system. In order to minimize disturbance to the facility, this project should be combined with the conveyance system improvements discussed in Section 7.5.5.2. Both the aeration system improvements and the conveyance piping improvements will require heavy construction work on the lagoon dikes. The lagoon dike roads are gravel roads that will not stand up well to the heavy construction traffic. Therefore, at the end of the construction work the gravel roads will need to be re-graded and re-surfaced with new crushed quarry rock. It makes sense to install the aeration system and the conveyance piping improvements at the same time to minimize the amount of roadway surface restoration that is required. Separating these two projects, will result in the need to rehabilitate the gravel roadways twice. For this reason, there is an economy of scale to combining these projects. Additionally, the project should address any spot repairs of riprap that are needed around the lagoons.

The proposed aeration system improvements include the installation of a diffused aeration system in the four lagoon cells. The system should be designed to treat the anticipated organic loading (Table 5-11) and produce effluent with BOD and TSS concentrations below 15 mg/L and 25 mg/L during the winter months (see Section 7.3.6). Based on some preliminary design calculations and consultation with manufacturers, blowers with a total size of 125 to 175 horsepower are anticipated. It is anticipated that the system will be designed with redundant blowers so that the aeration requirements can be met with the largest blower out of service. It is anticipated that the blowers will be located in a new blower building that is centrally located at the plant. In order to provide a building pad for the blower building, some fill in one of the lagoons is anticipated. Blower speeds should be controllable using variable frequency drives. It is anticipated that the improvements will include the installation of dissolved oxygen instruments in the lagoons. Data from these instruments can be used to adjust (manually or automatically) the speed of the blowers to minimize power consumption. The air will be distributed to the diffused aeration system by underground piping. Near the blower building, this piping is anticipated to be ductile iron. However, once the heat from the air is dissipated, HDPE piping should be used to minimize costs.

The proposed conveyance improvements include a new pump station to replace the existing station used to pump water from Cell 1 to Cell 2. A relatively simple, duplex submersible pump station should be sufficient. To convey water from Cell 2 to Cell 3, new transfer piping is recommended. Three pipes with buried valves are recommended. The pipes should be placed at the bottom, midpoint, and top of the Cell 2 water column. A similar arrangement is anticipated to convey water from Cell 3 to Cell 4.

The total recommended budget for this project is $5,989,000. A detailed breakdown of this budget is included in Appendix C. As described above (Section 7.5.2), this estimate is based on the installation of a diffused aeration system. As an alternative, the City could install floating mechanical aerators. However, floating mechanical aerators are less efficient and will have higher O&M costs as demonstrated in Section 7.5.2.

- *Chlorine Contact Chamber Improvements (Project T-4)*

This project is fairly straight-forward and includes the construction of new contact chamber immediately east of the existing contact chamber. Once completed, the two chambers will operate in series. This project also includes demolishing and replacing the effluent flow measurement flume with a new flume that is larger and can more accurately measure the higher flows anticipated during the planning period. It is envisioned that the new flume will be constructed at the upstream end of the new contact chamber. On the upstream side of the existing effluent flow measurement flume, at 16-inch by 12-inch reducer was installed in 2020 as part of the cell 4 outlet structure improvements. It is envisioned that this reducer will be removed and a 16-inch pipe will be constructed from this location to the new contact chamber. Water will flow from the Cell 4 outlet structure through the new 16-inch pipe to the new chlorine contact chamber. The new chamber will be constructed with a new flow measurement flume on the upstream side. On the downstream side of the new chamber, a new pipe will be installed to convey water from the new chamber to the upstream side of the old chamber. To achieve this configuration, the new chamber will need to have three baffles. The recommended design criteria for these improvements are listed in Table 7-5. The total recommended budget for this project is $858,000. A detailed breakdown of this budget is included in Appendix C.

Table 7-5 | Recommended Design Criteria - Project T-4 Chlorine Contact Chamber Improvements

Existing Contact Chamber Volume	90,000 gallons
New Contact Chamber Volume	90,000 gallons
Total Contact Chamber Volume	180,000 gallons
Contact Time	
Typical Discharge Rate (4 MGD)	± 60 minutes
New Contact Chamber Length to Width Ratio	40:1 (minimum)
New Effluent Flow Measurement Wier	12-inch Parshall Flume
Flow Measurement Range	0.08 – 7.4 mgd
Effluent Flow Meter	Ultrasonic level transducer

- *Land Application System Expansion Phase I (Project T-5)*

As described above (Section 7.3.7), the City should plan to expand the land application facilities during the planning period. A two-phase approach is recommended because the need for the additional land is largely growth driven and a two-phase approach will allow the City to implement the improvements incrementally as needed. The first phase includes a relatively straight-forward expansion of the existing system. The existing land application system includes three irrigated fields north of the City (see Section 4.5.8). These fields are referred to as the North, Middle, and South fields. Each field is fitted with a linear irrigation sprinkler. The total area that is currently irrigated is about 230 acres. The area under the Middle and South Irrigation sprinklers can easily be increased by making some modest improvements to the system (Figure 7-6). The improvements will enable the Middle and South sprinklers to travel further to the east than is currently possible and will increase the total area under irrigation by about 80 acres. The Phase I improvements will increase the total area under irrigation to about 310 acres. The existing irrigation pump station is adequately sized to provide water to all three sprinklers simultaneously. Therefore, the first phase of the expansion does not require any improvements to the irrigation pump station.

The first step required for this project is revising the agreement with the landowner to include the additional 82 acres. Once this is completed, the Recycled Water Use Plan (RWUP) will need to be amended to include the proposed additional acreage. At this time, it is recommended that the RWUP be amended for both phases of land application expansion (**Projects T-5 and T-6**), assuming an effluent reuse agreement can be made with the landowner for the future expansion.

Once the revised plan is approved by DEQ, the City can make the physical improvements to the system. The physical improvements to the system include the installation of additional distribution piping and risers along the northern edge of the Middle Field. Culverts will also need to be installed to enable the wheels of the sprinkler on the South Field to cross a ditch that runs north and south along the current easter edge of the field. The two end stops for the Middle and South Field sprinklers will also need to be relocated. The total recommended budget for this project is $241,000. A detailed breakdown of this budget is included in Appendix C.

- *Land Application System Expansion Phase II (Project T-6)*

Toward the end of the planning period, the City should anticipate the need to expand the land application facilities a second time. The owner of the existing site that the City is currently irrigating also owns property on the north side of Rogers Road (Figure 7-6 below) and has expressed an interest in irrigating these fields as well. This is a logical choice for the second phase of the expansion. In order to irrigate the fields north of Rogers Road the irrigation pump station forcemain piping must be extended north from south edge of the existing North Irrigation Site across Rogers Road to the new irrigation sites as shown in Figure 7-6 below. Two new linear irrigation sprinklers must also be installed. Finally, a third irrigation pump must be installed at the irrigation pump station. The pump station was designed for the installation of a third pump. So, the installation should be fairly straight-forward. These improvements will add about 115 acres to the system for a total of 425 acres of irrigated land. Prior to the construction of these improvements, the City will need to update the agreement with the land owner to include the new fields and revise the Recycled Water Use Plan (if not completed during **Project T-5**) and obtain DEQ approval of the revisions. The total recommended budget for this project is $1,526,000. A detailed breakdown of this budget is included in Appendix C.

- *Outfall Improvements (Project T-7)*

The existing river outfall pipes underneath lagoon cells #1 and #4 were video inspected and evaluated for improvements. The pipes appear to be in relatively good condition. However, given their age and location, it is recommended that they be reinforced with a liner during the planning period. **Project T-7** proposes cured-in-place pipe (CIPP) liners be installed underneath lagoon cells #1 and #4. It is recommended that this project be completed jointly with the City of Monmouth. This would include approximately 1,050 feet of 36-inch CIPP, 1,500 feet of 24-inch CIPP and rehabilitation of three manholes. It is recommended that this project be completed jointly with the City of Monmouth. The total recommended budget for this project is $1,054,000. A detailed breakdown of this budget is included in Appendix C.

Table 7-6 | Recommended Treatment Plant Improvements

Project Code	Project Description	Recommended Project Budget
T-1	Headworks and Cell 1 Distribution Pipe Improvements	$1,382,000
T-2	Lagoon Biosolids Removal Project	$4,140,000
T-3	Lagoon Aeration and Conveyance Piping Improvements	$5,989,000
T-4	Chlorine Contact Chamber Improvements	$858,000
T-5	Land Application System Expansion Phase I	$241,000
T-6	Land Application System Expansion Phase II	$1,526,000
T-7	Outfall Improvements	$1,054,000
	TOTAL	$15,190,000

Figure 7-5 | Recommended Wastewater Treatment Plant Improvements

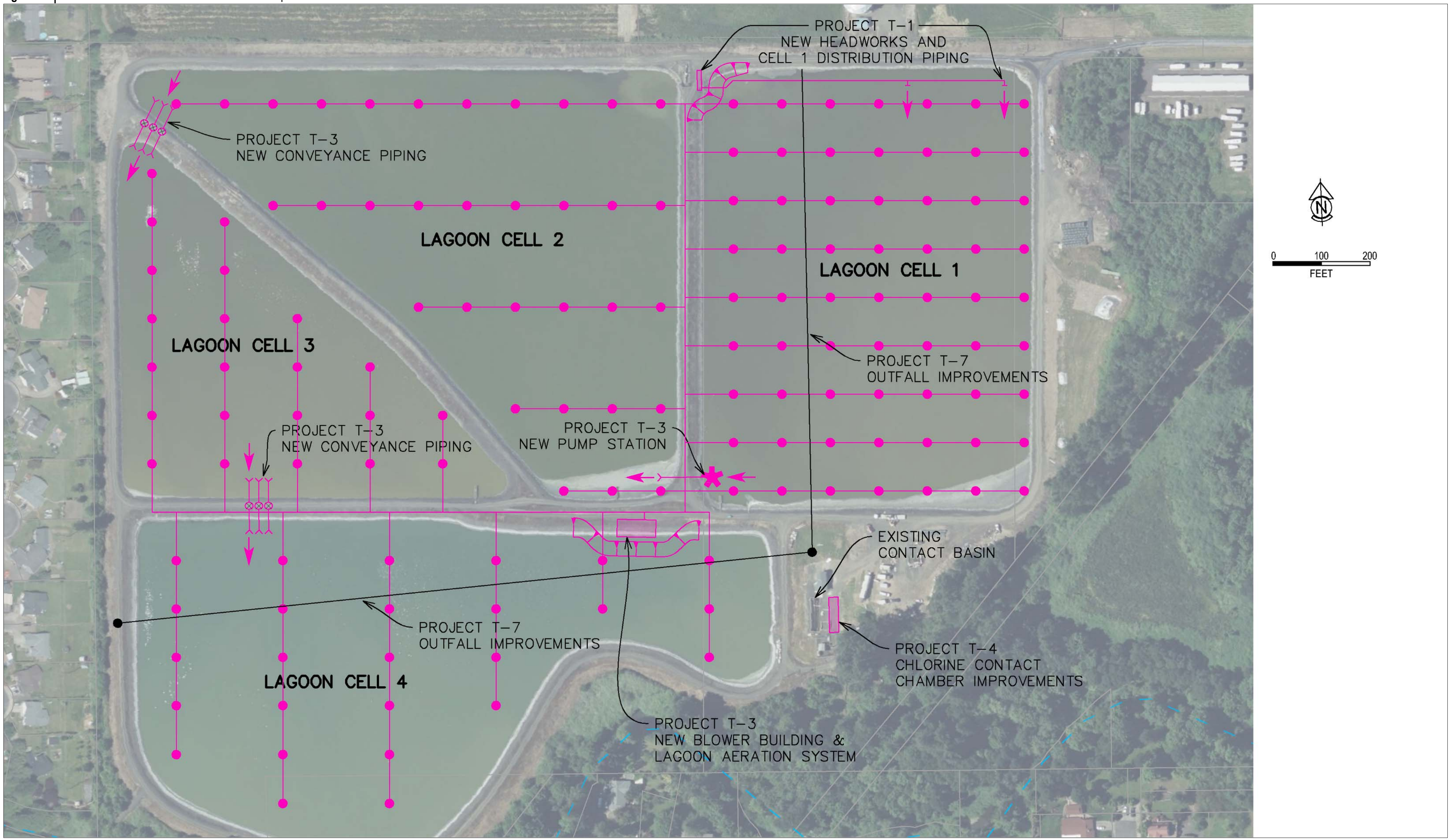
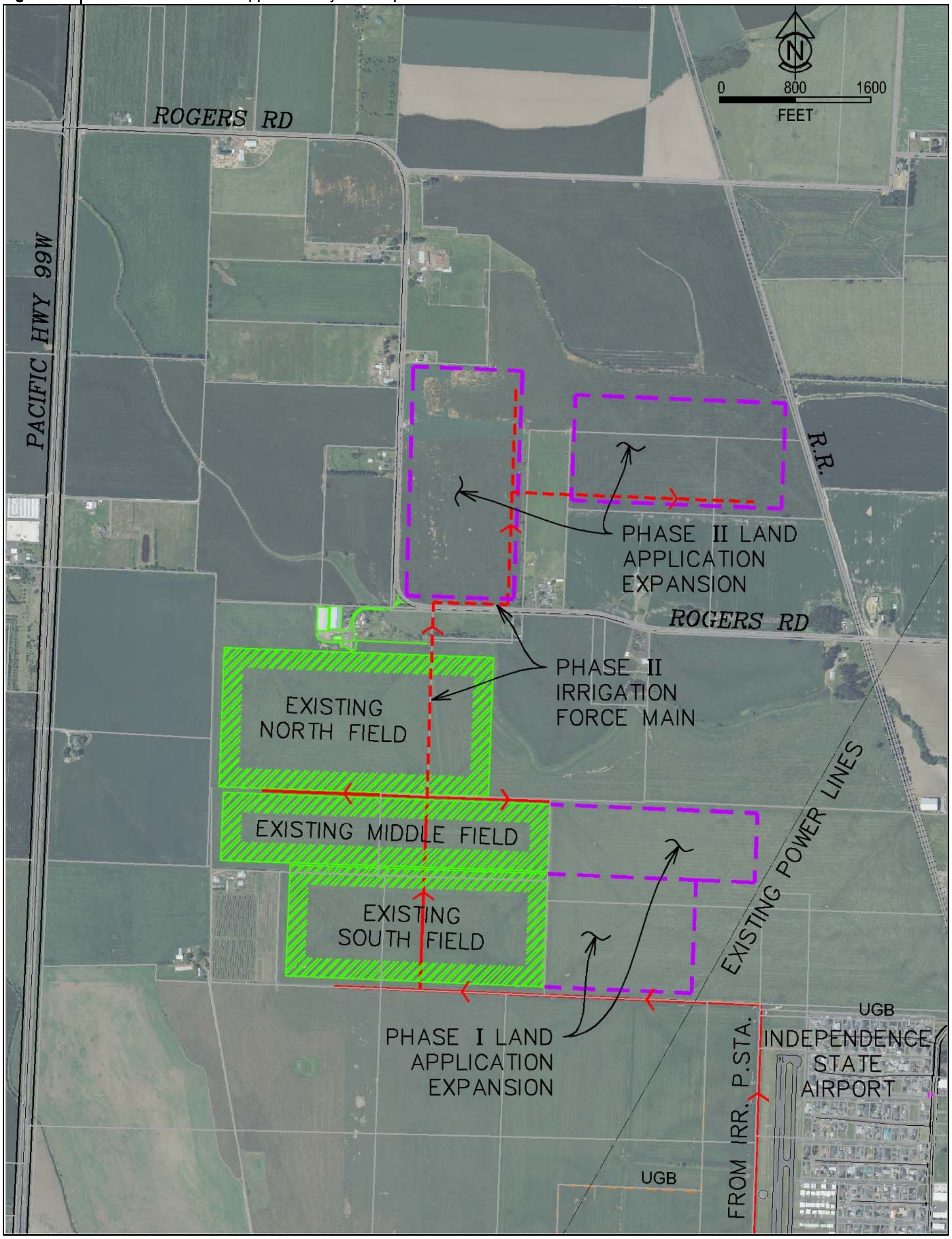


Figure 7-6 | Recommended Land Application System Improvements



CHAPTER 8

CAPITAL IMPROVEMENT PLAN

Chapter Outline

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 exist 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.

- 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 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. Maps are included at the end of this chapter that show the improvements by priority. These are Figure 8-1, Figure 8-2, Figure 8-3, and Figure 8-4.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 many of 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 1 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 1 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	Headworks and Cell 1 Distribution Pipe Improvements	1	$1,382,000
T-2	Lagoon Biosolids Removal	1	$4,140,000
T-3	Lagoon Aeration and Conveyance Piping Improvements	1	$5,989,000
G-2	Basin E Trunk Sewer	1	$557,000
G-5	C Street Clay Tile Sewer Replacement	1	$720,000
G-6	H Street from 3rd Street to Main Street Replacement	1	$331,000
G-7	Spruce Court to Briar Road Replacement	1	$304,000
G-8	E Street from 12th Street to 13th Street Replacement	1	$157,000
P-1	9th Street Pump Station Capacity Upgrade - Phase 1	1	$966,000
P-5	Maple Drive Pump Station Upgrade	1	$508,000
F-2	Maple Drive Pump Station Forcemain	1	$53,000
		Subtotal Priority 1	**$ 15,107,000**
G-3	Lagoon Pump Station Trunk Sewer	2	$692,000
G-4	12th Street Sewer Improvements	2	$319,000
P-3	Oak Street Pump Station Capacity Upgrade & Improvements	2	$786,000
P-4	North Main Pump Station Capacity Upgrade & Improvements	2	$309,000
P-6	Lagoon Pump Station Capacity Upgrade & Improvements	2	$411,000
P-7	Albert Street Pump Station Electrical Systems Upgrade	2	$244,000
P-8	Briar Road Pump Station Electrical Systems Upgrade	2	$155,000
P-9	13th Street Pump Station Electrical Systems Upgrade	2	$253,000
P-11	Stryker Road Pump Station Electrical Systems Upgrade	2	$364,000
P-15	Williams Street Pump Station Generator Upgrade	2	$60,000
T-4	Chlorine Contact Chamber Improvements	2	$858,000
T-5	Land Application System Expansion Phase I	2	$241,000
T-6	Land Application System Expansion Phase II	2	$1,526,000
T-7	Outfall Improvements	2	$1,054,000
M-3	Wastewater System Facilities Plan Update	2	$300,000
		Subtotal Priority 2	**$ 7,572,000**
G-1	9th Street Trunk Sewer	3	$447,000
G-9	13th Street Pump Station Sewer to Sub-basin C3	3	$347,000
G-10	Briar Road Pump Station Sewer to Sub-basin C5	3	$138,000
G-11	Mt. Fir Park Sewer Upgrade	3	$480,000
G-12	Sub-basin C3 Trunk Sewer to Undeveloped Area	3	$1,007,000
G-13	Sub-basin C4 Trunk Sewer to Undeveloped Area	3	$903,000
G-14	Sub-basin C5 Trunk Sewer to Undeveloped Area	3	$990,000
G-15	Hoffmann Road Sewer to Undeveloped Area	3	$351,000
G-16	Gun Club Road Sewer to Undeveloped Area	3	$1,597,000

Table 8-1 | Recommended Capital Improvement Priorities

Project Code [1]	Project	Priority	Total Estimated Project Cost [2]
G-17	Corvallis Road Sewer to Unsewered Area	3	$578,000
G-18	16th Street Sewer	3	$182,000
G-19	Talmadge Road Sewer	3	$608,000
G-20	Sub-basin C2 Sewer	3	$675,000
P-2	9th Street Pump Station Capacity Upgrade - Phase 3	3	$928,000
P-10	Mt. Fir Pump Station Capacity & Electrical Systems Upgrade	3	$256,000
P-12	New Ash Creek Pump Station	3	$865,000
P-13	New Corvallis Road Pump Station	3	$887,000
P-14	New Talmadge Road Pump Station & Forcemain	3	$605,000
F-1	Common Forcemain for the 9th Street and Lagoon Pump Stations	3	$806,000
F-3	New Ash Creek Pump Station Forcemain	3	$728,000
F-4	New Corvallis Road Pump Station Forcemain	3	$413,000
		Subtotal Priority 3	**$ 13,791,000**
		TOTAL	**$ 36,470,000**
Operation & Maintenance Programs and Projects			
Program-1	Sewer Cleaning and Inspection Program – Annual recurring program		$66,000 per year
Program-2	Sewer Rehabilitation & Replacement Program – Annual recurring program		$100,000 per year
M-1	Comprehensive Map Update – Annual project for five years		$10,000 per year
M-2	Sewer System Evaluation Study – Annual project for four years		Average $46,000 per year
	Subtotal Recurring Annual Programs / Projects Years 1 - 4		**$222,000**
	Subtotal Recurring Annual Programs / Projects Year 5		**$176,000**
	Subtotal Recurring Annual Programs Years 6- 20		**$166,000**

[1] Project Code Legend:
G = Gravity Sewer T = Treatment P = Pump Station F= Forcemain Program = O&M Program
M = Miscellaneous Project
[2] See Section 8.3 for basis of project cost estimates

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 August, 2021 ENR 20 City Construction Cost Index of 12,464. 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
- Gravity pipeline, open cut installation (materials, installation & surface restoration, etc.)
    - 8-inch - $130 per foot
    - 10-inch - $140 per foot
    - 12-inch - $150 per foot
    - 15-inch - $170 per foot
    - 18-inch - $180 per foot
- New Manholes (materials, installation, and surface restoration) - $8,000 each
- Rehabilitated Manholes with internal grout sealant (materials, installation, and surface restoration) - $4,000 each
- Service Laterals (materials, installation, and surface restoration) - $3,000 each
- Bypass pumping - $5,000 mobilization plus $5,000 per month
- Auger-bore crossing for stream, railroad, or highway (materials, installation, and surface restoration) - $1,000 per foot
- ODOT right-of-way crossing costs for surface restoration, construction administration and engineering - $10,000 lump sum per crossing
- 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, wetwell construction, building, pumps, mechanical piping, emergency power systems, 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.

- 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

8.4.3 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, electrical equipment, instrumentation, and energy costs.

- 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

8.5 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 Board 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 communities 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 the City's 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.

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 a municipality's basic taxing authority and are retired with property taxes based on an equitable distribution of the bonded obligation across the community'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 residents.

General obligation bonds are backed by the municipality's full faith and credit, as the municipality 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 municipality 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 municipality. 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 municipality’s pledge to charge user fees sufficient to pay all operating costs and debt 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 municipality'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, municipalities 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 municipality to provide two additional securities for revenue bonds that are not required for general obligation bonds. First, the municipality 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 municipality 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 District.

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 municipality 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 community 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 Board, 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

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 $3,000,000 (including all planning, final engineering, and construction). The project cannot be divided locally into phases with the expectation of receiving more than one $3,000,000 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 0.94 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.

The City currently has a CWSRF loan that has been used to finance several projects for sewer collection and wastewater treatment.

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 may 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.

Figure 8-1 | Map of Improvement Projects by Priority - North

Figure 8-2 | Map of Improvement Projects by Priority - Central

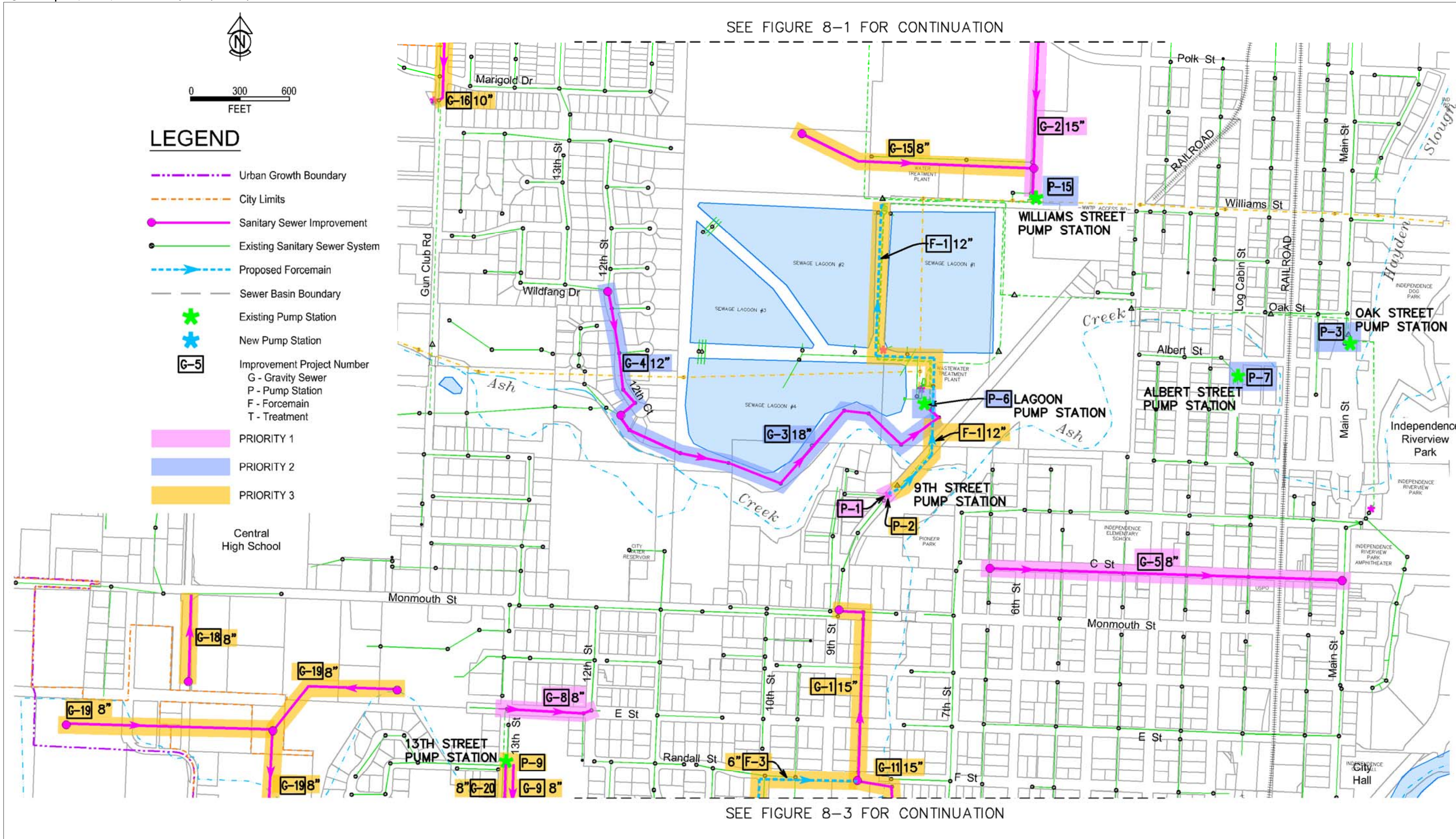


Figure 8-3 | Map of Improvement Projects by Priority - South

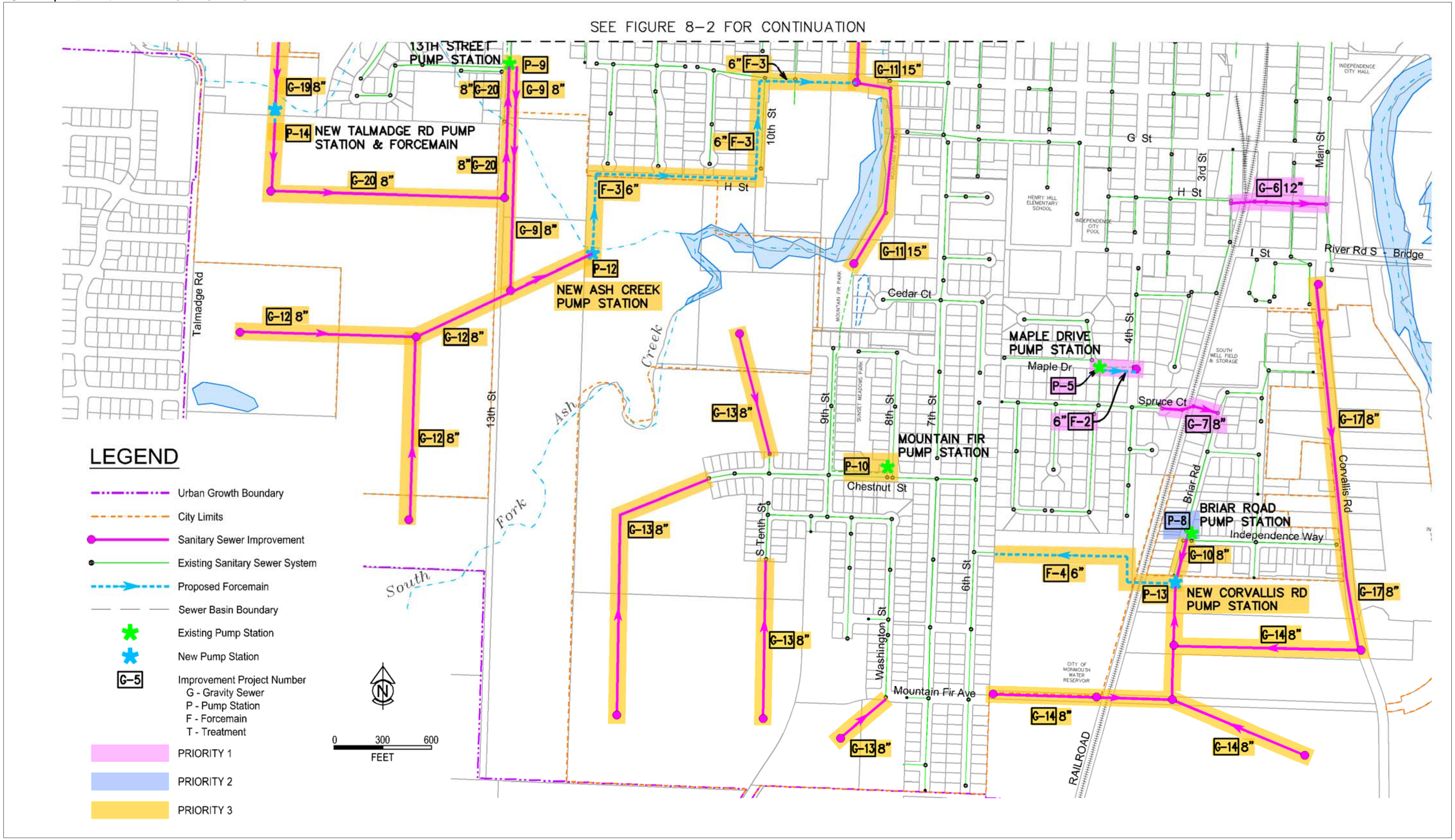
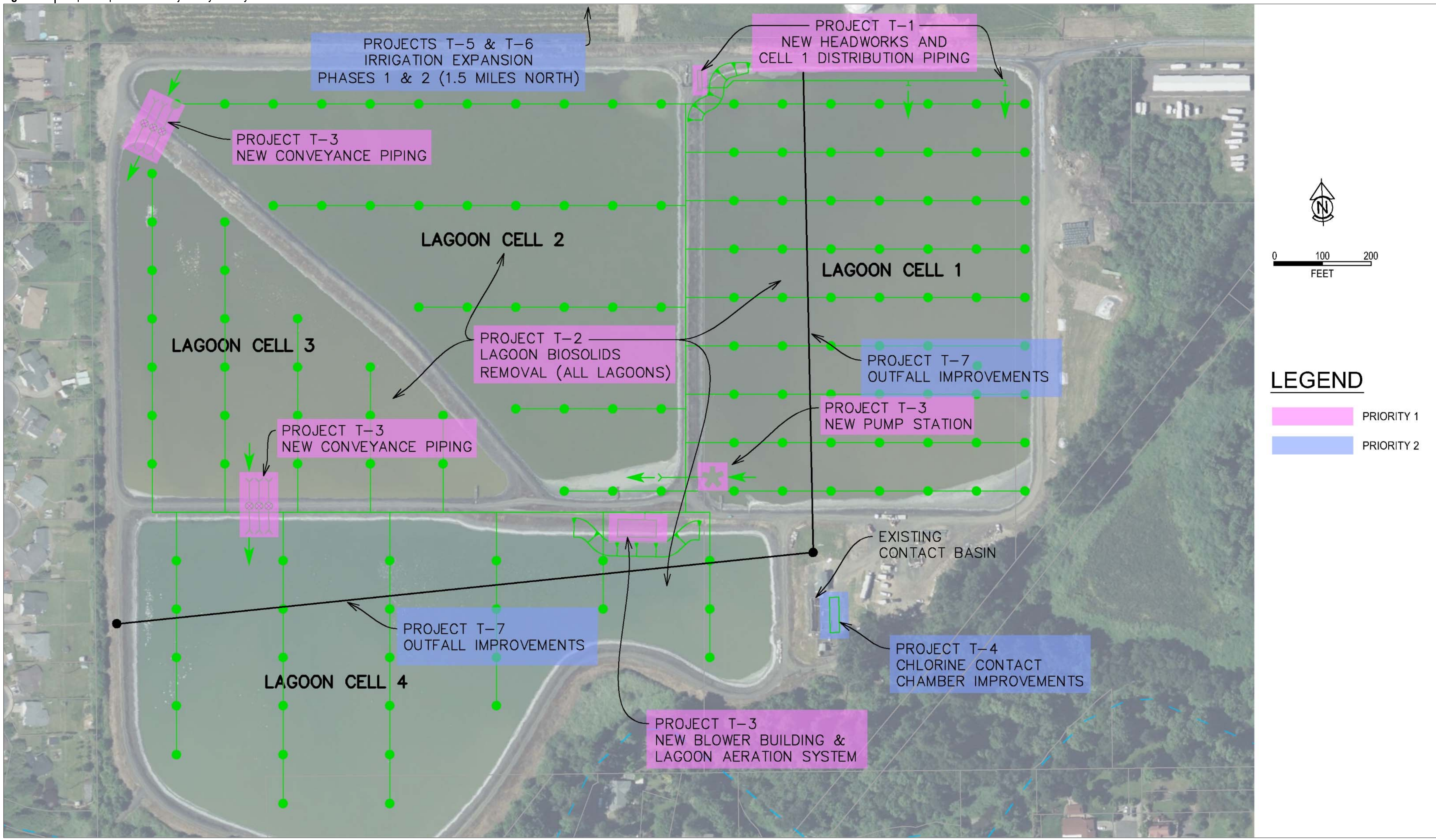


Figure 8-4 | Map of Improvement Projects by Priority – Wastewater Treatment Plant



APPENDICES

Appendix A

NPDES Permit

Appendix B

City of Independence Sanitary Sewer Maps

Appendix C

Capital Improvement Project Cost Estimates

APPENDIX A

NPDES PERMIT

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM
WASTE DISCHARGE PERMIT

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

Issued pursuant to ORS 468B.050 and The Federal Clean Water Act (The Clean Water Act)

ISSUED TO:
City of Independence
PO Box 7
Independence, OR 97351

SOURCES COVERED BY THIS PERMIT:

Type of Waste	Outfall Number	Outfall Location
Treated Wastewater	001	Willamette River 44.85806, -123.181384 River Mile 95.5
Recycled Water Reuse	002	Specified in Recycled Water Use Plan and in Site Authorization

FACILITY LOCATION:
Independence Sewage Treatment Plant
End of Williams Street
Independence, OR

Treatment System Class: Level II
(Refer to Schedule D, Condition 7. b. and c.)
Collection System Class: Level II

RECEIVING STREAM INFORMATION:
WRD Basin: Willamette
USGS Sub-Basin: Middle Willamette
Receiving Stream name: Middle Willamette
LLID: 1227618456580-95.5

County: Polk

EPA REFERENCE NO. OR002044-3

Issued in response to Application No. 972332 received November 26, 2008. This permit is issued based on the land use findings in the permit record.

Ranei Nomura

Ranei Nomura, Western Region Water Quality Permit Manager	5/20/2016 Signature Date	6/9/2016 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 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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LIST OF TABLES

SCHEDULE A: WASTE DISCHARGE LIMITS

1. Outfall 001 – Treated effluent from outfall 001 must meet the following limits:

a. BOD5 and TSS

i. June 1 – October 31. During this time period the permittee may not discharge to waters of the state.

ii. November 1 – May 31: During this time period the permittee must comply with the limits in the following table:

Table A1: BOD_5 and TSS Limits

Parameter	Average Effluent Concentrations, mg/L		Monthly Average lbs/day	Weekly Average lbs/day	Daily Maximum Lbs
	Monthly	Weekly			
BOD_5	30	45	500	750	1000
TSS	50	80	830	1200	1700

iii. Additional information for the limits in Tables A1 and A2 above.

(A) Average dry weather design flow to the facility equals 0.6 MGD. Winter mass load limits are based on the average wet weather flow to the facility equaling 2.0 MGD.

b. Additional Parameters.

Permittee must comply with the limits of the following table (when discharging to outfall 001):

Table A2: Limits for Additional Parameters

Other Parameters	Limits
BOD5 and TSS Removal Efficiency	May not be less than 85% monthly average for BOD5 and 65% monthly average TSS.
E. coli Bacteria (see Note a.)	Monthly log mean (same as geometric mean) may not exceed 126 organisms per 100 ml. No single sample may exceed 406 organisms per 100 ml.
pH	May not be outside the range of 6.1 to 9.0 S.U.
Total Residual Chlorine Concentration, (see Note b.)	The daily maximum effluent concentration limit is 0.12 mg/L. The monthly average effluent concentration limit is 0.070 mg/L.

Notes:
a. No single *E. coli* sample may exceed 406 organisms per 100 mL; however, DEQ will not cite a violation of this limit if the permittee takes at least 5 consecutive re-samples at 4 hour intervals beginning within 48 hours after the original sample was taken and the geometric mean of the 5 re-samples is less than or equal to 126 *E. coli* organisms/100 mL.
b. DEQ has established a minimum Quantitation Limit of 0.05 mg/L for Total Residual Chlorine.

2. Regulatory Mixing Zone

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

The portion of the Willamette River contained within a band extending out fifty (feet) from the west bank of the river and extending from a point fifty (50) feet upstream of the outfall to a point three-hundred (300) feet downstream from the outfall. The zone of immediate dilution (ZID) is the portion of the allowable mixing zone that is within thirty (30) feet of the point of discharge.

3. Outfall Inspection

During the year 2017 (2nd year of permit issuance), the permittee must inspect outfall 001 and submit a written report to DEQ within the same year regarding the integrity of the outfall. The report should include a description of the outfall as originally constructed, the condition of the current outfall and a discussion of any repairs that would need to be performed to return the outfall to its originally designed condition.

4. Groundwater Protection

The permittee may not conduct any activities that could cause an adverse impact on existing or potential beneficial uses of groundwater. All wastewater and process related residuals must be managed and disposed of in a manner that will prevent a violation of the Groundwater Quality Protection Rules (OAR Chapter 340, Division 40).

5. Outfall 002 - Recycled Water

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

a. Treated and used according to the criteria listed in Table A3.

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

c. Used in a manner and applied at a rate that does not have the potential to adversely impact 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 A3: Recycled Water Limits (when discharging)

Class	Level of Treatment (after disinfection unless otherwise specified)	Beneficial Uses (see Note c and d.)
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 nondisinfected 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 fire fighting using aircraft, street sweeping, or sanitary sewer flushing.
D.	Class D recycled water must be oxidized and disinfected. *E. coli* may not exceed: • A 30-day geometric mean of 126 organisms per 100 mL. • 406 organisms per 100 mL in any single sample.	Class D recycled water may be used for: • Nondisinfected uses. • Irrigation of firewood, ornamental nursery stock, Christmas trees, sod, or pasture for animals.

Notes:

c. The listed beneficial uses listed for class C and D are the beneficial uses identified by OAR 340-0055. The permittee's recycled water use plan must clearly identify the beneficial uses specific to the land application site(s).

d. The permittee must update the RWUP and submit the RWUP for DEQ review for any new land application site(s).

SCHEDULE B: MINIMUM MONITORING AND REPORTING REQUIREMENTS

1. Monitoring and Reporting Protocols

a. Test Methods

i. Test Methods – monitoring must be conducted according to test procedures in 40 CFR Part 136 and 40 CFR 503 for biosolids or other approved procedures as per Schedule F.

b. 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).

iii. For compliance and characterization purposes, the maximum acceptable QL is stated in this permit.

c. Implementation

i. The Laboratory QLs (adjusted for any dilutions) for analyses performed to demonstrate compliance with permit limits or as part of effluent characterization, must be at or below the QLs specified in the permit unless one of the conditions below is met.

(A) The monitoring result shows a detect above the laboratory reported QL.

(B) The monitoring result indicates nondetect at a DL which is less than the QL.

(C) 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 re-sampling or allow a higher QL to be reported.

d. Laboratory Quality Assurance and Quality Control

i. Laboratory Quality Assurance and Quality Control (QA/QC) – The permittee must develop and implement a written QA/QC program that conforms to the requirements of 40 CFR Part 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 a sample does not meet QA/QC requirements, the permittee must include the result in the discharge monitoring report (DMR) along with a notation (data qualifier) explaining how it does not meet QA/QC requirements, but the permittee must not use the result in any calculation required by the permit unless authorized by the DEQ permit inspector.

e. Reporting Procedures

i. Significant Figures

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

ii. Calculating Mass Loads

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

Example calculation:

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

2. Influent Monitoring and Reporting Requirements

The permittee must monitor influent at the wastewater system headworks prior to the flow splitter.

Table B1: Influent Monitoring

Item or Parameter	Time Period	Minimum Frequency	Sample Type/Required Action	Report
Total Flow (MGD)	Year-round	Daily	Measurement by totalizing meter	1. Daily values 2. Monthly total 3. Monthly Average 4. Maximum daily value 5. Minimum daily value
Flow Meter Calibration	Year-round	Annual	Verification	Report on DMR when the calibration was completed
BOD_5 and TSS (mg/L)	Year-round	Weekly	24-hour composite	1. Daily values 2. Monthly values
pH (S.U.)	Year-round	3/Week	Grab	1. Daily values 2. Maximum daily value

3. Effluent Monitoring and Reporting Requirements Outfall 001

The permittee must monitor effluent for Outfall 001 after chlorination and prior to combined effluent manhole for Independence and Monmouth.

Table B2: Effluent Monitoring Outfall 001

Item or Parameter	Time Period	Minimum Frequency[1]	Sample Type/Required Action	Report
Total Flow (MGD)	November 1 –May 31	Daily	Measurement by totalizing meter	1. Daily values 2. Monthly total 3. Monthly Average 4. Maximum daily value
Flow Meter Calibration	November 1 –May 31	Annual	Verification	Report that calibration was completed
BOD_5 and TSS (mg/L)	November 1 –May 31	Weekly	24-hour composite	1. Daily values 2. Monthly Average 3. Weekly Average 4. Maximum daily value
BOD_5 and TSS Mass Load (lb/day)	November 1 –May 31	Weekly	Calculation	1. Daily values 3. Monthly Average 4. Weekly Average 5. Maximum weekly value 4. Maximum daily value
BOD_5 and TSS Percent Removal (%)	November 1 –May 31	Monthly	Calculation	1. Monthly Average
pH (S.U.)	November 1 –May 31	3/Week	Grab	1. Daily values 2. Maximum daily value 3. Minimum daily value
E. coli	November 1 –May 31	Weekly	Grab	1. Daily value 2. Monthly geometric mean 3. Geometric mean of any re-samples
Chlorine Used (lbs/day)	November 1 –May 31	Daily	Measurement	1. Daily values 2. Monthly average

[1] When discharging

Item or Parameter	Time Period	Minimum Frequency[1]	Sample Type/Required Action	Report
Total Residual Chlorine (measure after dechlorination)	November 1 –May 31	Daily	Grab	1. Maximum Daily value 2.Monthly Average
Effluent temperature, Daily Maximum	November 1 –May 31	Daily, between 2:00 p.m. and 4:00 p.m.	Grab	1. Daily Maximum value 2. Monthly maximum value
Ammonia-Nitrogen as N (NH3-N)	November 1 –May 31	Monthly	Grab	1. Daily Value
Mercury[2]	November 1 –May 31	One sample annually, starting in 2017	Grab	1. Daily Value

Table B3: Lagoon Management

Item or Parameter	Time Period	Minimum Frequency3	Sample Type/Required Action	Report
Storage Lagoon Depth	November 1 –May 31	Weekly	Record	1. Daily Values
Sludge Depth in primary cell	November 1 –May 31	Once during the term of the permit	Measurement	1. Map of depths

[2] Mercury (total), CAS # 7439976, Required Quantitation Limit 0.001 μg/L

[3] When discharging

4. Recycled Water Monitoring Requirements: Outfall 002.

The permittee must monitor recycled water as listed below. The samples must be representative of the recycled water..

Table B4: Recycled Water Monitoring Requirements: Outfall 002

The permittee must monitor recycled water as listed below. The samples must be representative of the recycled water delivered for beneficial reuse at a location **after chlorination and prior to combined effluent manhole for Independence and Monmouth.** . The monitoring and reporting requirements are only applicable when land application of recycled water is occurring. The parameters must be reported on the applicable DMR.

Item or Parameter	Time Period	Minimum Frequency	Sample Type/Required Action	Report
Total Flow (MGD) and Quantity Irrigated (inches/acre)	During Irrigation period specified in RWUP	Daily	Measurement	1. Daily Values
Flow Meter Calibration	Specified in RWUP	Annually	Verification	1. Report that calibration was completed
Quantity Chlorine Used (lbs)	Specified in RWUP	Daily	Measurement	1. Daily Values
Chlorine, Total Residual (mg/L)	Specified in RWUP	Daily	Grab	1. Maximum Daily values 2.Monthly Average
pH	Specified in RWUP	Weekly	Grab	1. Daily Values
Total Coliform, Class C Recycled Water	Specified in RWUP	Weekly	Grab	1. Daily values 2. 7 day Median[4], of 23 org., 3. Maximum of 240 org., in any two consecutive samples.
E. coli, Class D Recycled Water	Specified in RWUP	Weekly	Grab	1. Daily values 2. The 30 day log mean 3. Maximum value

[4] Based on results of the last seven days that analyses have been completed.

Change in Recycled Water Class	2 weeks prior to a difference class of Recycled Water Use allowed by this permit	During Irrigation Season Each Year	Calculation	Written notification
Nitrogen Loading Rate (lbs per/acre-year)	specified in RWUP	Annually	Calculation	Report Beneficial Use in Annual Report
Nutrients (TKN, NO_2+NO_3-N, NH_3, Total Phosphorus)	Specified in RWUP	Quarterly	Grab	1. Daily Values

5. Permit Application Monitoring Requirements

The permittee must collect four samples for the Table B5 parameters. These samples must be collection in November, 2018; and January, March, and May, 2019. The results must be included with the applicable DMR.

Table B5: Outfall 001 Effluent Monitoring Required for NPDES Permit Application

Parameter
Dissolved Oxygen
Total Kjeldahl Nitrogen (TKN)
Nitrate Plus Nitrite Nitrogen
Oil and Grease
Phosphorus
TDS

6. Minimum Reporting Requirements

The permittee must report monitoring results as listed below.

Table B6: Reporting Requirements and Due Dates

Reporting Requirement	Frequency	Due Date (see note a.)	Report Form (unless otherwise specified in writing)	Submit To:
1. Table B1: Influent Monitoring 2. Table B2: Effluent Monitoring 3. Table B4: Recycled Water Monitoring	Monthly	15th day of the month following data collection	DEQ-approved discharge monitoring report (DMR) form, electronic and hardcopy. (See Notes b. through d.)	DEQ Regional Office
1. Recycled water annual report describing effectiveness of recycled water system in complying with the DEQ-approved recycled water use plan, OAR 340-055, and this permit. See Schedule D for more detail. 2. Table B4: Recycled Water Monitoring	Annually	January 15	2 hard copies and electronic copy in DEQ-approved format	One each to: • DEQ Regional Office • DEQ Water Reuse Program Coordinator
Wastewater solids annual report describing quality, quantity, and use or disposal of wastewater solids generated at the facility.	Annually	February 19	2 hard copies and electronic copy in DEQ-approved format	One each to: • DEQ Regional Office • DEQ Biosolids Program Coordinator
Inflow and infiltration report (see Schedule D for description)	Annually	February 19	1 hard copy and electronic copy in DEQ-approved format	DEQ Regional Office
Significant Industrial User Survey	Every 5 years	Report due in 2017.	1 hard copy and electronic copy in DEQ-approved format	DEQ Pretreatment Coordinator

Outfall Inspection Report	Every 5 years	Report due in 2017.	1 hard copy and electronic copy in DEQ-approved format	DEQ Regional Office

Notes:

a. For submittals that are provided to DEQ by mail, the postmarked date must not be later than the due date.
b. Name, certificate classification, and grade level of each responsible principal operator as well as identification of each system classification must be included on DMRs. Font size must not be less than 10 pt.
c. Equipment breakdowns and bypass events must be noted on DMRs.
d. DEQ anticipates implementing an electronic reporting system for DMRs. Once the electronic reporting system is in place, the permittee is required to submit DMRs electronically. Until the electronic reporting system is in place, the permittee must submit a hard copy of the DMR.

SCHEDULE D: SPECIAL CONDITIONS

1. Inflow and Infiltration

a. An annual inflow and infiltration report must be submitted to the DEQ as directed in Schedule B. The report must include the following:

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

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

   iii. A summary of sanitary sewer overflows that occurred during the previous year.

   iv. The summary should include the dates of any overflow, locations, estimated volume, cause, follow-up and monitoring results (include the date of the overflow, location, estimated volume, cause, and follow-up and monitoring results (if ambient water monitoring was done).

2. Emergency Response and Public Notification Plan

The permittee must develop and maintain an Emergency Response and Public Notification Plan (the Plan) as per Schedule F, Section B, Conditions 7 and 8. The permit holder must develop the plan within six months of permit issuance and update the Plan annually to ensure that telephone and email contact information for applicable public agencies are current and accurate. An updated copy of the plan must be kept on file at the wastewater treatment facility for Department review. The latest plan revision date must be listed on the Plan cover along with the reviewer's initials or signature.

3. Recycled Water Use Plan

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

b. Recycled Water Annual Report – The permittee must submit a recycled water annual report by the date specified in Schedule B. This report must describe the effectiveness of the system to comply with the approved recycled water use plan, the rules included in OAR 340-055, and the permit limits and conditions for recycled water contained in Schedule A. The plan must also include the monitoring data for the previous year as required in Schedule B.

4. Wastewater Reuse at the Treatment System

The permittee is exempt from the recycled water use requirements in OAR 340-055 when recycled water is used at the wastewater treatment system for landscape irrigation or for in-plant processes at a wastewater treatment system and 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. Contiguous property to the parcel of land upon which the treatment system is located is considered the wastewater treatment system site if under the same ownership.

c. Spray or drift or both from the use does not occur off the site.

d. Public access to the site is restricted.

5. 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 monitor, report, and dispose of solids as required under the permit of the receiving facility.

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.

6. Lagoon Solids

At least 60 days and preferably six months prior to the removal of accumulated solids from the lagoon, the permittee must submit to DEQ a biosolids management plan and land application plan. DEQ will provide an opportunity for comment on the biosolids management plan and land application plan as directed by OAR 340-050-0015(8).The permittee must follow the conditions in the approved plan.

7. 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.[1]

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 system as specified on p. 1 of this permit. Prior to the use of the recycled water irrigation system the permittee must designate a supervisor whose certification corresponds to a Class I wastewater treatment system or greater.

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 collection system, and at a grade equal to or greater than the wastewater system's classification as specified on p. 1 one of this permit. Prior to the use of the recycled water irrigation system the permittee must have its system supervised full-time by operator(s) who hold a valid certificate for the wastewater treatment at a grade equal to a Class I wastewater treatment system or greater.

d. The permittee's wastewater system may not be without the designated supervisor for more than 30 days. During this period, there must be another person available to supervise 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, if any, 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. The permittee may replace or re-designate the system supervisor with another properly certified operator at any time and must notify DEQ in writing within 30 days of replacement or re-designation of operator in charge. As of this writing, the notice of replacement or re-designation must be sent to Water Quality Division, Operator Certification Program, 700 NE Multnomah St. Suite #600, Portland, OR 97232. This address may be updated in writing by DEQ during the term of this permit.

h. When compliance with item (e) 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.

8. Spill/Emergency Response Plan

The permittee must have an up-to-date spill response plan available for review during inspection, for prevention and handling of spills and unplanned discharges. The spill response plan must include all of the following:

a. A description of the reporting system that will be used to alert responsible managers and legal authorities in the event of a spill.

b. A description of preventive measures and facilities (including an overall facility plot showing drainage patterns) to prevent, contain, or treat spills of these materials.

c. A description of the permittee's training program to ensure that employees are properly trained at all times to respond to unplanned and emergency incidents.

d. A description of the applicable reporting requirements. These must be consistent with the reporting requirements found in Schedule F, condition D.5.

9. Industrial User Survey

The permittee must conduct an industrial user survey to determine the presence of any industrial users discharging wastewaters subject to pretreatment and submit a report on the findings to DEQ in 2017. The purpose of the survey is to identify whether there are any categorical industrial users discharging to the POTW, and ensure regulatory oversight of these discharges to state waters. If the POTW has already completed a baseline IU Survey the results of this survey are to be provided to DEQ within two months of permit re-issuance.

Guidance on conducting IU Surveys and information on pretreatment requirements can be found at the DEQ Water Quality Permit Program website. Once an initial baseline IU Survey is conducted it is to be maintained by the POTW and made available for inspection by DEQ. Every 5 years from permit renewal, the permittee must submit an updated IU survey.

SCHEDULE F:

NPDES GENERAL CONDITIONS – DOMESTIC FACILITIES

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. The federal Clean Water Act provides for civil penalties not to exceed $37,500 and administrative penalties not to exceed $16,000 per day for each violation of any condition or limitation of this 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. The federal Clean Water Act provides for criminal penalties of not more than $50,000 per day of violation, or imprisonment of not more than 2 years, or both for second or subsequent negligent violations of this permit.

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 federal Clean Water Act provides for criminal penalties of $5,000 to $50,000 per day of violation, or imprisonment of not more than 3 years, or both for knowing violations of the permit. In the case of a second or subsequent conviction for knowing violation, a person is subject to criminal penalties of not more than $100,000 per day of violation, or imprisonment of not more than 6 years, or both.

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. Treatment of Single Operational Upset

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. Overflows from Wastewater Conveyance Systems and Associated Pump Stations

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. Public Notification of Effluent Violation or Overflow

If effluent limitations specified in this permit are exceeded or an overflow occurs that threatens public health, the permittee must take such steps as are necessary to alert the public, health agencies and other affected entities (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. Emergency Response and Public Notification Plan

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

a. Ensure that the permittee is aware (to the greatest extent possible) of such events;

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

B9. Removed Substances
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. Representative Sampling
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 B7.
   (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.

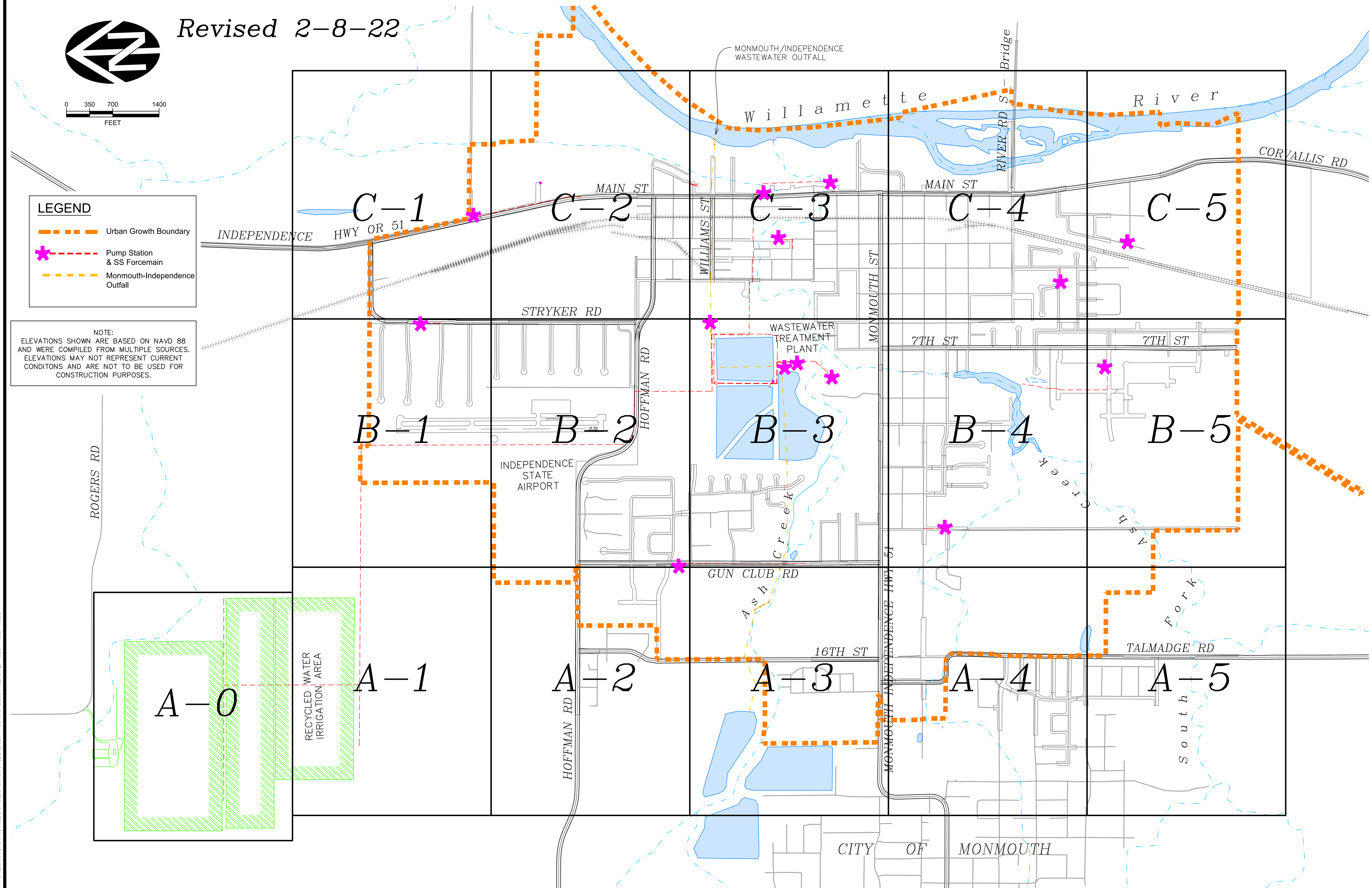
E21. *POTW* means a publicly-owned treatment works.

APPENDIX B

CITY OF INDEPENDENCE SANITARY SEWER MAPS

SANITARY SEWER MAP INDEX — CITY OF INDEPENDENCE

Revised 2–8–22



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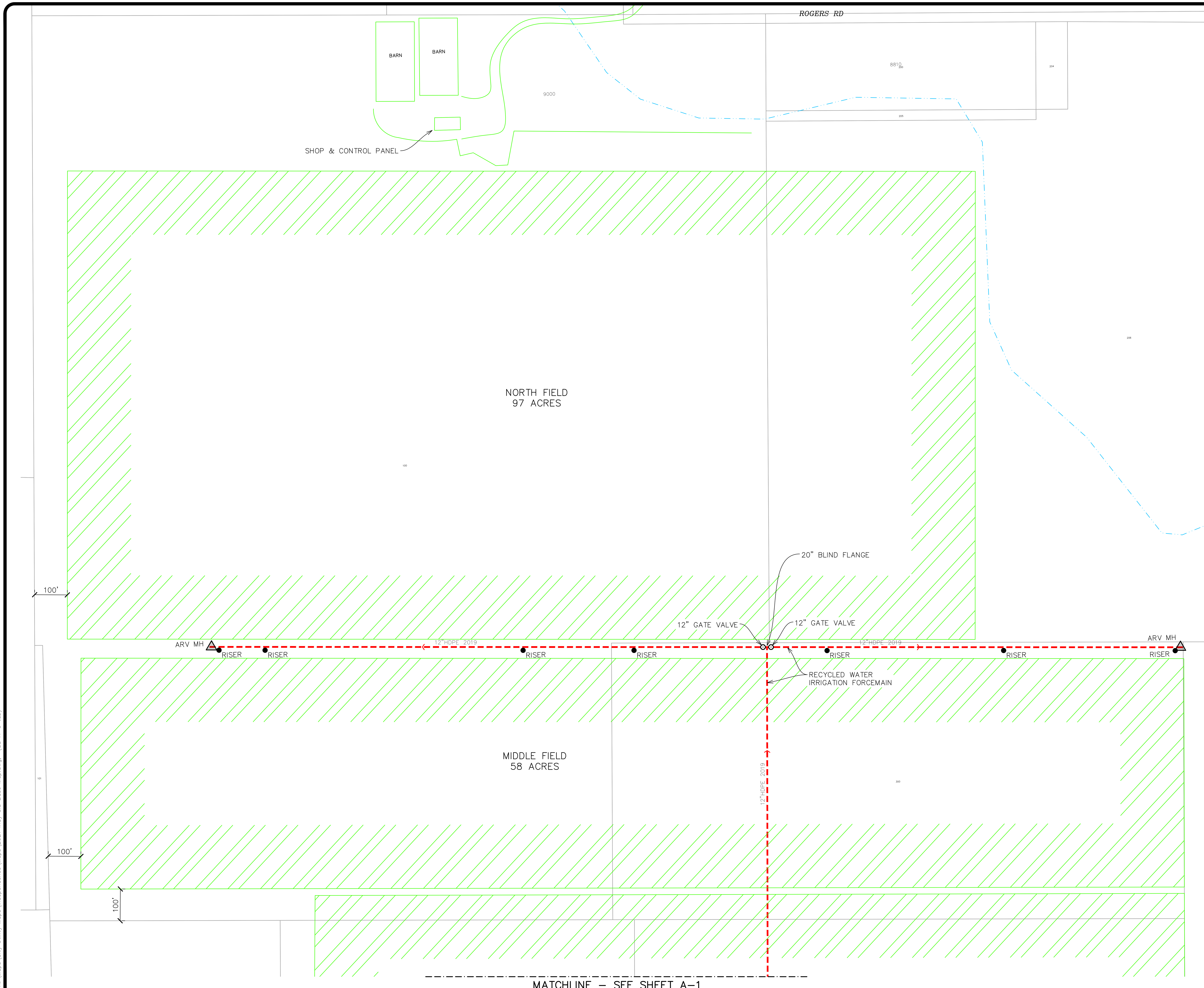
E-mail: westech@westech-eng.com

CITY OF INDEPENDENCE, OREGON
UTILITY MAP
SANITARY SEWER SYSTEM MAP INDEX

SHEET
INDEX
1 OF 17

JOB NUMBER
2814.3040.0



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FEET

LEGEND

- City Limits
- Urban Growth Boundary
- Sanitary Sewer
- Pump Station & SS Forcemain
- Monmouth-Independence Outfall
- Manhole / Number
- Cleanout
- Air Release Valve
- Valve
  - BFV = BUTTERFLY VALVE
  - RSGV= RESILIENT SEAT GATE VALVE
  - PV = PLUG VALVE
- Taxlot Boundary & Address #
- Rail Road

Pipe Materials

C – CONCRETE
CR – CONCRETE (RUBBER GASKET JOINT)
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T – TERRA COTTA
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CIPP – CURED IN PL PIPE LINER

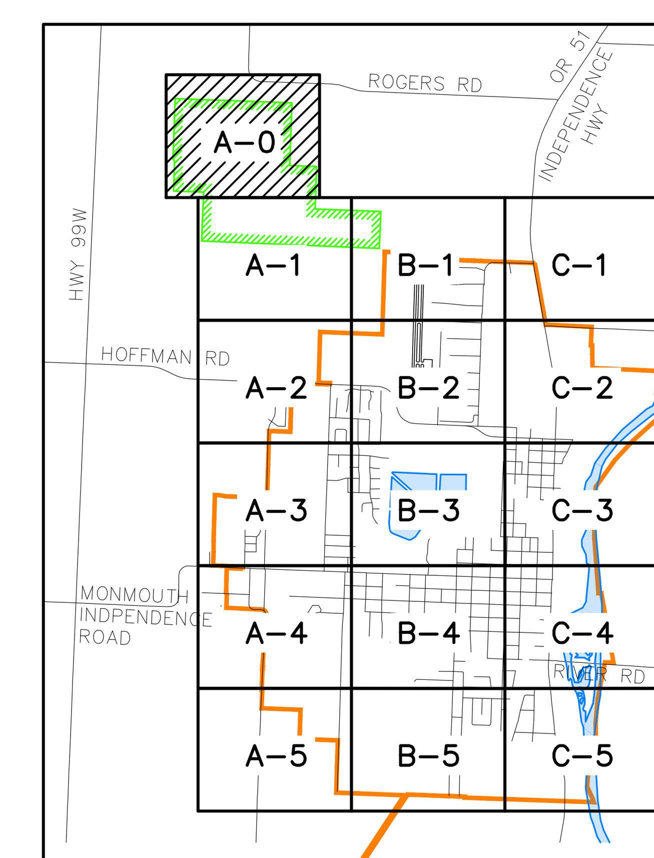
MH # KEY

BASIN LETTER–#

BASIN LETTER: PUMP STATION

A: OAK STREET
B: RIVERVIEW
C: 9TH STREET
D: LAGOON
E: WILLIAMS STREET
M: (MISCELLANEOUS)

NOTE:
ELEVATIONS SHOWN ARE BASED ON NAVD 88 AND WERE COMPILED FROM MULTIPLE SOURCES. ELEVATIONS MAY NOT REPRESENT CURRENT CONDITIONS AND ARE NOT TO BE USED FOR CONSTRUCTION PURPOSES.



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CITY OF INDEPENDENCE, OREGON
UTILITY MAP

SANITARY SEWER SYSTEM
MAP A-0

SHEET
A-0
2 OF 17

JOB NUMBER
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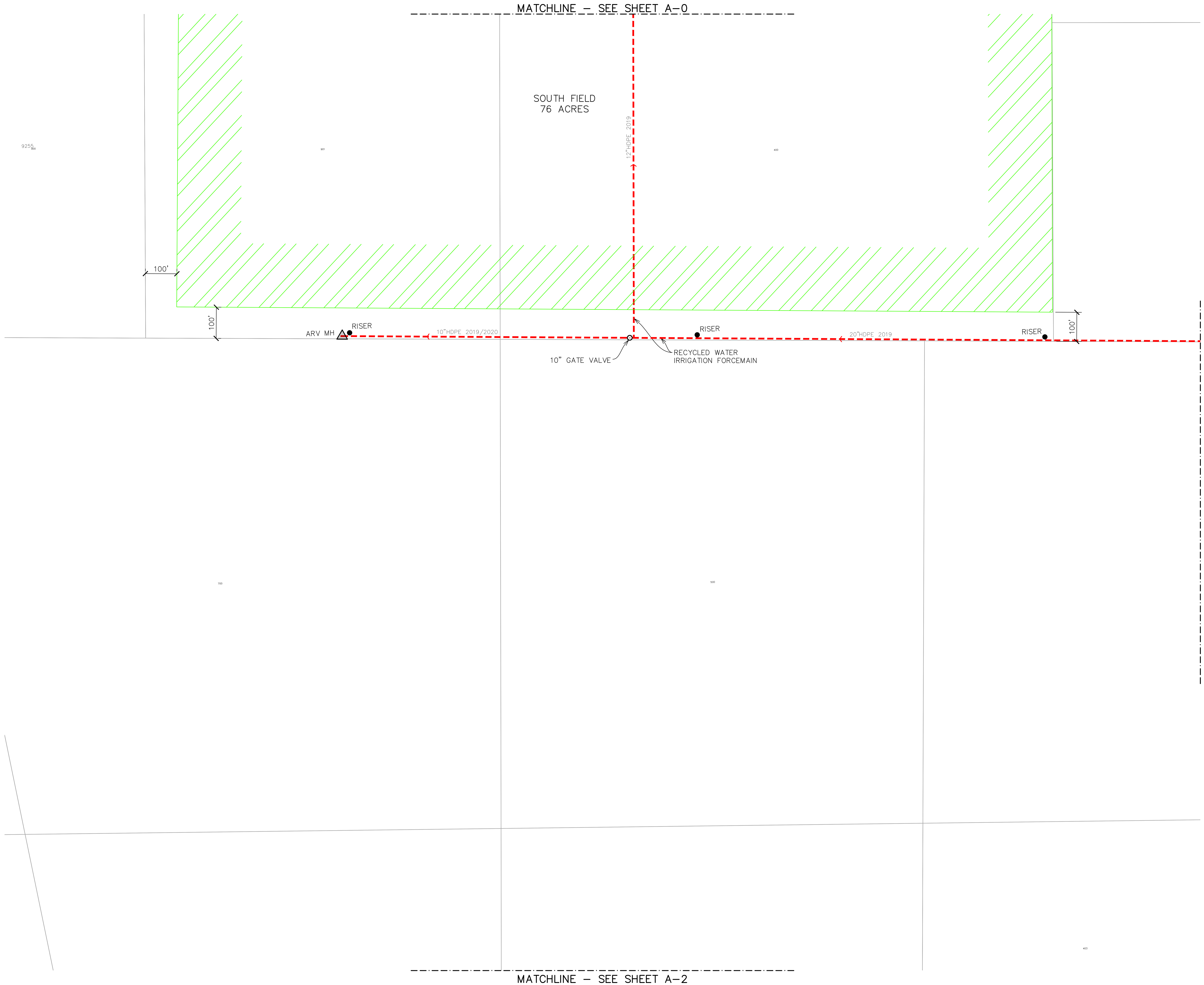

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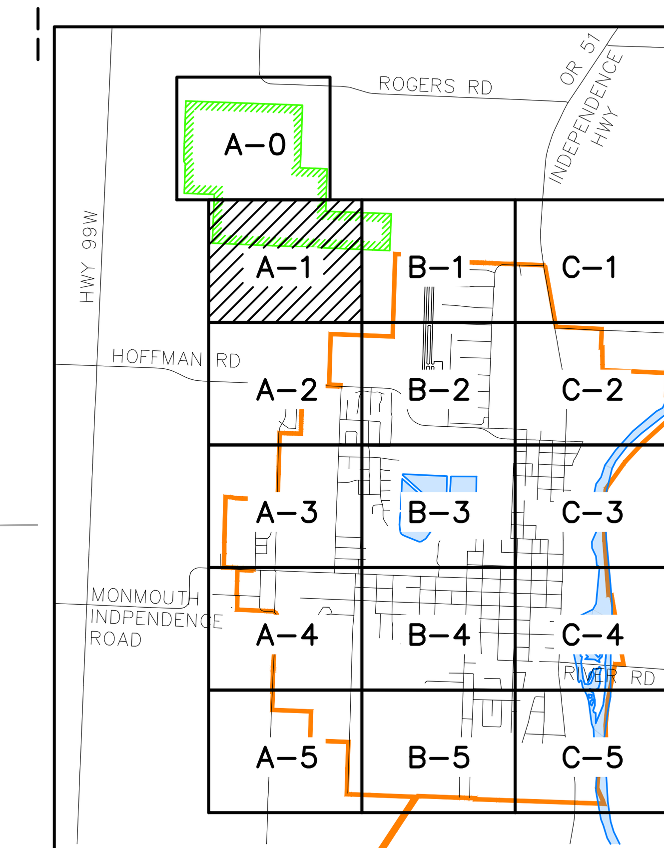

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CITY OF INDEPENDENCE, OREGON
UTILITY MAP
SANITARY SEWER SYSTEM
MAP A–1

SHEET A–1
3 OF 17

JOB NUMBER
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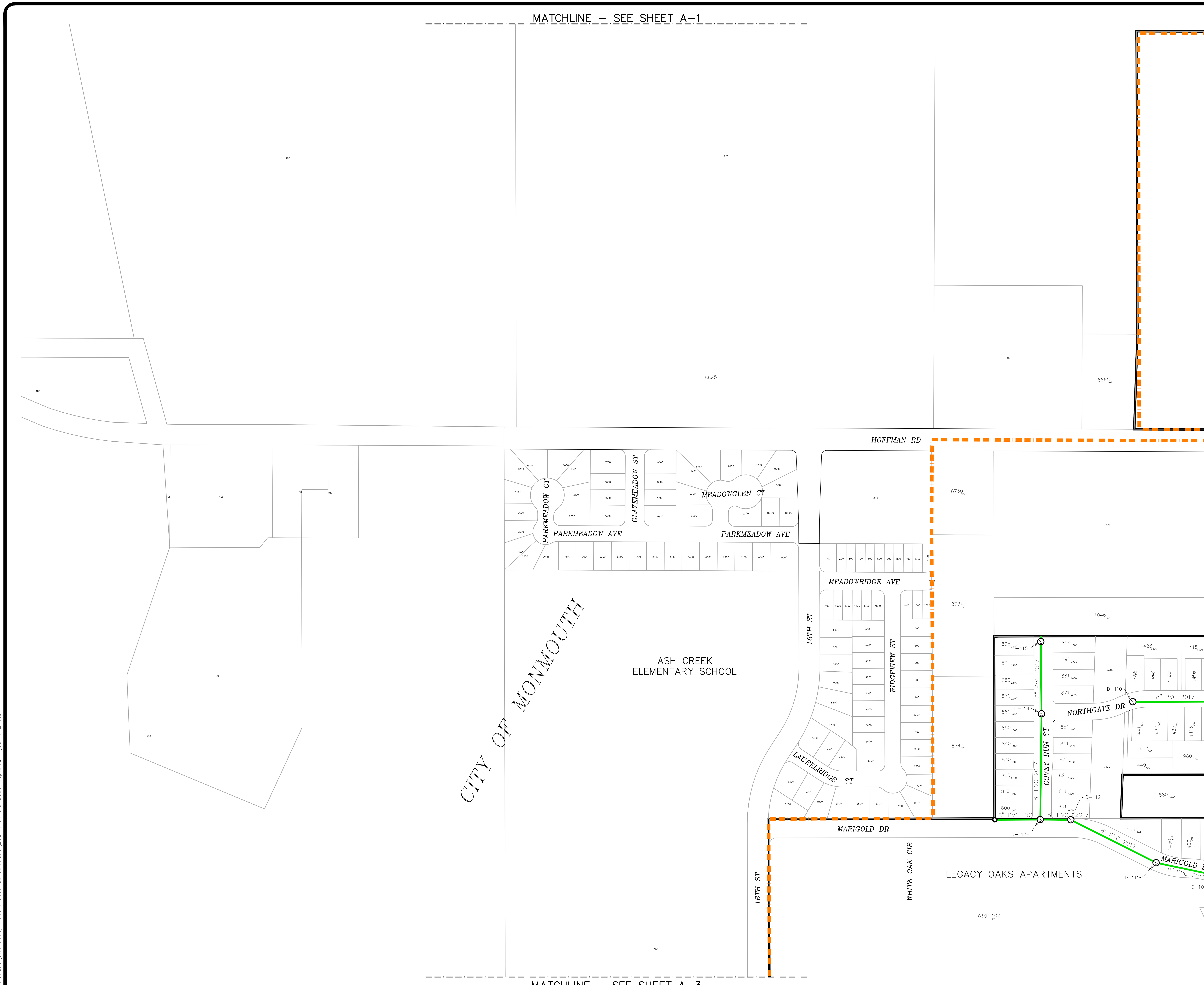

LEGEND

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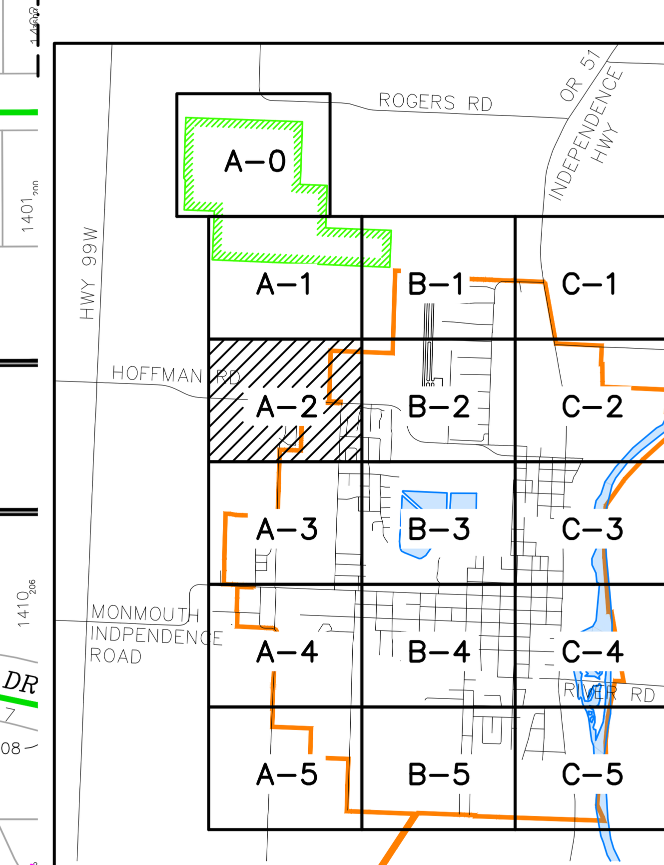

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CITY OF INDEPENDENCE, OREGON
UTILITY MAP

SANITARY SEWER SYSTEM MAP A-2

SHEET
A-2
4 OF 17

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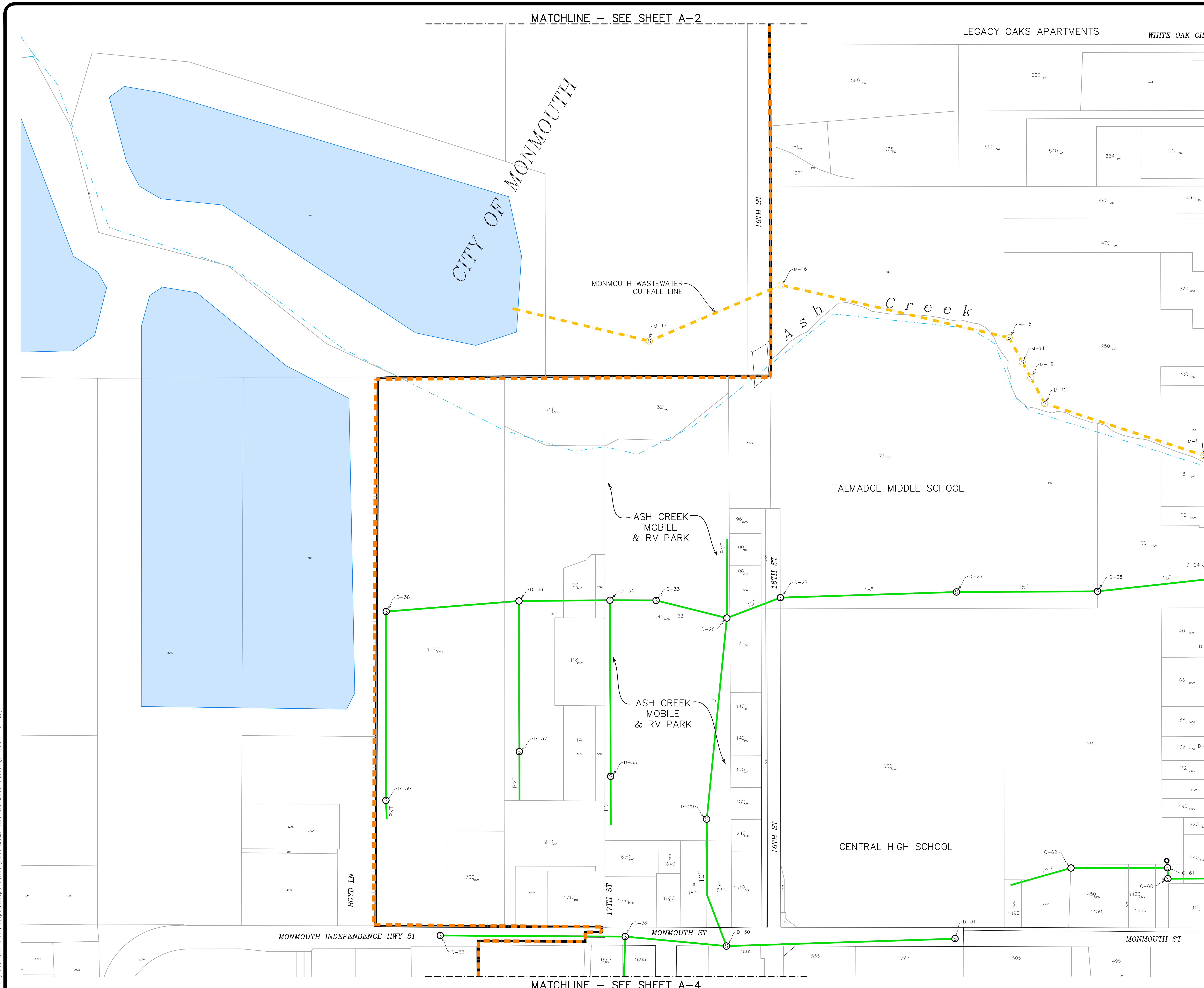

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FEET

LEGEND

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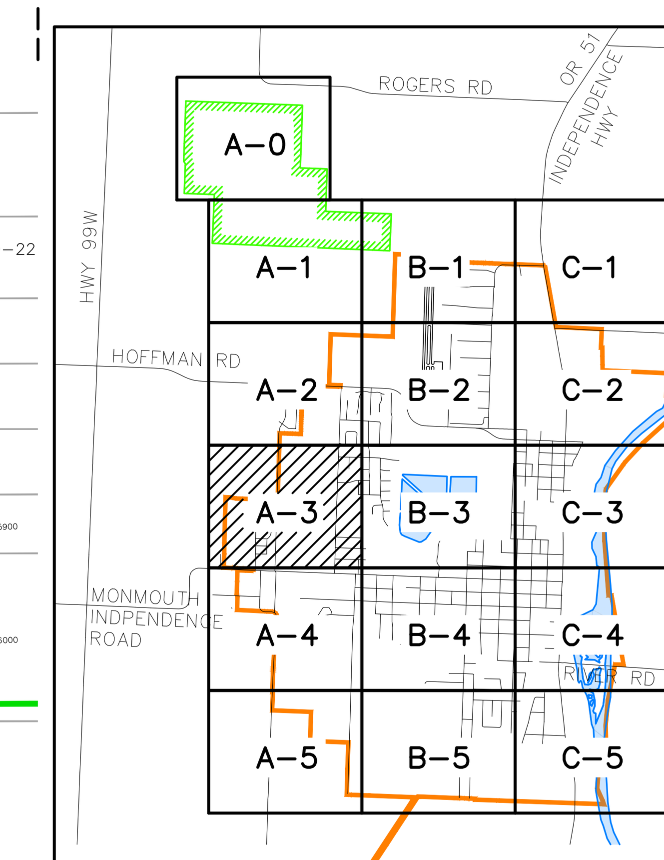

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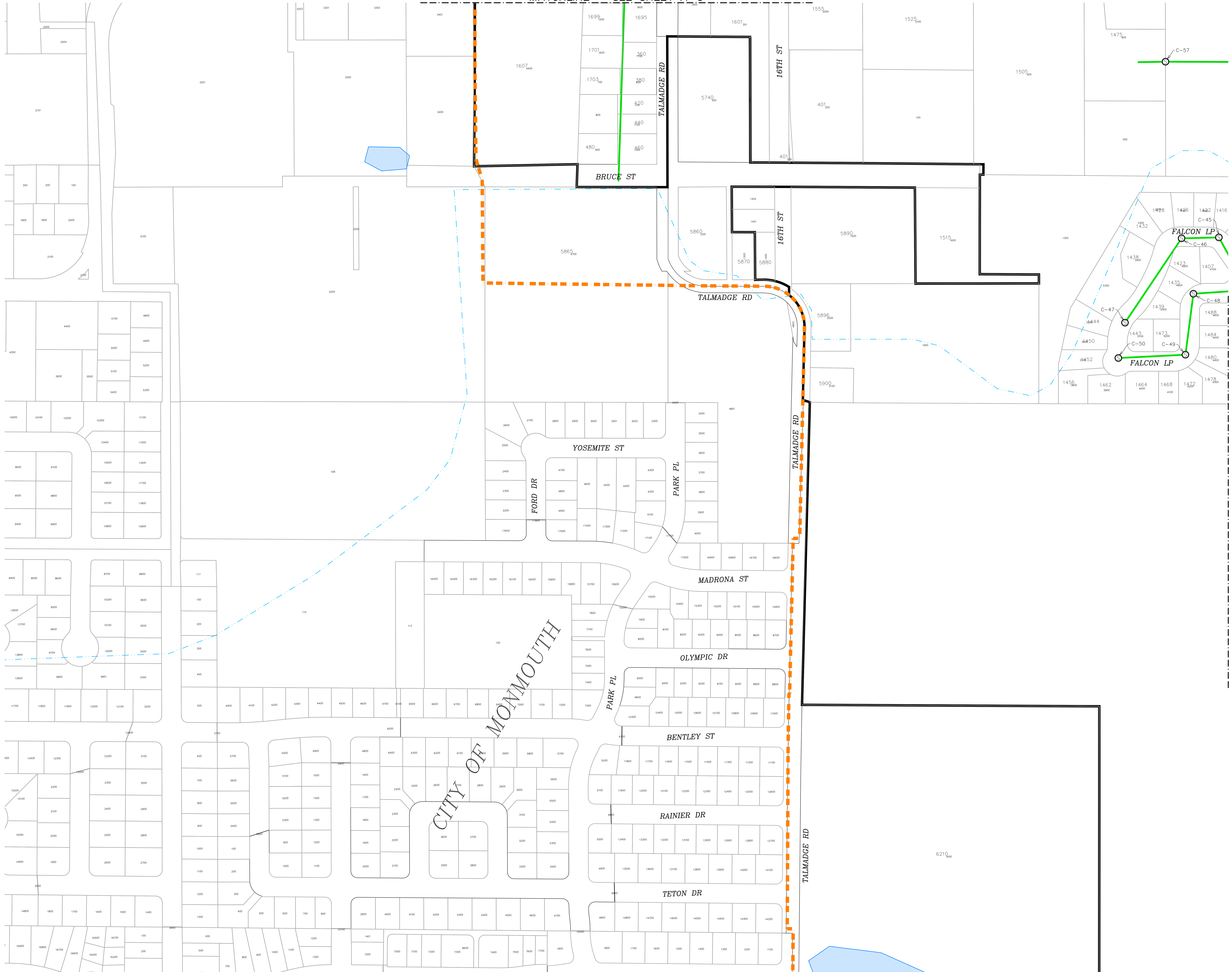
CITY OF INDEPENDENCE, OREGON
UTILITY MAP
SANITARY SEWER SYSTEM MAP A-3

SHEET
A-3
5 OF 17

JOB NUMBER
2814.3040.0

MATCHLINE – SEE SHEET A-3



MATCHLINE – SEE SHEET B-4

LEGEND

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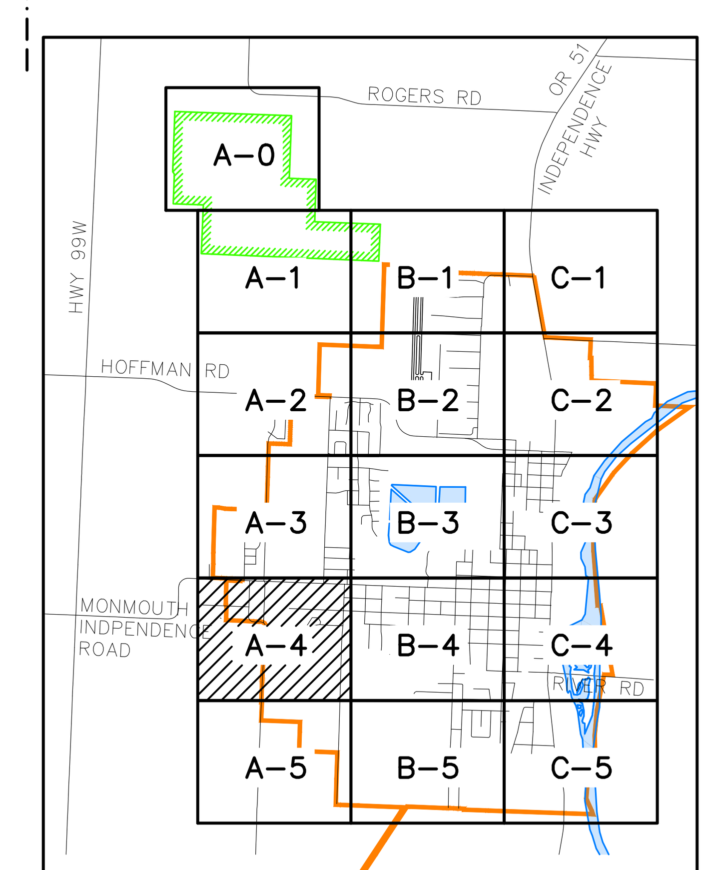

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MATCHLINE – SEE SHEET A-5

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CITY OF INDEPENDENCE, OREGON

UTILITY MAP

SANITARY SEWER SYSTEM MAP A-4

SHEET A-4
6 OF 17

JOB NUMBER
2814.3040.0

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1			

REVISIONS

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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 INDEPENDENCE, OREGON
UTILITY MAP

WATER SYSTEM MAP A-5

SHEET
A-5
5 OF 15

JOB NUMBER
2814.4020.0

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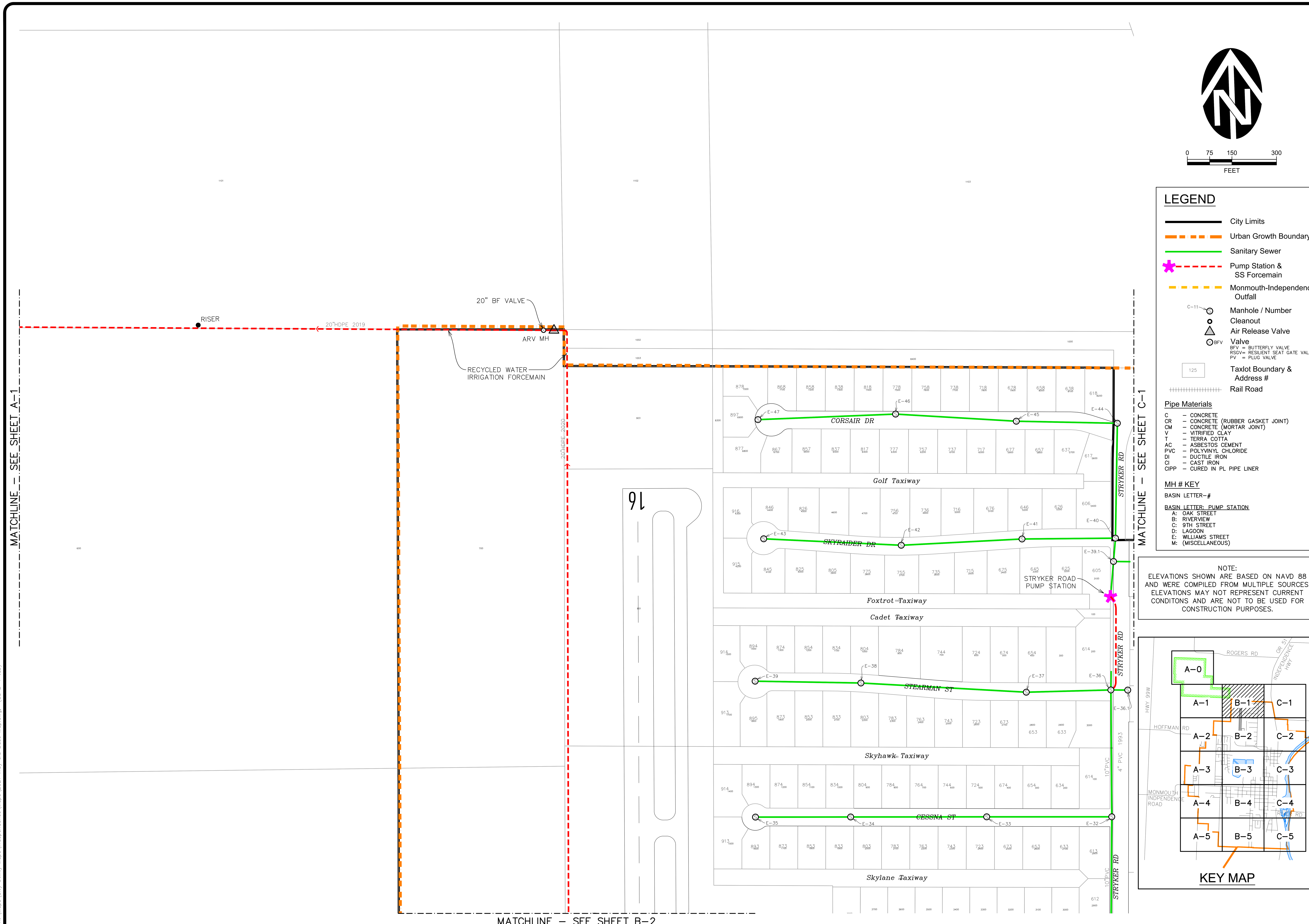

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CITY OF INDEPENDENCE, OREGON
UTILITY MAP
SANITARY SEWER SYSTEM
MAP B-1

SHEET
B-1
8 OF 17

JOB NUMBER
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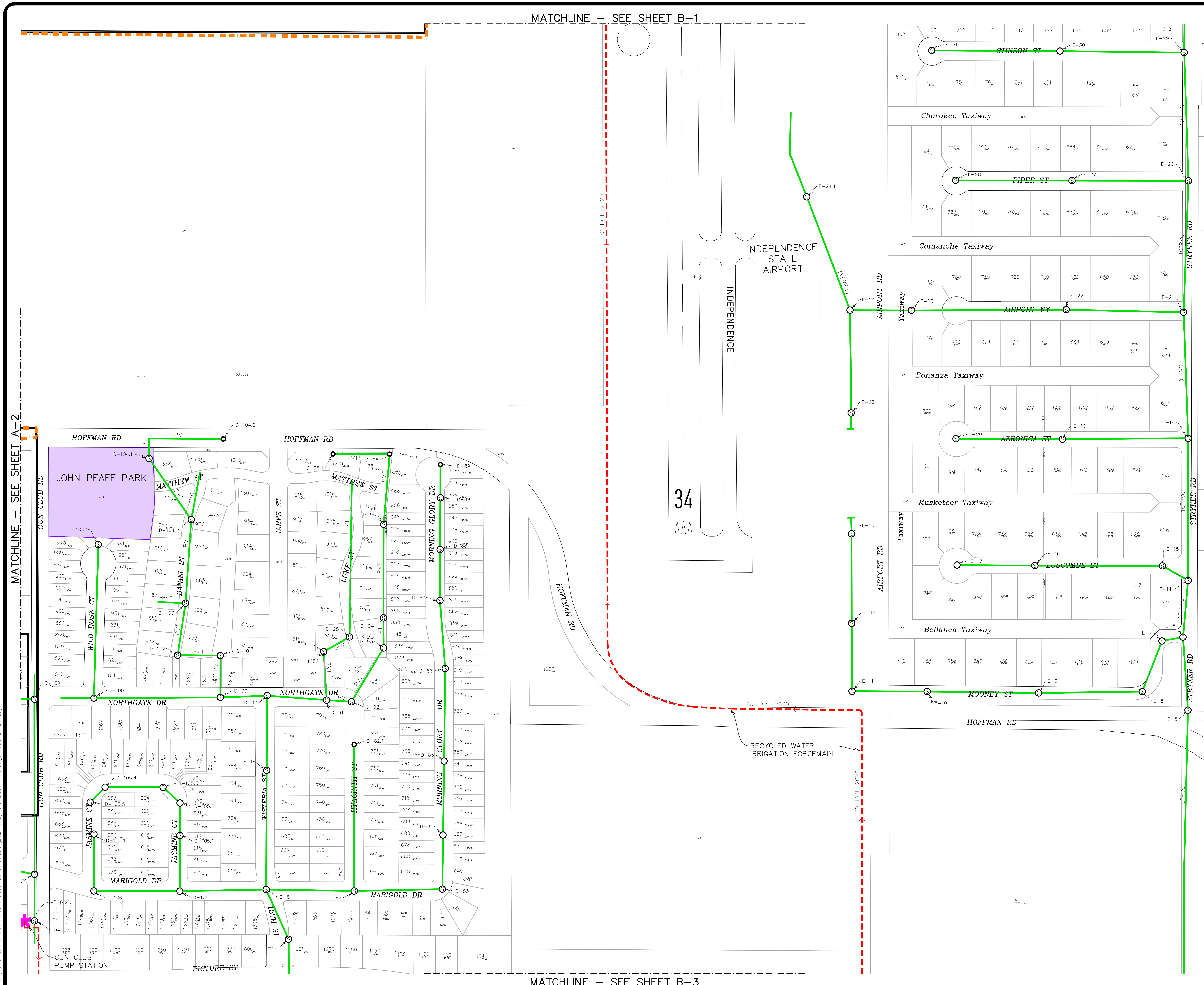
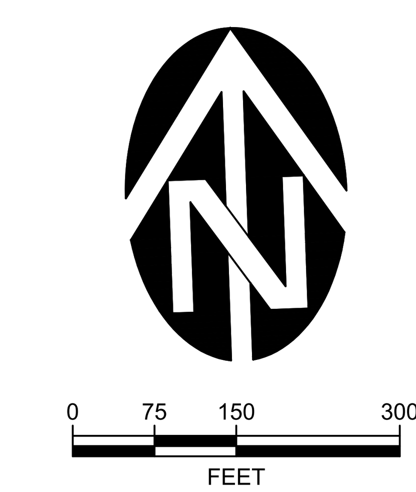




LEGEND

- City Limits
- Urban Growth Boundary
- Sanitary Sewer
- Pump Station & SS Forcemain
- Monmouth-Independence Outfall
- Manhole / Number
- Cleanout
- Air Release Valve
- Valve
  - BFV = BUTTERFLY VALVE
  - RSGV= RESILIENT SEAT GATE VALVE
  - PV = PLUG VALVE
- Taxlot Boundary & Address #
- Rail Road

Pipe Materials

- C – CONCRETE
- CR – CONCRETE (RUBBER GASKET JOINT)
- CM – CONCRETE (MORTAR JOINT)
- V – VITRIFIED CLAY
- T – TERRA COTTA
- AC – ASBESTOS CEMENT
- PVC – POLYVINYL CHLORIDE
- DI – DUCTILE IRON
- CI – CAST IRON
- CIPP – CURED IN PL PIPE LINER

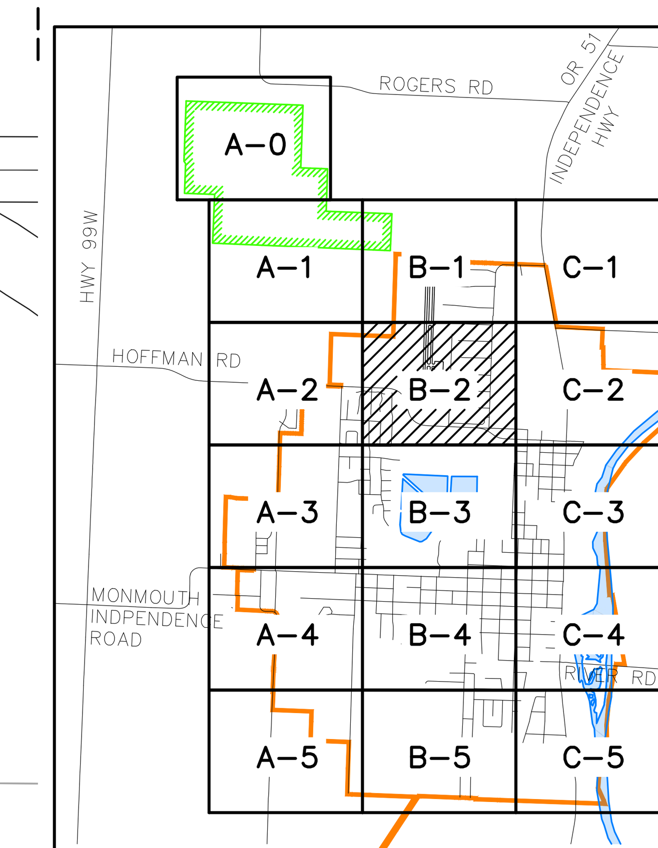
MH # KEY

BASIN LETTER–#

BASIN LETTER: PUMP STATION

- A: OAK STREET
- B: RIVERVIEW
- C: 9TH STREET
- D: LAGOON
- E: WILLIAMS STREET
- M: (MISCELLANEOUS)

NOTE:
ELEVATIONS SHOWN ARE BASED ON NAVD 88 AND WERE COMPILED FROM MULTIPLE SOURCES. ELEVATIONS MAY NOT REPRESENT CURRENT CONDITIONS AND ARE NOT TO BE USED FOR CONSTRUCTION PURPOSES.



KEY MAP

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CITY OF INDEPENDENCE, OREGON
UTILITY MAP

SANITARY SEWER SYSTEM MAP B-2

SHEET B-2
9 OF 17

JOB NUMBER 2814.3040.0

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MATCHLINE – SEE SHEET B–2
MATCHLINE – SEE SHEET B–4
MATCHLINE – SEE SHEET A–3
MATCHLINE – SEE SHEET C–3
WATER TREATMENT PLANT
WILLIAMS STREET PUMP STATION
RECYCLED WATER IRRIGATION FORCEMAIN
HEADWORKS PARSHALL FLUME
SEWAGE LAGOON #1
SEWAGE LAGOON #2
SEWAGE LAGOON #3
SEWAGE LAGOON #4
(2) 12" BYPASS
12" OVERFLOW
6" BYPASS
(2) 10" BYPASS
(2) 10" PVC FM
MONMOUTH/INDEPENDENCE WASTEWATER OUTFALL LINE
CELL 1–2 TRANSFER PUMP
10" BYPASS LINE
ARV
16" PVC FM
WASTEWATER TREATMENT PLANT
IRRIGATION PUMP STATION
BYPASS SEWER
CELL 4 OUTLET STRUCTURE
LAGOON PUMP STATION
MONMOUTH WASTEWATER OUTFALL LINE
9TH STREET PUMP STATION
PIONEER PARK
CITY WATER RESERVOIR
Ash Creek
PICTURE ST
PICTURE PL
RICHARD CT
HOWARD CT
WILLIAMS ST
DALE CT
KELLI CT
WILDFANG DR
SCOTT CT
DAWN CT
KYLE CT
13TH ST
12TH ST
GUN CLUB RD
RHODA LN
NORTHWAY ST
B ST
C ST
CENTRAL ST
MONMOUTH ST
11TH
9TH ST
7TH ST
6TH ST
0 75 150 300
FEET
LEGEND
City Limits
Urban Growth Boundary
Sanitary Sewer
Pump Station & SS Forcemain
Monmouth-Independence Outfall
Manhole / Number
Cleanout
Air Release Valve
Valve
BFV = BUTTERFLY VALVE
RSGV= RESILIENT SEAT GATE VALVE
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Taxlot Boundary & Address #
Rail Road
Pipe Materials
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CM – CONCRETE (MORTAR JOINT)
V – VITRIFIED CLAY
T – TERRA COTTA
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PVC – POLYVINYL CHLORIDE
DI – DUCTILE IRON
CI – CAST IRON
CIPP – CURED IN PL PIPE LINER
MH # KEY
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KEY MAP
A–0
A–1 B–1 C–1
A–2 B–2 C–2
A–3 B–3 C–3
A–4 B–4 C–4
A–5 B–5 C–5
REVIEW
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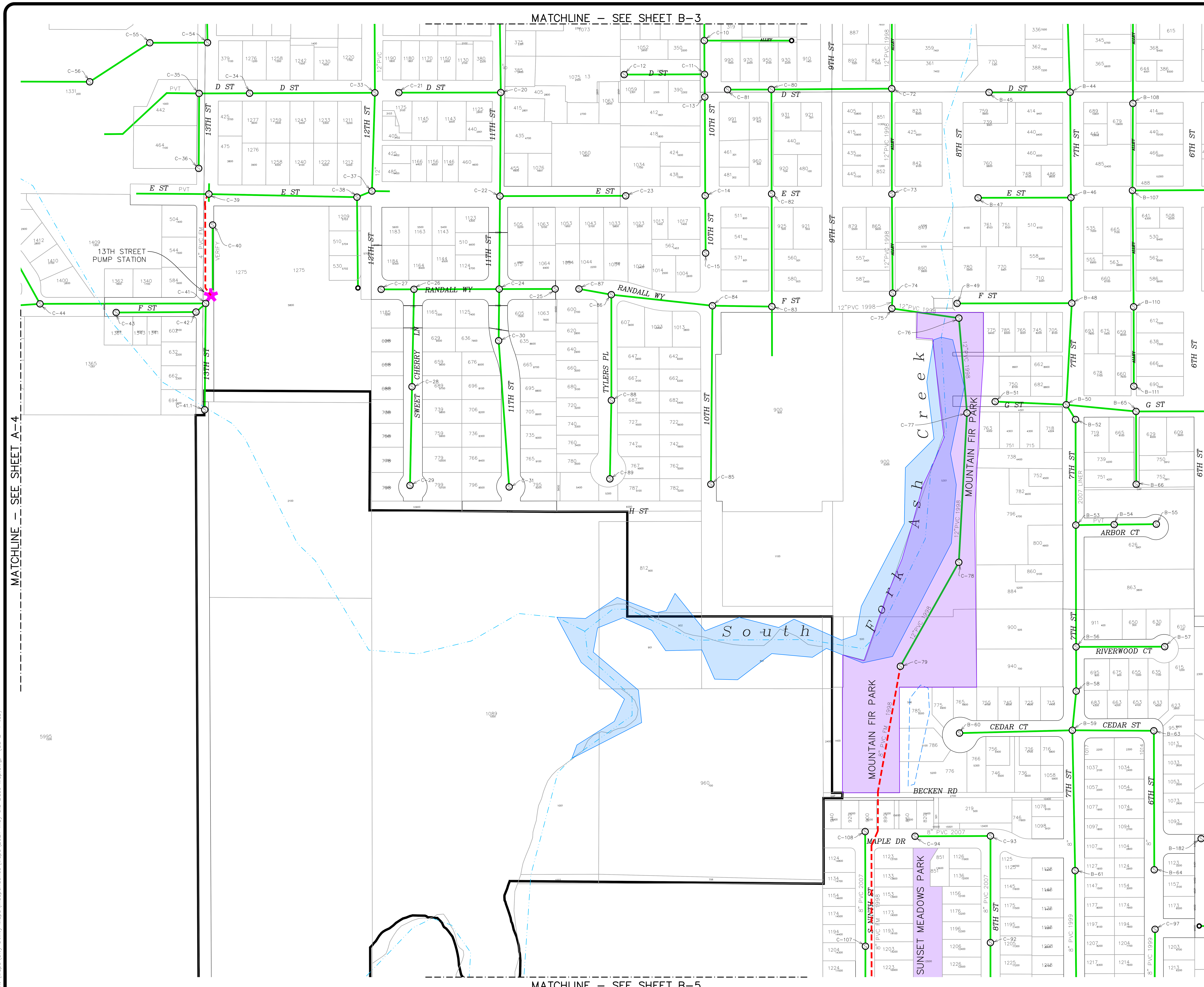
CITY OF INDEPENDENCE, OREGON
UTILITY MAP
SANITARY SEWER SYSTEM MAP B–3
DSN. PS
DRN. TMT
CKD. PS
DATE: APRIL 2021
SHEET B–3
10 OF 17
JOB NUMBER
2814.3040.0



LEGEND

- City Limits
- Urban Growth Boundary
- Sanitary Sewer
- Pump Station & SS Forcemain
- Monmouth-Independence Outfall
- C–11 Manhole / Number
- Cleanout
- Air Release Valve
- BFV Valve
  - BFV = BUTTERFLY VALVE
  - RSGV= RESILIENT SEAT GATE VALVE
  - PV = PLUG VALVE
- 125 Taxlot Boundary & Address #
- Rail Road

Pipe Materials

C	–	CONCRETE
CR	–	CONCRETE (RUBBER GASKET JOINT)
CM	–	CONCRETE (MORTAR JOINT)
V	–	VITRIFIED CLAY
T	–	TERRA COTTA
AC	–	ASBESTOS CEMENT
PVC	–	POLYVINYL CHLORIDE
DI	–	DUCTILE IRON
CI	–	CAST IRON
CIPP	–	CURED IN PL PIPE LINER

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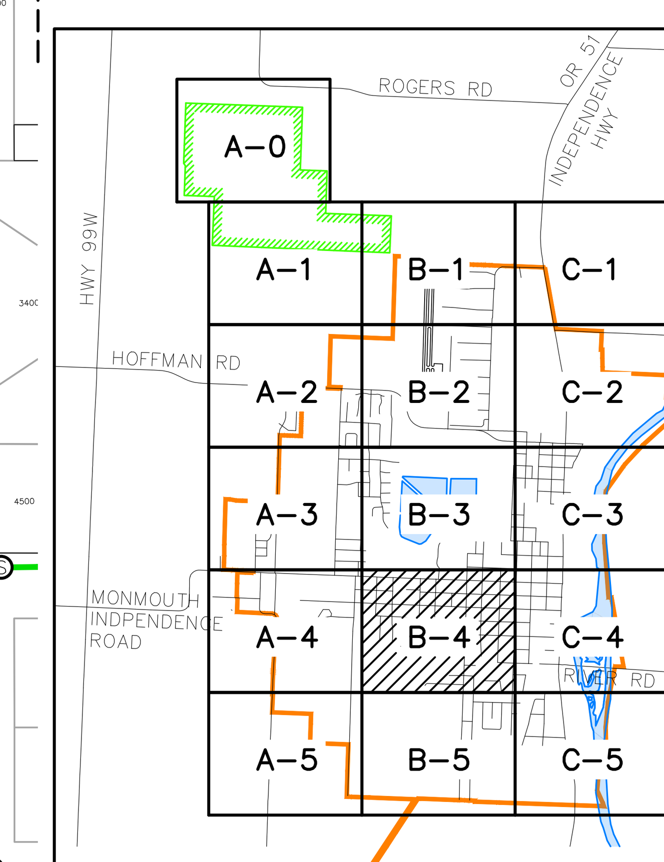

KEY MAP

NO.	DATE	DESCRIPTION	BY
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CITY OF INDEPENDENCE, OREGON

UTILITY MAP

SANITARY SEWER SYSTEM MAP B–4

SHEET B–4
11 OF 17

JOB NUMBER
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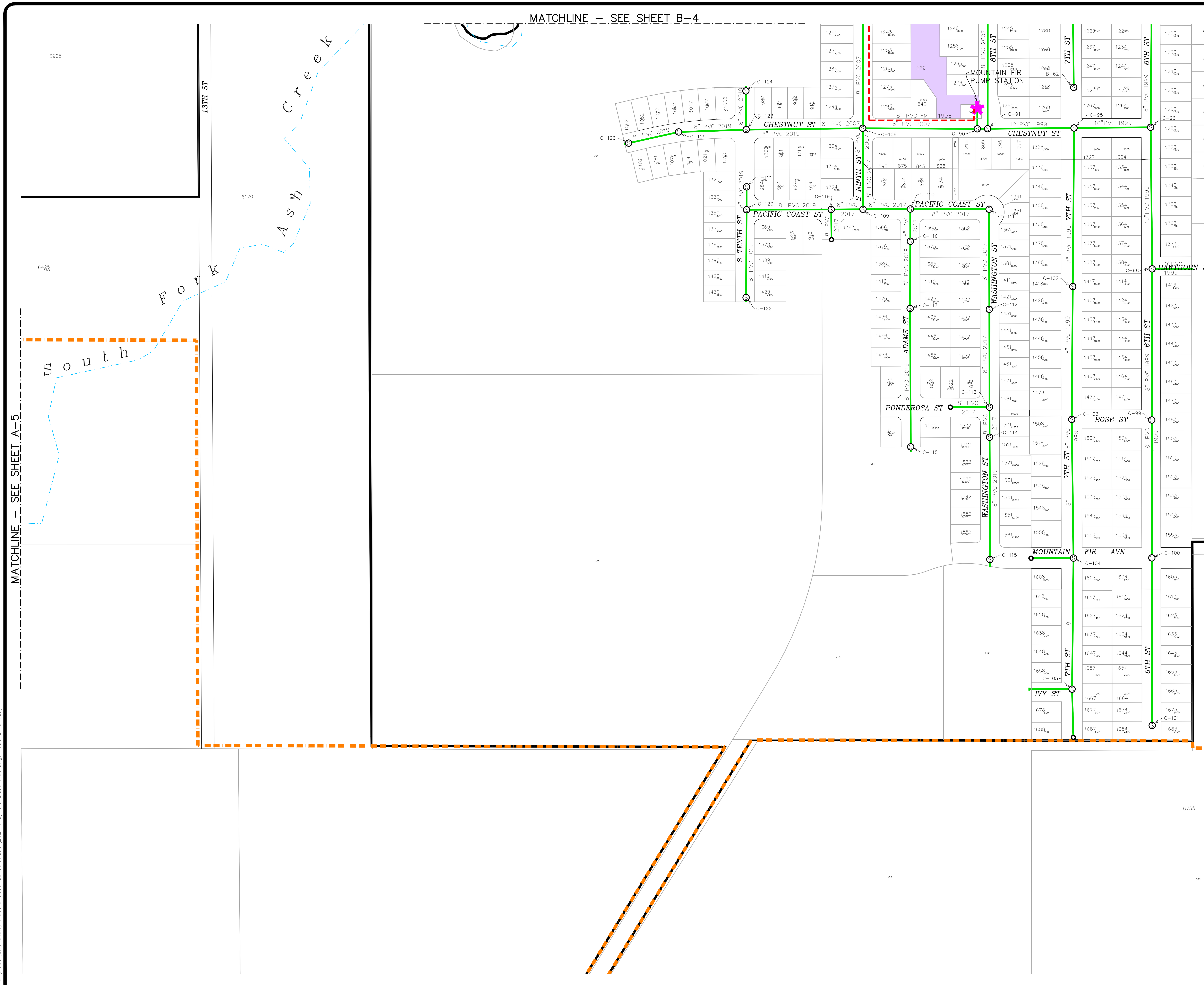

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FEET

LEGEND

- City Limits
- Urban Growth Boundary
- Sanitary Sewer
- Pump Station & SS Forcemain
- Monmouth-Independence Outfall
- Manhole / Number
- Cleanout
- Air Release Valve
- Valve
  - BFV = BUTTERFLY VALVE
  - RSGV= RESILIENT SEAT GATE VALVE
  - PV = PLUG VALVE
- Taxlot Boundary & Address #
- Rail Road

Pipe Materials

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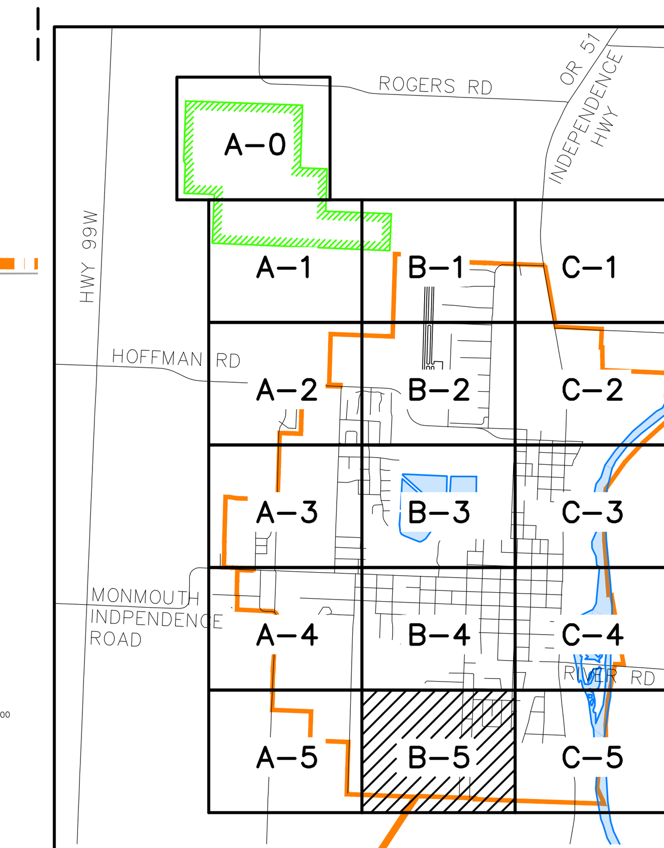

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CITY OF INDEPENDENCE, OREGON
UTILITY MAP

SANITARY SEWER SYSTEM MAP B–5

SHEET
B–5
12 OF 17

JOB NUMBER
2814.3040.0


LEGEND
City Limits
Urban Growth Boundary
Sanitary Sewer
Pump Station & SS Forcemain
Monmouth-Independence Outfall
Manhole / Number
Cleanout
Air Release Valve
Valve
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FEET
KEY MAP
A-0 A-1 A-2 A-3 A-4 A-5
B-1 B-2 B-3 B-4 B-5
C-1 C-2 C-3 C-4 C-5
ROGERS RD
HOFFMAN RD
MONMOUTH INDEPENDENCE ROAD
INDEPENDENCE HWY OR 51
HWY 99W
MATCHLINE – SEE SHEET B-1
MATCHLINE – SEE SHEET C-2
INDEPENDENCE HWY OR 51
INDEPENDENCE HWY
STRYKER RD
KEBEL YLINIEMI LN
HANNA RD
HANNA
Hayden Slough
R.R.
NORTH MAIN SEWER PUMP STATION
A-15 A-16 A-17 A-18 A-19 A-20 A-21 A-22 A-23 A-24 A-24.1 A-25
4025 4045 4085 4125 4185 4215 4245 4295 4305 4303 4309 4311 4395 4445 4450 4485 4500 4545 4570 4585 4590 4600 4620 7530
601 1595 1565 505 510 520 530 540 545 555 506 516 526 407 447 365 355 325 345
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CITY OF INDEPENDENCE, OREGON
UTILITY MAP
SANITARY SEWER SYSTEM MAP C-1
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SHEET
C-1
13 OF 17
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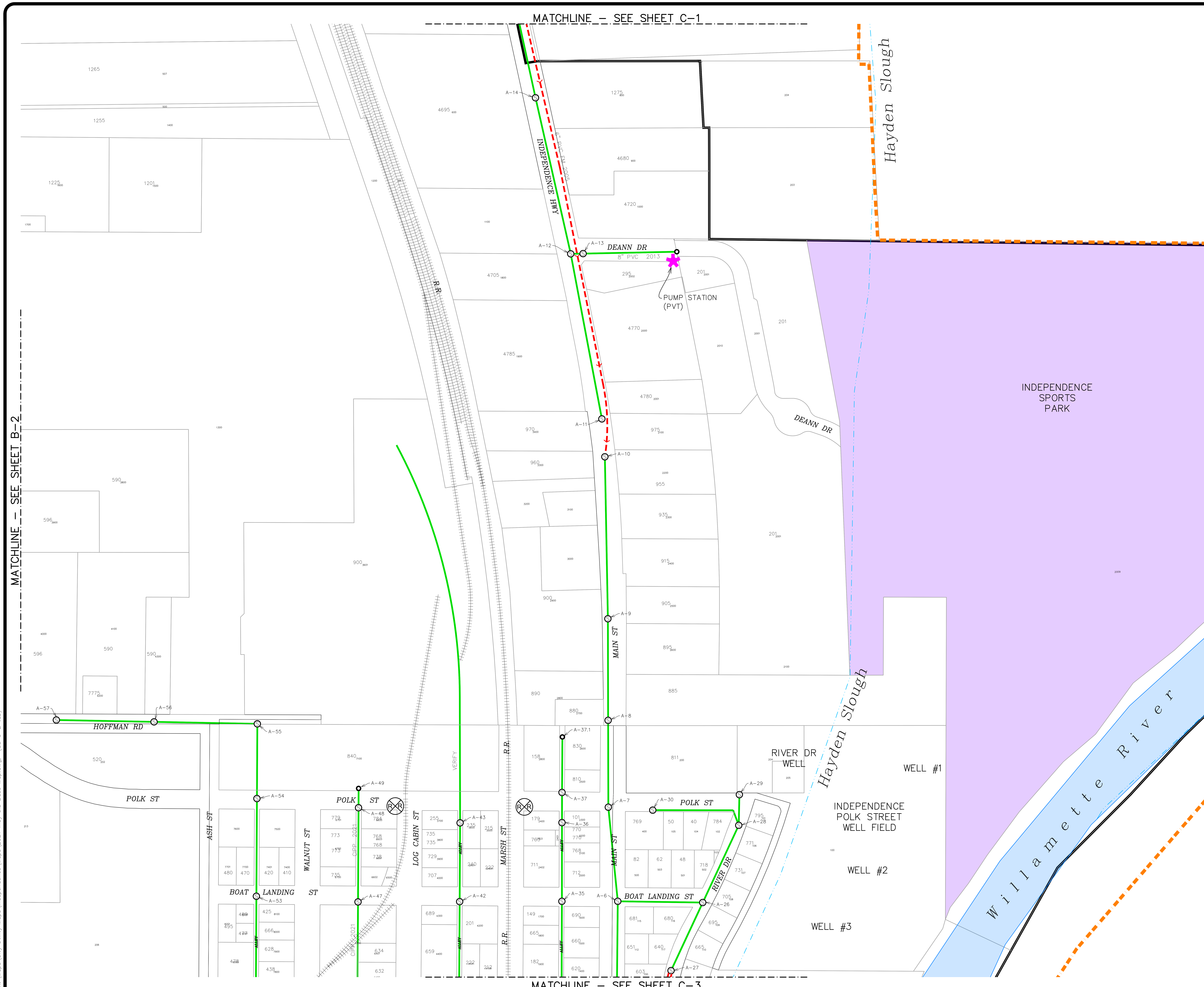

LEGEND

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- Manhole / Number
- Cleanout
- Air Release Valve
- Valve
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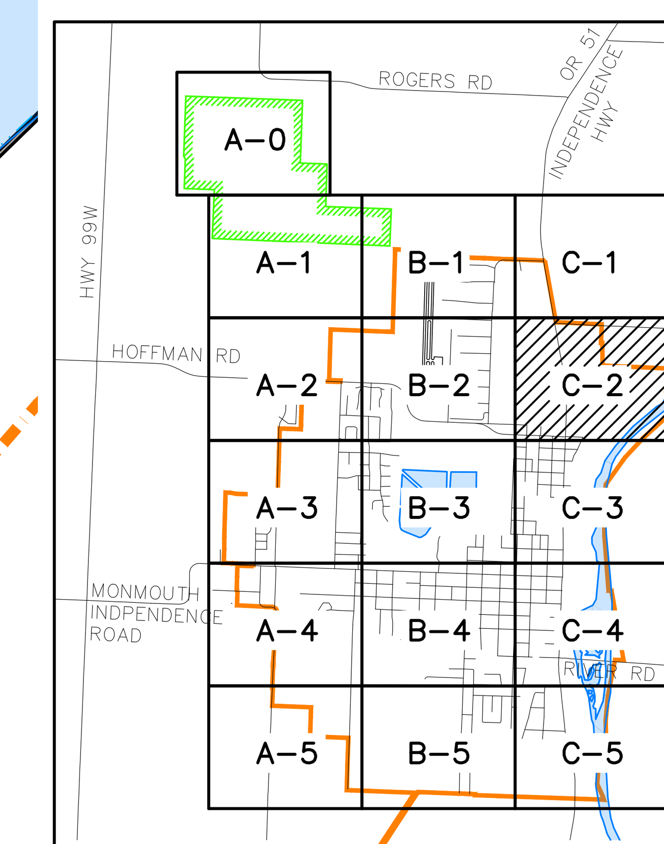

KEY MAP

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CITY OF INDEPENDENCE, OREGON
UTILITY MAP
SANITARY SEWER SYSTEM
MAP C-2

SHEET C-2
14 OF 17

JOB NUMBER
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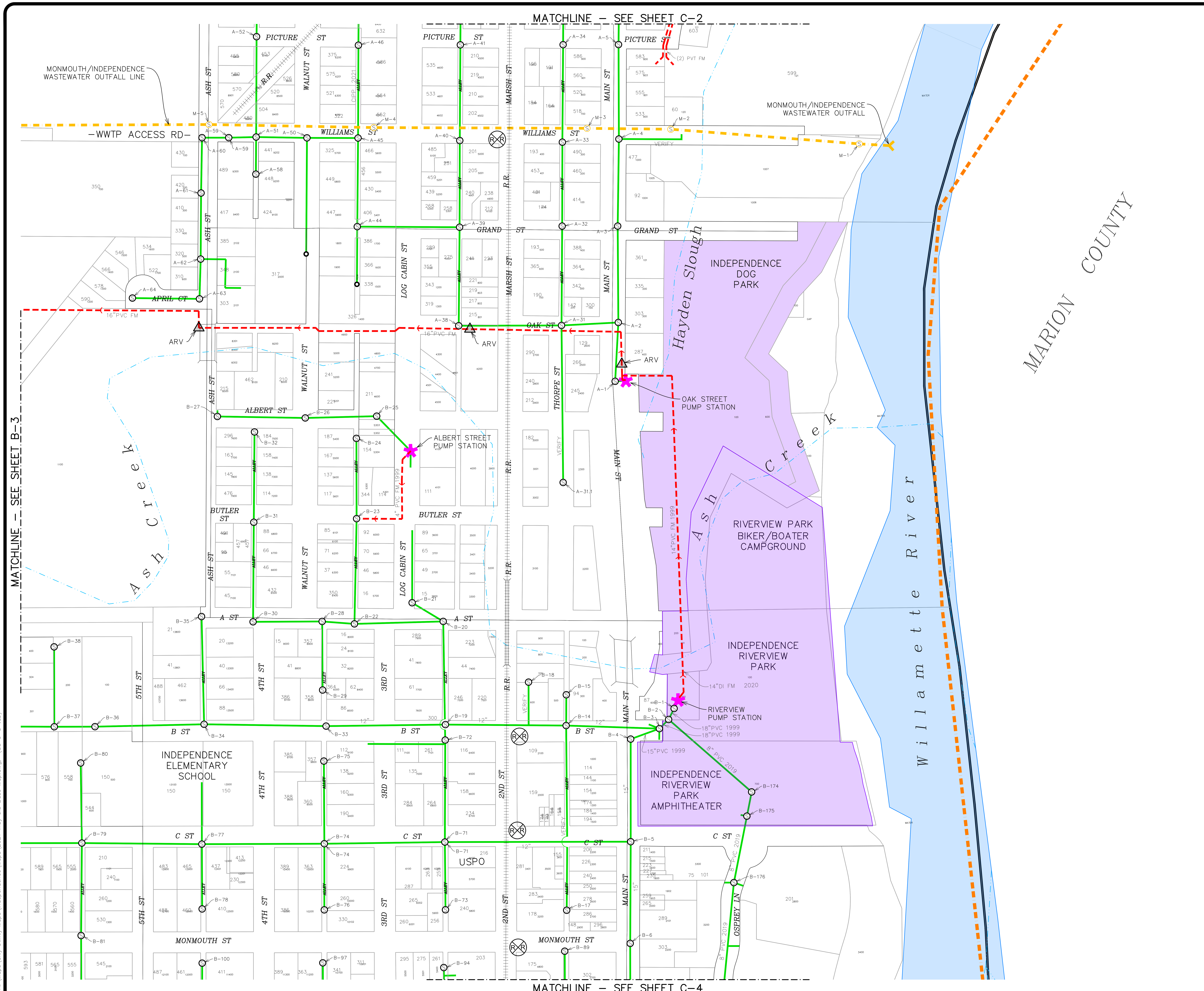

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FEET

LEGEND

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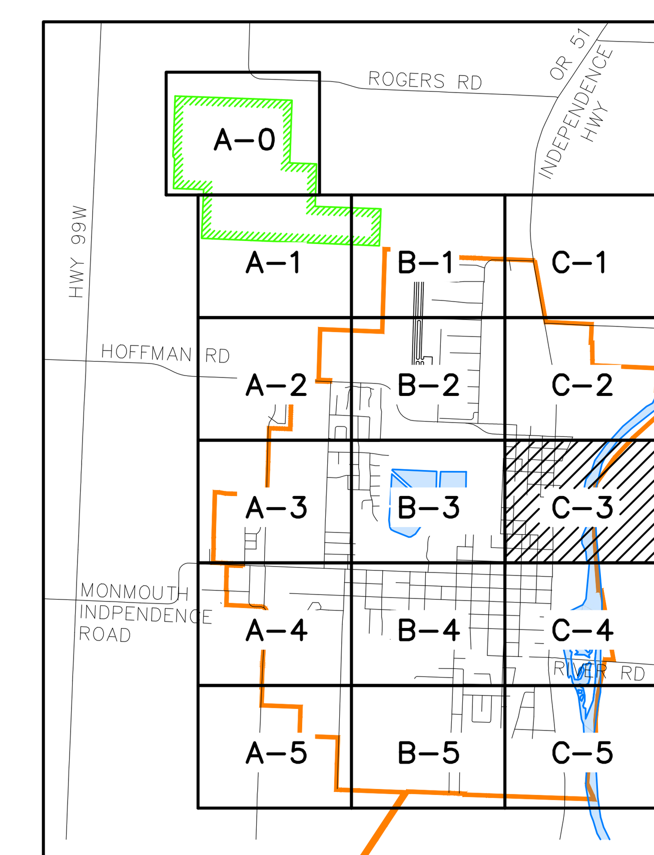

KEY MAP

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CITY OF INDEPENDENCE, OREGON
UTILITY MAP

SANITARY SEWER SYSTEM MAP C–3

SHEET C–3
15 OF 17

JOB NUMBER
2814.3040.0

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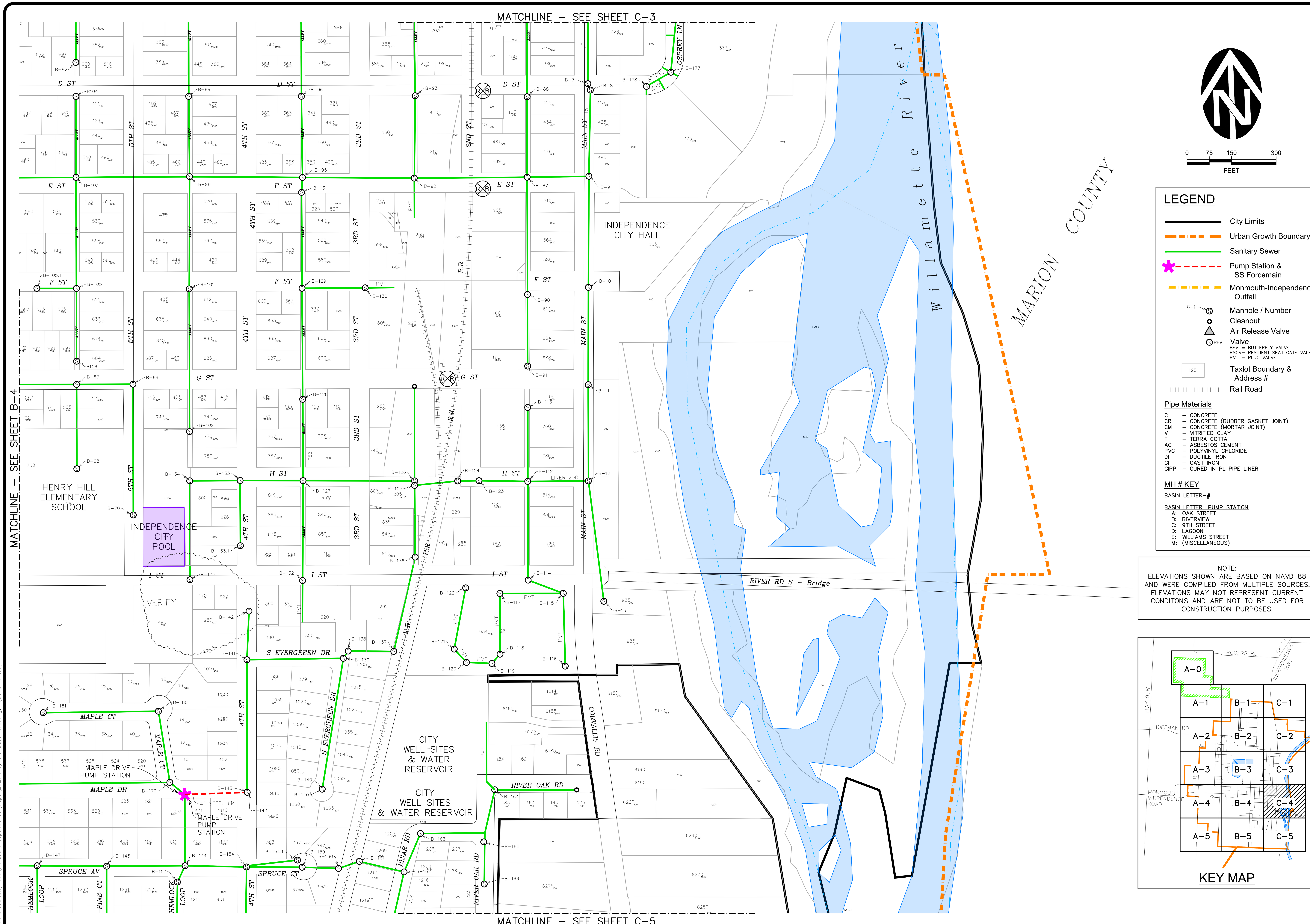

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CITY OF INDEPENDENCE, OREGON
UTILITY MAP
SANITARY SEWER SYSTEM MAP C-4

SHEET C-4
16 OF 17

JOB NUMBER 2814.3040.0

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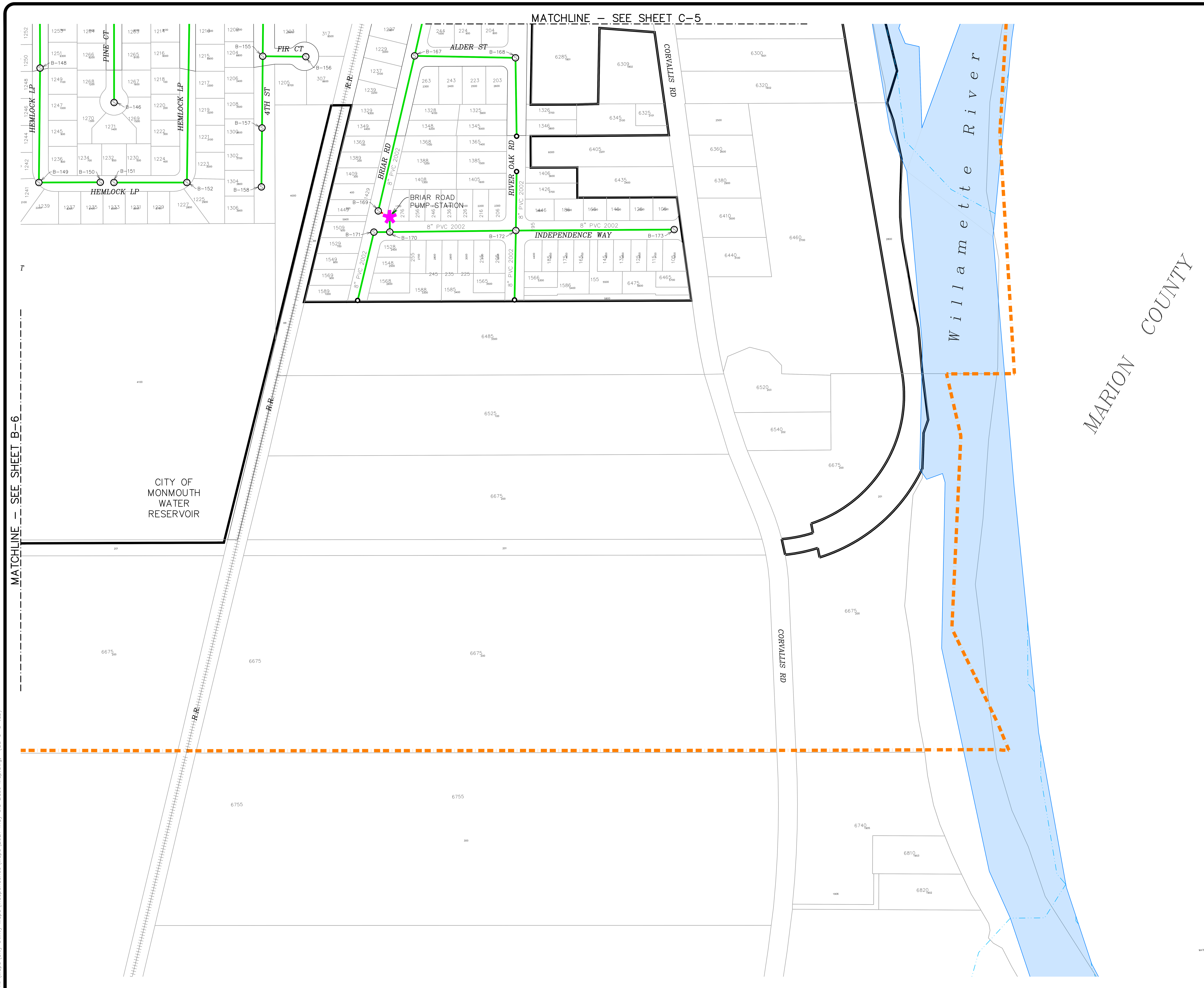

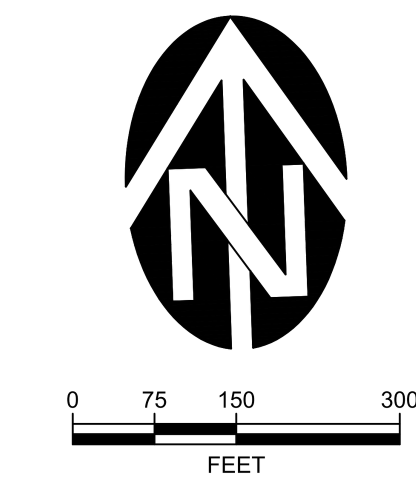

LEGEND

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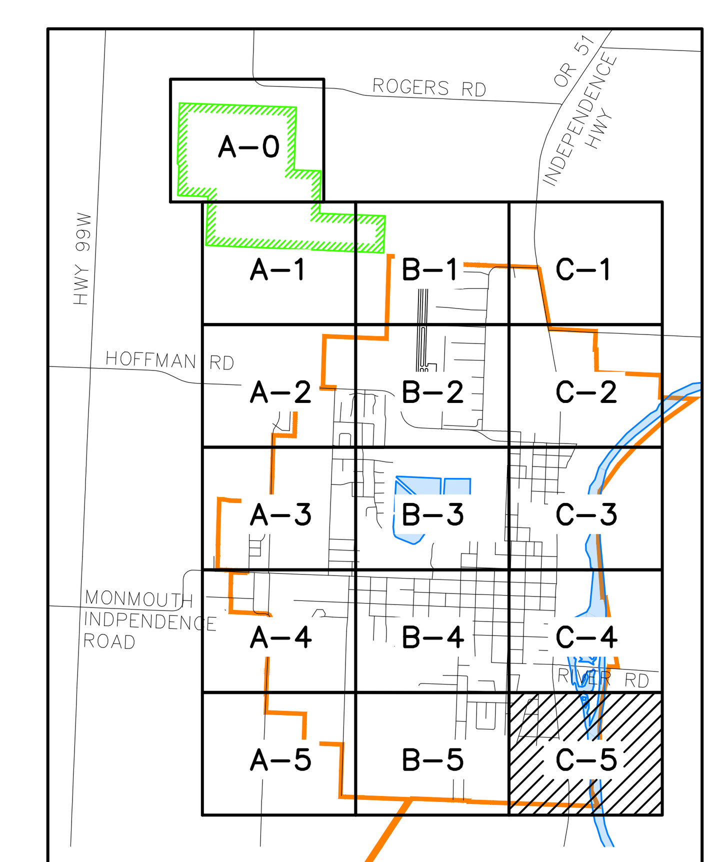
BASIN LETTER: PUMP STATION
- A: OAK STREET
- B: RIVERVIEW
- C: 9TH STREET
- D: LAGOON
- E: WILLIAMS STREET
- M: (MISCELLANEOUS)

NOTE:
ELEVATIONS SHOWN ARE BASED ON NAVD 88 AND WERE COMPILED FROM MULTIPLE SOURCES. ELEVATIONS MAY NOT REPRESENT CURRENT CONDITONS AND ARE NOT TO BE USED FOR CONSTRUCTION PURPOSES.



KEY MAP

NO.	DATE	DESCRIPTION	BY
1			

REVISIONS

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

DSN. PS
DRN. TMT
CKD. PS
DATE: APRIL 2021

REVIEW

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
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CITY OF INDEPENDENCE, OREGON
UTILITY MAP

SANITARY SEWER SYSTEM MAP C–5

SHEET C–5
17 OF 17

JOB NUMBER 2814.3040.0

Appendix C

Capital Improvement Project Cost Estimates

Recommended Capital Improvement Project Cost Estimates

3/8/2022

Independence Wastewater System Facilities Plan

Project Code	Priority (1-3)	Project Description	*Construction Costs* Diameter (in)	Length (ft)	Pipe Cost ($/ft)	New Manholes (qty.)	New Manhole Cost(1)	Rehab. Manholes (qty.)	Rehab. Manhole Cost(1)	Service Laterals (qty.)	Service Lateral Cost (1)	Bypass Pumping Cost (2)	Bore Cost for RR, or Stream Xing (3)	Other (4,5,6)	Total Construction Cost	*Soft Costs* Construction Contingency - 10%	Engineering - 20% (7)	Legal, Permits, & Admin. - 10%	*Total Cost* Project Cost Rounded	Cost by Priority: Priority 1	Priority 2	Priority 3
Gravity Collection System Improvements																						
G-1	3	9th Street Trunk Sewer Upgrade- Manhole C-7 to C-74	15	1,200	$ 170	-	$ -	6	$ 24,000	22	$ 66,000	$ 15,000	$ -	$ 10,000	$ 319,000	$ 31,900	$ 63,800	$ 31,900	$ 447,000	$ -	$ -	$ 447,000
G-2	1	Basin E Trunk Sewer- Manhole E-2 to E-18	15	2,000	$ 170	-	$ -	6	$ 24,000	8	$ 24,000	$ 10,000	$ -	$ -	$ 398,000	$ 39,800	$ 79,600	$ 39,800	$ 557,000	$ 557,000	$ -	$ -
G-3	2	Lagoon Pump Station Trunk Sewer- Manhole D-4 to D-14	18	2,500	$ 180	-	$ -	8	$ 32,000	-	$ -	$ 12,500	$ -	$ -	$ 494,500	$ 49,450	$ 98,900	$ 49,450	$ 692,000	$ -	$ 692,000	$ -
G-4	2	12th Street Sewer- Manhole D-14 to D-55	12	900	$ 150	-	$ -	6	$ 24,000	18	$ 54,000	$ 15,000	$ -	$ -	$ 228,000	$ 22,800	$ 45,600	$ 22,800	$ 319,000	$ -	$ 319,000	$ -
G-5	1	C Street Clay Tile Sewer Replacement – Manhole B-5 to B-83	8	2,200	$ 130	-	$ -	7	$ 28,000	25	$ 75,000	$ 15,000	$ 100,000	$ 10,000	$ 514,000	$ 51,400	$ 102,800	$ 51,400	$ 720,000	$ 720,000	$ -	$ -
G-6	1	H Street from 3rd Street to Main Street Replacement- Manhole B-12 to B-126	12	600	$ 150	-	$ -	6	$ 24,000	5	$ 15,000	$ 7,500	$ 100,000	$ -	$ 236,500	$ 23,650	$ 47,300	$ 23,650	$ 331,000	$ 331,000	$ -	$ -
G-7	1	Spruce Court to Briar Road Replacement - Manhole B-159 to B-162	8	350	$ 130	-	$ -	4	$ 16,000	6	$ 18,000	$ 7,500	$ 100,000	$ 30,000	$ 217,000	$ 21,700	$ 43,400	$ 21,700	$ 304,000	$ 304,000	$ -	$ -
G-8	1	E Street from 12th Street to 13th Street Replacement - Manhole C-37 to C-39	8	550	$ 130	-	$ -	3	$ 12,000	7	$ 21,000	$ 7,500	$ -	$ -	$ 112,000	$ 11,200	$ 22,400	$ 11,200	$ 157,000	$ 157,000	$ -	$ -
G-9	3	13th Street Pump Station Sewer to Sub-basin C3	8	1,400	$ 130	3	$ 24,000	-	$ -	8	$ 24,000	$ 7,500	$ -	$ 10,000	$ 247,500	$ 24,750	$ 49,500	$ 24,750	$ 347,000	$ -	$ -	$ 347,000
G-10	3	Briar Road Pump Station Sewer to Sub-basin C5	8	500	$ 130	2	$ 16,000	-	$ -	-	$ -	$ 7,500	$ -	$ 10,000	$ 98,500	$ 9,850	$ 19,700	$ 9,850	$ 138,000	$ -	$ -	$ 138,000
G-11	3	Mt. Fir Park Sewer Upgrade	15	1,400	$ 170	-	$ -	5	$ 20,000	-	$ -	$ 10,000	$ 75,000	$ -	$ 343,000	$ 34,300	$ 68,600	$ 34,300	$ 480,000	$ -	$ -	$ 480,000
G-12	3	Sub-basin C3 Trunk Sewer to Undeveloped Area	8	4,100	$ 130	12	$ 96,000	-	$ -	30	$ 90,000	$ -	$ -	$ -	$ 719,000	$ 71,900	$ 143,800	$ 71,900	$ 1,007,000	$ -	$ -	$ 1,007,000
G-13	3	Sub-basin C4 Trunk Sewer to Undeveloped Area	8	4,000	$ 130	10	$ 80,000	-	$ -	15	$ 45,000	$ -	$ -	$ -	$ 645,000	$ 64,500	$ 129,000	$ 64,500	$ 903,000	$ -	$ -	$ 903,000
G-14	3	Sub-basin C5 Trunk Sewer to Undeveloped Area	8	3,900	$ 130	10	$ 80,000	-	$ -	15	$ 45,000	$ -	$ 75,000	$ -	$ 707,000	$ 70,700	$ 141,400	$ 70,700	$ 990,000	$ -	$ -	$ 990,000
G-15	3	Hoffmann Road Sewer to Undeveloped Area	8	1,500	$ 130	4	$ 32,000	-	$ -	8	$ 24,000	$ -	$ -	$ -	$ 251,000	$ 25,100	$ 50,200	$ 25,100	$ 351,000	$ -	$ -	$ 351,000
G-16	3	Gun Club Road Sewer to Undeveloped Area	8 / 10	2,800 / 4,200	$ 130 / $140	18	$ 144,000	-	$ -	15	$ 45,000	$ -	$ -	$ -	$ 1,141,000	$ 114,100	$ 228,200	$ 114,100	$ 1,597,000	$ -	$ -	$ 1,597,000
G-17	3	Corvallis Road Sewer to Unsewered Area	8	2,300	$ 130	6	$ 48,000	-	$ -	22	$ 66,000	$ -	$ -	$ -	$ 413,000	$ 41,300	$ 82,600	$ 41,300	$ 578,000	$ -	$ -	$ 578,000
G-18	3	16th Street Sewer	8	600	$ 130	3	$ 24,000	-	$ -	6	$ 18,000	$ -	$ -	$ 10,000	$ 130,000	$ 13,000	$ 26,000	$ 13,000	$ 182,000	$ -	$ -	$ 182,000
G-19	3	Talmadge Road Sewer	8	2,500	$ 130	8	$ 64,000	-	$ -	15	$ 45,000	$ -	$ -	$ -	$ 434,000	$ 43,400	$ 86,800	$ 43,400	$ 608,000	$ -	$ -	$ 608,000
G-20	3	Sub-basin C2 Sewer	8	2,800	$ 130	8	$ 64,000	-	$ -	18	$ 54,000	$ -	$ -	$ -	$ 482,000	$ 48,200	$ 96,400	$ 48,200	$ 675,000	$ -	$ -	$ 675,000
Pump Station & Forcemain Improvements																						
P-1	1	9th Street Pump Station Capacity Upgrade - Phase 1	See detailed estimate for Project P-1												$ 743,000	$ 74,300	$ 74,300	$ 74,300	$ 966,000	$ 966,000	$ -	$ -
P-2	3	9th Street Pump Station Capacity Upgrade - Phase 3	See detailed estimate for Project P-2												$ 662,900	$ 66,290	$ 132,580	$ 66,290	$ 928,000	$ -	$ -	$ 928,000
P-3	2	Oak Street Pump Station Capacity Upgrade & Improvements	See detailed estimate for Project P-3												$ 561,500	$ 56,150	$ 112,300	$ 56,150	$ 786,000	$ -	$ 786,000	$ -
P-4	2	North Main Pump Station Capacity Upgrade & Improvements	See detailed estimate for Project P-4												$ 221,000	$ 22,100	$ 44,200	$ 22,100	$ 309,000	$ -	$ 309,000	$ -
P-5	1	Maple Drive Pump Station Upgrade	See detailed estimate for Project P-5												$ 363,000	$ 36,300	$ 72,600	$ 36,300	$ 508,000	$ 508,000	$ -	$ -
P-6	2	Lagoon Pump Station Capacity Upgrade & Improvements	See detailed estimate for Project P-6												$ 293,880	$ 29,388	$ 58,776	$ 29,388	$ 411,000	$ -	$ 411,000	$ -
P-7	2	Albert Pump Station Electrical Systems Upgrade	See detailed estimate for Project P-7												$ 174,000	$ 17,400	$ 34,800	$ 17,400	$ 244,000	$ -	$ 244,000	$ -
P-8	2	Briar Road Pump Station Electrical Systems Upgrade	See detailed estimate for Project P-8												$ 111,000	$ 11,100	$ 22,200	$ 11,100	$ 155,000	$ -	$ 155,000	$ -
P-9	2	13th Street Pump Station Electrical Systems Upgrade	See detailed estimate for Project P-9												$ 181,000	$ 18,100	$ 36,200	$ 18,100	$ 253,000	$ -	$ 253,000	$ -
P-10	3	Mt. Fir Pump Station Capacity & Electrical Systems Upgrade	See detailed estimate for Project P-10												$ 183,000	$ 18,300	$ 36,600	$ 18,300	$ 256,000	$ -	$ -	$ 256,000
P-11	2	Stryker Road Pump Station Upgrade	See detailed estimate for Project P-11												$ 260,000	$ 26,000	$ 52,000	$ 26,000	$ 364,000	$ -	$ 364,000	$ -
P-12	3	New Ash Creek Pump Station	See detailed estimate for Project P-12												$ 617,750	$ 61,775	$ 123,550	$ 61,775	$ 865,000	$ -	$ -	$ 865,000
P-13	3	New Corvallis Road Pump Station	See detailed estimate for Project P-13												$ 633,750	$ 63,375	$ 126,750	$ 63,375	$ 887,000	$ -	$ -	$ 887,000
P-14	3	New Talmadge Road Pump Station & Forcemain	See detailed estimate for Project P-14												$ 432,000	$ 43,200	$ 86,400	$ 43,200	$ 605,000	$ -	$ -	$ 605,000
P-15	2	Williams Street Pump Station Generator Upgrade	Not Used													Not Used			$ 60,000	$ -	$ 60,000	$ -
F-1	3	Common Forcemain for the 9th Street and Lagoon Pump Stations	See detailed estimate for Project F-1												$ 576,000	$ 57,600	$ 115,200	$ 57,600	$ 806,000	$ -	$ -	$ 806,000
F-2	1	Maple Drive Pump Station Forcemain	6	250	$ 150	-	-	-	-	-	-	-	$ -	$ -	$ 37,500	$ 3,750	$ 7,500	$ 3,750	$ 53,000	$ 53,000	$ -	$ -
F-3	3	New Ash Creek Pump Station Forcemain	6	2,800	$ 150	-	-	-	-	-	-	-	$ 100,000	$ -	$ 520,000	$ 52,000	$ 104,000	$ 52,000	$ 728,000	$ -	$ -	$ 728,000
F-4	3	New Corvallis Road Pump Station Forcemain	6	1,300	$ 150	-	-	-	-	-	-	-	$ 100,000	$ -	$ 295,000	$ 29,500	$ 59,000	$ 29,500	$ 413,000	$ -	$ -	$ 413,000
Treatment System & Miscellaneous Prioritized Improvements																						
T-1	1	Headworks and Cell 1 Distribution Pipe Improvements	See detailed estimate for Project T-1												$ 987,000	$ 98,700	$ 197,400	$ 98,700	$ 1,382,000	$ 1,382,000	$ -	$ -
T-2	1	Lagoon Biosolids Removal	Not Used													Not Used			$ 4,140,000	$ 4,140,000	$ -	$ -
T-3	1	Lagoon Aeration and Conveyance Piping Improvements	See detailed estimate for Project T-3												$ 4,278,000	$ 427,800	$ 855,600	$ 427,800	$ 5,989,000	$ 5,989,000	$ -	$ -
T-4	2	Chlorine Contact Chamber Improvements	See detailed estimate for Project T-4												$ 613,000	$ 61,300	$ 122,600	$ 61,300	$ 858,000	$ -	$ 858,000	$ -
T-5	2	Land Application System Expansion Phase I	See detailed estimate for Project T-5												$ 172,000	$ 17,200	$ 34,400	$ 17,200	$ 241,000	$ -	$ 241,000	$ -
T-6	2	Land Application System Expansion Phase II	See detailed estimate for Project T-6												$ 1,090,000	$ 109,000	$ 218,000	$ 109,000	$ 1,526,000	$ -	$ 1,526,000	$ -
T-7	2	Outfall Improvements	See detailed estimate for Project T-7												$ 753,000	$ 75,300	$ 150,600	$ 75,300	$ 1,054,000	$ -	$ 1,054,000	$ -
M-3	2	Wastewater Facilities Plan Update	Not Used													Not Used			$ 300,000	$ -	$ 300,000	$ -
																		TOTAL	$ 36,470,000	$ 15,107,000	$ 7,572,000	$ 13,791,000

Notes

1) Unit construction costs

New MH	$ 8,000
Rehab. MH	$ 4,000
Service Lateral	$ 3,000

(2) Bypass pumping cost estimated as $5,000 plus $5,000 per month
(3) Bore crossing $1,000 per foot
(4) ODOT right-of-way costs of $10,00
(5) Residential surface restoration/ landscaping costs of $30,00
(6) Pump station wetwell decommission, restoration, and connection costs $10,000 for G-9 and G-1
(7) Estimated engineering cost for P-1 reduced to 10% (design prepared)

(8) Sewer Pipe Costs

Diameter (in)	Cost ($/ft)
8	$ 130
10	$ 140
12	$ 150
15	$ 170
18	$ 180

City of Independence Wastewater Facilities Plan

9th Street Pump Station Capacity Upgrade - Phase I — Project P-1

Planning Level Cost Estimate

	Item	Qty	Unit	Unit Cost	Total Cost
General Items					
a.	Mobilization, Bonds, Permits and Insurance, (8% of total)	ALL	L.S.	Lump Sum	$55,000
b.	Surveying	ALL	L.S.	Lump Sum	$3,000
c.	Compaction and Materials Testing	ALL	L.S.	Lump Sum	$2,500
Site Work					
a.	Demolition. Erosion Control, Clearing & Seeding	ALL	L.S.	Lump Sum	$12,000
b.	General Excavation, Grading, Baserock Gravel Surfacing	ALL	L.S.	Lump Sum	$25,000
c.	Perimeter Chainlink Fence & Gates	340	L.F.	$125	$42,500
Gravity Sewer Improvements					
a.	60" Sanitary Sewer Manhole	1	Each	$10,000	$10,000
b.	Connections to Existing Manholes	1	Each	$1,500	$1,500
c.	6" Sanitary Sewer, Trench, Backfill & Surface Restoration	145	L.F.	$100	$14,500
d.	ARV Manhole, Valves & Piping	ALL	L.S.	Lump Sum	$15,000
e.	Rehab. Manholes	2	Each	$4,000	$8,000
Pump Station Wetwell Improvements					
a.	Demo. Topslab, Fillets and Mechanical Components	ALL	L.S.	Lump Sum	$7,500
b.	Wetwell Rehabilitation	ALL	L.S.	Lump Sum	$20,000
c.	New Cast-in-place Concrete	ALL	L.S.	Lump Sum	$30,000
d.	Submersible Sewage Pumps & Appurtenances	ALL	L.S.	Lump Sum	$108,000
e.	Wetwell Piping & Appurtenances	ALL	L.S.	Lump Sum	$35,000
f.	Bypass Pumping	ALL	L.S.	Lump Sum	$30,000
g.	Miscellaneous Mechanical	ALL	L.S.	Lump Sum	$15,000
Control Building Improvements					
a.	Generator Removal and Concrete Demo.	ALL	L.S.	Lump Sum	$10,000
b.	Miscellaneous Improvements	ALL	L.S.	Lump Sum	$18,000
Auxiliary Power Generator & Concrete Pad		ALL	L.S.	Lump Sum	$62,000
Electrical, Instrumentation & Controls					
a.	Power Service, 400 amp, 480 volt, Complete	ALL	L.S.	Lump Sum	$88,000
b.	Pump Disconnect Panel, Pump Control Panel, VFD's, and Wetwell Instruments	ALL	L.S.	Lump Sum	$63,500
c.	Miscellaneous Electrical & Controls, Telemetry	ALL	L.S.	Lump Sum	$47,000
Miscellaneous					
a.	As-built Drawings and O&M Manuals	ALL	L.S.	Lump Sum	$10,000
b.	SCADA Integration & Programming (L.S.)	ALL	L.S.	Lump Sum	$10,000
				TOTAL:	$743,000

City of Independence Wastewater Facilities Plan

9th Street Pump Station Capacity Upgrade - Phase 3 Project P-2

Planning Level Cost Estimate

Item		Qty	Unit	Unit Cost	Total Cost
CONSTRUCTION COSTS					
General Items					
a.	Mobilization, Bonds, Permits and Insurance, (8% of total)	ALL	L.S.	Lump Sum	$49,000
b.	Surveying, Materials Testing, Compaction	ALL	L.S.	Lump Sum	$6,000
c.	Clearing, Erosion Control & Seeding	ALL	L.S.	Lump Sum	$6,000
Site Work					
a.	Demolition	ALL	L.S.	Lump Sum	$5,000
b.	General Excavation and Grading	ALL	L.S.	Lump Sum	$5,000
c.	Base Rock & Gravel Surfacing	ALL	L.S.	Lump Sum	$15,000
Gravity Sewer Improvements					
a.	60" Sanitary Sewer Manhole	1	Each	$10,000	$10,000
b.	Connections to Existing Manholes	2	Each	$1,500	$3,000
c.	21" Sanitary Sewer, Trench, Backfill & Surface Restoration	80	L.F.	$190	$15,200
d.	8" Sanitary Sewer, Trench, Backfill & Surface Restoration	40	L.F.	$130	$5,200
Pump Station Wetwell Improvements					
a.	Wetwell Excavation, Backfill, Spoils Disposal, & Dewatering	ALL	L.S.	Lump Sum	$45,000
b.	Wet Well Structure	ALL	L.S.	Lump Sum	$35,000
c.	Submersible Sewage Pumps & Appurtenances	ALL	L.S.	Lump Sum	$120,000
d.	Wetwell Piping & Appurtenances	ALL	L.S.	Lump Sum	$35,000
e.	Valve Vault Structure	ALL	L.S.	Lump Sum	$20,000
f.	Valve Vault Piping & Appurtenances	ALL	L.S.	Lump Sum	$45,000
g.	ARV Vault, Valves & Piping	ALL	L.S.	Lump Sum	$15,000
Auxiliary Power Generator & Concrete Pad		ALL	L.S.	Lump Sum	$100,000
Electrical, Instrumentation & Controls					
a.	Pump Disconnect Panel, Pump Control Panel, VFD's, and Wetwell Instruments	ALL	L.S.	Lump Sum	$63,500
b.	Telemetry & SCADA Equipment	ALL	L.S.	Lump Sum	$15,000
c.	Miscellaneous Electrical & Controls	ALL	L.S.	Lump Sum	$30,000
Miscellaneous					
a.	As-built Drawings and O&M Manuals	ALL	L.S.	Lump Sum	$10,000
b.	SCADA Integration & Programming (L.S.)	ALL	L.S.	Lump Sum	$10,000
				TOTAL:	$662,900

City of Independence Wastewater Facilities Plan

Oak Street Pump Station Capacity Upgrade & Improvements — Project P-3

Planning Level Cost Estimate

	Item	Qty	Unit	Unit Cost	Total Cost
CONSTRUCTION COSTS					
General Items					
a.	Mobilization, Bonds, Permits and Insurance, (8% of total)	ALL	L.S.	Lump Sum	$42,000
b.	Surveying	ALL	L.S.	Lump Sum	$2,000
c.	Gravel Surfacing	ALL	L.S.	Lump Sum	$5,000
d.	Control Building Improvements	ALL	L.S.	Lump Sum	$10,000
Pump Station Wetwell Improvements					
a.	Demolition	ALL	L.S.	Lump Sum	$7,500
b.	Wetwell Rehabilitation	ALL	L.S.	Lump Sum	$20,000
c.	New Cast-in-place Concrete	ALL	L.S.	Lump Sum	$30,000
d.	Submersible Sewage Pumps & Appurtenances	ALL	L.S.	Lump Sum	$100,000
e.	Wetwell Piping & Appurtenances	ALL	L.S.	Lump Sum	$20,000
f.	Bypass Pumping	ALL	L.S.	Lump Sum	$30,000
g.	Miscellaneous Mechanical	ALL	L.S.	Lump Sum	$15,000
Auxiliary Power Generator & Concrete Pad		ALL	L.S.	Lump Sum	$57,000
Electrical, Instrumentation & Controls					
a.	Power Service, Complete	ALL	L.S.	Lump Sum	$75,000
b.	Pump Disconnect Panel, Pump Control Panel, VFD's, and Wetwell Instruments	ALL	L.S.	Lump Sum	$65,000
c.	Telemetry & SCADA Equipment	ALL	L.S.	Lump Sum	$15,000
d.	Temporary Electrical & Control System	ALL	L.S.	Lump Sum	$3,000
e.	Miscellaneous Electrical & Controls	ALL	L.S.	Lump Sum	$40,000
f.	Transformer Vault, Complete	ALL	L.S.	Lump Sum	$5,000
Miscellaneous					
a.	As-built Drawings and O&M Manuals	ALL	L.S.	Lump Sum	$10,000
b.	SCADA Integration & Programming (L.S.)	ALL	L.S.	Lump Sum	$10,000
				TOTAL:	$561,500

City of Independence Wastewater Facilities Plan

North Main Pump Station Capacity Upgrade & Improvements — Project P-4

Planning Level Cost Estimate

	Item	Qty	Unit	Unit Cost	Total Cost
CONSTRUCTION COSTS					
General Items					
a.	Mobilization, Bonds, Permits and Insurance, (8% of total)	ALL	L.S.	Lump Sum	$18,000
b.	Miscellaneous Civil Improvements	ALL	L.S.	Lump Sum	$20,000
Pump Station Wetwell Improvements					
a.	Submersible Sewage Pumps & Appurtenances	ALL	L.S.	Lump Sum	$40,000
b.	Bypass Pumping	ALL	L.S.	Lump Sum	$5,000
c.	Miscellaneous Mechanical	ALL	L.S.	Lump Sum	$15,000
Auxiliary Power Generator & Concrete Pad		ALL	L.S.	Lump Sum	$40,000
Electrical, Instrumentation & Controls					
a.	Pump Disconnect Panel, Pump Control Panel, VFD's, and Wetwell Instruments	ALL	L.S.	Lump Sum	$45,000
b.	Telemetry & SCADA Equipment	ALL	L.S.	Lump Sum	$8,000
c.	Miscellaneous Electrical & Controls	ALL	L.S.	Lump Sum	$20,000
Miscellaneous					
a.	As-built Drawings and O&M Manuals	ALL	L.S.	Lump Sum	$5,000
b.	SCADA Integration & Programming (L.S.)	ALL	L.S.	Lump Sum	$5,000
c.	Easement Acquisition	ALL	L.S.	Lump Sum	$20,000
				TOTAL:	$221,000

City of Independence Wastewater Facilities Plan

Maple Drive Pump Station Upgrade — Project P-5

Planning Level Cost Estimate

	Item	Qty	Unit	Unit Cost	Total Cost
CONSTRUCTION COSTS					
General Items					
a.	Mobilization, Bonds, Permits and Insurance	8	%	LS of Total	$25,000
b.	Bypass Pumping	ALL	L.S.	Lump Sum	$25,000
c.	Demolition of Existing Facilities & Wetwell Components	ALL	L.S.	Lump Sum	$5,000
Site Work					
a.	Curb, Gutter & Sidewalk	90	L.F.	$100	$9,000
b.	Base Rock & Asphalt Surfacing	ALL	L.S.	Lump Sum	$5,000
c.	Landscaping & Tree Removal	ALL	L.S.	Lump Sum	$12,000
d.	Reroute Residential Water Service	ALL	L.S.	Lump Sum	$3,000
Pump Station Wetwell Improvements					
a.	Wetwell Structure Modifications	ALL	L.S.	Lump Sum	$5,000
b.	Wetwell Rehabilitation	ALL	L.S.	Lump Sum	$15,000
c.	New Cast-in-place Top Slab, Hatch, and Fillets	ALL	L.S.	Lump Sum	$20,000
d.	Submersible Sewage Pumps & Appurtenances	ALL	L.S.	Lump Sum	$40,000
e.	Wetwell Piping & Appurtenances	ALL	L.S.	Lump Sum	$15,000
f.	Valve Vault Structure	ALL	L.S.	Lump Sum	$20,000
g.	Valve Vault Piping & Appurtenances	ALL	L.S.	Lump Sum	$40,000
Electrical, Instrumentation & Controls					
a.	Pump Disconnect Panel, Pump Control Panel, VFD's, and Wetwell Instruments	ALL	L.S.	Lump Sum	$50,000
b.	Telemetry & SCADA Equipment	ALL	L.S.	Lump Sum	$8,000
c.	Miscellaneous Electrical & Controls	ALL	L.S.	Lump Sum	$50,000
Miscellaneous					
a.	As-built Drawings and O&M Manuals	ALL	L.S.	Lump Sum	$8,000
b.	SCADA Integration & Programming	ALL	L.S.	Lump Sum	$8,000
				TOTAL:	$363,000

City of Independence Wastewater Facilities Plan

Lagoon Pump Station Capacity Upgrade & Improvements | Project P-6

Planning Level Cost Estimate

Item		Qty	Unit	Unit Cost	Total Cost
CONSTRUCTION COSTS					
General Items					
a.	Mobilization, Bonds, Permits and Insurance, (8% of total)	ALL	L.S.	Lump Sum	$22,000
Site Work					
a.	Excavation, Grading & Surfacing	ALL	L.S.	Lump Sum	$5,000
b.	Fencing	60	L.F.	$125	$7,500
c.	Handrails	36	L.F.	$80	$2,880
Control Building Improvements					
a.	Building Addition	150	SF	$250	$37,500
b.	Fill Drywell and Install Concrete Floor	ALL	L.S.	Lump Sum	$4,000
c.	Misc. Building Improvements	ALL	L.S.	Lump Sum	$10,000
Pump Station Improvements					
a.	Submersible Sewage Pump & Appurtenances	ALL	L.S.	Lump Sum	$20,000
b.	Wetwell & Discharge Piping and Appurtenances	ALL	L.S.	Lump Sum	$8,000
c.	Valve Vault Structure & Modifications	ALL	L.S.	Lump Sum	$15,000
a.	New Forcemain Connection Piping	ALL	L.S.	Lump Sum	$5,000
d.	Miscellaneous Mechanical	ALL	L.S.	Lump Sum	$5,000
Electrical, Instrumentation & Controls					
a.	Pump Disconnect Panel, Pump Control Panel, VFD's, and Wetwell Instruments	ALL	L.S.	Lump Sum	$80,000
b.	Telemetry & SCADA Equipment	ALL	L.S.	Lump Sum	$12,000
c.	Miscellaneous Electrical & Controls	ALL	L.S.	Lump Sum	$40,000
Miscellaneous					
b.	As-built Drawings and O&M Manuals	ALL	L.S.	Lump Sum	$10,000
c.	SCADA Integration & Programming	ALL	L.S.	Lump Sum	$10,000
				TOTAL:	$293,880

City of Independence Wastewater Facilities Plan

Albert Pump Station Electrical Systems Upgrade | Project P-7

Planning Level Cost Estimate

	Item	Qty	Unit	Unit Cost	Total Cost
CONSTRUCTION COSTS					
General Items					
a.	Mobilization, Bonds, Permits and Insurance, (8% of total)	ALL	L.S.	Lump Sum	$13,000
b.	Miscellaneous Civil and Mechanical Improvements	ALL	L.S.	Lump Sum	$25,000
Auxiliary Power Generator & Concrete Pad		ALL	L.S.	Lump Sum	$40,000
Electrical, Instrumentation & Controls					
a.	Pump Disconnect Panel, Pump Control Panel, VFD's, and Wetwell Instruments	ALL	L.S.	Lump Sum	$40,000
b.	Telemetry & SCADA Equipment	ALL	L.S.	Lump Sum	$8,000
c.	Miscellaneous Electrical & Controls	ALL	L.S.	Lump Sum	$40,000
Miscellaneous					
a.	As-built Drawings and O&M Manuals	ALL	L.S.	Lump Sum	$5,000
b.	SCADA Integration & Programming	ALL	L.S.	Lump Sum	$3,000
				TOTAL:	$174,000

City of Independence Wastewater Facilities Plan

Briar Road Pump Station Electrical Systems Upgrade

Project P-8

Planning Level Cost Estimate

	Item	Qty	Unit	Unit Cost	Total Cost
CONSTRUCTION COSTS					
General Items					
a.	Mobilization, Bonds, Permits and Insurance, (8% of total)	ALL	L.S.	Lump Sum	$10,000
Auxiliary Power Generator & Concrete Pad		ALL	L.S.	Lump Sum	$40,000
Electrical, Instrumentation & Controls					
a.	Pump Disconnect Panel, Pump Control Panel, VFD's, and Wetwell Instruments	ALL	L.S.	Lump Sum	$35,000
b.	Telemetry & SCADA Equipment	ALL	L.S.	Lump Sum	$8,000
c.	Miscellaneous Electrical & Controls	ALL	L.S.	Lump Sum	$10,000
Miscellaneous					
a.	As-built Drawings and O&M Manuals	ALL	L.S.	Lump Sum	$5,000
b.	SCADA Integration & Programming (L.S.)	ALL	L.S.	Lump Sum	$3,000
c.	Easement Acquisition	ALL	L.S.	Lump Sum	$20,000
				TOTAL:	$111,000

City of Independence Wastewater Facilities Plan

13th Street Pump Station Electrical Systems Upgrade — Project P-9

Planning Level Cost Estimate

Item		Qty	Unit	Unit Cost	Total Cost
CONSTRUCTION COSTS					
General Items					
a.	Mobilization, Bonds, Permits and Insurance, (8% of total)	ALL	L.S.	Lump Sum	$13,000
b.	Miscellaneous Civil and Mechanical Improvements	ALL	L.S.	Lump Sum	$25,000
c.	Demolish old 13th Street Pump Station	ALL	L.S.	Lump Sum	$5,000
Auxiliary Power Generator & Concrete Pad		ALL	L.S.	Lump Sum	$40,000
Electrical, Instrumentation & Controls					
a.	Pump Control Panel and Wetwell Instruments	ALL	L.S.	Lump Sum	$40,000
b.	Telemetry & SCADA Equipment	ALL	L.S.	Lump Sum	$8,000
c.	Miscellaneous Electrical & Controls	ALL	L.S.	Lump Sum	$25,000
Miscellaneous					
a.	As-built Drawings and O&M Manuals	ALL	L.S.	Lump Sum	$2,000
b.	SCADA Integration & Programming	ALL	L.S.	Lump Sum	$3,000
c.	Easement Acquisition	ALL	L.S.	Lump Sum	$20,000
				TOTAL:	$181,000

City of Independence Wastewater Facilities Plan

Mt. Fir Pump Station Capacity & Electrical Systems Upgrade — Project P-10

Planning Level Cost Estimate

	Item	Qty	Unit	Unit Cost	Total Cost
CONSTRUCTION COSTS					
General Items					
a.	Mobilization, Bonds, Permits and Insurance, (8% of total)	ALL	L.S.	Lump Sum	$12,000
b.	Miscellaneous Civil Improvements	ALL	L.S.	Lump Sum	$15,000
Pump Station Improvements					
a.	Submersible Sewage Pump & Appurtenances	ALL	L.S.	Lump Sum	$20,000
b.	Discharge Piping & Appurtenances	ALL	L.S.	Lump Sum	$12,000
d.	Miscellaneous Mechanical	ALL	L.S.	Lump Sum	$10,000
Electrical, Instrumentation & Controls					
a.	Pump Disconnect Panel, Pump Control Panel, VFD's, and Wetwell Instruments	ALL	L.S.	Lump Sum	$50,000
b.	Telemetry & SCADA Equipment	ALL	L.S.	Lump Sum	$8,000
c.	Miscellaneous Electrical & Controls	ALL	L.S.	Lump Sum	$40,000
d.	Temporary Electrical & Control System	ALL	L.S.	Lump Sum	$3,000
Miscellaneous					
a.	Control Building Improvements	ALL	L.S.	Lump Sum	$5,000
b.	As-built Drawings and O&M Manuals	ALL	L.S.	Lump Sum	$5,000
c.	SCADA Integration & Programming	ALL	L.S.	Lump Sum	$3,000
				TOTAL:	$183,000

City of Independence Wastewater Facilities Plan

Stryker Road Pump Station Upgrade — Project P-11

Planning Level Cost Estimate

	Item	Qty	Unit	Unit Cost	Total Cost
CONSTRUCTION COSTS					
General Items					
a.	Mobilization, Bonds, Permits and Insurance, (8% of total)	ALL	L.S.	Lump Sum	$19,000
b.	Miscellaneous Civil and Mechanical Improvements	ALL	L.S.	Lump Sum	$25,000
Pump Station Wetwell Improvements					
a.	Submersible Sewage Pumps & Appurtenances	ALL	L.S.	Lump Sum	$40,000
b.	Bypass Pumping	ALL	L.S.	Lump Sum	$5,000
c.	Miscellaneous Mechanical	ALL	L.S.	Lump Sum	$15,000
Auxiliary Power Generator & Concrete Pad		ALL	L.S.	Lump Sum	$40,000
Electrical, Instrumentation & Controls					
a.	Pump Disconnect Panel, Pump Control Panel, VFD's, and Wetwell Instruments	ALL	L.S.	Lump Sum	$40,000
b.	Telemetry & SCADA Equipment	ALL	L.S.	Lump Sum	$8,000
c.	Miscellaneous Electrical & Controls	ALL	L.S.	Lump Sum	$40,000
Miscellaneous					
a.	As-built Drawings and O&M Manuals	ALL	L.S.	Lump Sum	$5,000
b.	SCADA Integration & Programming	ALL	L.S.	Lump Sum	$3,000
c.	Easement Acquisition	ALL	L.S.	Lump Sum	$20,000
				TOTAL:	$260,000

City of Independence Wastewater Facilities Plan

New Ash Creek Pump Station — Project P-12

Planning Level Cost Estimate

Item		Qty	Unit	Unit Cost	Total Cost
CONSTRUCTION COSTS					
General Items					
a.	Mobilization, Bonds, Permits and Insurance, (8% of total)	ALL	L.S.	Lump Sum	$46,000
b.	Surveying	ALL	L.S.	Lump Sum	$3,000
c.	Compaction & Materials Testing	ALL	L.S.	Lump Sum	$3,000
d.	Erosion Control	ALL	L.S.	Lump Sum	$2,000
e.	Clearing	ALL	L.S.	Lump Sum	$4,000
Site Work					
a.	General Excavation & Grading	ALL	L.S.	Lump Sum	$10,000
b.	Base Rock & Gravel Surfacing	ALL	L.S.	Lump Sum	$20,000
c.	Bollards	ALL	L.S.	Lump Sum	$6,000
d.	Perimeter Chainlink Fence & Gates	200	L.F.	$125	$25,000
Gravity Sewer Improvements					
a.	60" Sanitary Sewer Manhole	2	Each	$10,000	$20,000
b.	8" Sanitary Sewer, Trench, Backfill & Surface Restoration	75	L.F.	$130	$9,750
Pump Station Wetwell Improvements					
a.	Wetwell Excavation, Backfill, Spoils Disposal, & Dewatering	ALL	L.S.	Lump Sum	$40,000
b.	Wet Well Structure	ALL	L.S.	Lump Sum	$35,000
c.	Submersible Sewage Pumps & Appurtenances	ALL	L.S.	Lump Sum	$40,000
d.	Wetwell Piping & Appurtenances	ALL	L.S.	Lump Sum	$20,000
e.	Valve Vault Structure	ALL	L.S.	Lump Sum	$20,000
f.	Valve Vault Piping & Appurtenances	ALL	L.S.	Lump Sum	$35,000
g.	ARV Vault, Valves & Piping	ALL	L.S.	Lump Sum	$12,000
Control Building					
a.	Concrete Slab	ALL	L.S.	Lump Sum	$25,000
b.	Control Building Structure & Appurtenances	ALL	L.S.	Lump Sum	$95,000
Auxiliary Power Generator & Concrete Pad		ALL	L.S.	Lump Sum	$52,000
Electrical, Instrumentation & Controls					
a.	Power Service, Complete	ALL	L.S.	Lump Sum	$20,000
b.	Miscellaneous Electrical & Controls	ALL	L.S.	Lump Sum	$55,000
Miscellaneous					
a.	As-built Drawings and O&M Manuals	ALL	L.S.	Lump Sum	$10,000
b.	SCADA Integration & Programming	ALL	L.S.	Lump Sum	$10,000
				TOTAL:	$617,750

City of Independence Wastewater Facilities Plan

New Corvallis Road Pump Station — Project P-13

Planning Level Cost Estimate

Item		Qty	Unit	Unit Cost	Total Cost
CONSTRUCTION COSTS					
General Items					
a.	Mobilization, Bonds, Permits and Insurance, (8% of total)	ALL	L.S.	Lump Sum	$47,000
b.	Surveying	ALL	L.S.	Lump Sum	$3,000
c.	Compaction & Materials Testing	ALL	L.S.	Lump Sum	$3,000
d.	Erosion Control	ALL	L.S.	Lump Sum	$2,000
e.	Clearing	ALL	L.S.	Lump Sum	$4,000
Site Work					
a.	General Excavation & Grading	ALL	L.S.	Lump Sum	$10,000
b.	Base Rock & Gravel Surfacing	ALL	L.S.	Lump Sum	$20,000
c.	Bollards	ALL	L.S.	Lump Sum	$6,000
d.	Perimeter Chainlink Fence & Gates	200	L.F.	$125	$25,000
Gravity Sewer Improvements					
a.	60" Sanitary Sewer Manhole	2	Each	$10,000	$20,000
b.	8" Sanitary Sewer, Trench, Backfill & Surface Restoration	75	L.F.	$130	$9,750
Pump Station Wetwell Improvements					
a.	Wetwell Excavation, Backfill, Spoils Disposal, & Dewatering	ALL	L.S.	Lump Sum	$50,000
b.	Wet Well Structure	ALL	L.S.	Lump Sum	$40,000
c.	Submersible Sewage Pumps & Appurtenances	ALL	L.S.	Lump Sum	$40,000
d.	Wetwell Piping & Appurtenances	ALL	L.S.	Lump Sum	$20,000
e.	Valve Vault Structure	ALL	L.S.	Lump Sum	$20,000
f.	Valve Vault Piping & Appurtenances	ALL	L.S.	Lump Sum	$35,000
g.	ARV Vault, Valves & Piping	ALL	L.S.	Lump Sum	$12,000
Control Building					
a.	Concrete Slab	ALL	L.S.	Lump Sum	$25,000
b.	Control Building Structure & Appurtenances	ALL	L.S.	Lump Sum	$95,000
Auxiliary Power Generator & Concrete Pad		ALL	L.S.	Lump Sum	$52,000
Electrical, Instrumentation & Controls					
a.	Power Service, Complete	ALL	L.S.	Lump Sum	$20,000
b.	Miscellaneous Electrical & Controls	ALL	L.S.	Lump Sum	$55,000
Miscellaneous					
a.	As-built Drawings and O&M Manuals	ALL	L.S.	Lump Sum	$10,000
b.	SCADA Integration & Programming	ALL	L.S.	Lump Sum	$10,000
				TOTAL:	$633,750

City of Independence Wastewater Facilities Plan

New Talmadge Road Pump Station & Forcemain — Project P-14

Planning Level Cost Estimate

Item		Qty	Unit	Unit Cost	Total Cost
CONSTRUCTION COSTS					
General & Site Work					
a.	Mobilization, Bonds, Permits and Insurance (8% of total)	ALL	L.S.	Lump Sum	$32,000
b.	General Excavation & Grading	ALL	L.S.	Lump Sum	$15,000
c.	Base Rock & Gravel Surfacing	ALL	L.S.	Lump Sum	$25,000
d.	Miscellaneous Site Work, Driveway, Fencing etc.	ALL	L.S.	Lump Sum	$35,000
Pump Station & Forcemain Improvements					
a.	Wetwell Excavation, Backfill, Spoils Disposal, & Dewatering	ALL	L.S.	Lump Sum	$35,000
b.	Wetwell Structure	ALL	L.S.	Lump Sum	$25,000
c.	Submersible Sewage Pumps & Appurtenances	ALL	L.S.	Lump Sum	$30,000
d.	Wetwell Piping & Appurtenances	ALL	L.S.	Lump Sum	$20,000
e.	Valve Vault Structure	ALL	L.S.	Lump Sum	$15,000
f.	Valve Vault Piping & Appurtenances	ALL	L.S.	Lump Sum	$25,000
g.	Forcemain, Trench, Backfill & Surface Restoration	200	L.F.	$120	$24,000
Electrical, Instrumentation & Controls					
a.	Power Service, Complete	ALL	L.S.	Lump Sum	$20,000
b.	Electrical & Controls	ALL	L.S.	Lump Sum	$65,000
c.	Auxiliary Power Generator & Concrete Pad	ALL	L.S.	Lump Sum	$40,000
Miscellaneous					
a.	As-built Drawings and O&M Manuals	ALL	L.S.	Lump Sum	$10,000
b.	SCADA Integration, Programming, Telemetry	ALL	L.S.	Lump Sum	$16,000
				TOTAL:	$432,000

City of Independence Wastewater Facilities Plan

Common Forcemain for the 9th Street and Lagoon Pump Stations Project F-1

Planning Level Cost Estimate

	Item	Qty	Unit	Unit Cost	Total Cost
CONSTRUCTION COSTS					
General Items					
a.	Mobilization, Bonds, Permits and Insurance, (8% of total)	ALL	L.S.	Lump Sum	$43,000
b.	Surveying	ALL	L.S.	Lump Sum	$4,000
c.	Compaction & Materials Testing	ALL	L.S.	Lump Sum	$3,000
d.	Erosion Control	ALL	L.S.	Lump Sum	$5,000
e.	Clearing	ALL	L.S.	Lump Sum	$6,000
Pump Station Forcemain Improvements					
a.	12-Inch Forcemain Pipe	2300	L.F.	$150	$345,000
b.	Ash Creek Bore Crossing	100	L.F.	$1,000	$100,000
c.	9th Street Pump Station Manifold Piping & Valves	ALL	L.S.	Lump Sum	$10,000
d.	Lagoon Pump Station Manifold Piping & Valves	ALL	L.S.	Lump Sum	$20,000
e.	Lagooon Dike Trench & Backfill	1300	L.F.	$25	$32,500
f.	Piping & Connection to Headworks	ALL	L.S.	Lump Sum	$7,500
				TOTAL:	$576,000

City of Independence Wastewater Facilities Plan

Headworks and Cell 1 Distribution Pipe Improvements — Project T-1

Planning Level Cost Estimate

Item	Qty	Unit	Unit Cost	Total Cost
CONSTRUCTION COSTS				
Mobilization (percentage of total)	8.0%	LS	$73,100	$73,100
Excavation and Subgrade Preparation	50	CY	$35	$1,800
Fill in Lagoon for Headworks Pad	1000	CY	$50	$50,000
Yard Piping				
Pipe Connections to Headworks Structure	6	EA	$2,500	$15,000
Relocate Piping from Existing Headworks	1	LS	$8,000	$8,000
Riverview Forcemain Piping Modifications	1	LS	$5,000	$5,000
Williams Street Forcemain Piping Mods	1	LS	$10,000	$10,000
Lagoon Pump Station Forcemain Mods	1	LS	$6,500	$6,500
9th Street Forcemain Piping Mods	1	LS	$7,500	$7,500
Burried Discharge Pipe to Cell 1	1	LS	$7,500	$7,500
Burried Discharge Pipe to Cell 2	1	LS	$5,500	$5,500
Cell 1 Influent Distribution Pipe	600	LF	$230	$138,000
Base Rock	60	CY	$45	$2,700
Gravel Surfacing	185	CY	$45	$8,300
Chain Link Fencing and Gates	1	LS	$20,000	$20,000
Demolish Existing Headworks	1	LS	$15,000	$15,000
Concrete				
Floor Slab & Footings	35	CY	$500	$17,500
Walls	65	CY	$750	$48,800
Miscellaneous Non-Structural Concrete	15	CY	$500	$7,500
Manually Cleaned Bar Screen	1	LS	$6,000	$6,000
Slide Gates	6	EA	$3,000	$18,000
Sluice Gates	2	EA	$6,000	$12,000
Washdown Water System	1	LS	$10,000	$10,000
Misc. Mechanical	1	LS	$35,000	$35,000
Stairs	1	EA	$6,500	$6,500
Handrails	135	LF	$85	$11,500
Grating & Frame	400	SF	$80	$32,000
Equipment				
Fine Screening Equipment	1	LS	$200,000	$200,000
Influent Sampler	1	LS	$8,500	$8,500
Influent Flow Meter	1	LS	$5,000	$5,000
Equipment Installation (20% of Equip. Cost)	1	LS	$42,700	$42,700
Electrical & Controls (20% of Total Cost)	1	LS	$152,000	$152,000
			TOTAL:	$987,000

City of Independence Wastewater Facilities Plan

Lagoon Aeration and Conveyance Piping Improvements　　Project　T-3

Planning Level Cost Estimate

Item	Qty	Unit	Unit Cost	Total Cost
CONSTRUCTION COSTS				
Mobilization (percentage of total)	8.0%	LS	$316,900	$316,900
Lagoon Aeration System				
Civil Sitework for Blower Building				
Excavation & Subgrade Preparation	90	CY	$35	$3,150
Fill in Lagoon for Blower Building Pad	750	CY	$50	$37,500
Base Rock	60	CY	$45	$2,700
Miscellaneous Civil	1	LS	$25,000	$25,000
Building Structure	1250	SF	$250	$312,500
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 Specialties				
Overhead Doors	1	LS	$20,000	$20,000
Intake and Exhaust Louvers	1	LS	$30,000	$30,000
Burried Air Distribution Piping				
16 Inch	500	LF	$120	$60,000
12 Inch	1,200	LF	$100	$120,000
8 Inch	500	LF	$75	$37,500
Air Lateral Connections	26	EA	$4,000	$104,000
Floating Air Headers				
6 Inch	9,300	LF	$25	$232,500
4 Inch	3,500	LF	$20	$70,000
3 Inch	2,000	LF	$20	$40,000
Lateral Cable Support System	26	EA	$10,000	$260,000
Aeration Equipment and Blowers	1	LS	$850,000	$850,000
Aeration Equipment Installation	1	LS	$170,000	$170,000
Ramps for Service Pontoon Boat	4	EA	$15,000	$60,000
Pontoon Boat & Trailer	1	LS	$30,000	$30,000
Utility Power Supply Conduits & Trenching	2,000	LF	$80	$160,000
Power Company Connection Fees	1	LS	$50,000	$50,000
Auxiliary Power Generator & ATS	1	LS	$100,000	$100,000
Electrical & Controls	1	LS	$332,000	$332,000
Conveyance Piping Improvements				
Erosion Control	1	LS	$5,000	$5,000
Miscellaneous Civil Improvements	1	LS	$40,000	$40,000
Cell 1 to Cell 2 Transfer Pump Station				
Pump Station Structure Including Coffer Dam	1	LS	$240,000	$240,000
Pumps, Discharge Piping, and Appurtenances	1	LS	$130,000	$130,000
Decomission Existing Pump Station	1	LS	$5,000	$5,000
Cell 2 to 3 Transfer Pipes Including Coffer Dam	1	LS	$70,000	$70,000
Cell 3 to 4 Transfer Pipes Including Coffer Dam	1	LS	$70,000	$70,000
Lagoon Dike Gravel Surfacing	2000	CY	$40	$80,000
Electrical & Controls	1	LS	$119,000	$119,000
			TOTAL:	$4,278,000

City of Independence Wastewater Facilities Plan

Chlorine Contact Chamber Improvements — Project T-4

Planning Level Cost Estimate

Item	Qty	Unit	Unit Cost	Total Cost
CONSTRUCTION COSTS				
Mobilization (percentage of total)	8.0%	LS	$45,000	$45,000
Shoring & Excavation	1	LS	$160,000	$160,000
Base Rock	145	CY	$45	$6,525
Miscellaneous Civil Improvements	1	LS	$25,000	$25,000
Concrete				
Bottom Slab	120	CY	$500	$60,000
Walls	200	CY	$750	$150,000
Structural Backfill	500	CY	$50	$25,000
Handrailing	185	LF	$85	$15,725
Grating	64	SF	$100	$6,400
Piping Connections to Structure	1	LS	$15,000	$15,000
Miscellaneous Mechanical Improvements	1	LS	$10,000	$10,000
Effluent Flow Measurement Flume	1	LS	$9,000	$9,000
Effluent Flow Meter	1	LS	$6,000	$6,000
Washdown Water System	1	LS	$5,000	$5,000
Inlet Piping	1	LS	$12,000	$12,000
Pipe Between Chambers	1	LS	$5,000	$5,000
Demolish Old Parshall Flume	1	LS	$5,000	$5,000
Electrical & Controls (10% of Total Cost)	1	LS	$52,000	$52,000
			TOTAL:	$613,000

City of Independence Wastewater Facilities Plan

Land Application System Expansion Phase I — Project T-5

Planning Level Cost Estimate

Item	Qty	Unit	Unit Cost	Total Cost
CONSTRUCTION COSTS				
Mobilization (percentage of total)	8.0%	LS	$13,000	$13,000
South Field Ditch Culverts	9	EA	$2,000	$18,000
Brush Clearing	1	LS	$3,500	$3,500
Distribution Piping on North Side of Middle Field	1740	LF	$60	$104,400
Connection to existing pipe	1	EA	$3,500	$3,500
Air Release Valves	1	EA	$7,500	$7,500
Irrigation Risers on north side of Middle Field	2	EA	$3,500	$7,000
Miscellaneous Improvements	1	LS	$10,000	$10,000
Relocate End Stops	2	EA	$2,500	$5,000
			TOTAL:	$172,000

City of Independence Wastewater Facilities Plan

Land Application System Expansion Phase II — Project T-6

Planning Level Cost Estimate

Item	Qty	Unit	Unit Cost	Total Cost
CONSTRUCTION COSTS				
Mobilization (percentage of total)	8.0%	LS	$81,000	$81,000
Reclaimed Water Distribution Piping	8050	LF	$60	$483,000
Auger Bore of Rogers Road	80	LF	$750	$60,000
Connection to Existing Pipe	1	EA	$5,000	$5,000
Air Release Valves	4	EA	$7,500	$30,000
Irrigation Risers	6	EA	$3,500	$21,000
Miscellaneous Improvements	1	LS	$10,000	$10,000
Irrigation Pump #3 Including Discharge Piping	1	LS	$90,000	$90,000
Electrical and Controls	1	LS	$50,000	$50,000
Linear Irrigaiton Sprinklers	2	EA	$130,000	$260,000
			TOTAL:	$1,090,000

City of Independence Wastewater Facilities Plan

Outfall Improvements Project T-7

Planning Level Cost Estimate

Item	Qty	Unit	Unit Cost	Total Cost
CONSTRUCTION COSTS				
Mobilization (percentage of total)	8.0%	LS	$56,000	$56,000
Cleaning and TV Inspection, pre-/post CIPP	1	LS	$28,000	$28,000
36" CIPP, installed under Lagoon 1	1,050	LF	$320	$336,000
24" CIPP, installed under Lagoon 4	1,500	LF	$190	$285,000
Manhole Rehabilitation	3	LS	$6,000	$18,000
Miscellaneous Work Items	1	LS	$30,000	$30,000
			TOTAL:	$753,000