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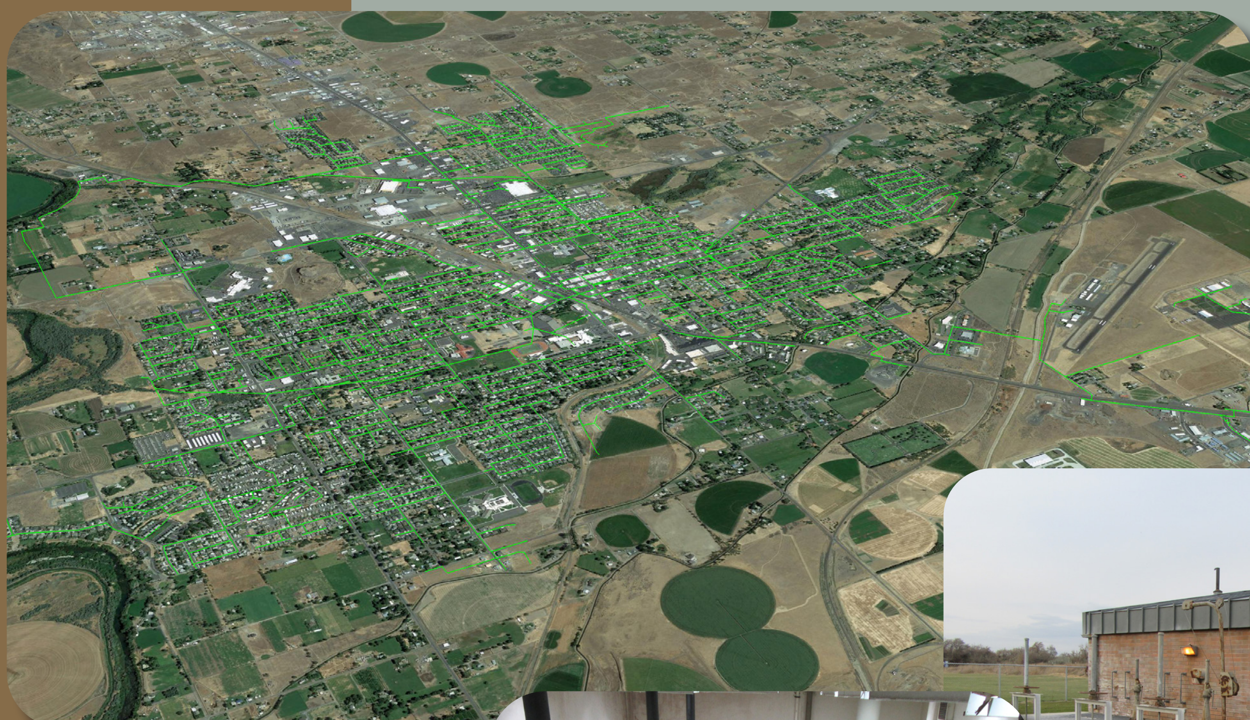
City of
Hermiston, Oregon
Sanitary Sewer Collection System Study

2021



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SANITARY SEWER COLLECTION SYSTEM STUDY

FOR

CITY OF HERMISTON, OREGON

2021

REGISTERED PROFESSIONAL
ENGINEER
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OREGON
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ANDERSON PERRY & ASSOCIATES, INC.

La Grande, Redmond, and Hermiston, Oregon
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Job No. 736-88

Table of Contents

CHART

TABLES

FIGURES

APPENDICES

Executive Summary

Introduction

This Executive Summary briefly summarizes the results of the Sanitary Sewer Collection System Study (Study) prepared by Anderson Perry & Associates, Inc., for the City of Hermiston, Oregon. The recommendations outlined herein have been developed in cooperation with the Hermiston City Council and City staff. The focus of this Study has been on the sanitary sewer collection system, including the piping and pumping systems, as well as maintenance of those systems. This Study includes an analysis of the existing system and its performance, an evaluation of the system needs both in terms of design standards and maintenance issues, evaluation of improvement alternatives, prioritization of improvements, review of the sewer department's financial status, and development of a project implementation plan. Included in this Executive Summary is a brief discussion of the existing sanitary sewer collection system, the evaluations conducted, the recommended prioritized improvements, and the project implementation plan. For a more detailed discussion of the information presented in this Executive Summary, please refer to the individual chapters of this Study.

The City recognizes the need for this Study, as it has been 22 years since the previous collection system study was prepared. Some problem areas identified in this Study will likely be compounded and create larger, more expensive repairs in the future if the City does not address them. This Study will act as a guide for continued improvements to the system's deficient areas over the next 20 years.

Sanitary Sewer Collection System Overview

The City originally installed sewer lines in residential areas in easements along back property lines to allow manholes to be accessed without disrupting traffic, reduce initial construction costs, and make construction easier. However, this practice was halted because, as residential areas were developed, the manholes were not reasonably accessible due to landscape overgrowth, fences, and other obstacles. Maintaining these lines is a burden for City personnel because they must access resident's back yards and disturb landscaping. All new sewer lines are now installed in the right-of-way to allow better access to manholes and sewer lines.

The recycled water treatment plant (RWTP) is located in the northwest corner of the urban growth boundary (UGB). Two main trunklines feed into the RWTP, one serving the west side of the City and the other serving the east side of the City. The east and west sides are broken into 37 basins. Generally, basins are geographic areas collecting wastewater to a defined point (i.e., another basin or lift station.) Although the RWTP is located at one of the lowest areas in the UGB, the area served by the sanitary sewer collection system is relatively flat, which has made installation of lift stations necessary. Currently, the City operates nine lift stations in the system.

A map of the City's existing sanitary sewer collection system, which identifies pipe sizes and materials, is provided in Appendix B. The original system was composed of vitrified clay pipe installed in the 1950s, with some brick and mortar manholes. As time progressed, concrete pipe and then transite (asbestos cement) pipe were added to the system followed by polyvinyl chloride (PVC) pipe. Ductile iron pipe was installed in some isolated areas. East side and west side trunklines are constructed of reinforced concrete pipe. Collection system pipe varies from 6 inches to 36 inches in diameter. Residential service lines are 4 inches in diameter. Most of the manholes throughout the City are precast concrete manholes. The collection system contains approximately 77 miles of collection system mains, not including services, and serves an area of approximately 3,350 acres.

Existing Infrastructure Evaluation

The primary purpose of this Study is to provide the City of Hermiston with guidance on how to improve the overall condition of its sanitary sewer collection system. To accomplish this, a television (TV) inspection was performed on approximately 64 pipe sections, or 15,220 feet of pipe. The collection system map was updated to ensure accuracy when determining flow direction, basin areas, and system component location and connectivity. Evaluations of primary and secondary trunklines as well as the lift stations were also conducted. These evaluations helped identify areas in the sanitary sewer collection system in need of rehabilitation and/or improvements.

Television Inspection

Areas to be inspected were based on the City's "monthly bad lines" list. Because the City's collection system is large, inspecting all pipes would be a sizeable endeavor and cost prohibitive. Thus, newly installed pipes and old pipes with no known issues were not TV-inspected. The "monthly bad lines" were strategically targeted to identify improvements that would provide the most benefit to the City's sanitary sewer collection system for the funds expended.

Deficiencies identified included protruding laterals, pipe sag, cracks and cavities, root intrusions, infiltration, changes in horizontal alignment without a manhole, etc. Inspected pipe sections were generally in poor condition with pipe sag being the predominant issue in nearly all lines.

Lift Station Evaluations

Nine sanitary sewer lift stations are located in the City of Hermiston. Lift Stations 1, 5, 10, and 12 serve the east side of the sewer system, while Lift Stations 3, 4, 6, 7, and 8 serve the west side. Lift Station 12 serves the area around the Eastern Oregon Trade and Event Center. Lift Station 1 is the primary lift station for the east side and Lift Station 8 is the primary lift station for the west side. Lift Stations 1 and 8 have three operational pumps while the remaining lift stations have only two pumps. Lift station age, pump operation hours, telemetry system, level sensing system, and control systems vary.

The lift stations were found to be in generally good condition; however, some critical issues need to be addressed. Lift Station 4 has a compromised forcemain that needs repaired or replaced. Valves and pumps in various lift stations need to be repaired or replaced. The City already has plans to replace several old pumps and valves in Lift Stations 1 and 8, as well as replacing the existing emergency generators with two natural gas generators. Telemetry is an issue at nearly all lift stations except Lift Stations 1 and 12, which have modern telemetry equipment installed. Other lift stations need the old Stead and Baggerly, Inc., auto-dialer systems updated to modern wireless systems. Additionally, the City would like to replace some of the level sensors with ultrasonic level sensing devices.

Capacity Evaluation

Lift station and pipelines are critical infrastructure in transporting sewage to the RWTP. As Hermiston continues to grow, lift station and pipe flows will also increase. To verify that the existing collection system may be able to convey anticipated future flows, analyses were performed on lift station and sewer system collection piping to provide insight and recommendations on where improvements to the sewer system may be considered.

Recommended System Improvements

Based on the results of the evaluations, the recommended improvements for the sanitary sewer system have been prioritized and placed into three categories. For purposes of discussion, the three categories are referred to as high priority improvements, medium priority improvements, and items to monitor. Furthermore, each category of recommended high priority improvements is divided into lift station improvements and collection system piping improvements.

Sanitary Sewer Collection System Improvements

The high priority sanitary sewer improvements are aimed to address pipe segments with compromised structural integrity, root intrusions, pipe sags, and to replace pipe segments to meet Oregon Department of Environmental Quality (DEQ) guidelines for sewer pipelines. The cost estimates for the high priority sanitary sewer improvements can be found on Figures 5-1 through 5-10.

Improvements designated as medium priority are related to improving minor structural deficiencies, pipe sags, minor root intrusions, and protruding laterals. It is recommended the City continue monthly cleaning of the sewer lines identified as medium priority. The medium priority improvements are not anticipated to cause an immediate operation problem for the City or contaminate groundwater (public harm). After the City completes the high priority improvements, the medium priority improvements can be revisited and prioritized.

The items to monitor are related to sewer segments that were TV-inspected and deemed acceptable, although the City has had problems with these segments in the past. Other items to monitor are capacity related. The capacity analysis of the collection system identified line segments that are forecasted to meet or exceed capacity within the planning period.

Lift Station Improvements

Through discussions with City personnel and analysis of the lift station evaluations, a list of prioritized lift station improvements has been developed. The cost estimates for the lift station improvements can be found on Figures 5-11 through 5-17.

Generally, the lift station improvements aim to improve operator safety, improve operation and maintenance, and update lift stations that have exceeded their service life to current industry standards.

Current Financial Status

Revenues and expenditures were obtained from the City’s audited financial statements and adopted budgets and include all costs for the sewer system, such as operation, maintenance, and replacement; staff payroll; existing debt service; and transfers to other accounts. These data are presented in detail in Chapter 6 to provide insight into the magnitude of costs required to operate the City’s existing sewer system.

Capital Improvements Plan

The City's Capital Improvements Plan (CIP) allocates funds each year to the Sewer Department to complete necessary upgrades to the sewer system. The City intends to maintain this approach, if possible, to complete the recommended improvements identified in this Study. For this reason, the sewer system improvements outlined in Chapter 5 have been prioritized systematically so the most critical projects, related to the reliability of the sewer system, are recommended to be completed first.

Action Items and Implementation Schedule

To move forward with completing the sewer system improvements summarized in this Study, the following action items and implementation plan need to occur.

Action Items

- This Study was sent to the DEQ for review and was approved in January 2021.
- The City Council needs to formally adopt this Study and the associated priority improvements outlined in Chapter 4.
- The City should review its Comprehensive Plan related to the public facilities planning element and update the Comprehensive Plan as needed with information presented in this Study.
- The City should update its CIP based on recommended high priority improvements identified in this Study.
- The City should seek to implement priority improvements as sufficient funds are generated in the Sewer Department.

The City Council and personnel should monitor the progress of sewer system improvements over the next five years. If sufficient revenue is not obtained, the City should consider pursuing outside funding assistance.

Chapter 1 - Introduction

Project Purpose and Need

The purpose of this Sanitary Sewer Collection System Study (Study) is to develop a planning document that characterizes the sanitary sewer collection system, identifies deficiencies, and prepares an implementation plan for correcting these deficiencies for the City of Hermiston, Oregon. This Study is intended to assist the City in making repairs and improvements to its collection system, identifying areas in immediate need, and identifying long-term improvements anticipated to occur with future City development. This Study is also intended to be used in conjunction with the City's Wastewater Facilities Plan (WWFP). This Study is not intended to serve as a comprehensive WWFP.

The City recognizes the need for this Study, as it has been 22 years since the previous collection system study was prepared. Some problem areas identified in this Study will likely be compounded and create larger, more expensive repairs in the future if the City does not address them. This Study will act as a guide for continued improvements to the system's deficient areas over the next 20 years.

Study Objectives

The Study has several objectives:

1. Update the collection system base map including piping, manholes, cleanouts, service lines, and other miscellaneous facilities.
2. Evaluate historical influent flow data to generally determine trends and the magnitude and seasonal variability of sanitary sewer collection system flows.
3. Investigate the collection system, including television (TV) inspection and infiltration and inflow (I/I) analysis, to help identify sources and locations of extraneous flows.
4. Outline and prioritize collection system improvements to help the City obtain the most benefit from the improvements for the funds expended.
5. Present information on deficiencies and recommended improvements for future updates to the City's Capital Improvements Plan including estimated costs.
6. Analyze financing options for needed system upgrades.

Project Authorization

The City, through an Agreement for Engineering Services signed April 27, 2015 (reference Work Order No. 53, dated July 18, 2019), authorized Anderson Perry & Associates, Inc., to prepare this Study. This Study was funded by the City through sewer user fees.

Study Organization

To complete the stated objectives, this Study is organized into five chapters. Following is a brief summary of the contents of each chapter.

Chapter 1, “Introduction,” identifies the project purpose and need and outlines project objectives.

Chapter 2, “Basic Planning and Design Data,” presents basic planning information from which design data were developed for evaluating the City’s existing sanitary sewer collection system. Historical flow data are presented.

Chapter 3, “Existing Infrastructure Evaluation,” presents the collection system inspections and provides a description of the existing sanitary sewer collection system. This chapter focuses on the collection system field investigation, including the TV inspection and I/I analysis, and details the results of these investigations.

Chapter 4, “Capacity Evaluation,” outlines the capacity analysis performed on the lift station and collection system piping for current and anticipated future flows.

Chapter 5, “Recommended System Improvements,” outlines the recommended sanitary sewer collection system improvements and prioritization. Additionally, estimated costs of the prioritized recommended improvements are presented.

Chapter 6, “Project Financing and Implementation,” discusses funding options from available state and federal funding programs, and a funding and implementation plan is presented.

Chapter 2 - Basic Planning and Design Data

Introduction

This chapter presents basic data that will allow the City of Hermiston to make informed decisions regarding sanitary sewer collection system improvements to keep the system serving the community. Some of the data presented herein are based on recorded flows indicated on the City's Discharge Monitoring Reports (DMRs), which are submitted monthly to the Oregon Department of Environmental Quality (DEQ).

Community Description

The City of Hermiston, incorporated in 1907, is located in the northwest portion of Umatilla County, Oregon. Umatilla County is bordered on the north by the Columbia River and Washington state, on the east by Union County and a portion of Wallowa County, on the south by Grant County, and on the west by Morrow County. The City is located approximately 26 miles south of Kennewick, Washington, and approximately 27 miles west of Pendleton, Oregon. Figure 2-1 shows the City's location as well as the city limits and the urban growth boundary (UGB). Hermiston is the largest city in eastern Oregon and serves a large rural area in addition to urbanized areas within its city limits. Due to its position near the junction of Interstates 82 and 84, Hermiston has become a commercial hub to many businesses.

Climate

Summers are typically dry with clear days, while winters bring rain, snow, and frozen soils. Temperatures vary from extremes of below 0° Fahrenheit (F) to just over 110°F. Extreme temperatures are not usually prolonged. A Western Regional Climate Center weather station is located in Hermiston. Based on the data compiled by the National Climatic Data Center, the average annual temperature for the City is approximately 52.7° F, and the annual average precipitation is approximately 9 inches.

Topography and Soils

Situated approximately 650 feet above sea level, the City is located on the Columbia Plateau, a wide flood basalt plateau that encompasses parts of Oregon, Washington, and Idaho. The lowest elevations in the UGB are along the Umatilla River and at the recycled water treatment plant (RWTP). An isolated butte in the eastern portion of the City is a high point within the UGB; however, the topography on the City's southern border slopes up to nearly 50 feet higher than the butte. The difference between the lowest and highest points within the UGB is approximately 240 feet. Other than the steeper slopes on the butte and the City's southern border, the remaining area generally has very mild to flat slopes. The relatively flat profile of the area serviced by the sanitary sewer collection system has necessitated the installation of nine lift stations.

Soils in the area are primarily composed of various kinds of sand with substratum gravel. According to the U.S. Department of Agriculture Natural Resources Conservation Service Web Soil Survey, the most common soil types in the UGB are Winchester sand, Adkins fine sandy loam, and Quincy loamy fine sand. These soils have excellent drainage properties; however, there are isolated areas where the substratum is cementitious and very poor drainage occurs. Approximately 0.4 percent of the area within the UGB is composed of Taunton fine sandy loam with a cemented material substratum located just a few feet below the surface. Sandy soil provides an adequate medium for sanitary sewer component installation. However, issues arise because sandy soils are not cohesive. Excavation walls slough off, creating wide excavations with sloped walls. Thus, installing deep pipes or manholes requires the excavation of large volumes of soil.

Population

To estimate the demand that may be placed on a municipal sanitary sewer collection system, a determination of the population to be served must be made. Population estimates are made with reference to time. Projections are usually made based on an annual percentage increase estimated from past growth rates, tempered by future expectations. The addition or deletion of a major business, industry, or recreation use in the area could significantly affect the population and the sanitary sewer collection system needs. The planning period for this Study extends through year 2043 as discussed in detail hereafter.

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

The historical population and forecasted population data within the UGB, as provided by the Population Research Center (PRC) located at Portland State University, are shown on Figure 2-2. This agency is recognized as the primary source of population data available in Oregon between the official U.S. Census data generated at the beginning of each decade. Past population figures from the PRC and the U.S. Census show the City's population has increased steadily from 9,408 in 1980 to 16,745 in 2010. This represents a historical growth rate between 1980 and 2010 of approximately 1.9 percent per year. The growth rate was reported to drop between 2010 and 2019 to 1.1 percent per year. The PRC estimated a population of 18,200 for 2018 and 18,415 for 2019.

In 2013, the Oregon Legislature passed House Bill (HB) 2253, which was signed by the governor. HB 2253 removed the responsibility for developing population projections from counties and assigned coordinated population forecasting to the PRC for cities and counties in Oregon outside the Portland metro boundary. HB 2253 was codified under Oregon Revised Statutes Chapter 195 and is further implemented under Oregon Administrative Rules (OAR) Chapter 660, Division 032. When changing a comprehensive plan based on a population forecast, OAR 660-032-0020(1) requires local governments to use the most recent final population forecast. The PRC completed the most recent final population projections for Umatilla County and all cities within the County, including the City of Hermiston, in 2019.

The PRC forecasts Umatilla County's population to increase at an annual rate of 0.5 percent between 2019 and 2044, and 0.4 percent between 2044 and 2069. During these same time periods, the City's population within the UGB is projected to increase at a rate of 1.0 percent between 2019 and 2044 and drop slightly to 0.8 percent between 2044 and 2069. The planning period for this Sanitary Sewer Collection System Study (Study) is 20 years and will end in 2040; however, since housing developments and similar projects often take years to complete, the population herein was projected past 2040 to the year 2043. This accounts for demand placed on the sanitary sewer collection system by additional population resulting from projects that may be initiated in the year 2040. Projecting the City's population to 2043 using the forecasted UGB 1.0 percent average annual growth rate indicated by the PRC yields a population of 23,382 within city limits. The PRC projects that the population within the current UGB during the year 2043 will be 26,766. Potentially, additional sewer service customers currently served by private septic systems in "urban" and "urbanizable" areas in the UGB could be acquired. As such, using only the projected city limit population may not accurately forecast the population to be served at the end of the 20-year planning period. Therefore, it was determined that using the projected new growth and an additional allowance for current users on septic systems would be prudent to consider for the planning period, as further discussed herein.

The City Council has had development of additional housing as one of its top priorities for at least the past four years. The City has a substantial amount of undeveloped, large, contiguous parcels with active development interest located within its UGB. This has taken the form of the City and Umatilla County partnering to invest approximately $4.5 million in extending nearly 2 miles of new water main and paving 0.5 mile of new road past or through 14 different parcels. Each parcel is a minimum of 10 acres in size, which means more than 300 acres in the northeast quadrant of the UGB are available for development. Additionally, to serve a new 600-student elementary school in the northeast quadrant of the UGB (approved for funding in a bond election in November 2019), the City partnered with a housing developer and the Hermiston School District to facilitate the extension of approximately 0.5 mile of new sewer main to this area. Construction of the school is expected to begin in late 2020.

As part of these infrastructure investments, the City of Hermiston has been in direct consultation with housing developers to ensure utilization of these investments. Table 2-1 shows housing developments that are either actively being built or are nearing the start of flatwork construction to develop housing lots within Hermiston's UGB. Based on a conservative estimation of housing market absorption rates at approximately 100 units per year, spread across the entire price-segments that these represent, the City estimates that approximately 880 new single-family residences will be built within city limits and will be connected to the sanitary sewer collection system by 2027. Assuming two people per household, this means approximately 1,700 additional residents will have services provided by the City by 2027. Add these new residents to the current 2019 population of 18,415, and the result is a population of 20,115 by the year 2027, all of which will be serviced by the City's sanitary sewer system. Since Table 2-1 represents only known housing developments actively being pursued, it is likely that additional multi-family developments will also occur over the same time frame.

TABLE 2-1
PLANNED HOUSING LOTS FOR EXISTING AND PROPOSED HOUSING DEVELOPMENTS

Housing Development	Housing Lots Planned	2020	2021	2022	2023	2024	2025	2026	2027
Cimmaron Terrace	99	25	25	25	24				
Highland Summit	25	20	5						
Theater Park	55	25	30						
Desert Sky	50	10	10	10	10	10			
Wolf Run I and II	35	10	5	10	10				
Legacy Park	100		10	30	30	30			
Santiago	200	25	25	25	25	25	25	25	25
Piercy/Diagonal	100			25	25	25	25		
Punkin Ridge	165					25	50	50	40
Maldaonado	50						25	25	
Annual		**115**	**110**	**125**	**124**	**115**	**125**	**100**	**65**
Total	**879**	**115**	**225**	**350**	**474**	**589**	**714**	**814**	**879**

The City's prioritization of housing development and its associated infrastructure investments show that the City has a growth-oriented mindset and is clearly taking active steps to maximize urban level development within its UGB. As city limits expand, the City plans to bring residents served by septic systems onto the City's sewer system whenever possible.

Although it is unlikely that 100 percent of the properties currently served by private septic systems within the City's UGB will be annexed and connected to the City's sanitary sewer collection system, it is likely that the City will be able to annex up to 80 percent of current septic users, as evidenced by the City's growth mindset. The difference between the estimated UGB population and the City's estimated population in 2019 is approximately 2,770. This portion of the population is assumed to be currently served by private septic systems. The PRC estimates a UGB population of 26,766 people in 2043. If the City actively provides sewer service to all new population growth from 2020 to 2043 and annexes 80 percent of septic users onto the sanitary sewer collection system, then the population serviced by the City's sanitary sewer collection system would be the PRC 2043 population of 26,766 less 20 percent of the 2,770 septic tank users, which yields a design population of 26,210. Table 2-2 summarizes these population values. The design population value is reasonable, as the City consistently provides sewer service to new growth and attempts to annex as many septic tank users onto the sewer system as possible.

TABLE 2-2
POPULATION SUMMARY

Area	2019 Population	Projected Growth Rate (Percent)	2043 Projected Population	Design Population[1]
City	18,415	1.0	23,382	26,210
UGB	21,185	1.0	26,766	-

[1] The design population was calculated based on three assumptions:

1) *The difference between the 2019 UGB population and the 2019 City population represents the population currently being serviced by private septic systems.*
2) *All future growth will be serviced by the City's sanitary sewer collection system.*
3) *Eighty percent of the population currently served by private septic systems will be annexed into the City's sanitary sewer collection system by the end of the planning period.*

It should be recognized that over the planning period of this Sanitary Sewer Collection System Study (Study), actual growth could exceed or fall below the projections presented on Figure 2-2 and discussed herein.

Service Area

The term "service area" refers to the area served by the City's sanitary sewer collection system. The present service area primarily consists of developed land within the city limits and "urban" areas within the UGB. The City's developed land use pattern is fairly compact, with larger undeveloped areas generally in the UGB adjacent to city limits. A considerable amount of "urbanizable" land within the UGB is anticipated to be annexed into the service area over the planning period. While the exact amount of "urbanizable" land that might be incorporated into the service area is difficult to predict, the City can influence which areas may be included through policies and plans identifying those areas preferred for expansion. For the purposes of this Study, the future service area consists of the present service area, "urban" areas within the UGB as shown on Hermiston's 2020 Comprehensive Plan Map located in Appendix A, and "urbanizable" areas in the UGB for which the City desires to plan for sanitary sewer collection service.

A few smaller undeveloped areas are spread throughout the City; however, most of these appear to be City parks or ball fields associated with schools or churches. The elevations of these areas are similar to surrounding areas already served by the sanitary sewer collection system. If these areas develop, the existing sanitary sewer collection system is anticipated to be extended as needed to serve them.

Sanitary Sewer Collection System History

The City has approximately 77 miles of collection system piping, not including service lines. The central portion of the system was constructed in the 1950s using vitrified clay pipe. Following the initial installation of clay pipe, the City has installed concrete piping, asbestos cement piping, and, most recently, polyvinyl chloride pipe. The primary collection system piping is shown on the Existing Sanitary Sewer Collection System Map in Appendix B.

Much of the collection system was originally installed along back property lines. This reduced the initial cost of construction and made construction easier. However, this creates difficulties with maintenance and repair in the long term. Due to landscaping, fencing, and structures, sections of pipe are nearly inaccessible. In some cases, connections of service laterals to main line piping cannot be found, or manholes cannot be accessed by equipment necessary to clean the pipes. The easements the City possesses for these lines should provide access to maintain and repair these lines, but the inconvenience caused by removing fences, trees, and other landscaped features, and sometimes structures, makes it difficult to continue maintenance and repairs on affected sewer lines.

Many of the collection system main line pipes are quite shallow for a sanitary sewer system. Normal pipe depths range from 6 to 12 feet and are often deeper. Some pipes in in the City are less than 6 feet deep, and others are as shallow as 3 feet.

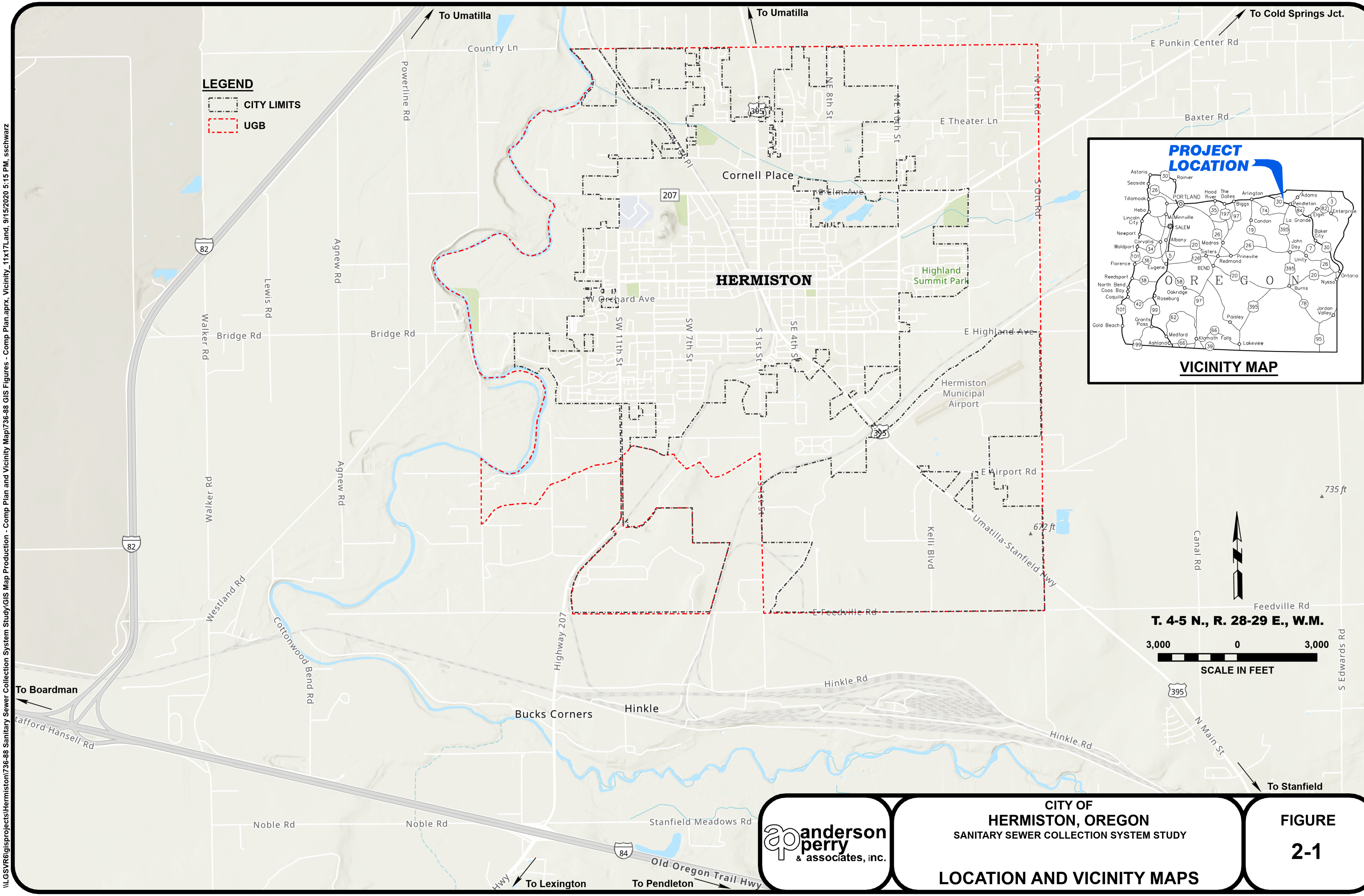
The collection system is divided into two primary areas: the east and west sides. The east and west side are further separated into 16 and 21 basins, respectively. Generally, a basin is a network of piping that serves a particular area that either converges on a specific location by gravity (another basin) or converges at a lift station. The east and west sides contain four and five lift stations, respectively.

Historical Sanitary Sewer Flow and Design Criteria

This section presents historical flow data based on the City's monthly DMRs submitted to the DEQ. Monthly DMRs for the period from January 2017 through December 2019 were reviewed. A copy of the daily DMR data is provided in Appendix C. The City's flowmeters located at the RWTP were used to record these flows.

Theoretically, influent flow should be equal to effluent flow. Figures 2-3 and 2-4 show DMR influent and effluent flow data. A summary of DMR data is presented on Figure 2-5. As shown, the influent and effluent flows were similar from February 2018 to May 2019, but from January 2017 to January 2018 the influent flow was consistently less than the effluent flow. The City recalibrated its influent flowmeter near the end of 2018 and, thereafter, had much more consistency between influent and effluent flows. Around June 2019, the influent flow began to vary significantly from the effluent flow again. Because of inconsistencies in influent flow data and because the effluent flow data seemed more reliable, effluent flow data were used to determine design criteria for this Study. Using the effluent flow data from the DMRs, the average annual flow (AAF) was determined to be 1.4 million gallons per day (MGD). Using the PRC 2019 certified population estimate for the City of 18,415, the equivalent wastewater contribution per person was 76 gallons per capita day (gpcd). For smaller sanitary sewer collection systems, AAFs typically range from 80 to 120 gpcd. The City of Hermiston's AAF of 76 gpcd is lower, which could indicate there is minimal infiltration and inflow (I/I) into the system. Further discussion of I/I is included in Chapter 3.

Estimating future flows is critical in determining recommended sewer system improvements. Flows were estimated for the year 2043 to account for projects initiated in 2040, which will further increase population. This will allow projects started in 2040 to proceed without pushing existing sewer lines past their flow capacities. To estimate the AAF for the year 2043, the annual base flow (ABF) must be determined. The ABF is calculated from the average of each month's minimum monthly flow. I/I is assumed to be the difference between the AAF and the ABF. The 2043 ABF is then calculated as the product of the 2019 ABF in gpcd and the forecasted population in 2043. The assumed I/I is then added to the 2043 ABF to determine the 2043 AAF. The ABF and AAF for 2043 were calculated to be 1.798 MGD (69 gpcd) and 1.935 MGD (74 gpcd), respectively. A summary of the design criteria is presented on Figure 2-6.



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CITY OF
HERMISTON, OREGON
SANITARY SEWER COLLECTION SYSTEM STUDY

LOCATION AND VICINITY MAPS

FIGURE
2-1

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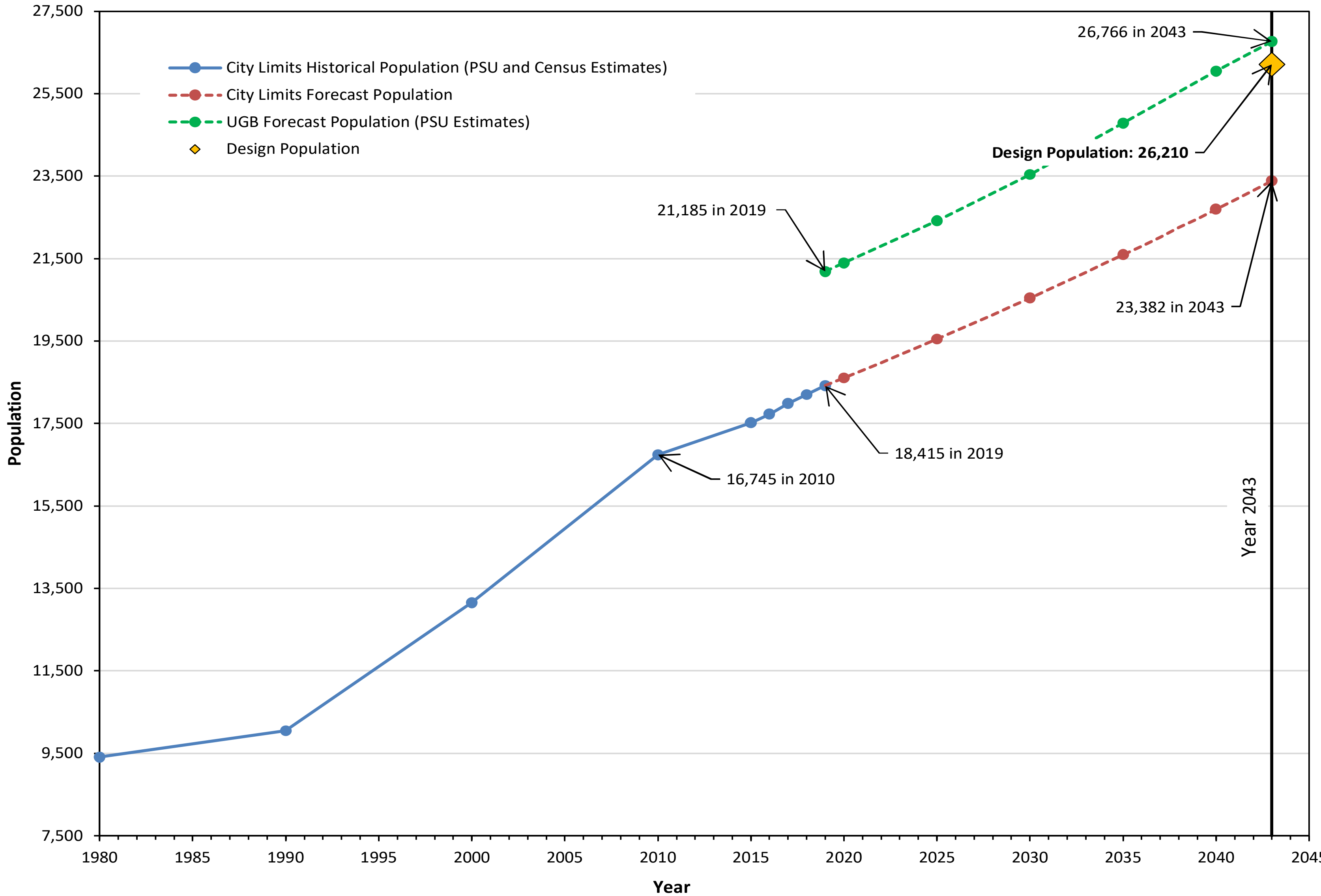

PSU = Portland State University
UGB = urban growth boundary

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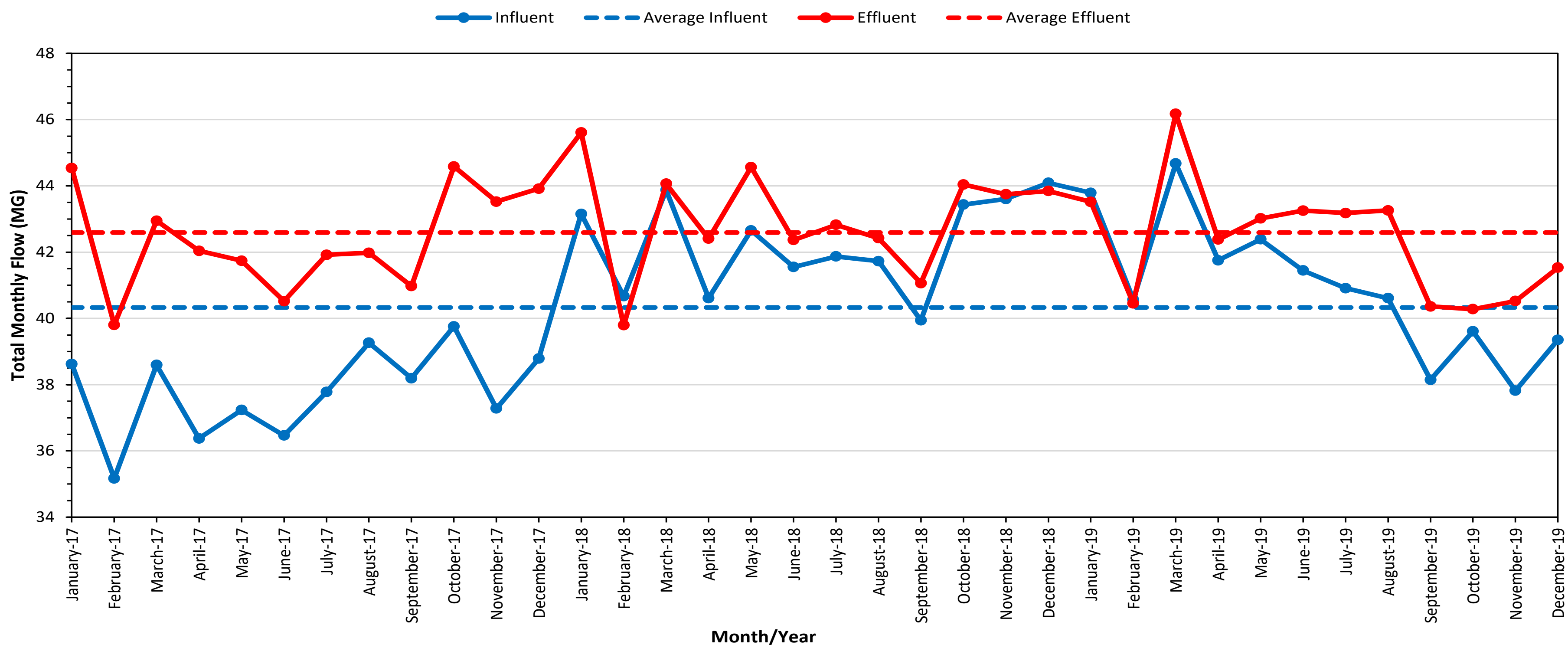
CITY OF
HERMISTON, OREGON
SANITARY SEWER COLLECTION SYSTEM STUDY
HISTORICAL AND FORECASTED POPULATION GROWTH

FIGURE 2-2



MG = million gallons

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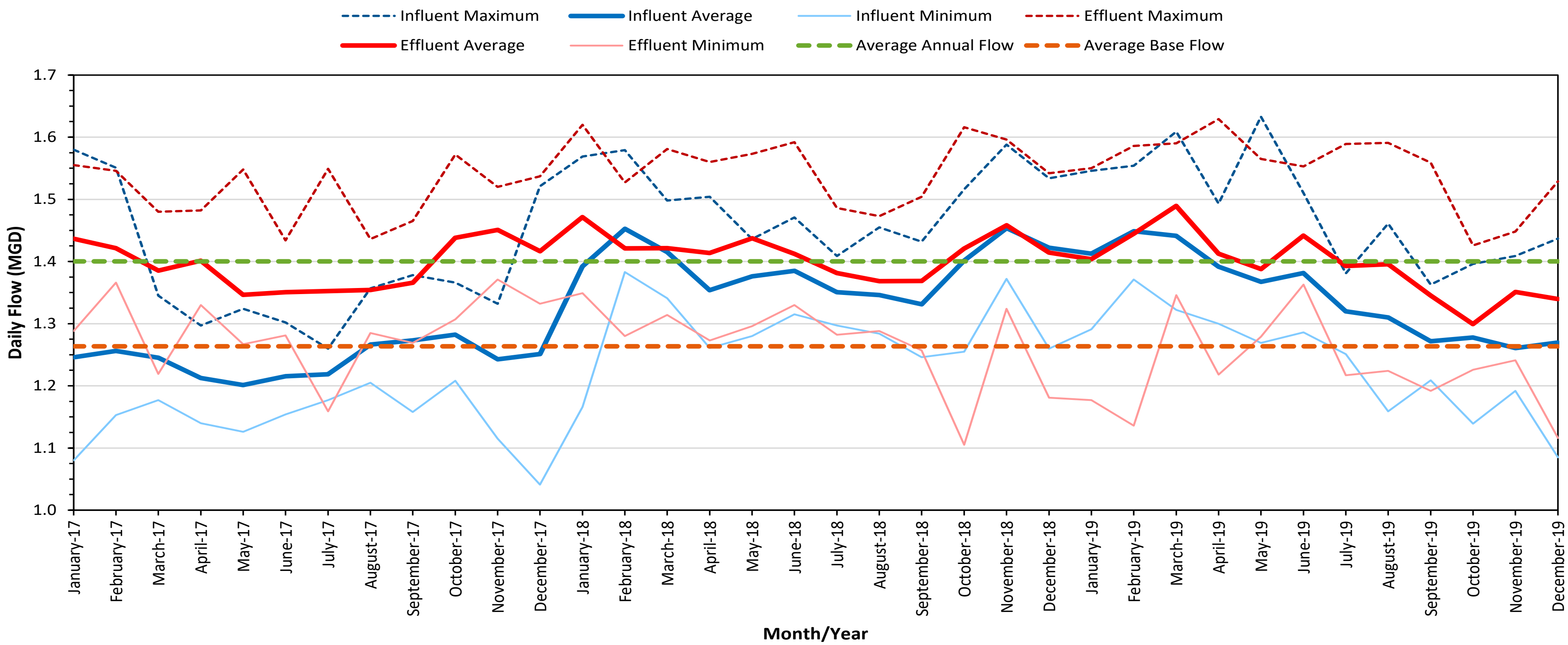
CITY OF
HERMISTON, OREGON
SANITARY SEWER COLLECTION SYSTEM STUDY

HISTORICAL SANITARY SEWER TOTAL MONTHLY FLOW

FIGURE
2-3



MG = million gallons

anderson perry & associates, inc.

CITY OF
HERMISTON, OREGON
SANITARY SEWER COLLECTION SYSTEM STUDY
HISTORICAL SANITARY SEWER
DAILY FLOW

FIGURE
2-4

CITY OF HERMISTON, OREGON
SUMMARY OF DMR DATA
JANUARY 2017 TO DECEMBER 2019

Treatment Plant Flow Summary								
Month	Influent Flow (MGD)				Effluent Flow (MGD)			
	Total	Average	Maximum	Minimum	Total	Average	Maximum	Minimum
January-17	38.624	1.246	1.580	1.080	44.538	1.437	1.555	1.288
February-17	35.169	1.256	1.551	1.153	39.805	1.422	1.546	1.366
March-17	38.595	1.245	1.345	1.177	42.946	1.385	1.480	1.219
April-17	36.375	1.213	1.297	1.140	42.040	1.401	1.482	1.330
May-17	37.235	1.201	1.324	1.126	41.739	1.346	1.548	1.267
June-17	36.466	1.216	1.302	1.154	40.520	1.351	1.434	1.281
July-17	37.778	1.219	1.260	1.177	41.921	1.352	1.549	1.159
August-17	39.263	1.267	1.357	1.205	41.978	1.354	1.436	1.285
September-17	38.194	1.273	1.378	1.158	40.974	1.366	1.465	1.269
October-17	39.757	1.282	1.366	1.208	44.584	1.438	1.572	1.307
November-17	37.282	1.243	1.332	1.115	43.524	1.451	1.520	1.371
December-17	38.787	1.251	1.521	1.041	43.914	1.417	1.537	1.332
January-18	43.152	1.392	1.569	1.166	45.610	1.471	1.620	1.349
February-18	40.669	1.452	1.579	1.383	39.793	1.421	1.527	1.280
March-18	43.871	1.415	1.498	1.341	44.066	1.421	1.581	1.314
April-18	40.614	1.354	1.504	1.261	42.406	1.414	1.560	1.273
May-18	42.657	1.376	1.436	1.280	44.564	1.438	1.573	1.296
June-18	41.550	1.385	1.471	1.315	42.366	1.412	1.592	1.330
July-18	41.870	1.351	1.409	1.297	42.824	1.381	1.486	1.282
August-18	41.728	1.346	1.455	1.284	42.419	1.368	1.473	1.288
September-18	39.940	1.331	1.432	1.246	41.064	1.369	1.504	1.257
October-18	43.434	1.401	1.516	1.255	44.041	1.421	1.616	1.105
November-18	43.605	1.454	1.588	1.372	43.748	1.458	1.596	1.324
December-18	44.092	1.422	1.534	1.260	43.846	1.414	1.542	1.181
January-19	43.790	1.413	1.546	1.291	43.519	1.404	1.550	1.177
February-19	40.566	1.449	1.554	1.371	40.453	1.445	1.586	1.136
March-19	44.676	1.441	1.609	1.322	46.172	1.489	1.590	1.346
April-19	41.753	1.392	1.493	1.300	42.380	1.413	1.629	1.218
May-19	42.387	1.367	1.633	1.269	43.018	1.388	1.565	1.279
June-19	41.445	1.382	1.510	1.286	43.254	1.442	1.553	1.363
July-19	40.911	1.320	1.381	1.251	43.179	1.393	1.589	1.217
August-19	40.611	1.310	1.461	1.159	43.259	1.395	1.591	1.224
September-19	38.148	1.272	1.363	1.209	40.360	1.345	1.559	1.192
October-19	39.608	1.278	1.396	1.139	40.278	1.299	1.426	1.226
November-19	37.818	1.261	1.409	1.192	40.525	1.351	1.448	1.241
December-19	39.354	1.269	1.437	1.085	41.531	1.340	1.529	1.116
Average:	40.327	1.326	1.455	1.224	42.588	1.400	1.539	1.264
Maximum:	44.676	1.454	1.633	1.383	46.172	1.489	1.629	1.371
Minimum:	35.169	1.201	1.260	1.041	39.793	1.299	1.426	1.105
Standard Deviation:	2.443	0.077	0.098	0.087	1.607	0.042	0.054	0.070

DMR = Discharge Monitoring Report

anderson perry & associates, inc.

CITY OF
HERMISTON, OREGON
SANITARY SEWER COLLECTION SYSTEM STUDY

SUMMARY OF DMR DATA

FIGURE
2-5

CITY OF HERMISTON, OREGON
SANITARY SEWER COLLECTION SYSTEM STUDY
DESIGN CRITERIA

	EXISTING[1,2] 2019		FUTURE 2043	
	I/I[3]	Total	I/I[4]	Total[5]
Population*		18,415		26,210
Average Base Flow (ABF), MGD[6]	----	1.264	----	1.798
Per Capita Flow, gpcd	----	69	----	69
Average Annual Flow (AAF), MGD	0.137	1.400	0.137	1.935
Per Capita Flow, gpcd	7	76	5	74
Average Dry Weather Flow (ADWF), MGD	0.117	1.381	0.117	1.916
Per Capita Flow, gpcd	6	75	4	73
Average Wet Weather Flow (AWWF), MGD	0.156	1.420	0.156	1.955
Per Capita Flow, gpcd	8	77	6	75
Maximum Month Wet Weather Flow (MMWWF), MGD	0.365	1.629	0.365	2.164
Per Capita Flow, gpcd	20	88	14	83
Peak Hour Flow (PHF), MGD[7]	----	3.781	----	7.741
Per Capita Flow, gpcd	----	205	----	295

*Population estimate and projections from the Population Research Center at Portland State University and growth experienced within the urban growth boundary. Refer to Chapter 2 for further discussion.

[1] The AAF, AWWF, and ADWF were determined by taking the average of the corresponding flows from 2017 through November 2019. Wet weather flows were estimated to occur from November through April, and dry weather flows were estimated to occur from May through October.

[2] Existing total flows are based on historical plant operating data (i.e., Discharge Monitoring Reports).

[3] The average contribution from I/I for each flow component (AAF, ADWF, AWWF, and MMWWF) was estimated by taking the difference of each of the current total flow values and the current base flow (example: average annual I/I contribution = current AAF - ABF = 1.328 MGD - 1.228 MGD = 0.100 MGD).

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

[5] Future total flow is estimated by taking the sum of the future ABF and I/I (example: AAF = 1.328 MGD + 0.100 MGD = 1.428 MGD).

[6] ABF is defined as the daily minimum flow recorded each month averaged over the three years of available data.

[7] The PHF was determined by multiplying the AAF by a peaking factor of 2.7. The peaking factor is an assumed value as no data exist that allow direct calculation to determine the value.

gpcd = gallons per capita day

MGD = million gallons per day

I/I = infiltration and inflow

Chapter 3 - Existing Infrastructure Evaluation

Introduction

The primary purpose of this Sanitary Sewer Collection System Study (Study) is to provide the City of Hermiston with guidance on how to improve the overall condition of its sanitary sewer collection system. To accomplish this, a television (TV) inspection was performed. The collection system map was updated to ensure accuracy when determining flow direction, basin areas, and system component location and connectivity. Evaluations of primary and secondary trunklines as well as the lift stations were also conducted. These evaluations helped identify areas in the sanitary sewer collection system in need of rehabilitation and/or improvements. This chapter of the Study describes and presents the results of the evaluations.

Collection System Overview

Introduction

The City's sanitary sewer collection system has some unique characteristics. The City originally installed sewer lines in residential areas in easements along back property lines to allow manholes to be accessed without disrupting traffic, reduce initial construction costs, and make construction easier. However, this practice was halted because, as residential areas were developed, the manholes were not reasonably accessible due to landscape overgrowth, fences, and other obstacles. Maintaining these lines is a burden for City personnel because they must access resident's back yards and disturb landscaping. All new sewer lines are now installed in the right-of-way to allow better access to manholes and sewer lines.

The recycled water treatment plant (RWTP) is located in the northwest corner of the urban growth boundary (UGB). Two main trunklines feed into the RWTP, one serving the west side of the City and the other serving the east side of the City. The east side consists of the City's industrial and commercial areas, as well as approximately 45 percent of the City's residential areas. The west side consists of approximately 55 percent of the City's residential areas with some commercial areas interspersed throughout. The east and west sides are broken into 37 basins, which are discussed in detail hereafter. Generally, basins are geographic areas collecting wastewater to a defined point (i.e., another basin or lift station.) Although the RWTP is located at one of the lowest areas in the UGB, the area served by the sanitary sewer collection system is relatively flat, which has made installation of lift stations necessary. Currently, the City operates nine lift stations in the system.

Basins

The City's existing sanitary sewer collection system (refer to the Existing Sanitary Sewer Collection System Map located in Appendix B) is composed of 35 major collection basins along with two additional basins designated for the east and west trunklines, referred to as E1 and W1, respectively. The west trunkline, Basin W1, collects flows from Basins W2 through W21, which serve primarily residential communities. Notable exceptions are Basins W2 and W19 through W21, which serve commercial areas in the heart of the City, and Basin W16, which serves only the Hermiston

High School. Other schools, parks, the community pool, churches, and various other buildings allowed in residential zones are intermittently distributed throughout Basins W3 through W15 and W17 through W18. The east trunkline, Basin E1, collects flows from Basins E2 through E16. Most basins are located in residential communities; however, Basin E13 encompasses the commercial and industrial park area southeast of the City as well as a large residential area on the City's south side. Basin E14 serves the Eastern Oregon Trade and Event Center (EOTEC), and there are some commercial areas within Basins E3, E7, E8, and E12. Basins E4 and E6 are small but serve commercial areas only.

System Components

A map of the City's existing sanitary sewer collection system, which identifies pipe sizes and materials, is provided in Appendix B. The original system was composed of vitrified clay pipe installed in the 1950s, with some brick and mortar manholes. As time progressed, concrete pipe and then transite (asbestos cement) pipe were added to the system followed by polyvinyl chloride (PVC) pipe. Ductile iron pipe was installed in some isolated areas. East side and west side trunklines are constructed of reinforced concrete pipe. Collection system pipe varies from 6 inches to 36 inches in diameter. Residential service lines are 4 inches in diameter. Most of the manholes throughout the City are precast concrete manholes. Nine lift stations are in operation to facilitate flow to the RWTP. The collection system contains approximately 77 miles of collection system mains, not including services, and serves an area of approximately 3,350 acres.

The original RWTP was located on the west side of the City where Lift Station 8 is now located. When the City expanded and needed additional treatment capacity, the current RWTP was constructed near the northwest corner of the UGB, and the old RWTP was converted to a lift station.

The City of Hermiston has worked to maintain and improve its sanitary sewer collection system. Recently, a new bypass pipe was installed on S.E. 7th Street. This bypass fixed a bottleneck where an 8-inch diameter section of pipe was between 10- and 12-inch sections of pipe.

Many sections of the sanitary sewer collection system are assumed to be in good condition, as the City has not had problems with the majority of the collection system's pipelines. However, with any collection system sewer, blockages occur, which are typically associated with a pipe deficiency or grease/debris buildup. A more in-depth discussion on the City's problematic pipe segments follows hereafter.

Mapping Revisions and Updates

Prior to this Study being undertaken, Anderson Perry & Associates, Inc. (AP) provided geographic information system (GIS) mapping services to the City of Hermiston. Record Drawings and City sewer maps were used in conjunction with input from the City's recycled water superintendent to create a GIS sewer map. The information contained in this GIS map was used to determine flow direction, delineate basin areas, assess pipe capacities, and help locate bottleneck lines. To use this map, AP had to ensure it was as accurate as reasonably possible. AP identified areas on the map where information was lacking and performed site visits to observe field conditions, as necessary. Based on field observations and coordination with City personnel, several areas on the map were corrected so basin areas and flows could be accurately determined.

To further increase the accuracy of the City's GIS map, the City purchased equipment that allows them to continuously update map information in the field. This equipment uses a real-time kinematic positioning technique in conjunction with the global positioning system to locate system components and structures (manholes, cleanouts, pipe segments, etc.) with a high level of accuracy. City personnel also update attribute information stored in the GIS map database. Attributes include, but are not limited to, distance from existing grade to invert, rim elevation, ownership information, component condition, etc. The location and associated attributes of a structure or component are updated on the GIS map in real time as they are collected by City personnel. This information allows the City and engineers to make educated decisions with regard to the City's collection system.

Sanitary Sewer Collection System Television Inspection

Introduction

As discussed previously, most of the City's collection system is assumed to be in good condition. However, the City periodically has sewer blockage, which typically indicate problem areas in the system. Common causes of sewer blockages are buildup of grease or debris, root intrusions, pipe sags, protruding service laterals, broken pipe segments, etc. If not addressed, sewer blockages can lead to costly repairs and can impact public safety if the blockage results in a sanitary sewer overflow (SSO).

The City tracks sewer blockages, and once a blockage occurs, the pipe segment is flagged and then cleaned. City personnel clean these lines with modern techniques and machinery to enable them to adequately restore sewage conveyance. If it is a reoccurring blockage, the City schedules cleaning of the pipe segment quarterly, and tracks these pipe segments as "semi-annual bad lines." Furthermore, if a pipe segment has more frequent sewer blockages, the pipe segment is flagged as a "monthly bad line," and the City performs cleaning on these lines monthly. Also, whenever a sewer blockage results in an SSO, the pipe segment is placed on the "monthly bad lines" list.

To address the problems associated with the bad lines, a TV inspection of the "monthly bad lines" was performed for the purpose of identifying underlying issues with the gravity mains and to develop recommendations for improvements.

Inspection Areas

Areas to be inspected were based on the City's "monthly bad lines" list. Because the City's collection system is large, inspecting all pipes would be a sizeable endeavor and cost prohibitive. Thus, newly installed pipes and old pipes with no known issues were not TV inspected. The "monthly bad lines" were strategically targeted to identify improvements that would provide the most benefit to the City's sanitary sewer collection system for the funds expended.

System Cleaning

City personnel have the resources to perform collection system cleaning, which greatly reduces the cost of inspections. Typically, cities contract with TV inspectors to clean the system prior to inspection, but in this instance City personnel were able to carry out this portion of the work. The recommended process for collection system cleaning involves the use of a high-pressure cleaning apparatus as well as a vacuum truck. The City has new equipment manufactured by Vactor, which was purchased from Owen Equipment, and older equipment manufactured by Vac-Con, Inc.

Collection system cleaning work is normally completed between two manholes or a manhole and a cleanout for one or more sections of pipe at a time. Cleaning is generally initiated at the most upstream main line pipe section for each problem line and continued in a downstream direction until the entire line has been cleaned. The cleaning apparatus, which consists of a pressure nozzle and hose, is inserted into the downstream manhole and the hose is pulled up through the sewer pipe against the direction of gravity flow using a nozzle that jets water back against the sewer pipe. Once the nozzle reaches the upstream manhole or cleanout, the water pressure is increased and the hose is reeled back to the downstream manhole. Any debris and solids removed by the cleaning process are washed to the downstream manhole and either removed with a vacuum hose, if there is a lot of debris, or washed downstream to the RWTP. Solids removed from the collection system are then disposed of in the proper manner. City personnel provided manhole numbers and a map to direct the cleaning and inspection process. The monthly cleaning process was coordinated to be in conjunction with the TV inspection of the lines. The City worked ahead of the TV inspection company to ensure that lines were as clean as possible when the TV inspections were performed. This resulted in a successful, efficient inspection of nearly all “monthly bad lines.”

Television Inspection Overview

A TV inspection of the City’s “monthly bad lines” was conducted from May 4 through May 15, 2020. To perform the inspection, the City utilized the services of River City Environmental, Inc. Personnel from the City of Hermiston, AP, and River City Environmental, Inc., assisted with the inspection work. The primary goals of the TV inspection were to identify the cause of poor flow in the lines, assess the condition of lines, and identify deficiencies including potential infiltration and inflow (I/I) sources.

The equipment used to TV inspect sanitary sewer collection system piping consisted of a waterproof camera unit mounted on a remote-controlled tractor, a closed-circuit TV monitor, and a digital recording system. The closed-circuit TV monitor, digital recording equipment, camera, and tractor controls, along with other ancillary equipment, were mounted in a box truck. The operator placed the back of the truck near a manhole and lowered the camera into the manhole and pipe. From the central control station, the operator maneuvered and adjusted the camera, viewed the image of the pipe on the monitor, and controlled the recording. Once the target section of piping had been televised, the operator winched the camera back to the truck via a cable connected to the camera unit.

The pipe sections within the collection system that were inspected are shown on the Television Inspection Map with Prioritized Recommended Improvements included in Appendix D. TV inspections occurred in lines located within Basins E3, E4, E7, E8, E10, E12, E13, E15, W6, W7, W8, W9, W11, W14, W15, W17, W18, and W20. TV inspection reports can be found in Appendix E.

Results

Most of the problem pipe sections identified for inspection and shown on the Television Inspection Map were successfully inspected between manholes with only a few encountered obstructions that prevented the camera unit from continuing. Obstructions encountered were a result of unknown bends in the pipe, protruding service lines, and excessive grease buildup.

Approximately 64 pipe sections or 15,220 feet of pipe were TV inspected. Deficiencies identified included protruding laterals, pipe sag, cracks and cavities, root intrusions, infiltration, changes in horizontal alignment without a manhole, etc. Inspected pipe sections were generally in poor condition with pipe sag being the predominant issue in nearly all lines. Runs of pipe that exhibited structural deficiencies (i.e., large cracks or missing sections of pipe) were considered high priority because these are sources of either seepage or infiltration and susceptible to further pipe degradation. Pipe sag issues were determined generally to be a medium priority repair. Concrete, transite, steel, and vitrified clay pipes generally had the majority of problems, while PVC pipe seemed to have the least. Photos of deficiencies in many of the pipes are shown in Appendix F and are referenced by location on the Television Inspection Map. The map also indicates the priority of the recommended improvements based on the inspection. Results are organized by basin and presented below. Basins without TV-inspected lines were omitted. It is recommended the City allocate funds as the budget allows to periodically TV-inspect known problem areas of the collection system. Future TV inspections may identify similar deficiencies as described below.

Basin E3

Basin E3 is located in the north-central portion of the City along E. Theater Lane and Highway 395. Two pipe sections were inspected from Manhole E3-41 to E3-39. Approximately 750 feet of pipe was inspected. Pipe sections were 8-inch PVC pipe and were in poor condition. Sags were the predominant issue in these pipe sections. Flow in many sections of the line moved only as fast as the camera, which is slower than 2 feet per second. Water level flow lines on the walls indicated that the flow depths were deeper at some point in the past. This may be due to a combination of the Hermiston Cinema, which is serviced by this line, being closed and buildup of debris in sagging areas that would obstruct flow. Due to low sloping sags, these lines are classified as medium priority (see Photo 59 in Appendix F).

Basin E4

Basin E4 is located in the north-central portion of the City along Highway 395 just west of Walmart. Four sections of pipe were inspected, with a total length of approximately 490 feet.

Two sections of 6-inch transite pipe were inspected from cleanout CO-44 to Manhole E4-1. These pipes were in extremely poor condition. Exposed, displaced gaskets were common, and cracks were found in the crown of the pipe. Sags were present, and in several instances the pipe wall was missing and sanitary sewer water was in direct contact with earth. These lines were classified as high priority and need to be repaired (see Photos 60 through 66 in Appendix F).

Two sections of pipe between Manholes E4-4 and E4-3 were also inspected. They consisted of 6-inch PVC and 6-inch transite pipe, respectively. These sections were in poor condition. Sags were the predominant issue in these pipe sections. Two offset joints were also observed. Only the first offset joint, 123 feet north of Manhole E4-2, was inspected because the camera lost traction due to grease in the PVC pipe. These pipes were classified as medium priority. Regular cleaning is recommended on a short-term basis in lieu of immediate repair of these lines (see Photo 79 in Appendix F). Opportunities for long-term replacement should be considered.

Basin E7

Basin E7 is located in the north-central portion of the City along Highway 395 just south of Walmart between E. Elm Avenue and E. Jennie Avenue. Ten sections of pipe were inspected, with a total length of approximately 2,330 feet.

Two sections of 8-inch transite pipe and three sections of 8-inch concrete pipe were inspected from Manhole E7-12 to Manhole E7-29 between E. Elm and E. Dogwood Avenues. These pipes were in poor condition. Deficiencies observed included mild joint separation, slight changes in horizontal alignment without a manhole, root intrusions, significant root intrusions within service laterals, protruding laterals, and mild to moderate sags. This line also had an abundant amount of solidified grease along the pipe sidewalls. Separated joints may lead to minor seepage. It is recommended the City contact and inform homeowners about the root intrusion problems in their service lines. The first and last sections of this line are the worst and were classified as medium priority. The other three sections are low priority. Regular cleaning is recommended on a short-term basis in lieu of immediate repair of these lines (see Photos 67 through 70, and 87 in Appendix F). Opportunities for long-term replacement should be considered.

Four sections of 8-inch concrete pipe were inspected from Manhole E7-22 to Manhole E7-30 along E. Dogwood Avenue. These pipes were in poor condition. Deficiencies observed included mild to moderate sags and protruding laterals. This line was also very greasy. A material change from concrete to PVC is located approximately 25 feet west of Manhole E7-30. The two upstream sections were classified as low priority, while the two downstream sections were classified as medium priority due to more pronounced sag issues (see Photos 71 and 89 in Appendix F).

The final section of line inspected was from Manhole E7-29 downstream to E7-30 along N.E. 4th Street. This line appeared as if it had not been cleaned. The camera pushed sedimented muck beneath the water surface up in front of the tractor. This resulted in a severe decrease in visibility unless the camera was oriented toward the crown of the pipe. Because no issues were readily apparent in the line other than sedimented muck, this pipe was classified as medium priority. Potential unseen issues could make this line a higher priority (see Photo 88 in Appendix F).

Basin E8

Basin E8 stretches from near the City Center to the City's northwest corner. Two sections of 6-inch concrete pipe were inspected. The total length of pipe inspected was approximately 480 feet.

One section of pipe is between upstream Manhole E8-15 and downstream Manhole E8-16 between N.E. 2nd and N.E. 3rd Streets. Due to an impassable protruding lateral, this line had to be inspected from both ends. Deficiencies included minor root intrusions, a section of missing sidewall that had been spot fixed with PVC, large sags, protruding laterals, significant root intrusions in two service lines, and a small cavity in the sidewall at one joint. It is recommended that homeowners associated with the root intrusions be contacted. This section of pipe was classified as medium priority because no urgent problems were present. However, because of the substantial issues, this section of pipe bordered on being classified as high priority (see Photos 80 through 85 in Appendix F).

The second section of pipe is between upstream Manhole E8-18 and downstream Manhole E8-17 between N.E. North and N.E. 2nd Streets. The only deficiencies observed were a medium sag and a protruding lateral. Due to the protruding lateral, only the most upstream 89 feet of this section was inspected. It is unknown why River City Environmental, Inc., did not inspect from the other direction against the flow. More deficiencies may be present in the uninspected portion of the line. This line was classified as medium priority (see Photo 86 in Appendix F).

Basin E10

Basin E10 is on the east end of the City along E. Diagonal Road. Two sections of 6-inch concrete pipe were inspected between upstream Manhole E10-20 and downstream Manhole E10-13. The total length of pipe inspected was approximately 290 feet.

Due to an impassable, protruding lateral only the most upstream 35 feet of line east of Manhole E10-20 was inspected, and only the first 259 feet south of Manhole E10-19 was inspected due to a change in pipe size and material to 8-inch PVC. The camera may not have been able to make it back over the lip caused by different diameter pipes. Deficiencies in these sections included large cracks, protruding laterals, large sags, obstruction in laterals, light deviations from horizontal alignment, medium sized root intrusions, holes in the sidewall, and separated joints. Large cracks and holes in the line are allowing sewer water to exfiltrate. Both sections of the line were classified as high priority (see Photos 72 through 78 in Appendix F).

Basin E12

Basin E12 is located in the south-central portion of the City from E. Main Street to E. Percy Avenue. Three sections of pipe were inspected. The total length of pipe inspected was approximately 1,090 feet.

Two sections of 8-inch concrete pipe were inspected from Manhole E12-23 to Manhole E12-39. Deficiencies observed in this line included medium to large sags, a section of bare steel pipe, and water flowing back into a low service line. It is recommended that the business owner be notified that their service lateral slopes down from where it connects to the main line before sloping back up. Both sections of pipe are classified as medium priority (see Photo 50 in Appendix F).

A single section of 8-inch vitrified clay pipe between upstream Manhole E12-53 and downstream Manhole E12-49 was inspected. This line should be replaced because it is vitrified clay, which is subject to cracking, and because of observed deficiencies that include large sags and offset joints. It is classified as high priority because of its material composition, age, offset joints, and because it is a critical part of the basin trunkline. It is also possible that structural deficiencies are beneath the water surface where the camera was inundated (see Photos 32 and 33 in Appendix F).

Basin E13

Basin E13 is located at the southeast end of the City and stretches out to include much of the industrial and commercial zoned areas within the city limits. Three sections of pipe were inspected. The total length of pipe inspected was approximately 1,070 feet.

Two sections of 10-inch vitrified clay pipe were inspected from cleanout CO-56 to Manhole E13-148 along E. Newport Avenue. Deficiencies observed included a protruding lateral, large cracks and cavities in the pipe, sags indicated by standing water, and small grout intrusions at multiple joints. Seepage is occurring at several large cracks and cavities. Due to pipe failure, this entire line was classified as high priority (see Photos 51 through 55 in Appendix F).

A single section of 8-inch transite pipe from upstream Manhole E13-123 to E13-99 running from S.E. 6th Street to S.E. 7th Street at the end of E. Pine Avenue was inspected. Deficiencies included large sags, a small root intrusion, and an egg-shaped lateral. This line was classified as medium priority (see Photos 34 through 38 in Appendix F).

Basin E15

Basin E15 is located on the east end of the City southeast of E. Diagonal Boulevard. Two sections of 8-inch cast iron pipe from upstream cleanout CO-20 to Manhole E15-54 along N.E. 9th Street were inspected. The total length of pipe inspected was approximately 430 feet. Deficiencies observed included standing water in a service line, cement lining deterioration on pipe invert exposing bare metal, and medium sags. Although there are only a few deficiencies with this line, it was classified as high priority due to bare metal being exposed to sewage flows (see Photos 39, 40, and 49 in Appendix F).

Basin W6

Basin W6 is located at the southwest corner of the City between W. Highland Avenue and S.W. Desert Oak Drive. The basin's eastern border is S.W. 11th Street. Four sections of pipe between Manholes W6-103 and W6-69 were inspected. The total length of pipe inspected was approximately 930 feet.

The two most upstream sections of inspected pipe consisted of 8-inch PVC. The next downstream section was 8-inch PVC with a transition to transite pipe approximately 233 feet east of Manhole W6-95. The most downstream section was 8-inch transite. With the exception of a small crack in the sidewall of the transite pipe approximately 340 feet east of Manhole W6-95, the only deficiencies encountered were small and medium sags. The most upstream pipe had only very small sags, so this line was classified as low priority. All other pipe sections were classified as medium priority (see Photos 9 through 13 in Appendix F).

Two downstream sections of pipe from Manhole W6-69 to Manhole W6-63 along W. Highland Avenue are known to have issues. Due to high flows, these lines were not inspected. City personnel checked flows at different times throughout the night to see if flows would decrease enough to allow inspection. The flows remained at very high levels each time they were observed. These sections of pipe remain uninspected. Considering the high amount of flows observed in this section, the pipe may be flowing at or near capacity during high flow periods.

Basin W7

Basin W7 is located in the west-central portion of the City northeast of the intersection of W. Highland Avenue and S.W. 11th Street. Two sections of concrete pipe were inspected between Manholes W7-6 and W7-8. The upstream and downstream sections consist of 6-inch and 8-inch diameter pipe, respectively. The total length of pipe inspected was approximately 550 feet.

Approximately 1 foot in from Manhole W7-6 was what appeared to be a white plastic bottle shoved into the pipe to patch a hole. A large root intrusion has since found its way in through this inadequate repair. Two other large root intrusions were observed in laterals 274 feet and 244 feet upstream from Manhole W7-8. It is recommended the City notify the homeowners of the root intrusions. One protruding lateral was observed. Several small sags were found throughout the line, and an offset joint and a joint crack were observed. The majority of the pipe was in fair condition; however, debris in the pipes indicated that the slope is probably too low. This line was classified as medium priority (see Photos 14 through 16, and 41 and 42 in Appendix F).

Basin W8

Basin W8 is located in the southwest portion of the City between W. Highland Avenue and the Maxwell Canal. It is also east of S.W. 11th Street. Four sections of 8-inch concrete pipe were inspected. The total length of pipe inspected was 1,270 feet.

One line consisting of two pipe sections is located from upstream Manhole W8-71 to downstream Manhole W8-69 between S.W. 10th Place and S.W. 10th Street. The upstream section had several laterals with minor root intrusions, but no other issues were observed. The downstream section of pipe had many medium to large sags throughout its entire length. It also had one lateral with a large root intrusion approximately 207 feet upstream from Manhole W8-69. The upstream section was classified as low priority while the downstream section was classified as medium priority (see Photo 17 in Appendix F).

Another line also consisting of two pipe sections is located from upstream Manhole W8-55 to downstream Manhole W8-16 along S.W. 9th Street. The downstream section had three protruding laterals that were not causing blockage and one lateral with a large root intrusion approximately 117 feet downstream of Manhole W8-17. Roots were not entering the main line. It is recommended the City notify the homeowner of the root intrusion in their lateral. A medium sag was observed in the upstream section of pipe. The downstream section of pipe was classified as low priority and the upstream section was classified as medium priority (see Photos 43 and 44 in Appendix F).

Basin W9

Basin W9 is located at the west end of the City south of W. Ridgeway Avenue, north of the west sanitary sewer main trunkline, and east of S.W. 11th Street. Twelve sections of pipe were inspected throughout the basin. The total length of pipe inspected was approximately 2,320 feet.

One section of 8-inch concrete pipe, approximately 238 feet long, is located between upstream Manhole W9-37 and downstream Manhole W9-40 along W. Madrona Avenue. Deficiencies observed in this line included large sags, one large root intrusion, and abrupt, small changes in slope at multiple pipe joints. Also, many small to medium root intrusions were observed at joints. Two medium to high severity root intrusions were noted at 80 feet and 122 feet downstream from Manhole W9-37. It is recommended the City notify associated homeowners of these intrusions. The flow lines on the pipe sidewalls were significantly higher than current flow levels. The flow lines indicate that, at some point in the past, water depths were approximately 80 percent of the pipe diameter in some areas. The slope of the pipe changes often, sometime giving the effect of a “roller coaster” like pipeline. Due to large root intrusions and very large sags, which have historically obstructed flow, this pipe was classified as high priority (see Photos 18 through 20 in Appendix F).

Another 8-inch concrete pipeline, approximately 577 feet long, is located from upstream Manhole W9-46 to downstream Manhole W9-47 between S.W. 11th Street and S.W. 10th Street. This line had large sags, abrupt changes in pipe slope, and sidewall deterioration with possible seepage. The flow line indicated on the pipe sidewall was higher than current flow levels but not as high as the previous line. Water depths varied from very shallow to more than half the pipe diameter. The upstream section was classified as high priority, while the downstream section was classified as medium priority (see Photos 24 through 26 in Appendix F).

An 8-inch concrete pipeline, approximately 1,068 feet long, was inspected between upstream Manhole W9-56 and downstream Manhole W9-61 along W. Orchard Avenue. The only observed deficiency in this line was large sags. Water level in the pipe varied drastically along the length of each pipe section. This was another pipe with “roller coaster” sags. Although no other issues were observed, there may be underlying issues where the flow was deep. This line was classified as medium priority; however, because sags were very large, pipe slope often varied drastically along the length of any given section, and because this is part of the basin trunkline, careful consideration should be given to repairing this pipeline. It could have been classified as high priority, but since only sag issues were found, it was classified as medium priority (see Photo 27 in Appendix F).

The section of pipe immediately downstream from the last pipeline is 10-inch concrete pipe and runs along S.W. 9th Street from Manhole W9-61 to Manhole W9-4. A very large sag was present at the upstream end of the pipe, at which point the camera was submerged. After 87 feet of submersion, the inspection was terminated. Because only sag was observed, this pipe was classified as medium priority. Two more downstream sections of 10-inch concrete pipe from Manhole W9-4 to W1-4 are known problem lines; however, they were not inspected due to high flows. City personnel checked flows at different times throughout the night to see if the flows would decrease enough to allow inspection. The flows remained at very high levels each time they were observed. These sections of pipe remain uninspected (see Photos 45 and 46 in Appendix F).

A line upstream of Manhole W9-39 that continues past Manhole W9-24 between W. Ridgeway Avenue and W. Madrona Avenue was inspected. Approximately 1 foot upstream of W9-24, the pipe had an abrupt change in horizontal alignment that was impassable for the camera; thus, only approximately 221 feet of this line was inspected. Sags were observed in the downstream section. Spalling concrete or holes in the pipe invert were also observed. Thus, the pipe was given a high priority classification. Due to the abrupt change in horizontal alignment, the upstream section of pipe was largely left uninspected and not classified (see Photos 2 through 4 in Appendix F).

The last section of pipe inspected in this basin was located from downstream Manhole W9-17 to upstream Manhole W9-18 between N.W. Logan Drive and N.W. Butte Drive. The first 57 feet of pipe north of Manhole W9-17 was inspected when an impassable protruding lateral was encountered. A very large sag was also observed that almost yielded a high priority classification; however, the line was classified as medium priority (see Photo 1 in Appendix F).

Basin W11

Basin W11 is located in the northwest portion of the City just southeast of Hermiston Butte. One section of pipe is between upstream Manhole W11-3 and downstream Manhole W11-14 just east of Ridgeway Village Apartments. Approximately 300 feet of pipe was inspected. Small to large sags were the primary issue observed, which led to a medium priority classification (see Photos 5 and 6 in Appendix F).

Basin W14

Basin W14 is located in the western portion of the City just northwest of West Park Elementary School. One section of 6-inch concrete immediately upstream from Manhole W14-12 was inspected. Due to an impassable change in horizontal alignment, the inspection was terminated 220 feet upstream of the manhole. Deficiencies observed included multiple medium to large pipe sags and root intrusions in that laterals. One large root intrusion was located approximately 168 feet upstream from the manhole. It is recommended the City notify the homeowner. This section of pipe was classified as medium priority (see Photos 22 and 23 in Appendix F).

Basin W15

Basin W15 is located in the south-central portion of the City along the Union Pacific Railroad (UPRR). Four sections of pipe were inspected. The total length of pipe inspected was approximately 870 feet.

The first section of pipe was a 296-foot-long, 8-inch diameter bare steel pipe located from upstream Manhole W15-89 to downstream Manhole W15-72 along S. 1st Street. Deficiencies observed included a crack across the invert of the pipe, small to medium sags, and offset joints. Because steel pipe should not be used as a sewer main and because seepage may be occurring through the crack, this section was classified as high priority (see Photos 30 and 31 in Appendix F).

Another line of 8-inch concrete pipe runs from upstream Manhole W15-72 to downstream Manhole W15-16 between W. Highland Avenue and W. Laird Avenue. Approximately 571 feet of pipe was inspected. Deficiencies included medium sags, protruding laterals, a small crack, minor infiltration at several joints, and a sizable root intrusion in a lateral roughly 106 feet downstream from Manhole W15-76. It is recommended the City notify the homeowner of the root intrusion in their service line. The entire line was classified as medium priority (see Photos 28 and 29 in Appendix F).

Basin W17

Basin W17 is located in the central portion of the City west of the UPRR. Three pipe sections were inspected. The total length of pipe inspected was roughly 480 feet.

One line of 8-inch vitrified clay pipe consists of two sections and runs from upstream Manhole W17-10, where Lift Station 6 discharges, to downstream Manhole W17-13. Inspection was terminated approximately 302 feet upstream of Manhole W17-12 as the camera was inundated much of the time. Medium to large sags were the predominant issue in these lines. Flow levels were higher in the downstream section of pipe, which is indicative of sag issues. This line was classified as medium priority (see Photos 47 and 48 in Appendix F).

One other section of 8-inch concrete pipe is located from upstream cleanout CO-32 to downstream Manhole W17-33 between W. Locust Avenue and W. Orchard Avenue. Approximately 51 feet of pipe was inspected before an impassable protruding lateral was reached. This section of pipe was not classified (see Photo 21 in Appendix F).

Basin W18

Basin W18 is located in the northwest section of the City east of the UPRR. One pipeline, consisting of four 8-inch concrete pipe sections, was inspected along N.W. Stockholm Street from upstream Manhole W18-25 to downstream Manhole W18-20. The total length of inspected pipe was approximately 1,080 feet. Deficiencies observed included minor root intrusions, minor cracks, and pipe sag. One lateral root intrusion approximately 72 feet downstream of Manhole W18-22 was blocking roughly half the service line. It is recommended that the homeowner be notified. This pipeline was classified as medium priority (see Photos 7 and 8 in Appendix F).

Basin W20

Basin W20 is located at the City's center and includes Hermiston City Hall. One section of 8-inch vitrified clay pipe between upstream Manhole W20-9 and downstream Manhole W20-17 was inspected. The line was somewhat greasy, and the camera unit was unable to traverse over a small joint lip approximately 270 feet downstream from Manhole W20-9. Deficiencies observed included small cracks in the pipe sidewall and small sags throughout the pipe section. At one point of shallow flow, grease flow lines on the pipe sidewall were halfway up the pipe sides, indicating that the flow depth has previously been much deeper. This is likely due to debris buildup in sags inhibiting flow and increasing flow depth. This pipe was classified as medium priority (see Photos 56 through 58 in Appendix F).

Access and Alignment

The TV inspection noted several locations where horizontal alignment changes prevented complete inspection of a run of pipe. Per Oregon Department of Environmental Quality guidelines, any change in horizontal alignment requires a manhole to properly access upstream and downstream pipe runs. Pipe bends without manhole access can be problematic and prohibit proper maintenance like navigating the TV inspection or cleaning equipment during a sewage blockage.

Protruding service laterals prevented complete TV inspection of the pipe runs. Protruding service laterals can pose operational problems for both pipe access and cleaning, as well as potential blockages.

It is recommended the City allocate funds yearly to improve access to the collection system by installing manholes at pipe bends and replacing protruding service laterals. Improved access would only be applicable to pipe runs with known alignment problems and/or pipe runs the City has not identified for replacement.

Summary/Conclusion

As expected, most of the collection system sewer lines that were TV-inspected were in poor condition. This is not an indication of the condition of the entire sanitary sewer collection system because only the "monthly bad lines" were inspected. The majority of inspected pipes were unreinforced concrete pipe. Transite, PVC, and vitrified clay pipes were also occasionally encountered. One cast iron pipe section and sections of bare steel pipe were also observed. All inspected lines presented various types of deficiencies, including offset/separated joints, root intrusions, structural cracking, infiltration, pipe cavities, holes in the pipe, and compromised structural integrity.

The primary deficiency consistently observed throughout the majority of inspected pipe sections was the presence of pipe sag. Pipe sags are created by a lack of compacted bedding material under the pipe. Pipe sags varied in severity but were often large, long, and pronounced. Pipe sags, especially when combined with shallow pipe slopes, make it difficult for water to carry solids downstream. As a result, solids get caught in sagging areas of pipe, build up over time, and obstruct flow, which increases the potential for blockage.

A few lines had large cracks and/or holes in the pipe invert and sidewall. These issues seemed to be more prevalent in vitrified clay and steel pipe sections. Seepage may be occurring in these areas, which could lead to localized contamination of groundwater. These pipes are high priority and need to be repaired.

Although TV inspections occurred in spring, a wet time of year when groundwater would be expected to be at higher levels, very little infiltration was observed. Since these are old lines with various issues, it would be expected that if infiltration were occurring, it would probably be at its worst in the pipe sections that were inspected. Since infiltration was only a minor issue in a very small number of inspected pipe sections, it is likely that the rest of the uninspected pipes in the system, which have no reported problems and are often newer, probably have very little infiltration issues.

Only a small percentage of the collection system piping was inspected because inspecting more of the system would have been cost prohibitive. Although lines the City has issues with were strategically selected to be inspected, this does not preclude the possibility that other deficiencies may exist in the uninspected portions of the collection system.

Infiltration and Inflow

Sanitary sewer collection, treatment, and disposal facilities are intended to serve the sanitary sewer needs of a community. Stormwater and groundwater are often introduced into sanitary sewer collection systems, usually through deficiencies in collection system piping and manholes or direct connections of inflow sources. This additional flow from either infiltration or inflow consumes system capacity. In cases where I/I is significant, collection, treatment, or disposal systems may need to be enlarged to account for the extraneous flows, or efforts to reduce I/I must be undertaken to restore capacity for sanitary sewer needs.

I/I in a collection system can occur during different events at different times of the year. Elevated groundwater in the Hermiston area can occur either during spring runoff periods or during the summer as irrigation in the area elevates shallow groundwater levels. During elevated groundwater periods, the collection system is susceptible to I/I if the collection system piping or structures are compromised. Specifically, the components of I/I are defined as follows:

- Infiltration - Water entering the collection system and service connections from the ground through such means as, but not limited to, defective pipes, pipe joints, and defective service line connections or manhole walls. Infiltration does not include, and is distinguished from, inflow.
- Inflow - Water discharged into a collection system and service connections from such sources as, but not limited to, roof drains, cellars, yard and area drains, foundation drains, sump pumps, cooling water discharges, drains from springs and swampy areas, manhole covers, cross connections from storm sewers and combined sewers, catch basins, stormwater, surface runoff, and street washes or drainage.
- I/I - The total quantity of water from both infiltration and inflow without distinguishing the source.

Most cities have some I/I contributing to their sanitary sewer collection systems. Excessive I/I can be a problem because these flows must be treated along with normal sewage flows and take up valuable treatment capacity at a city's treatment plant. Excessive I/I is defined as the quantity of I/I that can be economically eliminated from a collection system by rehabilitation or other means, as determined by a cost analysis that compares the cost effectiveness of correcting the I/I conditions with the total cost for transportation and treatment of I/I.

For projection purposes, it was assumed the current I/I flows experienced in the system would remain constant throughout the design period. Year 2043 I/I flows were not decreased for the following reasons:

- The nature of I/I corrective work in general is such that it is difficult to accurately predict future success.
- The magnitude of the City's I/I is such that results may not be seen for an extended period of time.

The U.S. Environmental Protection Agency (EPA) "Guide for Estimating Infiltration and Inflow," (Guide) dated June 2014, provides methods for analyzing RWTP influent data to estimate the I/I impact from the collection system. However, the data needed to follow the EPA methods outlined in the Guide were not available, nor does the City have the resources or equipment to collect the data needed. Therefore, the EPA requirements for estimating I/I per the Guide cannot be met.

As part of the EPA Water Infrastructure Outreach Program, guidelines for I/I evaluation were developed. One specific guideline developed with this program states “no further infiltration/inflow analysis will be required if domestic sewage plus non-excessive infiltration does not exceed 120 gallons per capita day (gpcd) during periods of high groundwater, and if the total daily flow during a storm does not exceed 275 gpcd, and there are no operational problems such as surcharges, bypasses, or poor treatment performance resulting from hydraulic overloading of the treatment works during storm events.”

The average annual flow (AAF), as discussed in Chapter 2, is 1.400 million gallons per day (MGD) (76 gpcd, which is calculated by dividing 1.400 MGD by the 2019 population of 18,415). The amount of I/I was estimated by subtracting the annual base flow (1.264 MGD) from the AAF (1.400 MGD), equating to approximately 0.137 MGD.

The maximum month wet weather flow of 1.629 MGD, recorded in April 2019, resulted in a flow of 88 gpcd, which is significantly lower than the 275 gpcd allowed by the EPA for total daily flow during a storm. The maximum average monthly flow was 1.489 MGD in March 2019, which equates to approximately 81 gpcd. The City’s per capita flows are significantly less than values allowed by the EPA guidelines, so no further infiltration analysis work is suggested for implementation at this time.

City personnel provided information on suspected problem areas in the collection system. No known areas of I/I were known to the City, but many collection system pipe sections with structural or conveyance deficiencies were identified. These lines are cleaned monthly to mitigate problems. Any other atypical problems are handled on a case-by-case basis.

TV inspection of the lines with known structural or conveyance deficiencies was performed, as previously discussed in the Television Inspection Overview section of this chapter. Inspections were performed in April 2020 when high water table elevations would be anticipated due to spring runoff. It rained on several of the days during the TV inspection process. Because these lines had many other deficiencies (cracks, cavities, holes, separated joints, root intrusions, etc.), and because elevated groundwater tables were likely, infiltration occurrences were more likely to be present in these problem lines than in the rest of the sanitary sewer collection system. However, infiltration was found in only one pipe section of the 64 pipe sections inspected. This is further evidence that I/I is not a significant issue in Hermiston’s collection system.

One source of inflow the City is aware of is the Hermiston Family Aquatic Center just north of Hermiston Butte on W. Elm Avenue. The aquatic center was constructed in 2004 and discharges to the sewer system several times per day during its regular cleaning cycle. This contributes to the average monthly flows during summer months and causes Lift Station 6 to temporarily exceed capacity before it catches up with the inflow surge. It is not typical to discharge pool water to sanitary sewer collection systems because it can often be discharged to storm systems such as swales or drywells. As the City expands and utilizes more of the RWTP capacity, it is recommended that means and methods to eliminate this inflow source be evaluated.

Other than the identified point source inflow, it does not appear that I/I is excessive in Hermiston’s collection system, and City operators do not suspect that I/I is a significant contributor to daily flows. However, the identification of I/I sources and their removal from the system through manhole and pipeline repair could reduce the total volume of water the City must treat and dispose of. This reduction could provide a cost savings to the City depending on the cost benefit of repairing sources of I/I.

Manhole Inspections

Inspections of individual manholes within the general area of the TV-inspected “monthly bad lines” were planned to be performed concurrently with TV inspections; however, a verbal report from City personnel indicated that only a few manholes were spot checked. City personnel determined these manholes were in good shape and decided not to inspect the rest of the manholes adjacent to TV-inspected lines. Instead, City personnel requested that the TV inspection company notify them of any manhole deficiencies encountered. No comments were received from the TV inspection company regarding manhole deficiencies. However, because manhole inspection was outside of the TV inspection company’s scope of work, manhole conditions could be further evaluated.

AP has reviewed the TV inspection videos. Although the TV inspection company did not specifically film manholes, portions of manholes were often visible in the videos. No deficiencies were observed in the limited amount of video showing manhole interiors. Although no deficiencies were observed, several manholes were observed as having concrete masonry block sidewalls. This is an old construction method that has not been recommended in the industry for many years. The age and construction type of these manholes may warrant the installation of new precast concrete manholes as future repairs to pipelines are made.

Lift Station Evaluations

Nine sanitary sewer lift stations are located in the City of Hermiston. Lift Stations 1, 5, 10, and 12 serve the east side of the sewer system, while Lift Stations 3, 4, 6, 7, and 8 serve the west side. Lift Station 12 serves the area around the EOTEC. Lift Station 1 is the primary lift station for the east side and Lift Station 8 is the primary lift station for the west side. Lift Stations 1 and 8 have three operational pumps while the remaining lift stations have only two pumps. Lift station age, pump operation hours, telemetry system, level sensing system, and control systems vary. Below is a description and evaluation of each lift station.

Lift Station 1

Lift Station 1, also known as “East Side,” was constructed in 1981 and is located on the east end of Hermiston at the intersection of E. Diagonal Boulevard, N.E. 7th Street, and E. Main Street. Lift Station 1 is the primary lift station for the City’s eastern sanitary sewer trunkline and pumps all the sanitary sewer water from Basins E10 to E16 north to Manhole E1-10 near the intersection of E. Sunset Drive and N.E. 7th Street. Lift Station 1 consists of a wetwell and a drywell. Wetwell capacity at its high level is approximately 18,600 gallons. A building above the drywell houses control equipment.

Three centrifugal pumps are located on the bottom floor of the drywell. The pumps are 3-phase, 60-hertz (Hz) pumps manufactured by Crane Demming. The smaller 10 horsepower (Hp) jockey pump is rated to pump 250 gallons per minute (gpm) against 45 feet of total dynamic head (TDH), and the two larger 25 Hp pumps are rated to pump 1,200 gpm against 49 feet of TDH.

Pumps are operated based on wetwell water levels, which are sensed by a purged-air, liquid level controller. Telemetry monitoring previously used an old auto-dialer system to notify City personnel when problems were detected. The City has replaced this old system with a new wireless communication system that transmits alarms directly to the RWTP, which are then routed by phone to appropriate City personnel.

Auxiliary power is provided by a 125 kilovolt-ampere (kVA), 3-phase, 60-Hz, synchronous alternating current generator located within the lift station building. It outputs 100 kilowatts (kW) and has a fuel tank capacity of 550 gallons. When the power goes out, the transfer switch automatically changes the power source to the generator. The City has purchased a new natural gas generator, which is anticipated to be installed in fall 2020.

Lift Station 1 has been maintained by City personnel and is cleaned approximately once every six months. All pumps have been rebuilt at some point, and motors and drive lines have been repaired or replaced. The jockey pump was replaced with a new pump in June 2020. As part of maintaining the lift station, the City has purchased a new set of valves including one intake plug valve, one check valve, and one discharge plug valve per pump for a total of nine valves. Two new large pumps have been purchased, along with three new sluice gates that control which chamber of the wetwell water is diverted to. Additionally, an air scrubber has been purchased to eliminate odors to allow air to be discharged from the building. The equipment, fittings, and valves are anticipated to be installed in fall 2020.

Lift Station 3

Lift Station 3 was constructed prior to 1970 and is located on Highway 395 just north of W. Ridgeway Avenue. Lift Station 3 pumps all the sewage from Basin W21, which is small and only includes approximately ten businesses, approximately 190 feet south to Manhole W20-1 on Highway 395 just south of W. Ridgeway Avenue. Lift Station 3 consists of a single chamber wetwell with no drywell. Wetwell capacity at its high level is approximately 200 gallons. Controls are located on the northwest corner of the intersection of Highway 395 and W. Ridgeway Avenue.

The wetwell houses two duplex, self-priming, constant speed, submersible pumps designed to pump against 23 feet of TDH. The design pump rate is unknown and was not tested due to limited access to the wetwell and safety reasons related to traffic control on Highway 395.

Pumps are operated based on information collected by a MultiTrode level sensing probe. Telemetry monitoring utilizes an auto-dialer system from Stead and Baggerly, Inc., to notify appropriate City personnel of alarms. No auxiliary power is available at this lift station. However, the lift station has very few services and a large wetwell capacity. Therefore, the pumps can be offline for a significant amount of time before a SSO would occur. Pumps at this lift station have very low run times.

Lift Station 3 has been maintained by City personnel and is cleaned approximately once every six months. Several years ago one pump was inoperable, but it has since been removed, rebuilt, and reinstalled. Access to the lift station for maintenance is a safety issue since the lift station wetwell is located in the southbound travel lane of Highway 395.

Lift Station 4

Lift Station 4 was rebuilt in 1989 and is located on the west side of the City at the intersection of W. Ridgeway Avenue and N.W. Butte Drive. Lift Station 4 pumps all the sewage from Basin W11 south to Manhole W9-12. Wetwell capacity at its high level is approximately 350 gallons. The wetwell consists of concrete masonry unit blocks. Controls are located on the surface adjacent to the wetwell.

Two duplex, self-priming, constant speed, submersible pumps are housed in the wetwell. Although documented pump rates were not discovered, a drawdown test indicated that the pumps provided a flow of approximately 170 gpm.

The water level is controlled with a level sensing probe, which provides information that determines when pumps run. Telemetry monitoring utilizes an auto-dialer system from Stead and Baggerly, Inc., to notify appropriate City personnel of alarms. No auxiliary power is available at this lift station. However, the wetwell capacity appears to be adequate to contain sewage flows during a predictable power outage.

The City cleans this wetwell approximately once every six months and provides maintenance on an as-needed basis. Due to degraded internal piping and valves, operation of the pumps can be problematic. Maintenance personnel have provided temporary fixes to the internal piping, but the lift station and forcemain have surpassed their design life.

Lift Station 5

Lift Station 5 was constructed in 1961 and rebuilt in 1982. It is located on the east side of the City at the intersection of E. Diagonal Boulevard and N.E. 10th Street. It pumps all the sewage from Basins E15 and E16 approximately 3,100 feet southwest along E. Diagonal Boulevard to Manhole E10-9. Lift Station 5 consists of a single chamber wetwell with no drywell. Wetwell capacity at its high level is approximately 400 gallons. Controls are located on the surface adjacent to the wetwell.

The wetwell houses two duplex, self-priming, constant speed, submersible pumps designed to pump against approximately 16 feet of TDH. Drawdown tests indicated a pumping rate of approximately 350 gpm for each pump.

Pumps are operated based on information collected by a level sensing probe. Telemetry monitoring utilizes an auto-dialer system from Stead and Baggerly, Inc., to notify appropriate City personnel of any issues. No auxiliary power is available at this lift station. However, the wetwell capacity appears to be adequate to contain sewage flows during a predictable power outage.

Lift Station 5 has been maintained by City personnel and is cleaned approximately once every six months. The level sensing probe has been replaced twice in the past and appears to be operating correctly. Hydrogen sulfide gases generated by the disturbance of the sewer water have caused some deterioration of the wetwell’s wall surfaces. A PVC drop bowl and pipe were installed several years ago to mitigate the problem. The motor was rebuilt in 2017 when amperage overdraw was detected. The probe is cleaned on a weekly basis.

Lift Station 6

Lift Station 6 is located on the west side of the City at the intersection of N. 1st Street and W. Ridgeway Avenue. Lift Station 6 pumps all the sewage from Basin W18 south along N. 1st Street to Manhole W17-10. Lift Station 6 consists of a single chamber wetwell, whose base is approximately 25 feet below grade, with a 10-foot deep drywell. Controls are located on the northwest corner of the intersection.

The wetwell houses two duplex, self-priming, constant speed, submersible pumps designed to pump against approximately 23 feet of TDH. Drawdown tests indicated a pumping rate of approximately 75 gpm for each pump.

Pumps are operated based on information collected by an ultrasonic level sensor that replaced old level sensing equipment. Telemetry monitoring utilizes an auto-dialer system from Stead and Baggerly, Inc., to notify appropriate City personnel of any alarms. No auxiliary power is available at this lift station. However, the wetwell capacity appears to be adequate to contain sewage flows during a predictable power outage.

Lift Station 6 has been maintained by City personnel and is cleaned approximately once every six months. Major clogging due to rags occurs approximately once per year and is a recurring issue. Hydrogen sulfide gases generated by the sewage create a corrosive environment. Many electrical components are housed below grade in the corrosive environment and need to be relocated to the surface.

Lift Station 7

Lift Station 7 is located on the west side of the City on the west side of N.W. 11th Street between W. Juanita Avenue and W. Hartley Avenue. Lift Station 7 pumps all the sewage from Basin W10 south along N.W. 11th Street to Manhole W9-36. Lift Station 7 consists of a single chamber wetwell with a small drywell directly above it that rises a short distance above the sidewalk. Wetwell capacity at its high level is approximately 400 gallons. Controls are located on the surface adjacent to the wetwell and drywell.

The wetwell houses two duplex, suction lift, vacuum-primed, constant speed pumps. Drawdown tests indicated a pumping rate of approximately 60 gpm for each pump.

Pumps are operated based on information collected by a level sensing probe. Telemetry monitoring utilizes an auto-dialer system from Stead and Baggerly, Inc., to notify appropriate City personnel of any alarms. No auxiliary power is available at this lift station. However, the wetwell capacity appears to be adequate to contain sewage flows during a predictable power outage.

Lift Station 7 has been maintained by City personnel and is cleaned approximately once every six months. The level sensing probe is cleaned weekly. Hydrogen sulfide gases generated by the sewage create a corrosive environment. Some electrical components are housed in the drywell where this corrosive environment exists. These components need to be relocated to the surface to prevent corrosion. Clogging due to rags is a recurring issue at this lift station. The installation of a submersible chopper pump has been discussed but has not occurred. Access to the wetwell has also been an issue for maintenance personnel. The entrance from the drywell to the wetwell is small and is crowded by internal piping and equipment. The drywell itself is partially encased in a concrete cylinder that rises above the sidewalk. The configuration of the drywell would need to be changed to improve access.

Lift Station 8

Lift Station 8, also known as “West Side,” was constructed in 1980 and is located on the west end of the City at the northeastern corner of Harrison Park. Lift Station 8 is the primary lift station for the City’s western sanitary sewer trunkline and pumps all sewage from Basins W3 to W21 north through approximately 3,300 feet of 12-inch Class 50 ductile iron pipe to Manhole W1-23 on W. Elm Avenue Extension. Lift Station 8 consists of a wetwell and a drywell. A building above the drywell houses control equipment.

Three 6-MVF-15, centrifugal, vertical, variable speed, single-stage, dry pit-type pumps with non-clogging impellers are located on the bottom floor of the drywell. The pumps are 3-phase, 480-volt (V), 60-Hz pumps manufactured by the Worthington Pump Corporation. Each is rated at 30 Hp with a design pump rate of 900 gpm against 74 feet of TDH. Although the pumps are supposed to be variable speed, some issues with the control system cause the pumps to run at their maximum capacity for all but the first and last few seconds of a run cycle. Attempts have been made to diagnose and fix these issues, but they have been unsuccessful.

Pumps are operated based on wetwell water levels that are sensed by a purged-air, liquid level controller. The control system is a CD-3000-SLB-A Peabody Flomatcher. Telemetry monitoring utilizes an old auto-dialer system by Stead and Baggerly, Inc., to notify City personnel when problems are detected.

Auxiliary power is provided by a 164 kVA, 480-V, 3-phase, 60-Hz diesel generator located on the first floor of the lift station building. It outputs 135 kW and has a fuel tank capacity of 550 gallons. When the power goes out, the transfer switch can automatically change the power source if the engine control switch is set to automatic. The switch can be set to manual if needed. The City has purchased a new natural gas generator that is anticipated to be installed in fall 2020.

Lift Station 8 has been maintained by City personnel and is cleaned approximately once every six months. The wetwell appears to be in good condition. An intake plug valve on Pump 1 has been replaced. Three discharge plug valves, three check valves, and two intake plug valves are on the City’s list to be replaced, but funds to purchase the replacement parts have not been made available. Because the control system does not allow pump speeds to vary, upgrades to the pump control system, potentially with new variable frequency drives (VFDs), are needed to replace the current system. New motors may be required when the VFDs are purchased and installed.

Lift Station 10

Lift Station 10, one of the newer lift stations, is located on the far east side of the City at the southwest corner of Highland Summit Park. Lift Station 10 pumps all the sewage from Basin E16 approximately 20 feet southwest to Manhole E15-7. Lift Station 10 consists of a single chamber wetwell. Controls are located on the surface adjacent to the wetwell.

The wetwell houses two duplex, self-priming, constant speed, submersible pumps. Drawdown tests indicated a pumping rate of approximately 240 gpm for each pump.

Pumps are operated based on information collected by a level sensing probe. Telemetry monitoring utilizes an auto-dialer system to notify appropriate City personnel of any issues. No auxiliary power is available at this lift station. However, there appears to be adequate wetwell capacity to contain sewage flows during a predictable power outage.

Lift Station 10 has been maintained by City personnel and is cleaned approximately once every six months. Hydrogen sulfide gases generated by sewage have caused some deterioration of the wetwell's wall surfaces. A PVC drop bowl and pipe were installed to mitigate further corrosion.

Lift Station 12

Lift Station 12 was constructed in 2015 and is located north of the EOTEC. Lift Station 12 pumps all the sewage from Basin E14 southwest to Manhole E13-159. Lift Station 12 consists of a single chamber wetwell. Controls are located on the surface adjacent to the wetwell.

The wetwell houses two duplex, self-priming, constant speed, Vaughn E-Series submersible chopper pumps. Drawdown tests indicated a pumping rate of approximately 240 gpm for each pump.

Pumps are operated based on information collected by a sensor float control switch. Telemetry monitoring utilizes a wireless communication system that transmits alarms directly to the RWTP, which are then routed by phone to appropriate City personnel. Auxiliary power is available at this lift station.

Lift Station 12 has been maintained by City personnel and is cleaned approximately once every six months. The telemetry system did not work properly in the past due to coding logic issues, which have since been resolved. During the summer months, a small air conditioning unit often must be used to keep components cool.

Lift Station Evaluation Summary

The lift stations were found to be in generally good condition; however, some critical issues need to be addressed. Lift Station 4 has a compromised forcemain that needs repaired or replaced. Valves and pumps in various lift stations need to be repaired or replaced. The City already has plans to replace several old pumps and valves in Lift Stations 1 and 8, as well as replacing the existing emergency generators with two natural gas generators. Telemetry is an issue at nearly all lift stations except Lift Stations 1 and 12, which have modern telemetry equipment installed. Other lift stations need the old Stead and Baggerly, Inc., auto-dialer systems updated to modern wireless systems. Additionally, the City would like to replace some of the level sensors with ultrasonic level sensing devices. These devices require less maintenance and typically have fewer issues.

Summary

Chapter 3 has outlined the overall inspection of the City's existing sanitary sewer collection system. Basins were identified and used to determine flows through the collection system. Mapping updates were completed as part of the Study. An evaluation of the City's problem area pipelines was presented, which found that most of the inspected pipes had sag issues. Other issues including protruding laterals, root intrusions, minor infiltration, holes in the pipe sidewall, etc., were identified. An evaluation of the collection lift stations was completed. The next chapter provides a current and future capacity evaluation of the trunklines and lift stations.

Chapter 4 - Capacity Evaluation

Introduction

Lift station and pipelines are critical infrastructure in transporting sewage to the recycled water treatment plant (RWTP). As Hermiston continues to grow, lift station and pipe flows will also increase. To verify that the existing collection system may be able to convey anticipated future flows, analyses were performed on lift station and sewer system collection piping to provide insight and recommendations on where improvements to the sewer system may be considered.

Trunkline Service Capacities

The City's sanitary sewer collection system conveys sewage to the RWTP through pipes of various materials, diameters, and slopes. These three variables, combined with water depths, are utilized with Manning's equation for gravity flow pipes to determine flow capacity.

The primary purpose of analyzing collection system pipe capacity is to determine where and when improvements will need to be made. In collaboration with City personnel, it was determined the sanitary sewer collection system primary and secondary trunklines should be analyzed. Secondary trunklines were selected and analyzed for each basin. Two main trunklines were analyzed: one collecting and conveying flows from the east basins to the RWTP, the other collecting and conveying flows from the west basins to the RWTP. See Appendix G for a summary of trunkline capacity analyses.

To analyze primary and secondary trunklines, several variables had to be determined or assumed. Pipe material was obtained from the City's geographic information system (GIS) database. Appropriate Manning's n values were then selected based on pipe material type. Flow depth directly correlates to flow, so it was assumed that pipes reached capacity when water depths reached 80 percent of the pipe diameter. The pipe is capable of higher flows when depths exceed this value, which means that calculated capacities have some factor of safety. Assumed depths along with the pipe diameters obtained from the City's GIS database enabled the cross-sectional flow area and hydraulic radius to be determined.

The slope was the final variable needed for input into Manning's equation. Because slopes could not always be determined from the City's GIS database, minimum pipe slopes were used in accordance with the Oregon Department of Environmental Quality's guidelines. If calculated required flow in a pipe was less than the flow capacity of the pipe at minimum slope, then pipes with greater slopes will not exceed pipe capacity and no further analysis is required. If a pipe at minimum slope exceeds capacity, then slopes from the GIS database were used if available.

To analyze pipes, capacities must be compared to their expected future flow. Because most of the City of Hermiston has a fairly consistent intermixture of residential and commercial areas, flows were based on basin areas. The only known flow data points were at lift stations and the RWTP. Known flows at lift stations were divided by the area of the upstream basins to determine a reasonable flow in gallons per acre per day (GPAD). The results indicated that most areas in the City experienced flows from approximately 410 to 460 GPAD. A reasonable value of 450 GPAD was used to determine sewer flow. This value was applied to areas that will be developed in the future and to some existing basin areas where flow could not be determined using lift station data.

Although many basin trunklines will experience increased flow as the City grows and provides additional sewer services, many basins are not expected to experience increased flows over time as a result of being landlocked by other basins or geographical features, or because future sewer development adjacent to the basin is not expected to connect to sewer lines within the basin. Basins in which little to no increased flows are expected with time include Basins E2, E4, E6 to E9, E11, E14, W3, W5, W7, W9 to W14, and W16 to W21. No capacity analysis was performed for the trunklines within these basins because no change in flow is expected to occur; total flow from the basin was still calculated because these flows must drain through other basins or trunklines and those flows are expected to increase over time. Below is a summary of the analysis of each primary and secondary trunkline expected to experience increased flow over time.

East Side Trunklines

Basin E1/East Trunkline

Basin E1/east trunkline represents the City's eastern sanitary sewer trunkline. The east truckline consists of reinforced concrete pipe, with diameters ranging from 15 to 36 inches. The trunkline begins at upstream Manhole E1-10 and flows downstream to the RWTP, collecting flows from eastern basins along the way.

In addition, several areas will eventually be developed that will connect directly to the trunkline. These areas will become new basins in the future. The first area is located west of N.E. 10th Street between E. Elm Avenue and E. Diagonal Boulevard. This area is approximately 39 acres in size and is projected to contribute approximately 17,400 gallons per day (gpd) to the trunkline flow. The second area is located between E. Theater Lane and E. Elm Avenue up to the urban growth boundary (UGB). This area is approximately 92 acres and is projected to contribute approximately 41,300 gpd to the trunkline flow. The third area is north of W. Theater Lane, west of Basin E2, and east of the Union Pacific Railroad (UPRR). This area is approximately 181 acres and is projected to contribute approximately 81,600 gpd to future flows. The last area is located north of McConnell and W. Nelson Lanes, east of N.W. Perez Lane, and west of the eastern primary trunkline. This area is approximately 46 acres and is projected to contribute approximately 20,700 gpd to future flows. Total additional future flows from this basin's future developed area may be up to approximately 161,000 gpd.

Analyzing this primary trunkline at a minimum slope with combined existing and future flows shows that most pipes have adequate capacity to accommodate future projected flows, with pipe flows ranging from 30 percent to 50 percent of capacity. The four most upstream pipe sections exceeded assumed pipe capacity by 57 percent when minimum slope was used; however, ground slopes are high in this area, with the trunkline flowing downhill, indicating that pipe slopes are probably greater than recommended minimums. Using the City's GIS data, actual pipe slopes were approximated and used to recalculate capacity utilization for the four most upstream pipe sections. At calculated slopes, the capacity utilization of these pipe sections drops to values that range from 22 to 31 percent. Therefore, based on the assumptions noted herein, it appears that the primary trunkline can adequately convey existing and future flows.

Basin E3 Trunkline

Basin E3 trunkline is located in the north-central portion of the City along E. Theater Lane and Highway 395. The trunkline consists of 8-inch transite pipe. The trunkline begins at upstream Manhole E3-39 and flows through the basin into the primary western trunkline at Manhole E1-29.

The area north of the basin up to the UGB has the potential to be developed in the future. When developed, this approximately 118-acre area is expected to contribute approximately 53,000 gpd to the basin's existing flows. Analyzing this trunkline at minimum slope with combined existing and future flows shows that the pipes appear to be adequate at 52 percent of capacity.

Basin E5 Trunkline

Basin E5 trunkline is located in the northeast corner of the City from primarily east of N.E. 4th Street and north of the Hermiston Ditch. The trunkline consists of 12- and 24-inch polyvinyl chloride (PVC) pipe. The trunkline begins at upstream Manhole E5-18 and flows through the basin into the primary western trunkline at Manhole E1-25.

The area north of the basin up to the UGB, the area east of the basin and north of E. Theater Lane up to the UGB, as well as a handful of properties just south of E. Theater Lane, have the potential to be developed in the future. When developed, this approximately 604-acre area is expected to contribute approximately 271,600 gpd to the basin's existing flows. Analyzing this trunkline at minimum slope with combined existing and future flows shows that the pipes appear to be adequate, ranging between 22 and 66 percent of capacity.

Basin E10 Trunkline

Basin E10 trunkline is on the east end of the City along E. Diagonal Road. The trunkline is composed of 8-inch pipe consisting of PVC, concrete, and vitrified clay. The trunkline begins at upstream Manhole E13-141 and flows through the basin into downstream Lift Station 1.

Although no area will be developed that will flow directly to this basin, all existing and future flows from Basins E12 to E16 will flow through at least part of this trunkline. Analyzing this trunkline at minimum slope with combined existing and future flows shows that all analyzed pipe sections appear to be undersized, with pipes flows ranging from 195 to 235 percent of capacity. The entire trunkline is projected to have inadequate capacity to convey future flows.

Basin E12 Trunkline

Basin E12 trunkline is located in the south-central portion of the City, from E. Main Street to E. Percy Avenue. The trunkline is composed of 8-inch pipe consisting of PVC, concrete, and vitrified clay. The trunkline begins at upstream Manhole E12-9 and flows through the basin into downstream Manhole E13-142.

The area south of the basin up to the UGB has the potential to be developed in the future. When developed, this approximately 214-acre area is expected to contribute approximately

96,000 gpd to the basin's existing flows. Analyzing this trunkline at minimum slope with combined existing and future flows shows that the pipes appear to be adequate, ranging between 61 and 88 percent of capacity.

Basin E13 Trunkline

Basin E13 trunkline is located at the southeast end of the City and stretches southeast to include much of the industrial and commercial zoned areas within city limits. The trunkline consists of 10-inch transite, 10-inch concrete, and 12-inch PVC pipe. The trunkline begins at upstream Manhole E13-51 and flows through the basin downstream to Manhole E13-141. Although more of the trunkline is located farther upstream, it was not analyzed because the upstream area is the City's large industrial and commercial zoned area. Because sewer flows can vary greatly depending on the businesses developed in the area and because it is extremely difficult to predict business development, the sewer collection system should be analyzed on a case-by-case basis.

Although the sewer collection system was not analyzed for future flows, current flow was predicted based on business type to determine how much capacity is currently utilized by this area. Using Oregon Administrative Rules 340-071-0220, Table 2, which provides estimated flows based on business type, a flow of 40,000 gpd was predicted to come from this area.

The area south of E. Highland Avenue and west of S.E. 10th Street has the potential to be developed in the future. When developed, this approximately 170-acre area is expected to contribute approximately 76,400 gpd to the basin's existing flows. Analyzing this trunkline at minimum slope with combined existing and future flows, but not including future flows from the commercial and industrial zones, shows that the pipes appear to be adequate, ranging between 14 and 93 percent of capacity. Because a few runs of pipe are nearing capacity at 93 percent, it is recommended further analysis be completed as development occurs.

Basin E15 Trunkline

Basin E15 trunkline is located on the east end of the City, southeast of E. Diagonal Boulevard. The trunkline consists of 8-inch PVC, 8-inch concrete, and 18-inch PVC pipe. The trunkline begins at upstream Manhole E15-7 and flows through the basin into downstream Lift Station 5.

The area south of Basin E16 and north of E. Highland Drive has the potential to be developed in the future. When developed, this approximately 225-acre area is expected to contribute approximately 101,200 gpd to the basin's existing flows. Increased future flow from Basin E16, as discussed hereafter, was also included as Basin E16 flows into Basin E15. Analyzing this trunkline at minimum slope with combined existing and future flows shows ten sections of pipe with inadequate capacity to convey future flows, with pipes exceeding capacity by 1 to 37 percent. Pipes exceeding capacity are 8-inch PVC and 8-inch concrete from upstream Manhole W15-12 to downstream Manhole W15-53. The most upstream pipe section sees flow only from Basin E16 through Lift Station 10. It can handle future flows, as shown in the Basin E16 trunkline analysis. All other pipes have acceptable capacities, with pipe flows ranging from 25 to 28 percent of capacity. These pipes performed well because of their larger (18-inch) diameter.

The area south of E. Theater Lane, east of N.E. 10th Street, west of the UGB, and north of the Field of Dreams baseball diamonds also has the potential to be developed. When developed, this approximately 470-acre area is expected to contribute approximately 212,800 gpd to the basin's existing flows. These flows will not flow through the existing basin trunkline. It is likely that a future lift station will pump this sewage to Manhole E15-44 on the north end of the basin. The pumped sewage will then travel through one pipe section to Lift Station 5. This single pipe section is 10-inch PVC and, when analyzed with future flows, yields a capacity utilization of 78 percent. This pipe section appears to be adequate to convey future flows.

Basin E16 Trunkline

Basin E16 trunkline is located east of Sandstone Middle School, north of E. Main Street, west of S. Townsend Road, and south of N.E. Misty Drive. All sections of pipe in this basin are 8-inch PVC; if one section of 8-inch PVC can adequately convey all flows from the basin, then all the pipes are adequate. The area east of the basin up to the UGB and all areas north of the basin up to the Field of Dreams baseball diamonds has potential to develop. When developed, this approximately 140-acre area is expected to contribute approximately 63,000 gpd to the basin's existing flows. Analyzing an 8-inch PVC pipe at minimum slope with combined existing and future flows results in a capacity utilization of 44 percent. All pipes within the basin will have lower capacity utilization ratios; thus, all existing sewer lines within the basin appear to be adequately sized to convey expected future flows from a capacity perspective.

West Side Trunklines

Basin W1/West Trunkline

Basin W1/west trunkline represents the City's western sanitary sewer trunkline. The western trunkline consists of reinforced concrete pipe, with diameters ranging from 18 to 24 inches. The trunkline begins at upstream Manhole W20-15 and flows downstream to the RWTP, collecting flows from western basins along the way.

In addition, several areas will eventually be developed that will connect directly to the trunkline. These areas will become new basins in the future. The first area is located west of the Lift Station 8 forcemain, south of Elm Avenue, east of the Umatilla River, and north of Hermiston Avenue. It is approximately 102 acres in size and is projected to contribute approximately 45,800 gpd to the trunkline flow. It is likely a new lift station will be needed to pump sewage from the low section near the river to the existing collection system.

The second area is located north of Elm Avenue, east of the Umatilla River open space zone, west of the Lift Station 8 forcemain, and south of McConnell Lane. This area is approximately 103 acres and will contribute approximately 46,500 gpd to the trunkline flow. Analyzing this primary trunkline at a minimum slope with combined existing and future flows shows that all pipes appear to have acceptable capacities, with pipe flows ranging from 2 to 85 percent of capacity. This primary trunkline appears to have adequate capacity to convey existing and future flows.

Basin W2 Trunkline

Basin W2 trunkline is located in the northwest portion of the City, from the hospital north to Smith Lane. Four sections of pipe, likely consisting of 12-inch PVC, comprise the trunkline. The trunkline begins at upstream Manhole W2-12 and flows through the basin into the western primary trunkline at Manhole W1-23.

The area east of the Lift Station 8 forcemain, west of Highway 395, and south of McConnell and Nelson Lanes that is not already included in the basin has the potential to be developed in the future. When developed, this approximately 219-acre area is expected to contribute approximately 98,700 gpd to the basin's existing flows. Analyzing this trunkline at minimum slope with combined existing and future flows shows that all pipes have acceptable capacities, with pipe flows at 32 percent of capacity. All existing sewer lines upstream of the trunkline are 12-inch PVC, which are anticipated to meet future flows. Future flows can be adequately conveyed by the existing secondary trunkline from a capacity analysis perspective.

Basin W4 Trunkline

Basin W4 trunkline is located on the western edge of the City between the western trunkline and W. Highland Avenue. The trunkline consists of 12- and 24-inch PVC pipe. The trunkline begins at upstream Manhole W4-1 and flows through the basin into the western primary trunkline at Manhole W1-19.

The area east of the basin, zoned in the City's Comprehensive Plan as future residential, has the potential to be developed in the future. When developed, this approximately 234-acre area is expected to contribute approximately 105,400 gpd to the basin's existing flows. Analyzing this trunkline at minimum slope with combined existing and future flows shows that all pipes have acceptable capacities, with pipe flows ranging from 8 to 30 percent of capacity. Future flows appear to be able to be adequately conveyed by the existing secondary trunkline from a capacity analysis perspective.

Basin W6 Trunkline

Basin W6 trunkline is located at the southwest corner of the City between W. Highland Avenue and S.W. Desert Oak Drive. The eastern border is S.W. 11th Street. The trunkline consists of 8-inch transite and 8-inch PVC pipe. The trunkline begins at upstream Manhole W6-7 and flows through the basin into the western primary trunkline at Manhole W1-18. Although there are more pipe sections upstream of Manhole W6-7, they do not need to be analyzed because if the downstream sections are acceptable, the upstream sections will also be acceptable.

The area south of the basin to the UGB has the potential for future development. When developed, this approximately 257-acre area is expected to contribute approximately 115,700 gpd to the basin's existing flows. Analyzing this trunkline at minimum slope with combined existing and future flows shows that ten of the 14 pipe segments have acceptable capacities of 98 percent. The other four exceeded capacity by 6 percent when minimum slopes were used. Actual slopes approximated from the City's GIS information were then used in place of minimum slopes, which resulted in pipe capacity utilization of 30 to 58 percent. Future flows appear to be able to be adequately conveyed by the existing secondary trunkline from a capacity analysis perspective.

Basin W8 Trunkline

Basin W8 trunkline is located in the southwest portion of the City between W. Highland Avenue and the Maxwell Canal. The trunkline consists of 8-inch PVC, 8-inch transite, and 8-, 10-, and 12-inch concrete pipe. The trunkline begins at upstream Manhole W8-84 and flows through the basin into the western primary trunkline at Manhole W1-4.

The area south of the basin to the UGB has the potential for future development. When developed, this approximately 52-acre area is expected to contribute approximately 23,300 gpd to the basin's existing flows. Analyzing this trunkline at minimum slope with combined existing and future flows shows that the pipes appear to have adequate capacity, with pipe flows ranging from 34 to 73 percent of capacity.

Basin W15 Trunkline

Basin W15 trunkline is located in the south-central portion of the City along the UPRR. Fifteen sections, consisting primarily of 8-inch concrete pipe, compose the trunkline. One section of 12-inch concrete pipe, two sections of 10-inch concrete pipe, and one section of 8-inch transite pipe were also present. The trunkline begins at upstream Manhole W15-47 and flows through the basin into the western primary trunkline at Manhole W1-3.

The area south of the basin up to the UGB has the potential for future development. When developed, this approximately 180-acre area is expected to contribute approximately 82,000 gpd to the basin's existing flows. Analyzing this trunkline at minimum slope with combined existing and future flows shows that most pipes meet capacity. Pipes sections that did not exceed capacity ranged from 57 percent to 81 percent of capacity. A single pipe section exceeded capacity by 4 percent.

Trunkline Capacity Summary

Primary and secondary trunkline capacities were analyzed because bottlenecks are most likely to occur in these areas. These areas were also analyzed because they are critical in conveying sanitary sewer flows to the RWTP. Several areas where future flows may exceed pipe capacity were identified. Total calculated flow was greater than the design criteria because this analysis was made based on areas developing up to the UGB. Although it is not likely that such development will occur based on the projected population, these analyses can be used to plan for improvements as development occurs and appropriately size pipes for full build-out.

Lift Station Capacity

The City's wastewater system operators manage nine public lift stations by performing regularly scheduled maintenance and repairs and recording pump operational information (including pump run hours). Although pump run hours cannot directly be used to obtain accurate flow data, they can be used to estimate the capacity of the lift stations to serve future development. The City provided pump hour meter readings from January 2017 through December 2019 for analysis. The data summary and analysis can be seen in the Lift Station Data Summary spreadsheets in Appendix H. For ease of reference, a summary is shown on Table 4-1, which displays the average daily run hours during the maximum month, the associated flows considering the design pumping rate, and both the current and projected capacity utilization of the lift station.

TABLE 4-1
LIFT STATION CAPACITY SUMMARY

			Run Hours per Day (2017 to 2019)		Gallons Pumped (2017 to 2019)		Projected - 2043		
Lift Station No.	No. of Pumps	Design Pumping Rate	Maximum Month Average Day	Lift Station Capacity Utilization (Percentage)	Maximum Daily Flow (MGD)	Percentage of Total Flow[1]	Estimated Maximum Daily Flow[2] (MGD)	Estimated Run Hours per Day[3] (Maximum)	Lift Station Capacity Utilization (Percentage)
1[4]	3	1,200	5.48	69	0.395	24.2	0.524	7.28	91
3[5]	2	Not Analyzed							
4	2	170	3.27	41	0.033	2.0	0.044	4.35	54
5	2	350	2.36	29	0.049	3.0	0.066	3.13	39
6	2	75	9.02	113	0.041	2.5	0.054	11.98	150
7	2	60	6.34	79	0.023	1.4	0.030	8.42	105
8	3	900	13.08	82	0.707	43.4	0.939	17.38	109
10	2	240	1.38	17	0.020	1.2	0.026	1.83	23
12	2	230	0.44	6	0.006	0.4	0.008	0.56	7

[1] *Total flow is assumed to be the maximum month wet weather flow in the system from Figure 2-6 Chapter 2.*

[2] *Estimated maximum daily flow is calculated from the Percentage of Total (Maximum) values provided in Figure 2-6 in Chapter 2.*

[3] *Estimated run hours per day were calculated from the design pumping rate.*

[4] *Lift Station 1 values are based on the two large pumps only. Jockey pump hours and flows were subtracted from the large pump calculations.*

[5] *Lift Station 3 was not analyzed because the design pumping data were not available and a drawdown test was not performed due to safety concerns (Highway 395 access).*

MGD = million gallons per day

Prior to discussing the design capacity of a lift station, a discussion on sewage flow rates entering a lift station is warranted. Although sewage flows entering a lift station are dependent on the type of sewer services (i.e., residential, commercial, industrial), sewage flow rates are typically highest in the morning and evening hours, lower during mid-day, and lowest during the night. Therefore, the pump run times are cyclical throughout the day to meet demand fluctuations.

Generally, lift station capacity is dependent on two variables: wetwell operational volume and the pump flow rate. Wetwell operational volumes should be large enough to prevent rapid pump cycling, yet small enough to prevent long detention times and associated odor release due to septic conditions. On average, typical detention times for a lift station range between 20 and 30 minutes and pump operation times range between five and ten minutes per hour.

Another design parameter for lift stations is the number of pumps installed to handle flow demands. The number of pumps to be installed in a lift station depends on the anticipated demand, flow variations, and reliability standards. In small lift stations, it is customary to install two pumps each with the capacity to handle peak demands. Therefore, the pumps alternate operation (lead-lag) to equalize wear and tear on the pumps. For larger lift stations, the number of pumps installed needs to handle the variation in influent flow rates without frequent pump cycles and without excessive wetwell storage volumes. This is typically achieved by installing three pumps; two pumps operating in parallel to meet peak demands and one for backup.

Looking at a 24-hour snapshot and considering the design parameters noted herein, lift stations should operate for approximately two to four hours per day under normal operating conditions. However, lift stations are designed with a peaking factor of approximately three to four to meet peak demands. This means that during maximum daily flow events for small lift stations, the total daily pump run hours should not exceed 16 hours of operation per day (8 hours per day for each pump) because each pump can theoretically pump the maximum daily flow and alternate operation. Total daily pump run hours of more than 16 hours for small lift stations indicate that modifications to the pump capacities or operational wetwell volumes should be considered. Since wetwell operational volumes are not easily modified, the preferred option is to increase lift station capacity by increasing pump flow rates.

For the large lift stations, pump run hours should not exceed 8 hours per day (4 hours per pump) because two pumps are dedicated to meet maximum daily flow events. Pump run hours exceeding 8 hours per day indicate pump modifications should be considered because both pumps operating together need to meet maximum daily flow demands.

Table 4-1 and the capacity analysis that follows use the maximum run hours per day that were taken from the maximum month for each lift station between January 2017 and December 2019 to analyze lift station capacities. Months with erroneous maximum run hour outliers associated with pump clogs or other issues were excluded from analysis. These values are included in the Lift Station Data Summary included in Appendix I. The maximum month for Lift Stations 1, 4, 5, 6, 7, 8, 10, and 12 were November 2019, September 2018, February 2019, July 2018, December 2018, August 2017, October 2018, and August 2018, respectively. The gallons pumped for each lift station were calculated using the design pumping rate.

Lift Station 8 operates in lead-lag control, which means two pumps can operate to meet high demand periods. Additionally, Lift Station 8 meets Class 2 reliability by having three pumps with the capacity to pump half of the maximum daily flow (one pump can be out of operation and still meet demands in lead-lag control). Lift Station 1 has three pumps with Pump 2 being a jockey pump. Pump 2 operates for significantly more hours than the higher capacity pumps but at a substantially lower capacity. The larger capacity pumps essentially operate in lead-lag but only have to pump what the jockey pump cannot handle. This lift station meets Class 2 reliability because the two larger pumps are each capable of pumping the maximum daily flow, excluding the pumped flows from the jockey pump. All other lift stations meet Class 2 reliability and operate in lead-lag control; however, only two pumps are installed in these lift stations and each pump is capable of pumping the maximum daily flow.

This means that during maximum daily flow events the total pump run hours for Lift Station 8 should be approximately 8 hours per day (4 hours per day for each pump). Because the other lift stations have two pumps (or three pumps with a jockey pump, in the case of Lift Station 1) capable of pumping maximum daily flows, each pump can theoretically pump 8 hours per day or the lift station can operate up to 16 hours per day (excluding any jockey pump run hours). By using the projected maximum daily flow (2.164 MGD), the percentage of sewage each pump station handles, and a maximum pump run time of 4 hours per day per pump (Lift Station 8) or 8 hours per day per pump (all other lift stations), the future capacity status of the lift stations can be estimated.

Lift Station 1

Lift Station 1 is the primary lift station on the east side of the City, located at the intersection of N.E. 7th Street and E. Main Street. Lift Station 1 is the only lift station with a jockey pump. Two larger capacity pumps alternate when the jockey pump cannot keep up with sewer flow. This lift station was analyzed as a two-pump lift station. The remaining flow and hours of the larger capacity pumps were analyzed as if the jockey pump was not present (i.e., all calculated flows associated with the jockey pump were removed from the maximum month average daily flow). The Lift Station 1 main pumps (combined) had an average maximum daily run time of 5.48 hours per day in November 2019. The average run times of Pumps 1 and 3 (the larger capacity pumps) were 2.5 and 3.0 hours, respectively. These run hours demonstrate that the pumps are operating as designed in an alternating pattern. The pump capacity of the two larger pumps installed at Lift Station 1 is 1,200 gpm each. Because pumps are not designed to operate at the same time during normal operation, the design capacity of Lift Station 1 is 1,200 gpm while omitting the jockey pump flows. With a maximum daily run time of 5.48 hours, Lift Station 1 is theoretically pumping approximately 0.395 MGD or 24.2 percent of the maximum daily flow to the RWTP.

Lift Station 1 operates 5.48 hours per day or at approximately 69 percent of its capacity. Assuming Lift Station 1 continues pumping approximately 24 percent of the City’s sewage during maximum daily demand periods, the future capacity status can be estimated by using the projected peak daily flow in 2043 of 1.629 MGD. Considering the current lift station pumping capacity of 1,200 gpm, Lift Station 1 could pump approximately 0.524 MGD during the maximum day, and combined pump run hours would be approximately 7.28 hours per day or 91 percent of capacity.

Lift Station 3

Lift Station 3 is located in the middle of Highway 395 at the intersection of W. Ridgeway Avenue. Lift Station 3 was not analyzed for several reasons. First, it serves only a small number of businesses, so flows are minimal. Second, the capacity of the pumps remains unknown. The capacity could not be found in the literature provided by the City. Due to access and safety issues, a drawdown test to determine capacity was not performed. Lastly, it is likely that the lift station will be abandoned or removed as part of a sewer system improvements project in the near future, so determining its future capacity is unnecessary.

Lift Station 4

Lift Station 4 is located at the intersection of N.W. Ridgeway Avenue and N.W. Butte Drive. Lift Station 4 had an average maximum daily run time of 3.27 hours in September 2017. The average run times of Pumps 1 and 2 were 1.5 and 1.8 hours, respectively. Operation is being evenly distributed between the pumps. The design capacity of the pumps at this lift station is 170 gpm. With a maximum daily run time of 3.27 hours and a design pumping rate of 170 gpm, this lift station is theoretically pumping approximately 0.033 MGD or 2 percent of the City’s sewage.

Lift Station 4 operates 3.27 hours on average during the maximum month, correlating to 41 percent of capacity. If the lift station continues pumping approximately 2 percent of the City's sewage through year 2043, the pumps would need to operate for approximately 4.35 hours per day and pump approximately 0.044 MGD. This would result in Lift Station 4 operating at approximately 54 percent of capacity.

Lift Station 5

Lift Station 5 is located at the intersection of E. Diagonal Boulevard and N.E. 10th Street. Lift Station 5 had an average maximum daily run time of 2.36 hours in February 2019. The average run time for both Pumps 1 and 2 was 1.2 hours. Operation is being evenly distributed between pumps. The design capacity of the pumps at this lift station is 350 gpm. With a maximum daily run time of 2.36 hours and a design pumping rate of 350 gpm, this lift station is theoretically pumping approximately 0.049 MGD or 3 percent of the City's sewage.

Lift Station 5 operates 2.36 hours on average during the maximum month, correlating to 29 percent of capacity. If the lift station continues pumping approximately 3 percent of the City's sewage through year 2043, the pumps would need to operate for approximately 3.13 hours per day and pump approximately 0.066 MGD. This would result in Lift Station 5 operating at approximately 39 percent of capacity.

Lift Station 6

Lift Station 6 is located at the intersection of N. 1st Place and W. Ridgeway Avenue. Lift Station 6 had an average maximum daily run time of 9.02 hours in July 2018. The average run times of Pumps 1 and 2 were 4.2 and 2.8 hours, respectively. Although the difference between hours is slightly greater than expected, the difference is less in most other months, thus pump operation is generally being evenly distributed between the pumps. The design capacity of the pumps at this lift station is 75 gpm. With a maximum daily run time of 9.02 hours and a design pumping rate of 75 gpm, this lift station is theoretically pumping approximately 0.041 MGD or 2.5 percent of the City's sewage.

Lift Station 6 operates 9.02 hours on average during the maximum month, correlating to 113 percent of capacity. If the lift station continues pumping approximately 2.5 percent of the City's sewage through year 2043, the pumps would need to operate for approximately 11.98 hours per day and pump approximately 0.054 MGD. This would result in Lift Station 6 operating at approximately 150 percent of capacity.

Lift Station 7

Lift Station 7 is located at the intersection of N.W. 11th Street and W. Hartley Avenue. Lift Station 7 had an average maximum daily run time of 6.34 hours in December 2018. The average run times of Pumps 1 and 2 were 4.1 and 2.3 hours, respectively. This distribution is atypical and is most likely due to impeller wear. The design capacity of the pumps at this lift station is 60 gpm. With a maximum daily run time of 6.34 hours and a design pumping rate of 60 gpm, this lift station is theoretically pumping approximately 0.023 MGD or 1.4 percent of the City's sewage.

Lift Station 7 operates 6.34 hours on average during the maximum month, correlating to 79 percent of capacity. If the lift station continues pumping approximately 1.4 percent of the City's sewage through year 2043, the pumps would need to operate for approximately 8.42 hours per day and pump approximately 0.030 MGD. This would result in Lift Station 7 operating at approximately 105 percent of capacity.

Lift Station 8

Lift Station 8 is the main lift station on the west side of Hermiston, located in the northeast corner of Harrison Park. Three pumps alternate days to pump sewer flows. Lift Station 8 had an average maximum daily run time of 13.08 hours in August 2017. The average run times of Pumps 1, 2, and 3 were 5.4, 4.0, and 3.6 hours, respectively. Operation is being distributed among the pumps in a slightly uneven fashion likely due to differing pump age, impeller wear, and pump rebuild times; however, flow is likely being evenly distributed even though hour meter readings vary slightly between pumps. The design capacity of the pumps at this lift station is 900 gpm. With a maximum daily run time of 13.08 hours and a design pumping rate of 900 gpm, this lift station is theoretically pumping approximately 0.707 MGD or 43.4 percent of the City's sewage.

Lift Station 8 operates 13.08 hours on average during the maximum month, correlating to 82 percent of capacity. If the lift station continues pumping approximately 43 percent of the City's sewage through year 2043, the pumps would need to operate for approximately 17.38 hours per day and pump approximately 0.939 MGD. This would result in Lift Station 8 operating at approximately 109 percent of capacity.

Lift Station 10

Lift Station 10 is located at the southwestern corner of Highland Park. Lift Station 10 had an average maximum daily run time of 1.38 hours in October 2018. The average run time for both Pumps 1 and 2 was 0.7 hour. Operation is being evenly distributed between the pumps. The design capacity of the pumps at this lift station is 240 gpm. With a maximum daily run time of 1.38 hours and a design pumping rate of 240 gpm, this lift station is theoretically pumping approximately 0.020 MGD or 1.2 percent of the City's sewage.

Lift Station 10 operates 1.38 hours on average during the maximum month, correlating to 17 percent of capacity. If the lift station continues pumping approximately 1.2 percent of the City's wastewater through the year 2043, the pumps would need to operate for approximately 1.83 hours per day and pump approximately 0.026 MGD. This would result in Lift Station 10 operating at approximately 23 percent of capacity.

Lift Station 12

Lift Station 12 is located at the north end of the Eastern Oregon Trade and Event Center (EOTEC). The lift station pump run hours vary drastically with the seasons because summer months see more events held at the EOTEC, such as the County fair. Lift Station 12 had an average maximum daily run time of 0.44 hour in August 2018. The average run time for both Pumps 1 and 2 was 0.2 hour. Operation is being evenly distributed between the pumps. The design capacity of the pumps at this lift station is 230 gpm. With a maximum daily run time of

0.44 hour and a design pumping rate of 230 gpm, this lift station is theoretically pumping approximately 0.006 MGD or 0.4 percent of the City's sewage.

Lift Station 12 operates 0.44 hour on average during the maximum month, correlating to 6 percent of capacity. If the lift station continues pumping approximately 0.4 percent of the City's wastewater through the year 2043, the pumps would need to operate for approximately 0.56 hour per day and pump approximately 0.008 MGD. This would result in Lift Station 12 operating at approximately 7 percent of capacity.

Lift Station Capacity Summary

Two main lift stations, Lift Stations 1 and 8, pump the majority of the flow for the City's sanitary sewer collection system. While most of the other lift stations are currently operating below design capacity, Lift Station 6 is currently operating above its design capacity. When lift station flows are projected to the year 2043 based on total percentage of flow to the RWTP, three of the nine lift stations, including Lift Stations 6, 7, and 8, will be operating above design capacity. Because it is difficult to determine exactly where City growth will occur, flows to lift stations may be different from the projected flows in this analysis. Lift station flows should be monitored as growth occurs, and improvements should be made prior to lift station capacity being surpassed.

Summary

Chapter 4 has outlined an overall capacity evaluation of the City's sanitary sewer collection system. Capacities of primary and secondary trunklines, as well as lift stations, were evaluated and problem areas were identified. The next chapter will provide suggestions on improvements that can be made to the City's sanitary sewer collection system.

Chapter 5 - Recommended System Improvements

Introduction

This chapter of the Sanitary Sewer Collection System Study (Study) presents the recommendations and associated cost estimates to complete system improvements based on the results of the collection system evaluation and capacity assessment. These recommendations are general in nature and some revisions may be necessary when actual field conditions are evaluated in detail.

Based on the results of the evaluation, the recommended improvements for the sanitary sewer system have been prioritized and placed into three categories. For purposes of discussion, the three categories are referred to as high priority improvements, medium priority improvements, and items to monitor. Furthermore, each category of recommended high priority improvements is divided into lift station improvements and collection system piping improvements. Separating the lift station improvements from the sanitary sewer system improvements gives the City options when planning construction projects along with the flexibility to lump similar projects together to save on construction costs depending on available budget.

High priority improvements reflect components of the system that appear to need immediate improvement or are considered necessary to remedy critical problem areas. High priority improvements generally consist of correcting pipe segments causing significant operational issues and updating the lift stations to meet current electrical code and/or Oregon Department of Environmental Quality (DEQ) standards while improving operator safety. Medium priority improvements are focused on correcting less severe problematic pipe segments and addressing capacity limitations in the lift stations and collection system piping. The items to monitor are those related to known problematic pipe segments where minor deficiencies were found, or where capacities are anticipated to be reached within the planning period.

The improvements further discussed in this chapter are intended to be general in nature. Detailed field investigations and topographic surveying is recommended to occur prior to design of a project and recommended improvements may need to be adjusted to meet field conditions.

Infiltration and Inflow-Related Improvements

Based on the television (TV) inspection review, input from City personnel, and analysis of system-wide flows compared to the U.S. Environmental Protection Agency sewage flow criteria, infiltration is not believed to be a wide-spread problem in the City's collection system.

The TV inspection identified only a few locations where water was infiltrating. However, many locations have the potential to be infiltration/seepage sources due to the large cracks and holes found in the sewer pipes. Therefore, structurally deficient pipe segments were identified as high priority and the minor infiltration sources were identified as medium priority.

Sanitary Sewer Collection System Improvements

Those sections of the City's collection system that were TV-inspected had varying structural conditions. Sections of clay pipe remain in the system and are prone to failure due to their age and the brittle nature of clay piping. The majority of inspected concrete pipe appeared to be fully intact with relatively minor areas in need of repair. These areas contained fractured sections likely caused from excessive ground surface loading. In nearly all pipe segments TV-inspected, pipe sags were a common occurrence. Pipe sags are known to cause sediment buildup or sewage blockages and to decrease pipe conveyance capacity. Service lines generally appeared to be in good condition, although some protruded into the main line and other lateral connections to the main lines had root intrusion. As the City proceeds with improvements to the collection system, it is important the requirements and guidelines for sewer pipelines established by the DEQ are followed. These guidelines are included in Appendix I. Key components of these guidelines include:

- Minimum diameter sewer lines of 8 inches (unless a 6-inch pipe is being tied into downstream)
- Locating manholes at:
  - Every change in grade, alignment, or pipe size
  - Each intersection or junction of sewers
  - The upper end of sewer mains
  - Intervals of 500 feet or less (except 24-inch and larger sewers)
- Cleanouts should not be substituted for manholes, except at the upper end of lateral sewer lines 250 feet or less in length

The objective of these guidelines is to construct a system that protects the surrounding environment and that can be properly and easily maintained. Any additional expense of implementing these guidelines when improvements are made should be easily offset with more efficient utilization of personnel time related to operation and maintenance activities in the future.

High Priority Sanitary Sewer Improvements

The high priority sanitary sewer improvements are aimed to address pipe segments with compromised structural integrity, root intrusions, pipe sags, and to replace pipe segments to meet DEQ guidelines for sewer pipelines. The cost estimates for the high priority sanitary sewer improvements can be found on Figures 5-1 through 5-10. The high priority sanitary sewer improvements are prioritized as follows:

1. Basin E4 between Cleanout CO-44 and Manhole E4-1

These pipe segments were found to have structural failures in multiple locations and failing joints. Due to the sewer lines being routed under Highway 395, using the pipe bursting method is recommended during construction. This will minimize surface restoration, traffic disruption, and improve contractor safety during installation.

2. Basin E10 between Manholes E10-13 and E12-20

Multiple deficiencies exist in the inspected pipe segments, including structural failures, protruding laterals, pipe sags, obstruction in laterals, root intrusions, and separated joints. Due to the multitude of problems associated with these pipe segments, it is recommended that conventional dig and replace construction methods be used.

3. Basin W9 between Manholes W9-2 and W1-5

The City identified these pipe segments as a high priority (even though the lines were not TV-inspected) due to known root intrusions and defective laterals. The pipes to be replaced are located mid-block between residential lots. Because multiple laterals need to be replaced, it is recommended the pipe segments be replaced by conventional dig and replace methods.

4. Basin W9 between Manholes W9-46 and W9-47

This line has large sags, abrupt changes in pipe slope, and sidewall deterioration. This pipe segment is believed to be near capacity during high flow periods because of the large sags. It is recommended the pipe segment be replaced by conventional dig and replace methods.

5. Basin W15 between Manholes W15-89 and W15-72

Steel pipe was installed at this location and a large crack has formed across the invert. Steel pipe should not be used for sewer because it is susceptible to accelerated corrosion, which leads to pipe failure. Therefore, it is recommended the pipe segment be replaced by conventional dig and replace methods.

6. Basin E13 between Cleanout CO-56 and Manhole E13-148

Two sections of vitrified clay pipe were installed at this location. The vitrified clay pipe is structurally compromised, exhibiting large cracks and missing sections of the pipe wall. Other deficiencies include protruding laterals, pipe sags, and failing joints. Therefore, it is recommended the pipe segment be abandoned in-place and existing sewer service connections rerouted to the adjacent sewer line.

7. Basin W9 between Manholes W9-39 and W9-24

The pipes inspected at this location consist of two sections of 6-inch concrete pipe. Due to a horizontal bend in the pipe preventing navigation of the TV camera, the upstream section of the pipe segment was not inspected. The sections of pipe successfully inspected have pipe sags and spalls or holes in the pipe invert. Due to pipe size not meeting the minimum requirements according to DEQ standards, the deficiencies identified, and the access restrictions, it is recommended the pipe segment be replaced by conventional dig and replace methods.

8. Basin W9 between Manholes W9-37 and W9-40

Deficiencies observed in this line included large pipe sags, root intrusions, and the pipe slope is inconsistent due to poor installation procedures. It is recommended that conventional dig and replace construction methods be used to correct the identified deficiencies.

9. Basin E15 between Cleanout CO-20 and Manhole E15-54

Two sections of 8-inch cast iron pipe were installed at this location. The deficiencies observed included improperly installed service line, pipe sags, and the cement lining is missing on the pipe invert exposing bare metal. Although only a few deficiencies are associated with this line, it was classified as high priority due to bare metal being exposed to sewage flows and its susceptibility to corrosion. It is recommended that conventional dig and replace construction methods be used to correct the identified deficiencies.

10. Basin E12 between Manholes E12-49 and E12-53

This line is identified as a high priority because it is vitrified clay with deficiencies including large pipe sags and offset joints. Other deficiencies are thought to exist in this line but large pipe sags hindered visibility during the TV inspection. Because of the material composition and the large pipe sags, it is recommended that conventional dig and replace construction methods be used to correct the identified deficiencies.

Medium Priority Improvements

Improvements designated as medium priority are related to improving minor structural deficiencies, pipe sags, minor root intrusions, and protruding laterals. Each deficiency has the potential to inhibit the natural sewage flow path in the collection system piping and may lead to an operational issue; however, these deficiencies are not considered urgent at this time. Therefore, it is recommended the City continue monthly cleaning of the sewer lines identified as medium priority. The TV inspection also identified a few locations of minor infiltration but the infiltration rate was low and impact to treatment at the recycled water treatment plant is minor.

The medium priority improvements are not anticipated to cause an immediate operation problem for the City or contaminate groundwater (public harm). After the City completes the high priority improvements, the medium priority improvements can be revisited and prioritized. As the implementation time frame for medium priority improvements is unknown, no cost estimates have been provided.

Items to Monitor

The items to monitor are related to sewer segments that were TV-inspected and deemed acceptable, although the City has had problems with these segments in the past (i.e., they are on the “bad lines” list).

Other items to monitor are capacity related. The capacity analysis of the collection system identified line segments in Basins E10, E15, W1, W8, and W15 that are forecasted to meet or exceed capacity within the planning period. One caveat is that the capacity analysis did not include flows from the industrial sector because flow demands vary drastically depending on the type of industrial development. Secondly, the capacity analysis looked at development of the entire urban growth boundary (UGB), which may or may not occur within the planning period. Therefore, it should be recognized that certain pipe segments may meet the City's flow demands throughout the planning period. Considering the pipe segments have some capacity for growth and the difficulty in predicting where development will occur, infers the importance of monitoring these pipe segments.

Proposed Gravity Trunklines

Background

As the population of the City increases, the collection system must be expanded to serve new development. Proposed gravity main trunkline locations, as shown on the Proposed Future Sanitary Sewer Trunklines and Lift Stations Map in Appendix J, will assist the City with planning future collection system infrastructure expansions based on where development occurs. While most development within the planning period is expected to occur in the northeast portion of the UGB, other areas have the potential to be developed. Because it is difficult to predict exactly where all development will occur within the UGB, gravity main trunkline and lift station locations were proposed to service all areas that could possibly develop between the existing collection system and the UGB. Proposed locations are for planning purposes and locations are subject to change with site-specific surveying and design layouts. The proposed locations are intended to provide the City with information to decide when gravity mains should be installed to serve other potential developments.

Proposed gravity main trunkline locations were determined based on the following criteria. First, the collection system should expand to areas that have the potential to be developed and have a need for sewer service. These areas were assumed to be the portion of land that lies outside city limits but within the UGB. No sewer gravity main trunklines were proposed for the southeast industrial/commercial area because new development here and its effects on the collection system will be evaluated on a case-by-case basis. Second, proposed locations had to be viable based on ground surface slope, minimum recommended sewer pipe slopes, and existing manhole depths as noted in the City's geographic information system data. While it is anticipated that most areas will be able to flow by gravity, two areas appear to require a lift station. Third, locations were proposed based on existing right-of-way (ROW) locations. Deviation from City and County ROWs was kept to a minimum to largely exclude the need for obtaining additional ROWs and/or easements.

Future Trunkline Locations

Future sewer gravity main trunklines are shown in areas that the City anticipates developing. To serve the northeast portion of the UGB, sewer lines can be extended from the intersection of E. Theater Lane and N.E. 10th Street north to the UGB. Another sewer line could potentially be installed from Manhole E5-50 on N.E. Aspen Drive east to N.E. 10th Street. The line could then continue north to E. Theater Lane, then east to approximately N.E. 18th Street. Past this point the grade elevation begins to drop. Although not shown on the map, the area east of N.E. 18th Street and north of E. Theater Lane is a low spot. If development reaches this point, a lift station will likely be required.

To serve areas in the eastern portion of the UGB, two lines are proposed. One line could be installed on E. Elm Avenue from Manhole E1-21 to approximately 3,500 feet east. Another main trunkline could be installed on E. Diagonal Boulevard beginning at Manhole E15-44 and continuing to the UGB.

Two areas south of the City are also anticipated to be developed within the planning period. The first area is located south of Highway 395, north of the A Line Canal and east of the Union Pacific Railroad (UPRR). This location can be serviced by extending the sewer lines on S. 1st Street and S.E. 4th Street. Although S.W. Cottonwood Drive is currently a dead-end road, it is anticipated the road and the sewer line would be able to be extended to serve this area as well. The area north of Feedville Road and between two UPRR tracks will likely be developed. This area would be serviced by extending sewer from Manhole W8-92 west to S.W. 11th Street, then south along S.W. 11th Street.

The last area the City believes will be developed is located east of S.W. 19th Court and south of W. Highland Avenue up to the UGB. This is a low spot that will require a lift station. The lift station would likely be located at the intersection of W. Highland Avenue and S.W. 23rd Street. It would pump the sewage up to S.W. 23rd Street where gravity flow would convey sewage north to W. Orchard Avenue, then east to Manhole W4-1.

Although not currently slated for development, the undeveloped land east of the Oregon State Police Department (bordered on three sides by W. Elm Avenue, N.W. 11th Street, and Smith Lane) is in a low spot. Due to its low elevation, development will necessitate installation of a lift station.

The proposed trunklines discussed herein are shown on the Proposed Future Sanitary Sewer Trunklines and Lift Stations Map in Appendix J. This map also shows additional proposed trunklines not specifically discussed herein due to being located in areas where the City does not expect development to occur. Excluding the southeast industrial/commercial area, proposed trunklines in areas not likely to develop are generally located at the northwest, southwest, and southeast corners of the UGB. All proposed trunklines should be installed on an as-needed basis when development would require the expansion of the collection system.

Lift Station Improvements

Each of the nine lift stations operated by the City were inspected in the field and a capacity analysis was performed. In general, the lift stations were found to be in good condition. However, through the inspections/analysis performed and discussions with City personnel, a list of prioritized lift station improvements has been developed. The cost estimates for the lift station improvements can be found on Figures 5-11 through 5-17, and a detailed description of the improvements follows.

1. Decommission Lift Station 3 and Reroute

Due to sewer system improvements completed in conjunction with Sunset Elementary School, maintenance/safety concerns related to the location of Lift Station 3, and its poor condition, the City determined that the lift station needs to be decommissioned. Currently, approximately five sewer connections contribute flow to the lift station. Approximately 1,400 feet of sewer main line are proposed to be installed along W. June Avenue and along back property lines parallel to the railroad to enable sewage conveyance via gravity flow to the existing sewer lines to the north. Sewer service lines would then be rerouted to the proposed sewer main. The City anticipates construction of this recommended improvement to the sanitary sewer collection system in 2021.

2. Reconstruct Lift Station 4 and Forcemain

Lift Station 4 has surpassed its useful life and City personnel spend a considerable amount of time keeping it functional. The wetwell is constructed of concrete masonry units and the pumps and forcemain are in dire need of repair. Additionally, the electrical and controls need replaced. Therefore, it is recommended that the entire lift station and forcemain be reconstructed.

3. Recoat Lift Station 5 Wetwell

The surface of the concrete wetwell for Lift Station 5 has been compromised by hydrogen sulfide gas due to turbulence generated from sewer main drop into the wetwell. The City installed an inside drop bowl to help isolate the hydrogen sulfide gas to mitigate further deterioration on the concrete. It is recommended the wetwell walls, mechanical pipe and fitting, and metal components be prepped and coated or replaced to prolong their integrity.

4. Upgrade Lift Station Telemetry

The telemetry at Lift Stations 4 through 8 has surpassed its useful life. In addition, Lift Station 10 has an auto-dialer that the City would like to replace with a dialer meeting current industry standards. Lift station telemetry should also be updated to current industry standards, likely using Federal Communications Commission-licensed radios or cellular modems.

5. Update Lift Station 6

Lift Station 6 has a drywell/wetwell configuration that impedes operator access and is a safety concern. Additionally, the current configuration has electrical components located in the drywell, which are susceptible to corrosion. It is recommended all the electrical components be removed from the drywell and access to the wetwell improved. The pumping capacity of Lift Station 6 also needs increased to meet current and future demands.

6. Update Lift Station 7

Similar to Lift Station 6, Lift Station 7 also needs to be updated to current industry standards and may need increased pumping capacity to meet future demands. Due to similar scopes of work and to save on construction costs, the City may lump the update of both lift stations into one project but each project is separated during the planning phase.

7. Update Lift Station 8 Electrical and Controls

The electrical and pump controls at Lift Station 8 have surpassed their useful life and need to be updated to current industry standards. It is recommended that pumping volumes and pump run hours be monitored as development occurs in areas served by Lift Station 8 as pumping capacities may need to be increased to meet future demands.

Summary

The fieldwork performed for this Study, the deficiencies noted, and the prioritized recommendations for improvements have all been reviewed with City personnel. One important factor requiring the City's consideration is the cost of correcting the identified deficiencies. With the cost estimates shown on Figures 5-1 through 5-17, the City can formulate a plan of action for addressing collection system and lift station needs.

If the recommended improvements are not pursued, the condition of the collection system and the existing lift stations will likely continue to degrade, compounding problems, increasing future replacement costs, and posing potential safety risks for City personnel when performing lift station maintenance. The benefits to pursuing the recommended improvements will be extensive. As a result of the collection system improvements, the reliability and safety of lift station operations would be improved, and the amount of maintenance required for the collection system is anticipated to be reduced, and annual operation and maintenance expenditures are anticipated to decrease.

CITY OF HERMISTON, OREGON
HIGHWAY 395 GRAVITY SEWER LINE REPLACEMENT
BASIN E4 BETWEEN CLEANOUT CO-44 AND MANHOLE E4-1
PRELIMINARY COST ESTIMATE
SEPTEMBER 2020

NO.	DESCRIPTION	UNIT	UNIT PRICE	ESTIMATED QUANTITY	TOTAL PRICE
1	Mobilization/Demobilization	LS	$ 10,250	All Req'd	$ 10,250
2	Temporary Protection and Direction of Traffic/Project Safety	LS	25,000	All Req'd	25,000
3	Bypassing of Sewer Line	LS	22,000	All Req'd	22,000
4	Pipe Burst Under Highway 395	LS	100,000	All Req'd	100,000
5	Manhole	EA	6,000	2	12,000
6	Sanitary Sewer Cleanout	EA	1,000	1	1,000
7	Remove and Dispose of Existing Manhole	EA	4,000	1	4,000
8	Connection to Existing Manhole	EA	2,000	1	2,000
9	8-inch Polyvinyl Chloride Gravity Sewer Line	LF	75	250	18,750
10	Sewer Service Connection	EA	2,000	2	4,000
11	Surface Restoration	LS	25,000	All Req'd	25,000
	Total Estimated Construction Cost				**$ 224,000**
	Administration, Legal, Engineering, and Contingencies @ 35%				79,000
	TOTAL ESTIMATED PROJECT COST (2020)				**$ 303,000**

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CITY OF
HERMISTON, OREGON
SANITARY SEWER COLLECTION SYSTEM STUDY
HIGHWAY 395 GRAVITY SEWER LINE REPLACEMENT
PRELIMINARY COST ESTIMATE

FIGURE 5-1

CITY OF HERMISTON, OREGON
S.E. 7TH STREET GRAVITY SEWER LINE REPLACEMENT
BASIN E10 BETWEEN MANHOLES E10-13 AND E12-20
PRELIMINARY COST ESTIMATE
SEPTEMBER 2020

NO.	DESCRIPTION	UNIT	UNIT PRICE	ESTIMATED QUANTITY	TOTAL PRICE
1	Mobilization/Demobilization	LS	$ 8,500	All Req'd	$ 8,500
2	Temporary Protection and Direction of Traffic/Project Safety	LS	5,000	All Req'd	5,000
3	Bypassing of Sewer Line	LS	15,000	All Req'd	15,000
4	Water/Sewer Crossing	EA	1,500	1	1,500
5	Manhole	EA	6,000	2	12,000
6	Remove and Dispose of Existing Manhole	EA	4,000	2	8,000
7	Connection to Existing Manhole	EA	2,000	1	2,000
8	8-inch Polyvinyl Chloride Gravity Sewer Line	LF	85	600	51,000
9	Sewer Service Connection	EA	2,000	9	18,000
10	Building and Fence Restoration	LS	40,000	All Req'd	40,000
11	Surface Restoration	LS	30,000	All Req'd	30,000
	Total Estimated Construction Cost				**$ 191,000**
	Administration, Legal, Engineering, and Contingencies @ 35%				67,000
	TOTAL ESTIMATED PROJECT COST (2020)				**$ 258,000**

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CITY OF
HERMISTON, OREGON
SANITARY SEWER COLLECTION SYSTEM STUDY
S.E. 7TH STREET GRAVITY SEWER LINE REPLACEMENT
PRELIMINARY COST ESTIMATE

FIGURE 5-2

CITY OF HERMISTON, OREGON
VICTORY SQUARE PARK GRAVITY SEWER LINE REPLACEMENT
BASIN W9 BETWEEN MANHOLES W9-2 AND W1-5
PRELIMINARY COST ESTIMATE
SEPTEMBER 2020

NO.	DESCRIPTION	UNIT	UNIT PRICE	ESTIMATED QUANTITY	TOTAL PRICE
1	Mobilization/Demobilization	LS	$ 4,250	All Req'd	$ 4,250
2	Bypassing of Sewer Line	LS	15,000	All Req'd	15,000
3	Water/Sewer Crossing	EA	1,500	1	1,500
4	Manhole	EA	6,000	2	12,000
5	Remove and Dispose of Existing Manhole	EA	4,000	2	8,000
6	Connection to Existing Manhole	EA	2,000	2	4,000
7	8-inch Polyvinyl Chloride Gravity Sewer Line	LF	75	310	23,250
8	Surface Restoration	LS	20,000	All Req'd	20,000
				Total Estimated Construction Cost	**$ 88,000**
				Administration, Legal, Engineering, and Contingencies @ 35%	31,000
				TOTAL ESTIMATED PROJECT COST (2020)	**$ 119,000**

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CITY OF
HERMISTON, OREGON
SANITARY SEWER COLLECTION SYSTEM STUDY
VICTORY SQUARE PARK GRAVITY SEWER LINE REPLACEMENT PRELIMINARY COST ESTIMATE

FIGURE
5-3

CITY OF HERMISTON, OREGON
W. JUNIPER AVENUE / W. PINE AVENUE GRAVITY SEWER LINE REPLACEMENT
BASIN W9 BETWEEN MANHOLES W9-46 AND W9-47
PRELIMINARY COST ESTIMATE
SEPTEMBER 2020

NO.	DESCRIPTION	UNIT	UNIT PRICE	ESTIMATED QUANTITY	TOTAL PRICE
1	Mobilization/Demobilization	LS	$ 15,150	All Req'd	$ 15,150
2	Bypassing of Sewer Line	LS	30,000	All Req'd	30,000
3	Manhole	EA	6,000	2	12,000
4	Remove and Dispose of Existing Manhole	EA	4,000	2	8,000
5	Connection to Existing Manhole	EA	2,000	1	2,000
6	8-inch Polyvinyl Chloride Gravity Sewer Line	LF	95	1,230	116,850
7	Sewer Service Connection	EA	2,000	33	66,000
8	Building and Fence Restoration	LS	70,000	All Req'd	70,000
9	Surface Restoration	LS	25,000	All Req'd	25,000
				Total Estimated Construction Cost	**$ 345,000**
				Administration, Legal, Engineering, and Contingencies @ 35%	121,000
				TOTAL ESTIMATED PROJECT COST (2020)	**$ 466,000**

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CITY OF
HERMISTON, OREGON
SANITARY SEWER COLLECTION SYSTEM STUDY
W. JUNIPER AVENUE / W. PINE AVENUE
GRAVITY SEWER LINE REPLACEMENT
PRELIMINARY COST ESTIMATE

FIGURE
5-4

CITY OF HERMISTON, OREGON
S. 1ST STREET GRAVITY SEWER LINE REPLACEMENT
BASIN W15 BETWEEN MANHOLES W15-89 AND W15-72
PRELIMINARY COST ESTIMATE
SEPTEMBER 2020

NO.	DESCRIPTION	UNIT	UNIT PRICE	ESTIMATED QUANTITY	TOTAL PRICE
1	Mobilization/Demobilization	LS	$ 4,500	All Req'd	$ 4,500
2	Temporary Protection and Direction of Traffic/Project Safety	LS	20,000	All Req'd	20,000
3	Bypassing of Sewer Line	LS	15,000	All Req'd	15,000
4	Water/Sewer Crossing	EA	1,500	1	1,500
5	Manhole	EA	6,000	1	6,000
6	Remove and Dispose of Existing Manhole	EA	4,000	1	4,000
7	Connection to Existing Manhole	EA	2,000	1	2,000
8	8-inch Polyvinyl Chloride Gravity Sewer Line	LF	75	320	24,000
9	Sewer Service Connection	EA	2,000	2	4,000
10	Surface Restoration	LS	25,000	All Req'd	25,000
	Total Estimated Construction Cost				**$ 106,000**
	Administration, Legal, Engineering, and Contingencies @ 35%				38,000
	TOTAL ESTIMATED PROJECT COST (2020)				**$ 144,000**

CITY OF HERMISTON, OREGON
E. NEWPORT AVENUE GRAVITY SEWER LINE IMPROVEMENTS
BASIN E13 BETWEEN CLEANOUT CO-56 AND MANHOLE E13-148
PRELIMINARY COST ESTIMATE
SEPTEMBER 2020

NO.	DESCRIPTION	UNIT	UNIT PRICE	ESTIMATED QUANTITY	TOTAL PRICE
1	Mobilization/Demobilization	LS	$ 3,500	All Req'd	$ 3,500
2	Temporary Protection and Direction of Traffic/Project Safety	LS	10,000	All Req'd	10,000
3	Bypassing of Sewer Line	LS	10,000	All Req'd	10,000
4	Manhole	EA	6,000	2	12,000
5	Remove and Dispose of Existing Manhole	EA	4,000	2	8,000
6	Connection to Existing Manhole	EA	2,000	1	2,000
7	Abandon Existing Sewer Line	LS	3,000	All Req'd	3,000
8	4-inch Polyvinyl Chloride Gravity Sewer Line	LF	50	150	7,500
9	Sewer Service Connection	EA	2,000	6	12,000
10	Surface Restoration	LS	15,000	All Req'd	15,000
				Total Estimated Construction Cost	**$ 83,000**
				Administration, Legal, Engineering, and Contingencies @ 35%	30,000
				TOTAL ESTIMATED PROJECT COST (2020)	**$ 113,000**

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CITY OF
HERMISTON, OREGON
SANITARY SEWER COLLECTION SYSTEM STUDY
E. NEWPORT AVENUE GRAVITY SEWER LINE IMPROVEMENTS
PRELIMINARY COST ESTIMATE

FIGURE 5-6

CITY OF HERMISTON, OREGON
W. MADRONA AVENUE / W. RIDGEWAY AVENUE SEWER LINE REPLACEMENT
BASIN W9 BETWEEN MANHOLES W9-39 AND W9-24
PRELIMINARY COST ESTIMATE
SEPTEMBER 2020

NO.	DESCRIPTION	UNIT	UNIT PRICE	ESTIMATED QUANTITY	TOTAL PRICE
1	Mobilization/Demobilization	LS	$ 9,050	All Req'd	$ 9,050
2	Temporary Protection and Direction of Traffic/Project Safety	LS	5,000	All Req'd	5,000
3	Bypassing of Sewer Line	LS	20,000	All Req'd	20,000
4	Water/Sewer Crossing	EA	1,500	1	1,500
5	Manhole	EA	6,000	2	12,000
6	Remove and Dispose of Existing Manhole	EA	4,000	1	4,000
7	Connection to Existing Manhole	EA	2,000	1	2,000
8	8-inch Polyvinyl Chloride Gravity Sewer Line	LF	95	510	48,450
9	Sewer Service Connection	EA	2,000	14	28,000
10	Building and Fence Restoration	LS	35,000	All Req'd	35,000
11	Surface Restoration	LS	17,000	All Req'd	17,000
	Total Estimated Construction Cost				**$ 182,000**
	Administration, Legal, Engineering, and Contingencies @ 35%				64,000
	TOTAL ESTIMATED PROJECT COST (2020)				**$ 246,000**

CITY OF HERMISTON, OREGON
W. MADRONA AVENUE GRAVITY SEWER LINE REPLACEMENT
BASIN W9 BETWEEN MANHOLES W9-37 AND W9-40
PRELIMINARY COST ESTIMATE
SEPTEMBER 2020

NO.	DESCRIPTION	UNIT	UNIT PRICE	ESTIMATED QUANTITY	TOTAL PRICE
1	Mobilization/Demobilization	LS	$ 4,000	All Req'd	$ 4,000
2	Temporary Protection and Direction of Traffic/Project Safety	LS	7,000	All Req'd	7,000
3	Bypassing of Sewer Line	LS	15,000	All Req'd	15,000
4	Connection to Existing Manhole	EA	2,000	2	4,000
5	8-inch Polyvinyl Chloride Gravity Sewer Line	LF	80	250	20,000
6	Sewer Service Connection	EA	2,000	6	12,000
7	Surface Restoration	LS	20,000	All Req'd	20,000
				Total Estimated Construction Cost	**$ 82,000**
				Administration, Legal, Engineering, and Contingencies @ 35%	29,000
				TOTAL ESTIMATED PROJECT COST (2020)	**$ 111,000**

CITY OF HERMISTON, OREGON
N.E. 9TH STREET GRAVITY SEWER LINE REPLACEMENT
BASIN E15 BETWEEN CLEANOUT CO-20 AND MANHOLE E15-54
PRELIMINARY COST ESTIMATE
SEPTEMBER 2020

NO.	DESCRIPTION	UNIT	UNIT PRICE	ESTIMATED QUANTITY	TOTAL PRICE
1	Mobilization/Demobilization	LS	$ 5,750	All Req'd	$ 5,750
2	Temporary Protection and Direction of Traffic/Project Safety	LS	8,000	All Req'd	8,000
3	Bypassing of Sewer Line	LS	18,000	All Req'd	18,000
4	Water/Sewer Crossing	EA	1,500	1	1,500
5	Manhole	EA	6,000	1	6,000
6	Cleanout	EA	2,000	1	2,000
7	Remove and Dispose of Existing Manhole	EA	4,000	1	4,000
8	Connection to Existing Manhole	EA	2,000	1	2,000
9	Connection to Existing Sewer Line	EA	2,000	1	2,000
10	8-inch Polyvinyl Chloride Gravity Sewer Line	LF	75	450	33,750
11	Sewer Service Connection	EA	2,000	4	8,000
12	Surface Restoration	LS	30,000	All Req'd	30,000
	Total Estimated Construction Cost				**$ 121,000**
	Administration, Legal, Engineering, and Contingencies @ 35%				43,000
	TOTAL ESTIMATED PROJECT COST (2020)				**$ 164,000**

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CITY OF
HERMISTON, OREGON
SANITARY SEWER COLLECTION SYSTEM STUDY
N.E. 9TH STREET GRAVITY SEWER LINE REPLACEMENT
PRELIMINARY COST ESTIMATE

FIGURE
5-9

CITY OF HERMISTON, OREGON
S.E. 5TH STREET GRAVITY SEWER LINE REPLACEMENT
BASIN E12 BETWEEN MANHOLES E12-49 AND E12-53
PRELIMINARY COST ESTIMATE
SEPTEMBER 2020

NO.	DESCRIPTION	UNIT	UNIT PRICE	ESTIMATED QUANTITY	TOTAL PRICE
1	Mobilization/Demobilization	LS	$ 4,750	All Req'd	$ 4,750
2	Temporary Protection and Direction of Traffic/Project Safety	LS	7,000	All Req'd	7,000
3	Bypassing of Sewer Line	LS	15,000	All Req'd	15,000
4	Manhole	EA	6,000	2	12,000
5	Remove and Dispose of Existing Manhole	EA	4,000	2	8,000
6	Connection to Existing Sewer Line	EA	2,000	4	8,000
7	8-inch Polyvinyl Chloride Gravity Sewer Line	LF	75	350	26,250
8	Sewer Service Connection	EA	2,000	3	6,000
9	Surface Restoration	LS	25,000	All Req'd	25,000
				Total Estimated Construction Cost	**$ 112,000**
				Administration, Legal, Engineering, and Contingencies @ 35%	40,000
				TOTAL ESTIMATED PROJECT COST (2020)	**$ 152,000**

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CITY OF
HERMISTON, OREGON
SANITARY SEWER COLLECTION SYSTEM STUDY
S.E. 5TH STREET GRAVITY SEWER LINE REPLACEMENT
PRELIMINARY COST ESTIMATE

FIGURE 5-10

CITY OF HERMISTON, OREGON
DECOMMISSION LIFT STATION 3 AND REROUTE
PRELIMINARY COST ESTIMATE
SEPTEMBER 2020

NO.	DESCRIPTION	UNIT	UNIT PRICE	ESTIMATED QUANTITY	TOTAL PRICE
1	Mobilization/Demobilization	LS	$ 18,250	All Req'd	$ 18,250
2	Temporary Protection and Direction of Traffic/Project Safety	LS	30,000	All Req'd	30,000
3	8-inch Gravity Sewer Line	LF	75	1,350	101,250
4	4-inch Sewer Service Line	LF	40	2,200	88,000
5	Connection to Existing Manhole	EA	2,500	1	2,500
6	Adjustment of Utilities to Grade	EA	500	4	2,000
7	Private Lift Station	EA	10,000	5	50,000
8	Sewer Manhole	EA	6,000	4	24,000
9	Surface Restoration	LS	50,000	All Req'd	50,000
10	Abandon Manhole and Lift Station	LS	32,000	All Req'd	32,000
				Total Estimated Construction Cost	**$ 398,000**
				Administration, Legal, Engineering, and Contingencies @ 35%	140,000
				TOTAL ESTIMATED PROJECT COST (2020)	**$ 538,000**

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CITY OF
HERMISTON, OREGON
SANITARY SEWER COLLECTION SYSTEM STUDY
DECOMMISSION LIFT STATION 3
AND REROUTE
PRELIMINARY COST ESTIMATE

FIGURE
5-11

CITY OF HERMISTON, OREGON
RECONSTRUCT LIFT STATION 4 AND FORCEMAIN
PRELIMINARY COST ESTIMATE
SEPTEMBER 2020

NO.	DESCRIPTION	UNIT	UNIT PRICE	ESTIMATED QUANTITY	TOTAL PRICE
1	Mobilization/Demobilization	LS	$ 15,000	All Req'd	$ 15,000
2	Temporary Protection and Direction of Traffic/Project Safety	LS	5,000	All Req'd	5,000
3	Bypassing of Sewer Line	LS	20,000	All Req'd	20,000
4	Demolition	LS	20,000	All Req'd	20,000
5	Pipes, Pumps, Equipment, and Vaults	LS	185,000	All Req'd	185,000
6	8-inch Sewer Forcemain	LF	50	130	6,500
7	Electrical and Control Work	LS	35,000	All Req'd	35,000
8	Connection to Existing Manhole	EA	2,500	1	2,500
9	Connection to Existing Sewer Line	EA	1,500	2	3,000
10	Surface Restoration	LS	6,000	All Req'd	6,000
11	Fencing	LS	8,000	All Req'd	8,000
				Total Estimated Construction Cost	**$ 306,000**
				Administration, Legal, Engineering, and Contingencies @ 35%	108,000
				Property Acquisition	40,000
				TOTAL ESTIMATED PROJECT COST (2020)	**$ 454,000**

CITY OF HERMISTON, OREGON
RECOAT LIFT STATION 5 WETWELL
PRELIMINARY COST ESTIMATE
SEPTEMBER 2020

NO.	DESCRIPTION	UNIT	UNIT PRICE	ESTIMATED QUANTITY	TOTAL PRICE
1	Mobilization/Demobilization	LS	$ 4,000	All Req'd	$ 4,000
2	Mechanical System Painting	LS	4,000	All Req'd	4,000
3	Wetwell Cleaning	LS	8,000	All Req'd	8,000
4	Prepare and Recoat Wetwell	LS	30,000	All Req'd	30,000
5	Bypass Pumping	LS	12,000	All Req'd	12,000
	Total Estimated Construction Cost				**$ 58,000**
	Administration, Legal, Engineering, and Contingencies @ 35%				21,000
	TOTAL ESTIMATED PROJECT COST (2020)				**$ 79,000**

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CITY OF
HERMISTON, OREGON
SANITARY SEWER COLLECTION SYSTEM STUDY
RECOAT LIFT STATION 5 WETWELL
PRELIMINARY COST ESTIMATE

FIGURE
5-13

CITY OF HERMISTON, OREGON
UPGRADE LIFT STATION TELEMETRY
PRELIMINARY COST ESTIMATE
SEPTEMBER 2020

NO.	DESCRIPTION	UNIT	UNIT PRICE	ESTIMATED QUANTITY	TOTAL PRICE
1	Mobilization/Demobilization	LS	$ 5,000	All Req'd	$ 5,000
2	Telemetry Site Assessment	LS	10,000	All Req'd	10,000
3	Lift Station Telemetry Equipment and Controls	EA	15,000	7	105,000
				Total Estimated Construction Cost	**$ 120,000**
				Administration, Legal, Engineering, and Contingencies @ 15%	18,000
				TOTAL ESTIMATED PROJECT COST (2020)	**$ 138,000**

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CITY OF
HERMISTON, OREGON
SANITARY SEWER COLLECTION SYSTEM STUDY
UPGRADE LIFT STATION TELEMETRY
PRELIMINARY COST ESTIMATE

FIGURE
5-14

CITY OF HERMISTON, OREGON
UPDATE LIFT STATION 6
PRELIMINARY COST ESTIMATE
SEPTEMBER 2020

NO.	DESCRIPTION	UNIT	UNIT PRICE	ESTIMATED QUANTITY	TOTAL PRICE
1	Mobilization/Demobilization	LS	$ 16,000	All Req'd	$ 16,000
2	Project Safety	LS	15,000	All Req'd	15,000
3	Lift Station Demolition Work	LS	20,000	All Req'd	20,000
4	Wetwell Rehabilitation	LS	25,000	All Req'd	25,000
5	Lift Station Pumps, Piping, and Equipment	LS	185,000	All Req'd	185,000
6	Lift Station Electrical and Controls	LS	35,000	All Req'd	35,000
7	Bypass Pumping	LS	20,000	All Req'd	20,000
8	Surface Restoration	LS	6,000	All Req'd	6,000
9	Site Fencing	LS	10,000	All Req'd	10,000
				Total Estimated Construction Cost	**$ 332,000**
				Administration, Legal, Engineering, and Contingencies @ 35%	117,000
				Property Acquisition	100,000
				TOTAL ESTIMATED PROJECT COST (2020)	**$ 549,000**

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CITY OF
HERMISTON, OREGON
SANITARY SEWER COLLECTION SYSTEM STUDY
UPDATE LIFT STATION 6
PRELIMINARY COST ESTIMATE

FIGURE
5-15

CITY OF HERMISTON, OREGON
UPDATE LIFT STATION 7
PRELIMINARY COST ESTIMATE
SEPTEMBER 2020

NO.	DESCRIPTION	UNIT	UNIT PRICE	ESTIMATED QUANTITY	TOTAL PRICE
1	Mobilization/Demobilization	LS	$ 14,000	All Req'd	$ 14,000
2	Project Safety	LS	20,000	All Req'd	20,000
3	Lift Station Demolition Work	LS	20,000	All Req'd	20,000
4	Wetwell Rehabilitation	LS	25,000	All Req'd	25,000
5	Lift Station Pumps, Piping, and Equipment	LS	150,000	All Req'd	150,000
6	Lift Station Electrical and Controls	LS	35,000	All Req'd	35,000
7	Bypass Pumping	LS	20,000	All Req'd	20,000
8	Surface Restoration	LS	6,000	All Req'd	6,000
				Total Estimated Construction Cost	**$ 290,000**
				Administration, Legal, Engineering, and Contingencies @ 35%	102,000
				TOTAL ESTIMATED PROJECT COST (2020)	**$ 392,000**

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CITY OF
HERMISTON, OREGON
SANITARY SEWER COLLECTION SYSTEM STUDY
UPDATE LIFT STATION 7
PRELIMINARY COST ESTIMATE

FIGURE
5-16

CITY OF HERMISTON, OREGON
UPDATE LIFT STATION 8 ELECTRICAL AND CONTROLS
PRELIMINARY COST ESTIMATE
SEPTEMBER 2020

NO.	DESCRIPTION	UNIT	UNIT PRICE	ESTIMATED QUANTITY	TOTAL PRICE
1	Mobilization/Demobilization	LS	$ 10,000	All Req'd	$ 10,000
2	Project Safety	LS	10,000	All Req'd	10,000
3	Demolition Work	LS	20,000	All Req'd	20,000
4	Electrical Work	LS	120,000	All Req'd	120,000
5	Instrumentation and Controls	LS	70,000	All Req'd	70,000
	Total Estimated Construction Cost				**$ 230,000**
	Administration, Legal, Engineering, and Contingencies @ 35%				81,000
	TOTAL ESTIMATED PROJECT COST (2020)				**$ 311,000**

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CITY OF
HERMISTON, OREGON
SANITARY SEWER COLLECTION SYSTEM STUDY
UPDATE LIFT STATION 8
ELECTRICAL AND CONTROLS
PRELIMINARY COST ESTIMATE

FIGURE
5-17

Chapter 6 - Project Financing and Implementation

Introduction

This chapter evaluates the financial status of the City of Hermiston's Sewer Department and outlines alternatives for financing system improvements. A summary of state and federal funding programs is presented, including a review of funding options potentially available to the City for sewer system improvements. To construct some or all of the recommended improvements, it is important for the City of Hermiston to develop a project financing and implementation plan.

A detailed analysis of the City's current sewer rate structure is beyond the scope of this Sanitary Sewer Collection System Study (Study). However, a Sewer and Water Utility Rate Study (Rate Study) prepared by Anderson Perry & Associates, Inc., was completed in October 2018 at the request of the City. Some discussion of the existing and proposed rate structure as well as the current and future water system budgets is included herein. As a general rule, most utility rate structures include funding for periodic minor system improvements and maintenance, staff payroll costs, and set-aside for future improvements.

Current Sewer Use Rates and Revenue

Operation and maintenance of the existing sewer system is financed through the City's annual budget. Revenue is obtained from monthly sewer user fees, account setup fees, and service connection fees.

Sewer Use Rates

A summary of the existing sewer rate structure enacted in March 2020 is shown on Table 6-1.

TABLE 6-1
EXISTING SEWER RATE STRUCTURE[1]

Description	Billing Units[1]	Base Rate	Usage Rate (per 1,000 gallons)
Sewer - Residential	6,669	$35.63	$3.05
Sewer - Commercial	408	$35.63	$3.05

[1] *Number of billing units provided by the City using May 2018 data.*

The rate structure shown on Table 6-1 is designed in such a way that all sewer units are treated equally whether residential or commercial. Under this rate structure, all units are charged a flat base rate and a set rate per 1,000 gallons of average water use for the winter months of December through February. The flat base rate for all units is $35.63 and the usage rate is $3.05 per 1,000 gallons. With this rate in place and scheduled annual rate increases, it appears the City will be able to generate the revenue needed to meet projected expenditures and capital improvements projects identified in the Study.

It is recommended that the City continue to evaluate on an annual basis actual water use from December through February and whether potential reduced water use will impact its sewer sales revenue projections. It may be necessary to adjust rates if winter water use declines.

Current Financial Status

The annual cost of operating and maintaining the City's sewer system is summarized on Figure 6-1. The costs presented were obtained from the City's audits and include all costs for the sewer fund, such as operation, maintenance, and replacement (OM&R) and staff payroll. It is important to note the Water and Sewer Departments' funds are tracked separately but are treated as one fund from an accounting standpoint. Additionally, repayment requirements for loans held by either department are split equally between them.

Historical and Projected Budget Trends

A graphical plot of the City's sewer system budget for Sewer Department funds, showing total revenue, total debt service and transfers, and total OM&R expenditures, as noted above, is presented on Chart 6-1.

CHART 6-1
HISTORICAL AND PROJECTED SEWER BUDGET

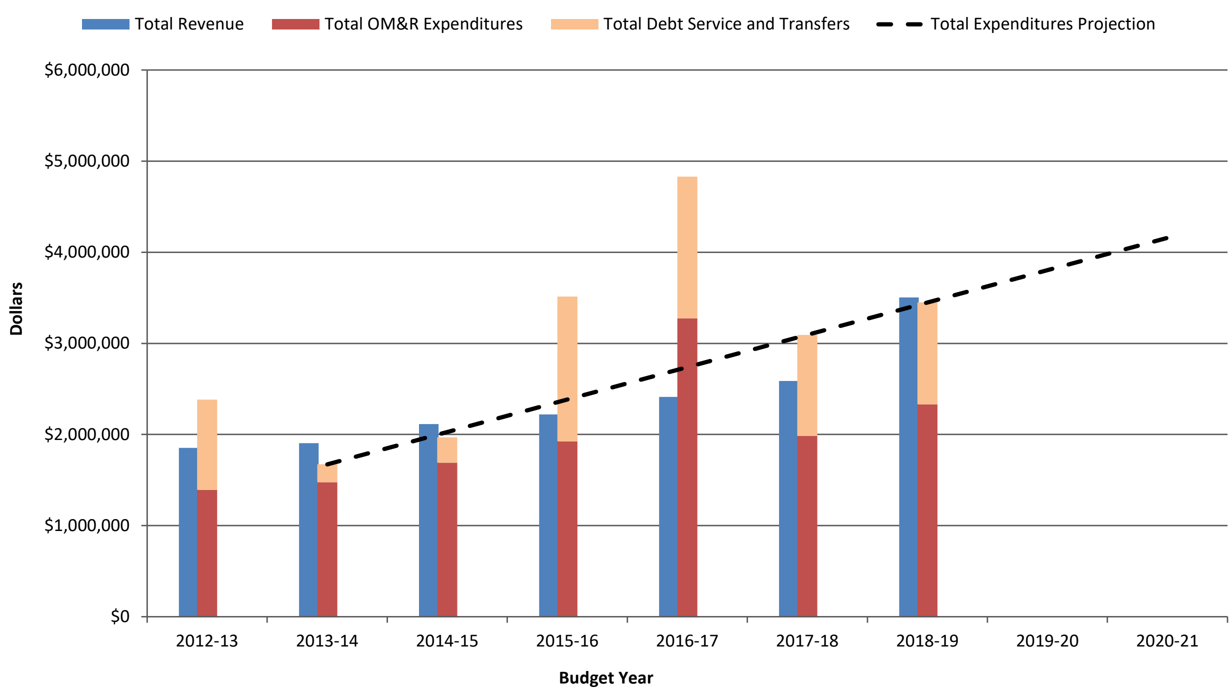

Figure 6-1 and Chart 6-1 show that the City's expenditures have generally exceeded total revenues in most years. However, the City raised sewer rates in 2019 and 2020, which is expected to bring sewer revenues in line with projected expenditures.

Existing Debt

The City has four debt service payments being paid for out of the Water and Sewer Department fund. Details of the loans are shown on Figure 6-2. These debt service payments are further discussed below.

Clean Water State Revolving Fund Loans No. R43770 and No. R43771

In fiscal year (FY) 2012-13, the City began to make draws on two loan agreements with the Oregon Department of Environmental Quality (DEQ). These loans were part of a combination grant/loan agreement for recycled water system improvements that included the construction of upgrades to the City's Recycled Wastewater Treatment Plant (RWTP). The total project cost was estimated at approximately $30 million. The initial amount of the loan given to the City to fund the project was $15,456,973. Half of these loans were assigned to the Sewer Department because the City combines the Water and Sewer Departments for accounting purposes. Loan No. R43770 and Loan No. R43771 carry an annual interest rate of 2.83 percent and 2.65 percent, respectively, and the term for the loans is 20 years. Future payments required for these loans are noted in Appendix K, along with other pertinent information about the loans.

Water and Sewer System Revenue Bond Series 2014

In FY 2014-15, the City began to make draws on a revenue bond that was issued in early 2014. This revenue bond was issued in part to make water system improvements. The main improvement to the water system included a new water line along Feedville Road that ties into the City's RWTP. The initial amount of the bond was $4,175,000, of which half was assigned to the Sewer Department. This bond carries an annual interest rate of 3.83 percent over the life of the bond, and the term for the bond is 25 years. Information about the bond and future payments required for this bond are provided in Appendix K.

Full Faith and Credit Obligations Revenue Bond Series 2017

In FY 2017-18, the City began to make draws on a revenue bond that was issued in 2017. This revenue bond was issued in part to make water system improvements. The other portion of the bond was for urban renewal, sewer, and other miscellaneous projects. The main improvement to the water system was upgrading or replacing all water meters in the City. This project included upgrading all radio read meter registers with cellular read registers and endpoints and replacing all manual read meters with new meters, registers, and endpoints. The project also included insulating all meter boxes. The total project cost was approximately $1,500,000. The initial amount of the bond was $6,755,000 of which $3,160,000 was assigned to the Water and Sewer Department fund and approximately half of that portion was assigned to the Sewer Department. This bond carries an annual interest rate of 3.04 percent over the life of the bond, and the term for the bond is 20 years. Future payments required for this bond are provided in Appendix K, along with other pertinent information about the bond.

Capital Improvements Plan

The City has elected to take a Capital Improvements Plan (CIP) approach for completing the recommended sewer system improvements projects. This requires City funds be allocated each year to the Sewer Department to complete necessary upgrades to the sewer system. City personnel have indicated that the City would like to take this approach, if possible, with the recommended improvements in this Study. For this reason, the sewer system improvements outlined in Chapter 5 have been prioritized systematically so the most critical projects, related to the reliability of the sewer system, are recommended to be completed first.

An analysis was completed to demonstrate a possible implementation schedule that the City could pursue to fund future improvements by increasing sewer rates. The analysis is shown on Figure 6-3. This figure was generated as part of the Rate Study. On this figure, rates are increased by FY 2019-20, then are raised annually throughout the forecast period (10 years) to account for anticipated inflation. Inflation for the sewer fund personnel, materials, and services is assumed to occur at an annual rate of 3 percent and the population is assumed to increase at an annual rate of 1.5 percent. In October 2018, the City adopted a utility rate ordinance that increases the sewer rates as shown on Figure 6-3 to adequately fund the Sewer Department and set aside reserve funds to implement sewer system improvements projects.

Sewer System Improvements Funding

To pursue the recommended sewer system improvements discussed in Chapter 5, the City may choose to obtain outside funding assistance. Outside funding assistance would enable a needed sewer system improvement project to be implemented sooner than a CIP approach would normally allow. For informational purposes, a summary of state and federal grant and loan programs that can provide assistance on municipal improvement projects is included herein. These programs offer various levels of funding aimed at different types of projects. These include programs administered by the U.S. Economic Development Administration (EDA), Business Oregon, and others.

These agencies can provide low interest loan funding and, possibly, grant funding for assisting communities on public works projects. Some of the funding programs provide funding only if the improvements address documented compliance issues. A summary of potential funding programs follows.

Summary of Potential Funding Programs

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

State Grant and Loan Programs

Oregon Department of Environmental Quality

Clean Water State Revolving Fund Program

The Clean Water State Revolving Fund (CWSRF) Program is administered by the DEQ and provides low interest rate loans to public agencies for the planning, design, and construction of water pollution control facilities (e.g., wastewater treatment plants), as well as for some publicly-owned estuary management and non-point source control projects. Priority in the agency's ranking process is always given to projects addressing documented water quality problems and health hazards.

Under the CWSRF Program rules, interest rates on all design and/or construction loans are set at two-thirds of the current municipal bond rate during the quarter that the loan agreement is signed. Facility planning loans have a variable interest rate (currently 2.8 percent) with repayment in five years or less. Loans for design and construction currently have an interest rate of approximately 3.4 percent with repayment over 20 years. In addition, fees are being assessed to cover program administration costs by the DEQ. A loan processing fee of 1.5 percent is included in the loan amount, a servicing fee of 0.5 percent of the outstanding balance is added to the 3.4 percent current interest rate, and a loan reserve fee equal to the annual debt service must be set aside in a separate fund, resulting in a net interest rate under the program of approximately 4.75 percent assessed annually. Under "hardship" cases where the City's residential sewer rates would exceed 1.75 percent of the median household income (MHI), higher priority rankings for funding are given. However, the City of Hermiston's current sewer rates would not meet the hardship criterion. It does appear that this program is a likely source of loan funds the City could pursue for some of the identified improvement projects.

Business Oregon

Special Public Works Fund

The Special Public Works Fund (SPWF) program was established by the Oregon Legislature in 1985 to primarily provide loan funding for municipally owned infrastructure and other facilities that support economic and community development in Oregon. Loans and grants are available to municipalities for planning, designing, purchasing, improving, and constructing municipally owned facilities, replacing owned essential community facilities, and emergency projects as a result of a disaster.

For design and construction projects, loans are primarily available; however, grants are available for and limited to projects that will create and/or retain traded-sector jobs. A traded-sector industry sells its goods or services into nationally or internationally competitive markets. The maximum grant award is $500,000 or 85 percent of the project cost, whichever is less. The grant amount per project is based on up to $5,000 per eligible job created or retained. Loans range in size from less than $100,000 to $10 million. The SPWF is able to offer very attractive interest rates that reflect tax-exempt market rates for creditors. Loan terms can be up to 25 years or the useful life of the project, whichever is less. If the City of Hermiston can tie the needed improvements to job creation, the SPWF may be an available funding source for sewer system improvements.

Water/Wastewater Financing Program

This is a loan and grant program that provides for the design and construction of public infrastructure when needed to ensure compliance with the Safe Drinking Water Act (SDWA) or the Clean Water Act (CWA). To be eligible, a system must have received, or is likely to soon receive, a notice of non-compliance by the appropriate regulatory agency associated with the SDWA or CWA.

While primarily a loan program, grants are available for municipalities that meet eligibility criteria. The loan/grant amounts are determined by financial analysis of the applicant's ability to afford a loan (debt capacity, repayment sources, current and projected utility rates, and other factors). The maximum loan term is 25 years or the useful life of the infrastructure financed, whichever is less. The maximum loan amount is $10 million per project and is determined by financial review and may be offered through a combination of direct and/or bond-funded loans. Loans are generally repaid with utility revenues or voter-approved bond issues. A limited tax general obligation pledge may also be required. Creditworthy applicants may be funded through the sale of state revenue bonds. The maximum grant is $750,000 per project based on a financial analysis. An applicant is not eligible for grant funds if the applicant's annual MHI is equal to or greater than 100 percent of the state average MHI for the same year. In addition, an applicant is not eligible for grant funds if the applicant does not have a documented compliance issue that is in need of correction. At this time, it does not appear that the City meets the requirements to be eligible for the Water/Wastewater Financing Program.

Community Development Block Grant Program

The primary objective of the Community Development Block Grant (CDBG) program is development of viable (livable) urban communities by expanding economic opportunities and providing decent housing and a suitable living environment principally for persons of low and moderate incomes.

This is a federally funded grant program. The state receives an annual allocation from Housing and Urban Development for the CDBG program. Grant funding is subject to applicant need, availability of funds, and any other restrictions in the state's Method of Distribution (i.e., program guidelines). It is not possible to determine how much, if any, grant funds may be awarded prior to an analysis of the application and financial information.

Eligibility for the CDBG program requires that greater than 51 percent of persons within the community fall into the low to moderate income (LMI) category. According to the City and County demographics utilized by Business Oregon, which was based on data from 2013 to 2017, the City of Hermiston had approximately 43.29 percent of the population within the LMI category. The CDBG program would also require residential sewer rates to exceed $52.81 per month. Additionally, an applicant is not eligible for grant funds if the applicant does not have a documented compliance issue that is in need of correction. At this time, the City is not aware of any compliance issues. Therefore, at this time, funding from the CDBG program does not appear to be available to the City.

Oregon Bond Bank

The State of Oregon has developed the Oregon Bond Bank. The Bond Bank is a loan source available to cities for improvement projects. Business Oregon also uses the Bond Bank as the source of loan funds for the Water/Wastewater and Special Public Works Fund programs. Periodically, the State of Oregon sells bonds, using the State's higher credit rating, to maintain a pool of money that the State can, in turn, loan to cities, counties, and special districts. The State pays the bonding costs and buys down the interest rate a small amount. The current interest rate is 5.25 percent. Local government agencies can finance a loan obtained from the Oregon Bond Bank based on either a local general obligation bond election or a local revenue bond authorization; either way, the interest rate is the same. Application for loans through the Oregon Bond Bank are accepted at any time by the State. This loan source is attractive to small communities because of the slightly lower interest rate and because the local government is not faced with expensive bonding costs. This program will not be as helpful as financing through the CWSRF because the interest rate from the Oregon Bond Bank is higher. This funding program is a potential option for the City of Hermiston.

Business Oregon - Regional Development Officer

Since program eligibility and funds availability may change from year to year, potential applicants are encouraged to contact their respective Regional Development Officer to obtain the most accurate and up-to-date information for each program.

Business Oregon Rate Requirements for Low Interest Loans and Grants

Business Oregon is currently using 1.25 percent of a community's five-year MHI as the basis for residential monthly sewer user cost requirements to be eligible for low-interest loan or grant funding. In the City's case, the five-year MHI (2012 to 2017) was $50,694. This MHI results in a required monthly residential sewer user cost of $52.81 to qualify for low interest loan or grant funding. The City does not currently meet the 1.25 percent MHI threshold to obtain low interest loans and/or grant funds through Business Oregon. It should be noted that this criterion can change on an annual basis, so periodically checking on current Business Oregon rate requirements is recommended.

Federal Grant and Loan Programs

U.S. Economic Development Administration

The EDA has grant and loan funds similar to those available through Business Oregon's SPWF program. Monies are available to public agencies to fund projects that stimulate the economy of an area, and the overall goal of the program is to create or retain jobs. The EDA has invested a great deal of money in Oregon to fund public works improvement projects in areas where new industries were locating or planned to locate in the future. In addition, the agency has a program known as the Public Works Impact Program to fund projects in areas with extremely high rates of unemployment. This program is targeted toward creating additional jobs and reducing the unemployment rate in the area. If the City's sewer system improvements can be linked directly to industrial expansion or job retention/expansion, the City could be in a competitive position to receive funding under EDA programs.

Pursuing Potential Outside Project Funding Assistance

Based on the estimated costs provided herein, the City may elect to pursue loan funding. If a sewer system improvements project is pursued, it is recommended the City thoroughly investigate potential available funding sources to verify the best funding package is obtained for the project. The following sections provide information on pursuing funding through Business Oregon or other local financing sources. This assumes the City is looking for outside funding assistance rather than implementing the CIP approach discussed earlier in this chapter.

One Stop Meeting and Project Notification and Intake Form

To evaluate all potential project funding options, a One Stop meeting is generally requested by a city. One Stop meetings are typically scheduled in Salem where representatives of Business Oregon and other funding agencies meet with the city to discuss the project and funding needs and identify the funding program best suited for the project. To avoid requiring city representatives to travel to Salem, Business Oregon has recently been holding these meetings locally or through video or telephone conferencing. Business Oregon utilizes a Project Notification and Intake Form (PNIF) to outline a city's project, including the needs, project requirements, affected area, estimated project cost, time frame, schedule, etc. Business Oregon evaluates the project based on information presented on the PNIF to determine the best funding program suited to the project. The city is usually invited to submit a funding application to the best funding program(s) identified in the One Stop meeting.

Local Financing Options

Regardless of the ultimate project scope and agency from which funds are obtained, the City of Hermiston may need to develop authorization to incur debt (i.e., bonding) for the recommended improvements. The need to develop authorization to incur debt depends on funding agency requirements and provisions in the City Charter. The need for bonding by the City has been eliminated by most state funding programs. However, if a bond election is required, there are generally two options the City may use for its bonding authority: general obligation bonds and revenue bonds. General obligation bonds require a vote of the people to give the City the authority to repay the debt service through tax assessments, sewer revenues, or a combination of both. The City's taxing authority provides the guarantee for the debt. Revenue bonds are financed through revenues of the sewer system. Authority to issue revenue bonds can come in two forms. One would be through a local bond election similar to that needed to sell a general obligation bond, and the second would be through Council action authorizing the sale of revenue bonds, if the City Charter allows. If more than 5 percent of the registered voters do not object to the bonding authority resolution during a 60-day remonstrance period, the City would have authority to sell these revenue bonds.

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

Action Items and Implementation Schedule

To move forward with completing the sewer system improvements summarized in this Study, the following action items and implementation plan need to occur.

Action Items

- This Study was sent to the DEQ for review and was approved in January 2021.
- The City Council needs to formally adopt this Study and the associated priority improvements outlined in Chapter 4.
- The City should review its Comprehensive Plan related to the public facilities planning element and update the Comprehensive Plan as needed with information presented in this Study.
- The City should update its CIP based on recommended high priority improvements identified in this Study.
- The City should seek to implement priority improvements as sufficient funds are generated in the Sewer Department.
- The City Council and personnel should monitor the progress of sewer system improvements over the next five years. If sufficient revenue is not obtained, the City should consider pursuing outside funding assistance.

Recommended Improvements Summary Implementation Plan

The key to implementing the recommended improvements outlined in this Study is the ability of the City to allocate monies to fund these improvements, while working closely with its citizens to inform them of the sewer system needs and the necessity for increased sewer user rates.

Sewer system improvements as outlined in this Study are intended to provide the City with a reliable, quality sewer system that will meet the needs of the City for the planning period and beyond. As development occurs, sewer system improvements will help the City to meet these needs. With the CIP approach, the City eliminates the need to borrow additional funds while completing the improvements projects. However, sewer rates will need to be raised as outlined within the Rate Study to adequately fund the recommended system improvements over the 20-year planning period.

CITY OF HERMISTON, OREGON
SEWER SYSTEM COLLLECTION SYSTEM STUDY
HISTORICAL SEWER DEPARTMENT FUNDS

Fiscal Year	Revenue					Expenditures						Net Operating Income (Loss)[3]
						OM&R Expenditures						
	Sales	Connections and Services	Septic Tank Services	Miscellaneous Revenue	Total Revenue	Personnel Services	Materials and Services	Capital Outlay	Transfers[1]	Debt Services[2]	Total Expenditures	
2012-13	$ 1,814,847	$ 10,825	$ 18,873	$ 8,509	$ 1,853,054	$ 1,011,165	$ 380,919	-	$ 835,000	$ 156,311	$ 2,383,395	$ (530,341)
2013-14	$ 1,881,390	$ 10,800	$ 12,296	-	$ 1,904,486	$ 1,070,864	$ 405,633	-	$ 39,750	$ 156,791	$ 1,673,038	$ 231,448
2014-15	$ 2,098,019	$ 15,200	$ 1,883	-	$ 2,115,102	$ 1,135,522	$ 550,645	$ 4,990	$ 23,000	$ 255,359	$ 1,969,516	$ 145,586
2015-16	$ 2,187,655	$ 16,835	$ 1,650	$ 14,660	$ 2,220,800	$ 1,185,130	$ 731,399	$ 8,374	$ 418,000	$ 1,171,862	$ 3,514,765	$ (1,293,965)
2016-17	$ 2,280,183	$ 11,925	$ 730	$ 120,722	$ 2,413,560	$ 1,229,321	$ 2,046,698	-	$ 300,000	$ 1,253,615	$ 4,829,634	$ (2,416,074)
2017-18	$ 2,562,872	$ 20,725	$ 677	$ 3,681	$ 2,587,955	$ 1,130,557	$ 817,100	$ 35,000	$ 1,108,799	-	$ 3,091,456	$ (503,501)
2018-19	$ 3,459,581	$ 24,545	-	$ 20,051	$ 3,504,177	$ 1,258,914	$ 1,052,754	$ 19,896	$ 104,000	$ 1,013,872	$ 3,449,436	$ 54,741

Notes:

[1] Transfers include equipment and miscellaneous reserve, rate stabilization, and general fund expenses.

[2] Debt Services refers to transfers to bonded debt. Loan amounts held by either the Water or Recycled Water Departments are split equally between them.

[3] Net Operating Income does not cash carryover from previous years or transfers from reserves.

OM&R = Operation, Maintenance, and Replacement

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CITY OF
HERMISTON, OREGON
SANTIARY SEWER COLLECTION SYSTEM STUDY
HISTORICAL SEWER
DEPARTMENT FUNDS

FIGURE
6-1

CITY OF HERMISTON, OREGON
SANITARY SEWER COLLECTION SYSTEM STUDY
SEWER DEPARTMENT DEBT SERVICE SUMMARY

Loan	Financer	Loan Date	Original Loan Amount		Interest Rate	Maturity Date
CWSRF R43770	DEQ	November 2012	$	2,023,664	2.83 percent	May 1, 2032
CWSRF R43771	DEQ	November 2012	$	5,704,823	2.65 percent	May 1, 2032
Series 2014 W&S	Bond	April 2014	$	2,087,500	3.83 percent	November 1, 2039
FF&C Series 207	Bond	September 2017	$	1,580,000	3.04 percent	September 1, 2037
		Total	**$**	**11,395,987**		

Notes:
1. Loan amounts are half of overall loans due to being split equally between the Water and Sewer Departments.

CWSRF = Clean Water State Revolving Fund
DEQ = Oregon Department of Environmental Quality
W&S = Water and Sewer
FF&C = Full Faith and Credit Obligation

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CITY OF
HERMISTON, OREGON
SANITARY SEWER COLLECTION SYSTEM STUDY
SEWER DEPARTMENT DEBT SERVICE SUMMARY

FIGURE
6-2

CITY OF HERMISTON, OREGON
SANITARY SEWER COLLECTION SYSTEM STUDY
PROJECTED SEWER RATES, REVENUES, AND EXPENDITURES

Sewer Fund

FY	Sewer Rates: Residential: EDU Flat Rate	Sewer Rates: Residential: Rate/1,000 Gal	Sewer Rates: Commercial/Motel: Flat Rate	Sewer Rates: Commercial/Motel: Rate/1,000 Gal	Revenues: Recycled Water Sales	Revenues: Recycled Water Connection and Services	Revenues: Septic Tank Service	Revenues: Miscellaneous	Revenues: Total Revenue
2018-19	$ 30.00	$ 3.00	$ 30.00	$ 3.00	$ 3,459,581	$ 24,545	$ -	$ 20,051	$ 3,504,177
2019-20	$ 30.63	$ 3.05	$ 30.63	$ 3.05	$ 3,615,262	$ 15,000	$ 1,500	$ 3,000	$ 3,634,762
2020-21	$ 31.55	$ 3.14	$ 31.55	$ 3.14	$ 3,777,949	$ 15,000	$ 1,500	$ 3,000	$ 3,797,449
2021-22	$ 32.50	$ 3.24	$ 32.50	$ 3.24	$ 3,947,957	$ 15,000	$ 1,500	$ 3,000	$ 3,967,457
2022-23	$ 33.47	$ 3.33	$ 33.47	$ 3.33	$ 4,125,615	$ 15,000	$ 1,500	$ 3,000	$ 4,145,115
2023-24	$ 34.47	$ 3.43	$ 34.47	$ 3.43	$ 4,311,267	$ 15,000	$ 1,500	$ 3,000	$ 4,330,767
2024-25	$ 35.51	$ 3.54	$ 35.51	$ 3.54	$ 4,505,274	$ 15,000	$ 1,500	$ 3,000	$ 4,524,774
2025-26	$ 36.57	$ 3.64	$ 36.57	$ 3.64	$ 4,708,012	$ 15,000	$ 1,500	$ 3,000	$ 4,727,512
2026-27	$ 37.67	$ 3.75	$ 37.67	$ 3.75	$ 4,919,872	$ 15,000	$ 1,500	$ 3,000	$ 4,939,372
2027-28	$ 38.80	$ 3.86	$ 38.80	$ 3.86	$ 5,141,267	$ 15,000	$ 1,500	$ 3,000	$ 5,160,767
2028-29	$ 39.97	$ 3.98	$ 39.97	$ 3.98	$ 5,372,624	$ 15,000	$ 1,500	$ 3,000	$ 5,392,124

FY	Expenditures: Personnel Services	Expenditures: Materials and Services	Expenditures: Capital Outlay	Expenditures: Transfers	Expenditures: Rate Stabilization	Expenditures: General Fund	Expenditures: Debt Service	Expenditures: Long-Term Capital Improvements	Expenditures: Total Expenditures	Net Income (Loss)	Recycled Water Fund Ending Balance
2018-19	*$ 1,258,914*	$ 1,052,754	$ 19,896	$ 104,000	$ -	$ -	$ 1,013,872		$ 3,449,436		*$ 365,000*
2019-20	$ 1,296,681	$ 1,084,337	$ 20,000		$ -	$ -	$ 1,013,872	$ -	$ 3,414,890	$ 219,872	*$ 584,872*
2020-21	$ 1,335,582	$ 1,116,867	$ 20,000		$ -	$ -	$ 1,011,608	$ -	$ 3,484,057	$ 313,392	*$ 898,264*
2021-22	$ 1,375,649	$ 1,150,373	$ 20,000		$ -	$ -	$ 1,010,208	$ -	$ 3,556,230	$ 411,227	*$ 1,309,491*
2022-23	$ 1,416,919	$ 1,184,884	$ 20,000		$ -	$ -	$ 1,005,519	$ -	$ 3,627,322	$ 517,793	*$ 1,827,284*
2023-24	$ 1,459,426	$ 1,220,430	$ 20,000		$ -	$ -	$ 1,005,616	$ -	$ 3,705,473	$ 625,295	*$ 2,452,579*
2024-25	$ 1,503,209	$ 1,257,043	$ 20,000		$ -	$ -	$ 1,002,922	$ -	$ 3,783,174	$ 741,600	*$ 3,194,179*
2025-26	$ 1,548,305	$ 1,294,755	$ 20,000		$ -	$ -	$ 999,985	$ -	$ 3,863,045	$ 864,467	*$ 4,058,645*
2026-27	$ 1,594,755	$ 1,333,597	$ 20,000		$ -	$ -	$ 996,803	$ -	$ 3,945,155	$ 994,217	*$ 5,052,863*
2027-28	$ 1,642,597	$ 1,373,605	$ 20,000		$ -	$ -	$ 995,824	$ -	$ 4,032,026	$ 1,128,740	*$ 6,181,603*
2028-29	$ 1,691,875	$ 1,414,813	$ 20,000		$ -	$ -	$ 991,996	$ -	$ 4,118,684	$ 1,273,439	*$ 7,455,042*

General Notes:
1. Sewer rates are those that were in place at the beginning of the FY.
2. Costs (blue) shown for FY 2018-19 are costs (provided by the City of Hermiston).
3. Typical residential sewer rates are for connections inside the City.
4. Costs shown for future years are proposed budget costs, using the FY 2018-19 budget as the base.

EDU = equivalent dwelling unit
FY = fiscal year
Gal = gallon
= Cash carryover from 2017/18 budget year.

Assumptions:

Assumed Consumer Price Index increase of:	3%
Assumed population growth rate:	1.50%
Assumed inflation rate:	3%

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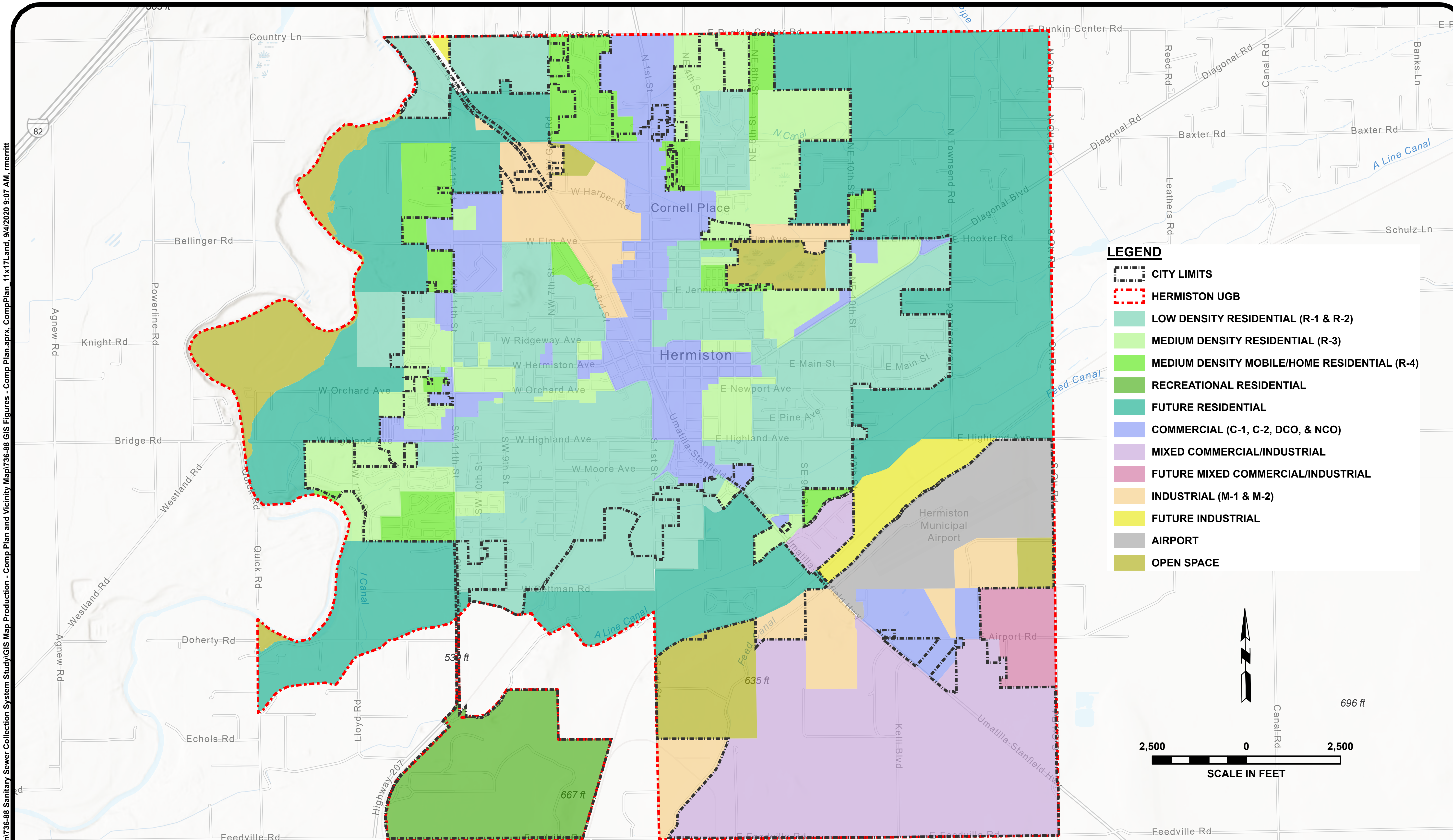
CITY OF
HERMISTON, OREGON
SANITARY SEWER COLLECTION SYSTEM STUDY
PROJECTED SEWER RATES, REVENUES, AND EXPENDITURES

FIGURE 6-3

Appendices Table of Contents

APPENDIX A
2020 Comprehensive Plan Map



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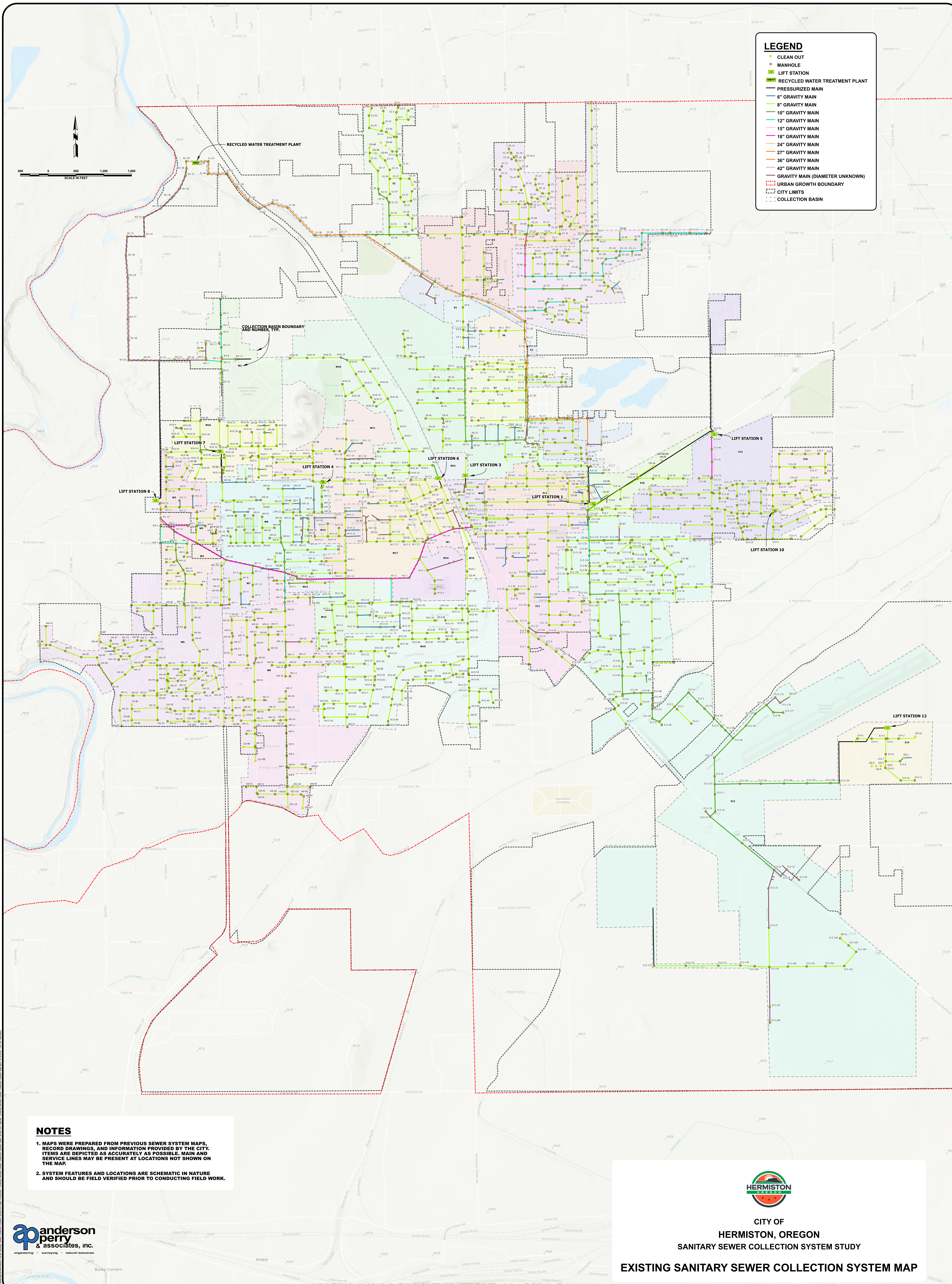
CITY OF
HERMISTON, OREGON
SANITARY SEWER COLLECTION SYSTEM STUDY

2020 COMPREHENSIVE PLAN MAP

APPENDIX
A

APPENDIX B
Existing Sanitary Sewer Collection System Map



NOTES

1. MAPS WERE PREPARED FROM PREVIOUS SEWER SYSTEM MAPS, RECORD DRAWINGS, AND INFORMATION PROVIDED BY THE CITY. ITEMS ARE DEPICTED AS ACCURATELY AS POSSIBLE. MAIN AND SERVICE LINES MAY BE PRESENT AT LOCATIONS NOT SHOWN ON THE MAP.
2. SYSTEM FEATURES AND LOCATIONS ARE SCHEMATIC IN NATURE AND SHOULD BE FIELD VERIFIED PRIOR TO CONDUCTING FIELD WORK.

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HERMISTON OREGON

CITY OF
HERMISTON, OREGON
SANITARY SEWER COLLECTION SYSTEM STUDY

EXISTING SANITARY SEWER COLLECTION SYSTEM MAP

APPENDIX C
Discharge Monitoring Report Flow Data

Treatment Plant Flow		
Date	Influent (MGD)	Effluent (MGD)
1/1/17	1.12	1.288
1/2/17	1.258	1.475
1/3/17	1.17	1.351
1/4/17	1.159	1.442
1/5/17	1.58	1.361
1/6/17	1.152	1.454
1/7/17	1.08	1.383
1/8/17	1.242	1.47
1/9/17	1.193	1.452
1/10/17	1.197	1.402
1/11/17	1.176	1.465
1/12/17	1.176	1.437
1/13/17	1.263	1.555
1/14/17	1.177	1.484
1/15/17	1.221	1.454
1/16/17	1.195	1.498
1/17/17	1.181	1.535
1/18/17	1.282	1.49
1/19/17	1.23	1.492
1/20/17	1.269	1.426
1/21/17	1.319	1.47
1/22/17	1.358	1.512
1/23/17	1.262	1.425
1/24/17	1.271	1.305
1/25/17	1.301	1.449
1/26/17	1.285	1.389
1/27/17	1.309	1.41
1/28/17	1.269	1.475
1/29/17	1.328	1.441
1/30/17	1.3	1.411
1/31/17	1.301	1.337
2/1/17	1.551	1.388
2/2/17	1.347	1.37
2/3/17	1.16	1.41
2/4/17	1.188	1.383
2/5/17	1.281	1.415
2/6/17	1.296	1.447
2/7/17	1.214	1.402
2/8/17	1.192	1.405
2/9/17	1.204	1.439
2/10/17	1.278	1.423
2/11/17	1.207	1.439
2/12/17	1.265	1.437
2/13/17	1.179	1.366
2/14/17	1.153	1.378
2/15/17	1.208	1.405
2/16/17	1.207	1.373
2/17/17	1.261	1.426
2/18/17	1.215	1.399
2/19/17	1.245	1.417
2/20/17	1.37	1.498

2/21/17	1.39	1.546
2/22/17	1.243	1.435
2/23/17	1.22	1.43
2/24/17	1.235	1.442
2/25/17	1.238	1.409
2/26/17	1.319	1.471
2/27/17	1.25	1.434
2/28/17	1.253	1.418
3/1/17	1.241	1.415
3/2/17	1.25	1.441
3/3/17	1.259	1.48
3/4/17	1.243	1.434
3/5/17	1.288	1.465
3/6/17	1.235	1.448
3/7/17	1.232	1.431
3/8/17	1.24	1.406
3/9/17	1.26	1.361
3/10/17	1.195	1.219
3/11/17	1.231	1.34
3/12/17	1.258	1.383
3/13/17	1.231	1.367
3/14/17	1.282	1.395
3/15/17	1.256	1.384
3/16/17	1.236	1.405
3/17/17	1.239	1.397
3/18/17	1.22	1.427
3/19/17	1.29	1.356
3/20/17	1.245	1.391
3/21/17	1.307	1.38
3/22/17	1.25	1.454
3/23/17	1.238	1.341
3/24/17	1.345	1.46
3/25/17	1.177	1.285
3/26/17	1.245	1.349
3/27/17	1.229	1.361
3/28/17	1.195	1.287
3/29/17	1.262	1.336
3/30/17	1.178	1.322
3/31/17	1.238	1.426
4/1/17	1.191	1.376
4/2/17	1.297	1.456
4/3/17	1.207	1.433
4/4/17	1.219	1.437
4/5/17	1.246	1.42
4/6/17	1.228	1.458
4/7/17	1.234	1.481
4/8/17	1.176	1.394
4/9/17	1.267	1.482
4/10/17	1.187	1.42
4/11/17	1.204	1.387
4/12/17	1.285	1.414
4/13/17	1.193	1.356
4/14/17	1.206	1.407
4/15/17	1.145	1.38
4/16/17	1.239	1.405

4/17/17	1.215	1.394
4/18/17	1.187	1.366
4/19/17	1.212	1.367
4/20/17	1.181	1.349
4/21/17	1.186	1.365
4/22/17	1.145	1.36
4/23/17	1.254	1.426
4/24/17	1.264	1.406
4/25/17	1.215	1.381
4/26/17	1.24	1.403
4/27/17	1.194	1.366
4/28/17	1.14	1.387
4/29/17	1.18	1.33
4/30/17	1.238	1.434
5/1/17	1.205	1.375
5/2/17	1.203	1.322
5/3/17	1.324	1.403
5/4/17	1.291	1.391
5/5/17	1.266	1.415
5/6/17	1.174	1.358
5/7/17	1.23	1.439
5/8/17	1.221	1.418
5/9/17	1.238	1.361
5/10/17	1.233	1.334
5/11/17	1.177	1.295
5/12/17	1.235	1.368
5/13/17	1.143	1.319
5/14/17	1.224	1.367
5/15/17	1.205	1.346
5/16/17	1.242	1.289
5/17/17	1.155	1.272
5/18/17	1.161	1.267
5/19/17	1.17	1.316
5/20/17	1.132	1.294
5/21/17	1.205	1.356
5/22/17	1.189	1.345
5/23/17	1.197	1.289
5/24/17	1.159	1.548
5/25/17	1.152	1.316
5/26/17	1.197	1.326
5/27/17	1.126	1.301
5/28/17	1.155	1.303
5/29/17	1.243	1.377
5/30/17	1.198	1.311
5/31/17	1.185	1.318
6/1/17	1.193	1.281
6/2/17	1.16	1.313
6/3/17	1.187	1.288
6/4/17	1.213	1.364
6/5/17	1.188	1.366
6/6/17	1.207	1.369
6/7/17	1.253	1.378
6/8/17	1.214	1.309
6/9/17	1.302	1.366
6/10/17	1.189	1.434

6/11/17	1.275	1.428
6/12/17	1.19	1.383
6/13/17	1.274	1.32
6/14/17	1.154	1.318
6/15/17	1.267	1.326
6/16/17	1.213	1.361
6/17/17	1.215	1.327
6/18/17	1.212	1.381
6/19/17	1.23	1.383
6/20/17	1.216	1.304
6/21/17	1.172	1.316
6/22/17	1.214	1.379
6/23/17	1.256	1.427
6/24/17	1.188	1.356
6/25/17	1.215	1.35
6/26/17	1.186	1.331
6/27/17	1.231	1.399
6/28/17	1.208	1.298
6/29/17	1.224	1.341
6/30/17	1.22	1.324
7/1/17	1.22	1.42
7/2/17	1.196	1.312
7/3/17	1.177	1.335
7/4/17	1.185	1.272
7/5/17	1.181	1.317
7/6/17	1.206	1.326
7/7/17	1.188	1.375
7/8/17	1.191	1.368
7/9/17	1.203	1.159
7/10/17	1.232	1.289
7/11/17	1.203	1.348
7/12/17	1.229	1.336
7/13/17	1.222	1.372
7/14/17	1.22	1.393
7/15/17	1.251	1.411
7/16/17	1.23	1.355
7/17/17	1.194	1.259
7/18/17	1.249	1.338
7/19/17	1.226	1.334
7/20/17	1.209	1.317
7/21/17	1.219	1.413
7/22/17	1.216	1.303
7/23/17	1.26	1.417
7/24/17	1.239	1.352
7/25/17	1.223	1.549
7/26/17	1.228	1.484
7/27/17	1.227	1.34
7/28/17	1.215	1.364
7/29/17	1.258	1.341
7/30/17	1.253	1.408
7/31/17	1.228	1.314
8/1/17	1.235	1.316
8/2/17	1.244	1.37
8/3/17	1.271	1.405
8/4/17	1.25	1.416

8/5/17	1.238	1.3
8/6/17	1.343	1.436
8/7/17	1.297	1.431
8/8/17	1.274	1.409
8/9/17	1.286	1.387
8/10/17	1.309	1.406
8/11/17	1.296	1.415
8/12/17	1.32	1.362
8/13/17	1.232	1.345
8/14/17	1.227	1.364
8/15/17	1.251	1.33
8/16/17	1.21	1.285
8/17/17	1.228	1.299
8/18/17	1.205	1.31
8/19/17	1.276	1.326
8/20/17	1.245	1.311
8/21/17	1.233	1.351
8/22/17	1.303	1.32
8/23/17	1.282	1.342
8/24/17	1.257	1.291
8/25/17	1.231	1.354
8/26/17	1.307	1.344
8/27/17	1.357	1.427
8/28/17	1.272	1.351
8/29/17	1.246	1.302
8/30/17	1.269	1.315
8/31/17	1.269	1.358
9/1/17	1.202	1.308
9/2/17	1.254	1.287
9/3/17	1.158	1.269
9/4/17	1.324	1.414
9/5/17	1.232	1.356
9/6/17	1.269	1.449
9/7/17	1.296	1.282
9/8/17	1.276	1.362
9/9/17	1.364	1.429
9/10/17	1.378	1.447
9/11/17	1.292	1.394
9/12/17	1.312	1.337
9/13/17	1.288	1.361
9/14/17	1.256	1.35
9/15/17	1.208	1.358
9/16/17	1.284	1.403
9/17/17	1.365	1.436
9/18/17	1.296	1.423
9/19/17	1.284	1.355
9/20/17	1.245	1.384
9/21/17	1.208	1.324
9/22/17	1.188	1.362
9/23/17	1.238	1.322
9/24/17	1.298	1.465
9/25/17	1.331	1.453
9/26/17	1.269	1.336
9/27/17	1.274	1.326
9/28/17	1.283	1.351
9/29/17	1.243	1.331
9/30/17	1.279	1.3
10/1/17	1.328	1.402
10/2/17	1.208	1.353

10/3/17	1.229	1.335
10/4/17	1.218	1.362
10/5/17	1.262	1.391
10/6/17	1.247	1.402
10/7/17	1.276	1.307
10/8/17	1.285	1.426
10/9/17	1.313	1.367
10/10/17	1.299	1.395
10/11/17	1.32	1.478
10/12/17	1.291	1.47
10/13/17	1.296	1.48
10/14/17	1.28	1.49
10/15/17	1.353	1.572
10/16/17	1.337	1.478
10/17/17	1.289	1.463
10/18/17	1.299	1.505
10/19/17	1.348	1.51
10/20/17	1.294	1.475
10/21/17	1.32	1.43
10/22/17	1.366	1.514
10/23/17	1.254	1.448
10/24/17	1.248	1.442
10/25/17	1.286	1.426
10/26/17	1.258	1.445
10/27/17	1.231	1.531
10/28/17	1.241	1.408
10/29/17	1.328	1.491
10/30/17	1.229	1.418
10/31/17	1.224	1.37
11/1/17	1.266	1.442
11/2/17	1.271	1.502
11/3/17	1.19	1.465
11/4/17	1.289	1.454
11/5/17	1.332	1.518
11/6/17	1.218	1.475
11/7/17	1.238	1.439
11/8/17	1.239	1.434
11/9/17	1.25	1.41
11/10/17	1.234	1.451
11/11/17	1.271	1.43
11/12/17	1.307	1.47
11/13/17	1.232	1.39
11/14/17	1.195	1.48
11/15/17	1.299	1.52
11/16/17	1.26	1.416
11/17/17	1.181	1.467
11/18/17	1.228	1.475
11/19/17	1.285	1.475
11/20/17	1.275	1.503
11/21/17	1.23	1.405
11/22/17	1.33	1.473
11/23/17	1.282	1.403
11/24/17	1.145	1.412
11/25/17	1.168	1.371
11/26/17	1.281	1.441
11/27/17	1.205	1.472
11/28/17	1.301	1.486
11/29/17	1.115	1.419
11/30/17	1.165	1.426

12/1/17	1.175	1.497
12/2/17	1.15	1.41
12/3/17	1.252	1.361
12/4/17	1.159	1.35
12/5/17	1.176	1.376
12/6/17	1.228	1.369
12/7/17	1.253	1.447
12/8/17	1.188	1.367
12/9/17	1.303	1.507
12/10/17	1.323	1.46
12/11/17	1.252	1.429
12/12/17	1.218	1.411
12/13/17	1.27	1.462
12/14/17	1.259	1.385
12/15/17	1.19	1.427
12/16/17	1.244	1.375
12/17/17	1.362	1.436
12/18/17	1.321	1.464
12/19/17	1.282	1.378
12/20/17	1.247	1.41
12/21/17	1.25	1.403
12/22/17	1.245	1.529
12/23/17	1.385	1.508
12/24/17	1.145	1.354
12/25/17	1.041	1.332
12/26/17	1.218	1.365
12/27/17	1.235	1.391
12/28/17	1.263	1.426
12/29/17	1.521	1.338
12/30/17	1.392	1.537
12/31/17	1.24	1.41
1/1/18	1.303	1.458
1/2/18	1.291	1.471
1/3/18	1.297	1.495
1/4/18	1.212	1.427
1/5/18	1.238	1.415
1/6/18	1.344	1.62
1/7/18	1.328	1.399
1/8/18	1.229	1.469
1/9/18	1.293	1.517
1/10/18	1.505	1.505
1/11/18	1.449	1.449
1/12/18	1.166	1.457
1/13/18	1.414	1.536
1/14/18	1.332	1.43
1/15/18	1.332	1.578
1/16/18	1.378	1.472
1/17/18	1.316	1.481
1/18/18	1.363	1.537
1/19/18	1.387	1.435
1/20/18	1.482	1.559
1/21/18	1.569	1.536
1/22/18	1.51	1.496
1/23/18	1.407	1.42
1/24/18	1.518	1.4
1/25/18	1.461	1.349
1/26/18	1.431	1.414
1/27/18	1.521	1.499
1/28/18	1.55	1.441

1/29/18	1.519	1.436
1/30/18	1.557	1.447
1/31/18	1.45	1.462
2/1/18	1.524	1.503
2/2/18	1.457	1.416
2/3/18	1.513	1.449
2/4/18	1.579	1.508
2/5/18	1.465	1.399
2/6/18	1.459	1.417
2/7/18	1.412	1.408
2/8/18	1.437	1.396
2/9/18	1.434	1.49
2/10/18	1.507	1.459
2/11/18	1.513	1.411
2/12/18	1.4	1.434
2/13/18	1.462	1.387
2/14/18	1.461	1.339
2/15/18	1.447	1.346
2/16/18	1.415	1.359
2/17/18	1.383	1.419
2/18/18	1.399	1.352
2/19/18	1.454	1.49
2/20/18	1.413	1.453
2/21/18	1.433	1.527
2/22/18	1.399	1.468
2/23/18	1.399	1.479
2/24/18	1.506	1.425
2/25/18	1.519	1.372
2/26/18	1.398	1.28
2/27/18	1.432	1.398
2/28/18	1.449	1.409
3/1/18	1.456	1.436
3/2/18	1.375	1.471
3/3/18	1.481	1.552
3/4/18	1.481	1.487
3/5/18	1.444	1.505
3/6/18	1.379	1.581
3/7/18	1.444	1.478
3/8/18	1.424	1.487
3/9/18	1.368	1.424
3/10/18	1.415	1.439
3/11/18	1.496	1.413
3/12/18	1.447	1.457
3/13/18	1.475	1.397
3/14/18	1.412	1.429
3/15/18	1.347	1.359
3/16/18	1.412	1.391
3/17/18	1.498	1.429
3/18/18	1.445	1.342
3/19/18	1.367	1.421
3/20/18	1.379	1.367
3/21/18	1.413	1.378
3/22/18	1.415	1.368
3/23/18	1.425	1.362
3/24/18	1.381	1.389
3/25/18	1.341	1.314
3/26/18	1.395	1.404
3/27/18	1.387	1.367
3/28/18	1.384	1.346

3/29/18	1.358	1.388
3/30/18	1.366	1.421
3/31/18	1.461	1.464
4/1/18	1.397	1.273
4/2/18	1.394	1.5
4/3/18	1.402	1.425
4/4/18	1.404	1.442
4/5/18	1.367	1.408
4/6/18	1.291	1.403
4/7/18	1.463	1.463
4/8/18	1.297	1.297
4/9/18	1.294	1.317
4/10/18	1.302	1.387
4/11/18	1.485	1.445
4/12/18	1.312	1.423
4/13/18	1.326	1.377
4/14/18	1.36	1.455
4/15/18	1.504	1.551
4/16/18	1.333	1.435
4/17/18	1.322	1.411
4/18/18	1.295	1.359
4/19/18	1.343	1.356
4/20/18	1.308	1.403
4/21/18	1.358	1.45
4/22/18	1.34	1.51
4/23/18	1.354	1.395
4/24/18	1.326	1.347
4/25/18	1.361	1.401
4/26/18	1.323	1.314
4/27/18	1.345	1.371
4/28/18	1.261	1.463
4/29/18	1.399	1.56
4/30/18	1.348	1.465
5/1/18	1.325	1.336
5/2/18	1.307	1.347
5/3/18	1.376	1.422
5/4/18	1.28	1.439
5/5/18	1.334	1.313
5/6/18	1.434	1.488
5/7/18	1.431	1.409
5/8/18	1.416	1.418
5/9/18	1.411	1.56
5/10/18	1.371	1.493
5/11/18	1.436	1.428
5/12/18	1.353	1.394
5/13/18	1.416	1.538
5/14/18	1.381	1.453
5/15/18	1.436	1.452
5/16/18	1.354	1.483
5/17/18	1.374	1.523
5/18/18	1.324	1.377
5/19/18	1.407	1.437
5/20/18	1.396	1.449
5/21/18	1.406	1.561
5/22/18	1.416	1.476
5/23/18	1.396	1.296
5/24/18	1.377	1.444
5/25/18	1.341	1.334
5/26/18	1.302	1.423

5/27/18	1.324	1.416
5/28/18	1.435	1.343
5/29/18	1.377	1.499
5/30/18	1.362	1.573
5/31/18	1.359	1.44
6/1/18	1.315	1.402
6/2/18	1.376	1.357
6/3/18	1.471	1.592
6/4/18	1.351	1.416
6/5/18	1.349	1.446
6/6/18	1.355	1.376
6/7/18	1.375	1.4
6/8/18	1.382	1.349
6/9/18	1.373	1.412
6/10/18	1.347	1.399
6/11/18	1.392	1.453
6/12/18	1.352	1.36
6/13/18	1.408	1.392
6/14/18	1.384	1.417
6/15/18	1.351	1.33
6/16/18	1.339	1.366
6/17/18	1.443	1.477
6/18/18	1.449	1.43
6/19/18	1.44	1.47
6/20/18	1.422	1.377
6/21/18	1.395	1.464
6/22/18	1.412	1.394
6/23/18	1.351	1.41
6/24/18	1.455	1.485
6/25/18	1.399	1.503
6/26/18	1.378	1.366
6/27/18	1.378	1.353
6/28/18	1.375	1.362
6/29/18	1.355	1.375
6/30/18	1.378	1.433
7/1/18	1.357	1.437
7/2/18	1.356	1.429
7/3/18	1.321	1.398
7/4/18	1.297	1.298
7/5/18	1.313	1.335
7/6/18	1.337	1.403
7/7/18	1.323	1.485
7/8/18	1.409	1.468
7/9/18	1.335	1.412
7/10/18	1.347	1.478
7/11/18	1.331	1.344
7/12/18	1.355	1.345
7/13/18	1.348	1.365
7/14/18	1.356	1.353
7/15/18	1.377	1.45
7/16/18	1.389	1.486
7/17/18	1.385	1.333
7/18/18	1.405	1.305
7/19/18	1.389	1.388
7/20/18	1.325	1.282
7/21/18	1.326	1.37
7/22/18	1.359	1.439
7/23/18	1.37	1.329
7/24/18	1.323	1.359

7/25/18	1.312	1.312
7/26/18	1.331	1.345
7/27/18	1.32	1.357
7/28/18	1.314	1.293
7/29/18	1.3888	1.43
7/30/18	1.368	1.394
7/31/18	1.403	1.402
8/1/18	1.351	1.342
8/2/18	1.343	1.329
8/3/18	1.307	1.351
8/4/18	1.292	1.342
8/5/18	1.335	1.406
8/6/18	1.341	1.362
8/7/18	1.36	1.343
8/8/18	1.386	1.37
8/9/18	1.402	1.402
8/10/18	1.417	1.423
8/11/18	1.317	1.309
8/12/18	1.333	1.416
8/13/18	1.363	1.408
8/14/18	1.347	1.39
8/15/18	1.363	1.308
8/16/18	1.394	1.345
8/17/18	1.339	1.459
8/18/18	1.318	1.288
8/19/18	1.344	1.411
8/20/18	1.394	1.444
8/21/18	1.333	1.301
8/22/18	1.334	1.4
8/23/18	1.308	1.339
8/24/18	1.292	1.305
8/25/18	1.284	1.371
8/26/18	1.455	1.473
8/27/18	1.315	1.316
8/28/18	1.376	1.4
8/29/18	1.351	1.374
8/30/18	1.348	1.318
8/31/18	1.286	1.374
9/1/18	1.246	1.294
9/2/18	1.252	1.351
9/3/18	1.383	1.504
9/4/18	1.311	1.274
9/5/18	1.334	1.37
9/6/18	1.33	1.304
9/7/18	1.321	1.362
9/8/18	1.338	1.317
9/9/18	1.432	1.473
9/10/18	1.331	1.341
9/11/18	1.357	1.398
9/12/18	1.347	1.391
9/13/18	1.293	1.257
9/14/18	1.329	1.417
9/15/18	1.347	1.429
9/16/18	1.422	1.474
9/17/18	1.386	1.393
9/18/18	1.275	1.322
9/19/18	1.339	1.331
9/20/18	1.325	1.374
9/21/18	1.356	1.325

9/22/18	1.342	1.365
9/23/18	1.381	1.467
9/24/18	1.28	1.359
9/25/18	1.306	1.387
9/26/18	1.301	1.305
9/27/18	1.345	1.353
9/28/18	1.282	1.304
9/29/18	1.273	1.351
9/30/18	1.376	1.472
10/1/18	1.361	1.105
10/2/18	1.318	1.616
10/3/18	1.376	1.4
10/4/18	1.255	1.216
10/5/18	1.385	1.513
10/6/18	1.337	1.358
10/7/18	1.435	1.482
10/8/18	1.396	1.409
10/9/18	1.473	1.587
10/10/18	1.354	1.43
10/11/18	1.296	1.384
10/12/18	1.34	1.399
10/13/18	1.317	1.383
10/14/18	1.46	1.567
10/15/18	1.412	1.385
10/16/18	1.406	1.431
10/17/18	1.403	1.36
10/18/18	1.422	1.441
10/19/18	1.365	1.35
10/20/18	1.421	1.457
10/21/18	1.455	1.437
10/22/18	1.458	1.455
10/23/18	1.451	1.442
10/24/18	1.405	1.408
10/25/18	1.401	1.426
10/26/18	1.435	1.403
10/27/18	1.459	1.43
10/28/18	1.502	1.439
10/29/18	1.516	1.501
10/30/18	1.404	1.414
10/31/18	1.416	1.413
11/1/18	1.532	1.491
11/2/18	1.48	1.433
11/3/18	1.526	1.479
11/4/18	1.556	1.534
11/5/18	1.536	1.58
11/6/18	1.464	1.451
11/7/18	1.422	1.532
11/8/18	1.372	1.427
11/9/18	1.387	1.409
11/10/18	1.373	1.41
11/11/18	1.565	1.489
11/12/18	1.453	1.458
11/13/18	1.441	1.395
11/14/18	1.471	1.466
11/15/18	1.414	1.406
11/16/18	1.484	1.51
11/17/18	1.538	1.499
11/18/18	1.588	1.596
11/19/18	1.379	1.384

11/20/18	1.377	1.431
11/21/18	1.376	1.432
11/22/18	1.393	1.357
11/23/18	1.389	1.324
11/24/18	1.427	1.367
11/25/18	1.465	1.526
11/26/18	1.438	1.497
11/27/18	1.436	1.472
11/28/18	1.467	1.503
11/29/18	1.419	1.451
11/30/18	1.437	1.439
12/1/18	1.455	1.472
12/2/18	1.513	1.484
12/3/18	1.47	1.52
12/4/18	1.405	1.451
12/5/18	1.384	1.457
12/6/18	1.38	1.416
12/7/18	1.381	1.41
12/8/18	1.35	1.384
12/9/18	1.501	1.509
12/10/18	1.41	1.403
12/11/18	1.466	1.368
12/12/18	1.424	1.333
12/13/18	1.354	1.478
12/14/18	1.436	1.525
12/15/18	1.505	1.542
12/16/18	1.534	1.487
12/17/18	1.422	1.417
12/18/18	1.474	1.429
12/19/18	1.341	1.415
12/20/18	1.44	1.371
12/21/18	1.374	1.423
12/22/18	1.384	1.399
12/23/18	1.457	1.385
12/24/18	1.477	1.385
12/25/18	1.26	1.181
12/26/18	1.362	1.327
12/27/18	1.402	1.414
12/28/18	1.469	1.438
12/29/18	1.459	1.324
12/30/18	1.419	1.339
12/31/18	1.384	1.36
1/1/19	1.291	1.277
1/2/19	1.436	1.447
1/3/19	1.346	1.3
1/4/19	1.415	1.405
1/5/19	1.308	1.247
1/6/19	1.46	1.41
1/7/19	1.363	1.287
1/8/19	1.419	1.36
1/9/19	1.4	1.36
1/10/19	1.398	1.416
1/11/19	1.342	1.387
1/12/19	1.367	1.386
1/13/19	1.421	1.477
1/14/19	1.511	1.439
1/15/19	1.36	1.433
1/16/19	1.423	1.47
1/17/19	1.391	1.357

1/18/19	1.448	1.418
1/19/19	1.427	1.433
1/20/19	1.546	1.177
1/21/19	1.448	1.459
1/22/19	1.53	1.519
1/23/19	1.435	1.488
1/24/19	1.403	1.407
1/25/19	1.41	1.526
1/26/19	1.408	1.439
1/27/19	1.486	1.55
1/28/19	1.415	1.469
1/29/19	1.402	1.355
1/30/19	1.399	1.443
1/31/19	1.382	1.378
2/1/19	1.394	1.136
2/2/19	1.52	1.138
2/3/19	1.554	1.512
2/4/19	1.403	1.407
2/5/19	1.378	1.418
2/6/19	1.439	1.345
2/7/19	1.376	1.441
2/8/19	1.371	1.368
2/9/19	1.483	1.415
2/10/19	1.52	1.56
2/11/19	1.383	1.454
2/12/19	1.496	1.502
2/13/19	1.499	1.444
2/14/19	1.401	1.384
2/15/19	1.415	1.458
2/16/19	1.432	1.461
2/17/19	1.525	1.479
2/18/19	1.472	1.527
2/19/19	1.411	1.515
2/20/19	1.384	1.41
2/21/19	1.4	1.428
2/22/19	1.453	1.534
2/23/19	1.512	1.513
2/24/19	1.532	1.508
2/25/19	1.453	1.503
2/26/19	1.483	1.586
2/27/19	1.421	1.497
2/28/19	1.456	1.51
3/1/19	1.448	1.481
3/2/19	1.432	1.416
3/3/19	1.563	1.548
3/4/19	1.365	1.443
3/5/19	1.397	1.5
3/6/19	1.458	1.476
3/7/19	1.473	1.511
3/8/19	1.469	1.56
3/9/19	1.415	1.346
3/10/19	1.492	1.545
3/11/19	1.455	1.491
3/12/19	1.455	1.469
3/13/19	1.507	1.408
3/14/19	1.41	1.445
3/15/19	1.477	1.569
3/16/19	1.501	1.486
3/17/19	1.609	1.59

3/18/19	1.448	1.552
3/19/19	1.469	1.538
3/20/19	1.463	1.534
3/21/19	1.482	1.45
3/22/19	1.478	1.541
3/23/19	1.442	1.355
3/24/19	1.481	1.561
3/25/19	1.392	1.5189
3/26/19	1.33	1.491
3/27/19	1.348	1.493
3/28/19	1.348	1.468
3/29/19	1.362	1.514
3/30/19	1.322	1.373
3/31/19	1.385	1.499
4/1/19	1.33	1.406
4/2/19	1.37	1.414
4/3/19	1.302	1.407
4/4/19	1.328	1.377
4/5/19	1.338	1.385
4/6/19	1.359	1.401
4/7/19	1.46	1.487
4/8/19	1.445	1.4
4/9/19	1.446	1.346
4/10/19	1.462	1.629
4/11/19	1.423	1.218
4/12/19	1.445	1.358
4/13/19	1.394	1.347
4/14/19	1.493	1.454
4/15/19	1.394	1.425
4/16/19	1.42	1.509
4/17/19	1.412	1.53
4/18/19	1.432	1.583
4/19/19	1.46	1.487
4/20/19	1.443	1.512
4/21/19	1.428	1.5
4/22/19	1.427	1.533
4/23/19	1.337	1.246
4/24/19	1.336	1.327
4/25/19	1.338	1.302
4/26/19	1.339	1.346
4/27/19	1.317	1.282
4/28/19	1.437	1.491
4/29/19	1.3	1.328
4/30/19	1.338	1.35
5/1/19	1.339	1.359
5/2/19	1.397	1.342
5/3/19	1.352	1.363
5/4/19	1.36	1.315
5/5/19	1.339	1.357
5/6/19	1.374	1.34
5/7/19	1.329	1.411
5/8/19	1.335	1.279
5/9/19	1.334	1.314
5/10/19	1.303	1.298
5/11/19	1.332	1.306
5/12/19	1.433	1.42
5/13/19	1.337	1.36
5/14/19	1.341	1.323
5/15/19	1.357	1.304

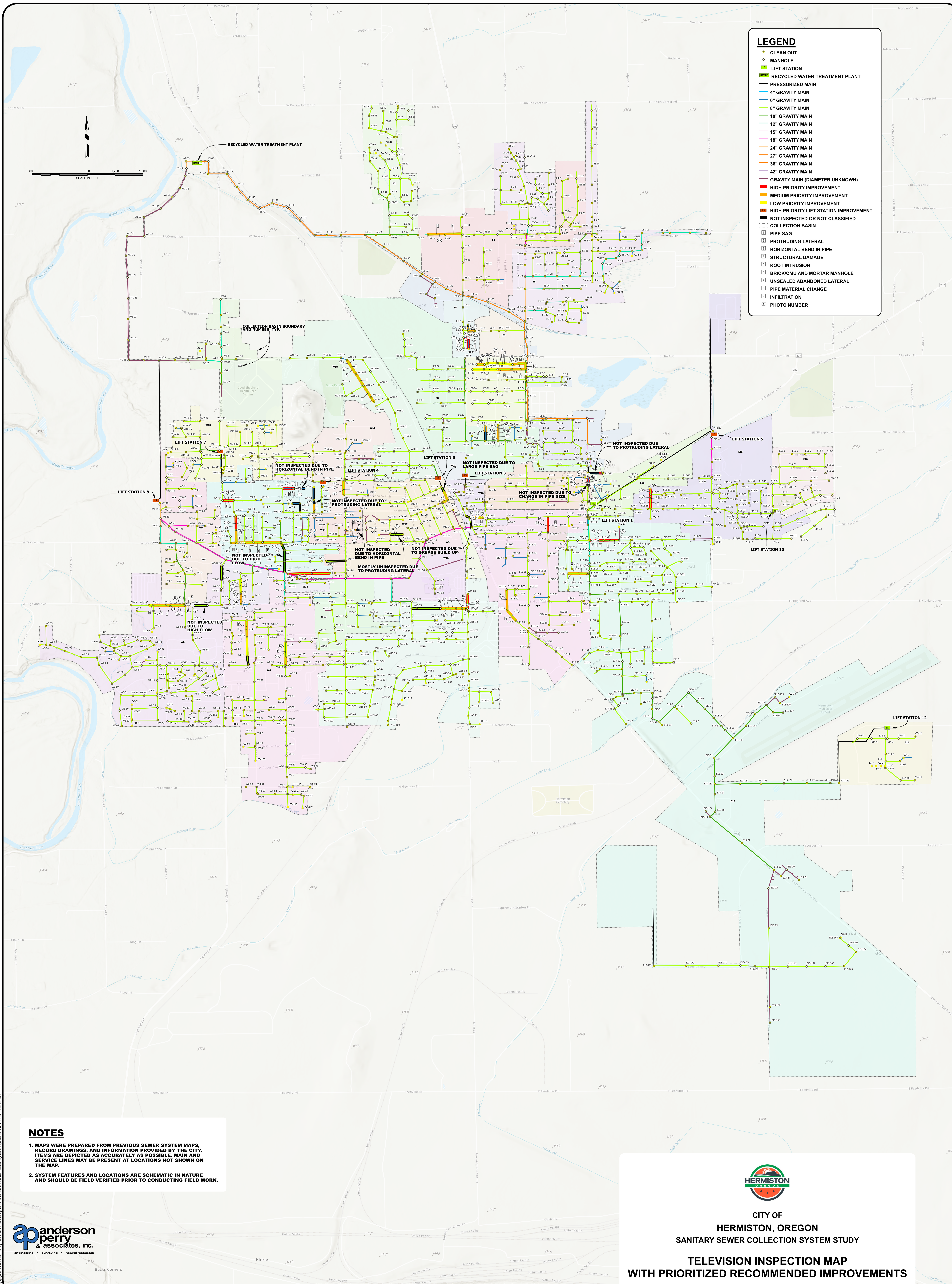
5/16/19	1.41	1.377
5/17/19	1.353	1.395
5/18/19	1.326	1.337
5/19/19	1.45	1.43
5/20/19	1.406	1.386
5/21/19	1.397	1.454
5/22/19	1.333	1.479
5/23/19	1.368	1.469
5/24/19	1.346	1.456
5/25/19	1.269	1.346
5/26/19	1.359	1.42
5/27/19	1.633	1.565
5/28/19	1.335	1.436
5/29/19	1.404	1.465
5/30/19	1.376	1.458
5/31/19	1.36	1.454
6/1/19	1.369	1.406
6/2/19	1.51	1.553
6/3/19	1.452	1.476
6/4/19	1.428	1.45
6/5/19	1.413	1.45
6/6/19	1.348	1.429
6/7/19	1.367	1.401
6/8/19	1.372	1.393
6/9/19	1.48	1.482
6/10/19	1.431	1.461
6/11/19	1.418	1.493
6/12/19	1.436	1.468
6/13/19	1.401	1.423
6/14/19	1.4	1.435
6/15/19	1.39	1.402
6/16/19	1.45	1.482
6/17/19	1.418	1.417
6/18/19	1.381	1.402
6/19/19	1.361	1.446
6/20/19	1.345	1.444
6/21/19	1.347	1.418
6/22/19	1.317	1.363
6/23/19	1.38	1.446
6/24/19	1.327	1.467
6/25/19	1.293	1.43
6/26/19	1.319	1.379
6/27/19	1.286	1.458
6/28/19	1.336	1.461
6/29/19	1.303	1.386
6/30/19	1.367	1.533
7/1/19	1.328	1.382
7/2/19	1.351	1.426
7/3/19	1.291	1.338
7/4/19	1.287	1.348
7/5/19	1.307	1.391
7/6/19	1.289	1.344
7/7/19	1.375	1.492
7/8/19	1.339	1.418
7/9/19	1.323	1.395
7/10/19	1.361	1.425
7/11/19	1.359	1.439
7/12/19	1.354	1.386
7/13/19	1.317	1.364

7/14/19	1.363	1.427
7/15/19	1.381	1.418
7/16/19	1.33	1.359
7/17/19	1.331	1.414
7/18/19	1.349	1.392
7/19/19	1.302	1.589
7/20/19	1.286	1.217
7/21/19	1.378	1.483
7/22/19	1.336	1.378
7/23/19	1.349	1.385
7/24/19	1.263	1.358
7/25/19	1.272	1.385
7/26/19	1.274	1.36
7/27/19	1.251	1.405
7/28/19	1.304	1.364
7/29/19	1.273	1.33
7/30/19	1.326	1.478
7/31/19	1.262	1.289
8/1/19	1.302	1.399
8/2/19	1.301	1.591
8/3/19	1.253	1.285
8/4/19	1.33	1.441
8/5/19	1.329	1.41
8/6/19	1.308	1.324
8/7/19	1.346	1.478
8/8/19	1.339	1.387
8/9/19	1.342	1.403
8/10/19	1.326	1.413
8/11/19	1.367	1.443
8/12/19	1.322	1.369
8/13/19	1.29	1.416
8/14/19	1.316	1.453
8/15/19	1.289	1.387
8/16/19	1.277	1.454
8/17/19	1.243	1.224
8/18/19	1.324	1.41
8/19/19	1.365	1.474
8/20/19	1.425	1.542
8/21/19	1.384	1.451
8/22/19	1.288	1.37
8/23/19	1.286	1.461
8/24/19	1.255	1.297
8/25/19	1.461	1.494
8/26/19	1.159	1.296
8/27/19	1.299	1.369
8/28/19	1.282	1.308
8/29/19	1.265	1.289
8/30/19	1.288	1.331
8/31/19	1.25	1.29
9/1/19	1.275	1.559
9/2/19	1.346	1.192
9/3/19	1.27	1.378
9/4/19	1.257	1.329
9/5/19	1.276	1.382
9/6/19	1.257	1.285
9/7/19	1.298	1.324
9/8/19	1.363	1.433
9/9/19	1.296	1.37
9/10/19	1.291	1.373

9/11/19	1.256	1.353
9/12/19	1.234	1.265
9/13/19	1.213	1.317
9/14/19	1.26	1.311
9/15/19	1.347	1.385
9/16/19	1.321	1.365
9/17/19	1.254	1.402
9/18/19	1.275	1.356
9/19/19	1.222	1.336
9/20/19	1.281	1.359
9/21/19	1.218	1.268
9/22/19	1.258	1.303
9/23/19	1.354	1.467
9/24/19	1.235	1.323
9/25/19	1.25	1.364
9/26/19	1.322	1.37
9/27/19	1.212	1.259
9/28/19	1.209	1.265
9/29/19	1.287	1.381
9/30/19	1.211	1.286
10/1/19	1.221	1.352
10/2/19	1.237	1.265
10/3/19	1.208	1.269
10/4/19	1.229	1.324
10/5/19	1.224	1.289
10/6/19	1.33	1.426
10/7/19	1.301	1.307
10/8/19	1.297	1.313
10/9/19	1.264	1.343
10/10/19	1.24	1.251
10/11/19	1.259	1.302
10/12/19	1.299	1.274
10/13/19	1.367	1.358
10/14/19	1.296	1.293
10/15/19	1.291	1.269
10/16/19	1.321	1.3
10/17/19	1.341	1.279
10/18/19	1.261	1.286
10/19/19	1.331	1.287
10/20/19	1.396	1.345
10/21/19	1.341	1.307
10/22/19	1.372	1.327
10/23/19	1.276	1.28
10/24/19	1.169	1.241
10/25/19	1.269	1.226
10/26/19	1.267	1.26
10/27/19	1.328	1.356
10/28/19	1.265	1.265
10/29/19	1.226	1.3
10/30/19	1.243	1.33
10/31/19	1.139	1.254
11/1/19	1.218	1.241
11/2/19	1.271	1.307
11/3/19	1.332	1.353
11/4/19	1.252	1.275
11/5/19	1.251	1.314
11/6/19	1.214	1.355
11/7/19	1.227	1.414
11/8/19	1.205	1.372

11/9/19	1.252	1.379
11/10/19	1.254	1.344
11/11/19	1.286	1.388
11/12/19	1.256	1.409
11/13/19	1.222	1.379
11/14/19	1.24	1.307
11/15/19	1.242	1.355
11/16/19	1.262	1.286
11/17/19	1.354	1.429
11/18/19	1.305	1.279
11/19/19	1.295	1.326
11/20/19	1.301	1.448
11/21/19	1.218	1.365
11/22/19	1.192	1.317
11/23/19	1.233	1.324
11/24/19	1.409	1.397
11/25/19	1.23	1.36
11/26/19	1.29	1.381
11/27/19	1.288	1.343
11/28/19	1.24	1.408
11/29/19	1.21	1.334
11/30/19	1.269	1.336
12/1/19	1.292	1.374
12/2/19	1.24	1.402
12/3/19	1.241	1.386
12/4/19	1.247	1.315
12/5/19	1.237	1.329
12/6/19	1.264	1.323
12/7/19	1.262	1.282
12/8/19	1.341	1.325
12/9/19	1.263	1.529
12/10/19	1.266	1.378
12/11/19	1.437	1.478
12/12/19	1.14	1.364
12/13/19	1.298	1.428
12/14/19	1.332	1.471
12/15/19	1.361	1.324
12/16/19	1.303	1.308
12/17/19	1.253	1.309
12/18/19	1.26	1.284
12/19/19	1.281	1.334
12/20/19	1.302	1.31
12/21/19	1.259	1.275
12/22/19	1.277	1.311
12/23/19	1.272	1.259
12/24/19	1.324	1.407
12/25/19	1.085	1.116
12/26/19	1.221	1.294
12/27/19	1.244	1.272
12/28/19	1.23	1.253
12/29/19	1.255	1.284
12/30/19	1.246	1.388
12/31/19	1.321	1.419
Avg:	1.33	1.40
Max:	1.63	1.63
Min:	1.04	1.11
Std Dev:	0.10	0.08

APPENDIX D
Television Inspection Map with Prioritized Recommended Improvements



NOTES

1. MAPS WERE PREPARED FROM PREVIOUS SEWER SYSTEM MAPS, RECORD DRAWINGS, AND INFORMATION PROVIDED BY THE CITY. ITEMS ARE DEPICTED AS ACCURATELY AS POSSIBLE. MAIN AND SERVICE LINES MAY BE PRESENT AT LOCATIONS NOT SHOWN ON THE MAP.
2. SYSTEM FEATURES AND LOCATIONS ARE SCHEMATIC IN NATURE AND SHOULD BE FIELD VERIFIED PRIOR TO CONDUCTING FIELD WORK.

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

CITY OF
HERMISTON, OREGON
SANITARY SEWER COLLECTION SYSTEM STUDY

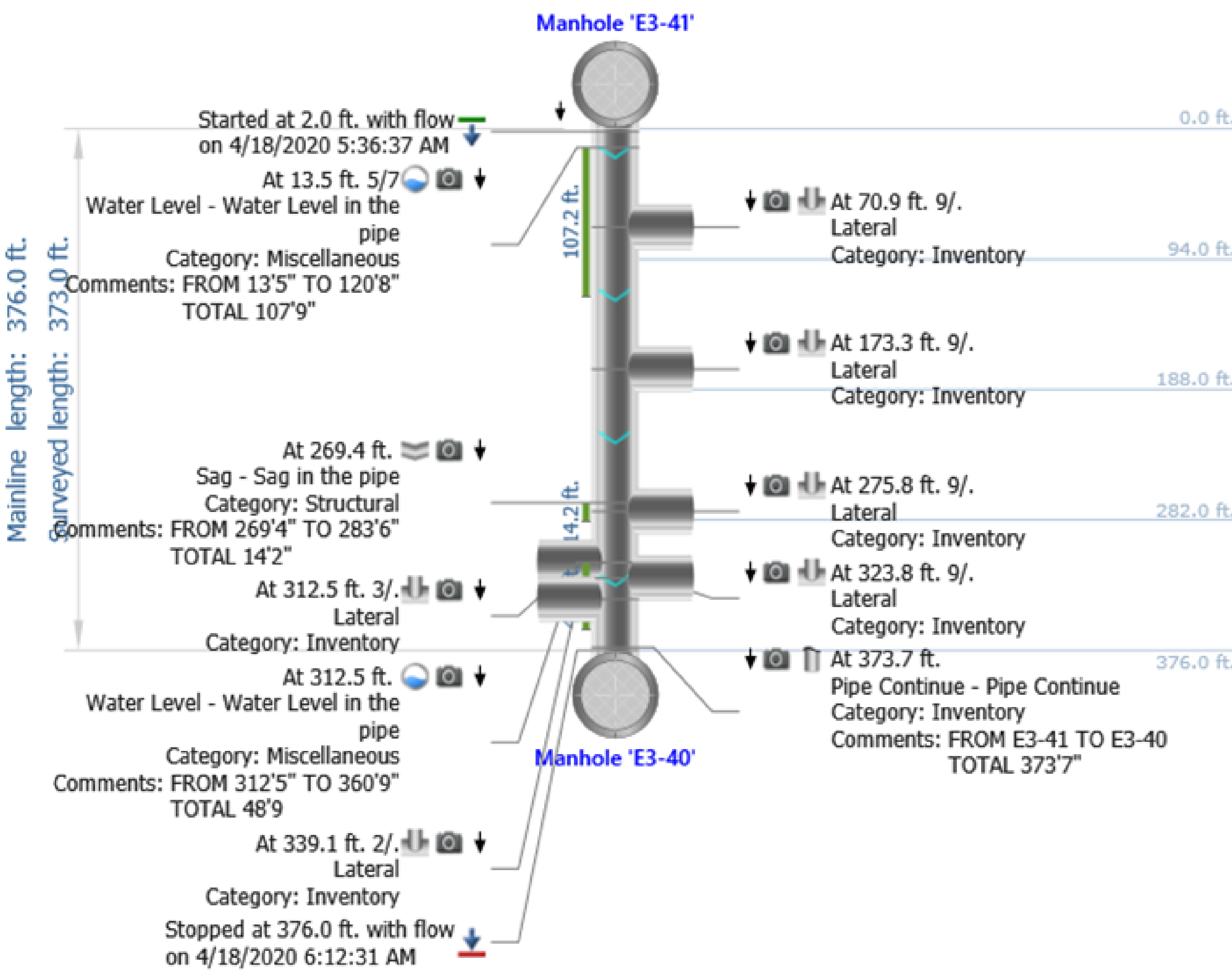
TELEVISION INSPECTION MAP WITH PRIORITIZED RECOMMENDED IMPROVEMENTS

APPENDIX E
Television Inspection Reports

River City Environmental
5410 NE 109th Ave
Portland, OR 97220
(503) 252-6144 Office

Main Inspections Pipe Run with Anomaly Probability

Project name:	Mainline ID:	City:	Address:
CITY OF HERMISTON	**E3-41**	**HERMISTON E3-41 TO E3-40**	**W THEATER LN BY GOODWILL**
Start date/time:	Direction:	Weather:	Surface condition:
5/14/2020 3:45 PM	**With the flow**	**Dry**	
Pipe shape:	Pipe material:	Pipe height:	Pipe width:
	PVC	**8.0 in.**	**8.0 in.**

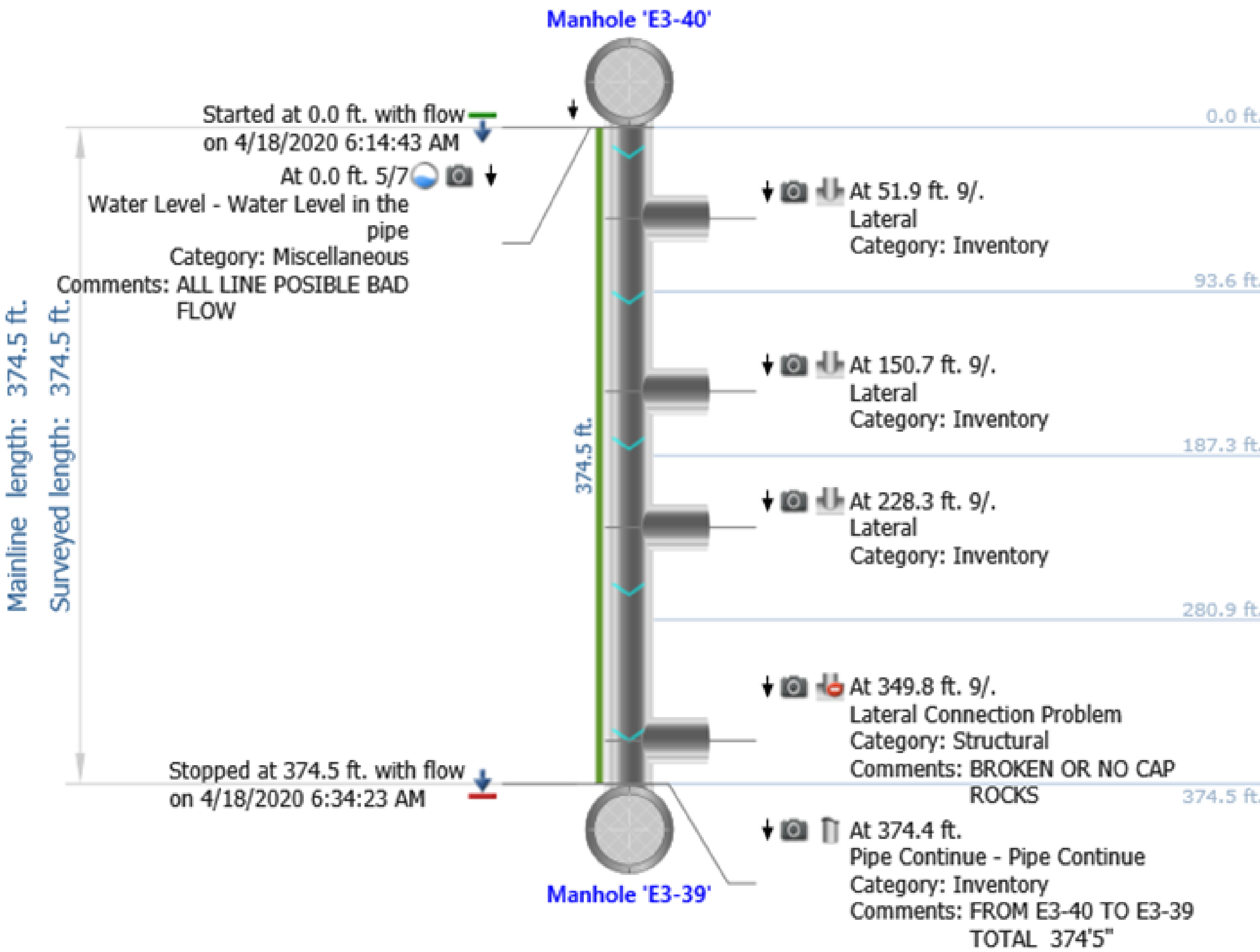


This report may contain 'false' positives due to the detection of anomalies other than voids.

River City Environmental
5410 NE 109th Ave
Portland, OR 97220
(503) 252-6144 Office

Main Inspections Pipe Run with Anomaly Probability

Project name:	Mainline ID:	City:	Address:
CITY OF HERMISTON	**E3-40**	**HERMISTON E3-40 TO E3-39**	**W THEATER LN BY GOODWILL**
Start date/time:	Direction:	Weather:	Surface condition:
5/14/2020 4:20 PM	**With the flow**	**Dry**	**Asphalt**
Pipe shape:	Pipe material:	Pipe height:	Pipe width:
	PVC	**8.0 in.**	**8.0 in.**

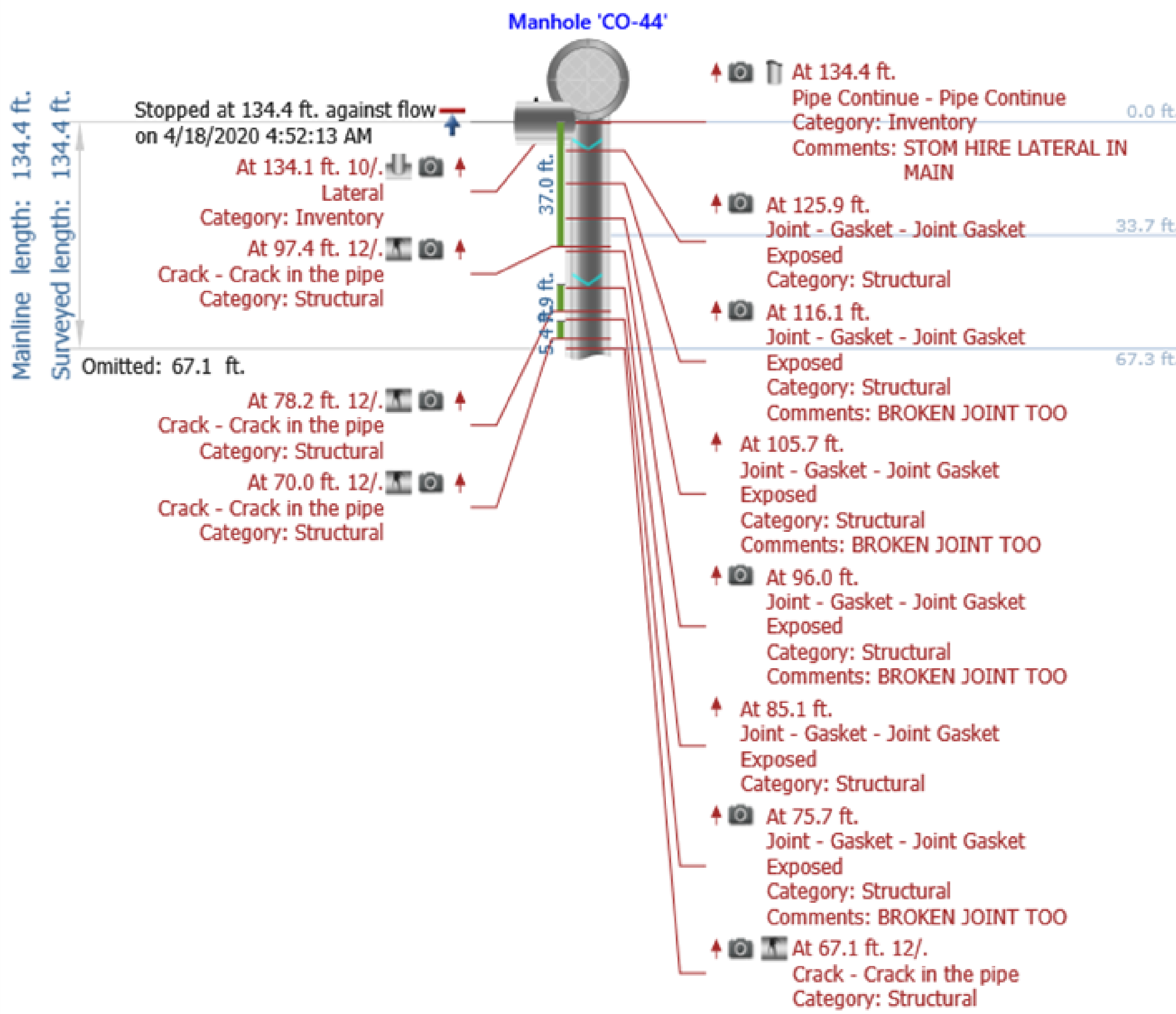


This report may contain ‘false’ positives due to the detection of anomalies other than voids.

River City Environmental
5410 NE 109th Ave
Portland, OR 97220
(503) 252-6144 Office

Main Inspections Pipe Run with Anomaly Probability

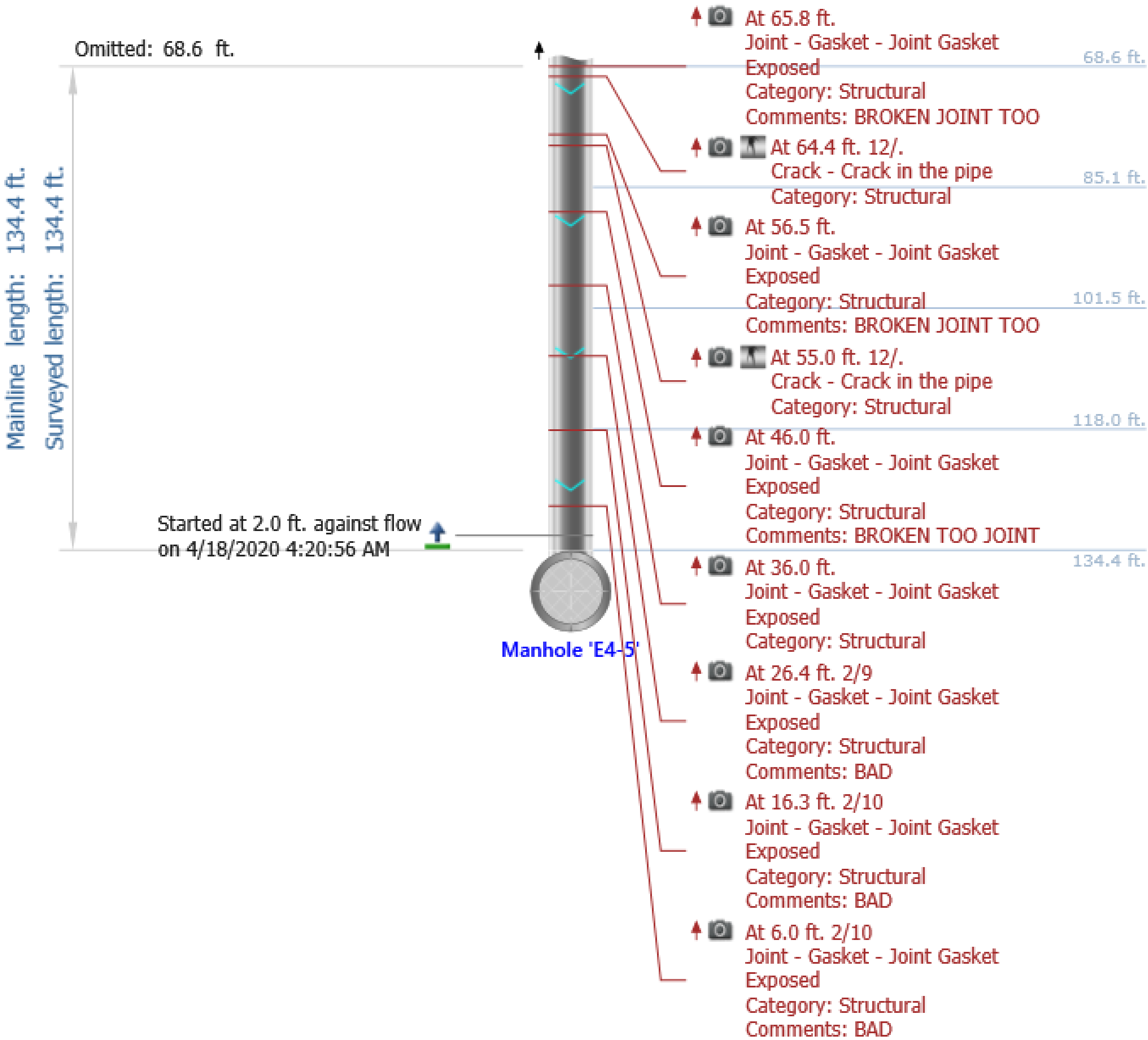
Project name:	Mainline ID:	City:	Address:
CITY OF HERMISTON	**E4-5**	**HERMISTON E4-5 TO CO-44**	**BY MCDONALD'S**
Start date/time:	Direction:	Weather:	Surface condition:
5/14/2020 1:50 PM	**Against the flow**	**Dry**	
Pipe shape:	Pipe material:	Pipe height:	Pipe width:
	Concrete	**6.0 in.**	**6.0 in.**



This report may contain ‘false’ positives due to the detection of anomalies other than voids.

Project name:	Mainline ID:	Start date/time:	Direction:
CITY OF HERMISTON	**E4-5**	**5/14/2020 1:50 PM**	**Against the flow**

Weather:
Dry

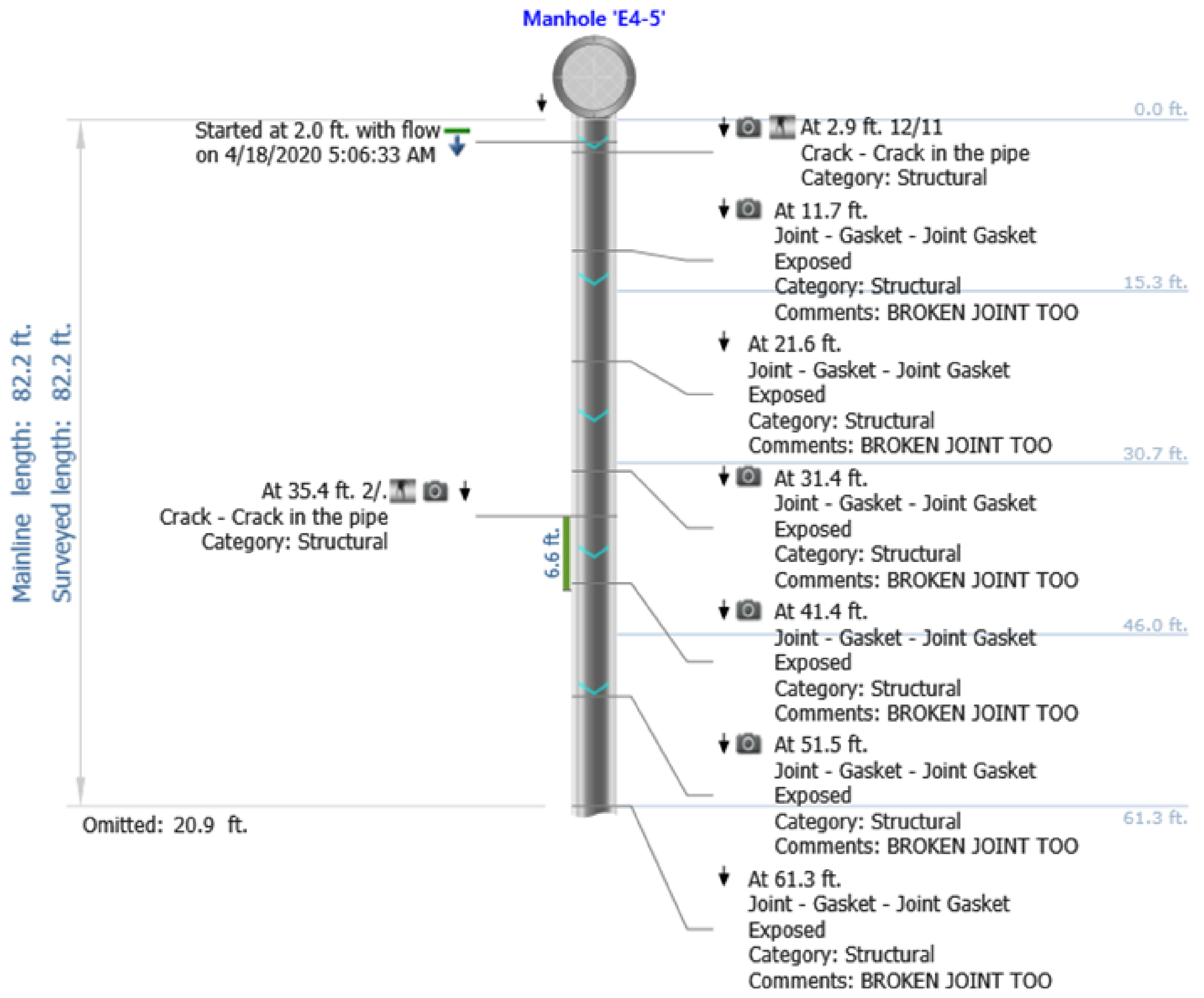


This report may contain ‘false’ positives due to the detection of anomalies other than voids.

River City Environmental
5410 NE 109th Ave
Portland, OR 97220
(503) 252-6144 Office

Main Inspections Pipe Run with Anomaly Probability

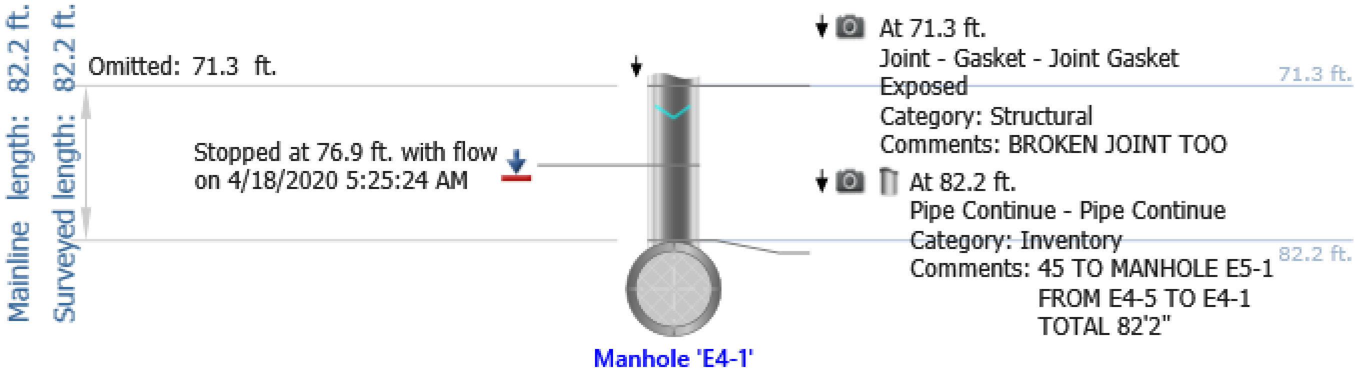
Project name:	Mainline ID:	City:	Address:
CITY OF HERMISTON	**E5-5**	**HERMISTON E4-5 TO E4-1**	**BY MCDONALD'S**
Start date/time:	Direction:	Weather:	Surface condition:
5/14/2020 2:35 PM	**With the flow**	**Dry**	
Pipe shape:	Pipe material:	Pipe height:	Pipe width:
	Cement	**6.0 in.**	**6.0 in.**



This report may contain ‘false’ positives due to the detection of anomalies other than voids.

Project name:	Mainline ID:	Start date/time:	Direction:
CITY OF HERMISTON	**E5-5**	**5/14/2020 2:35 PM**	**With the flow**

Weather:
Dry

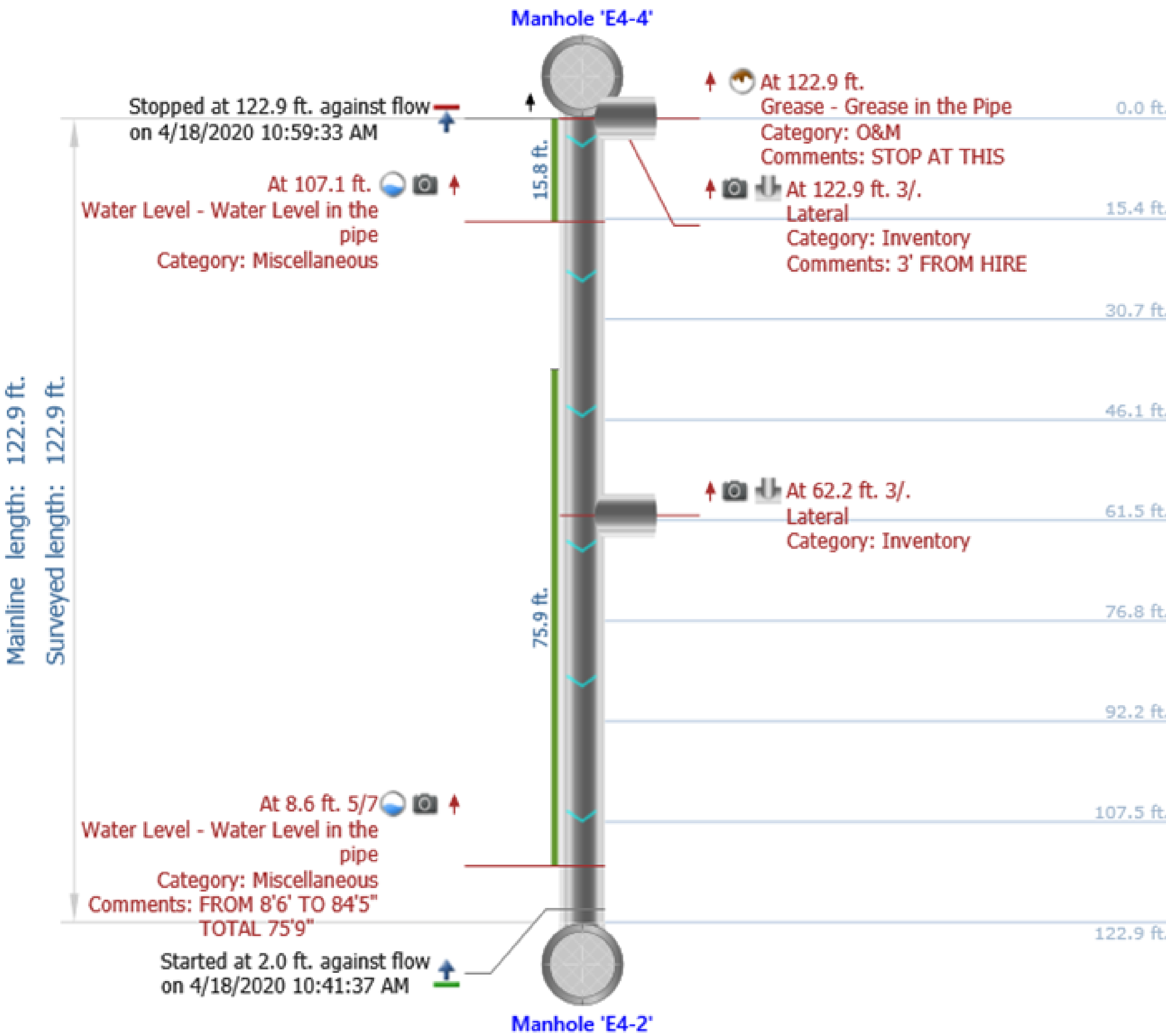


This report may contain ‘false’ positives due to the detection of anomalies other than voids.

River City Environmental
5410 NE 109th Ave
Portland, OR 97220
(503) 252-6144 Office

Main Inspections Pipe Run with Anomaly Probability

Project name:	Mainline ID:	City:	Address:
CITY OF HERMISTON	**E4-2**	**HERMISTON E4-4 TO E4-2**	**E CORNELL PL**
Start date/time:	Direction:	Weather:	Surface condition:
5/15/2020 7:00 AM	**Against the flow**	**Dry**	**Asphalt**
Pipe shape:	Pipe material:	Pipe height:	Pipe width:
	PVC	**6.0 in.**	**6.0 in.**



This report may contain ‘false’ positives due to the detection of anomalies other than voids.

River City Environmental
5410 NE 109th Ave
Portland, OR 97220
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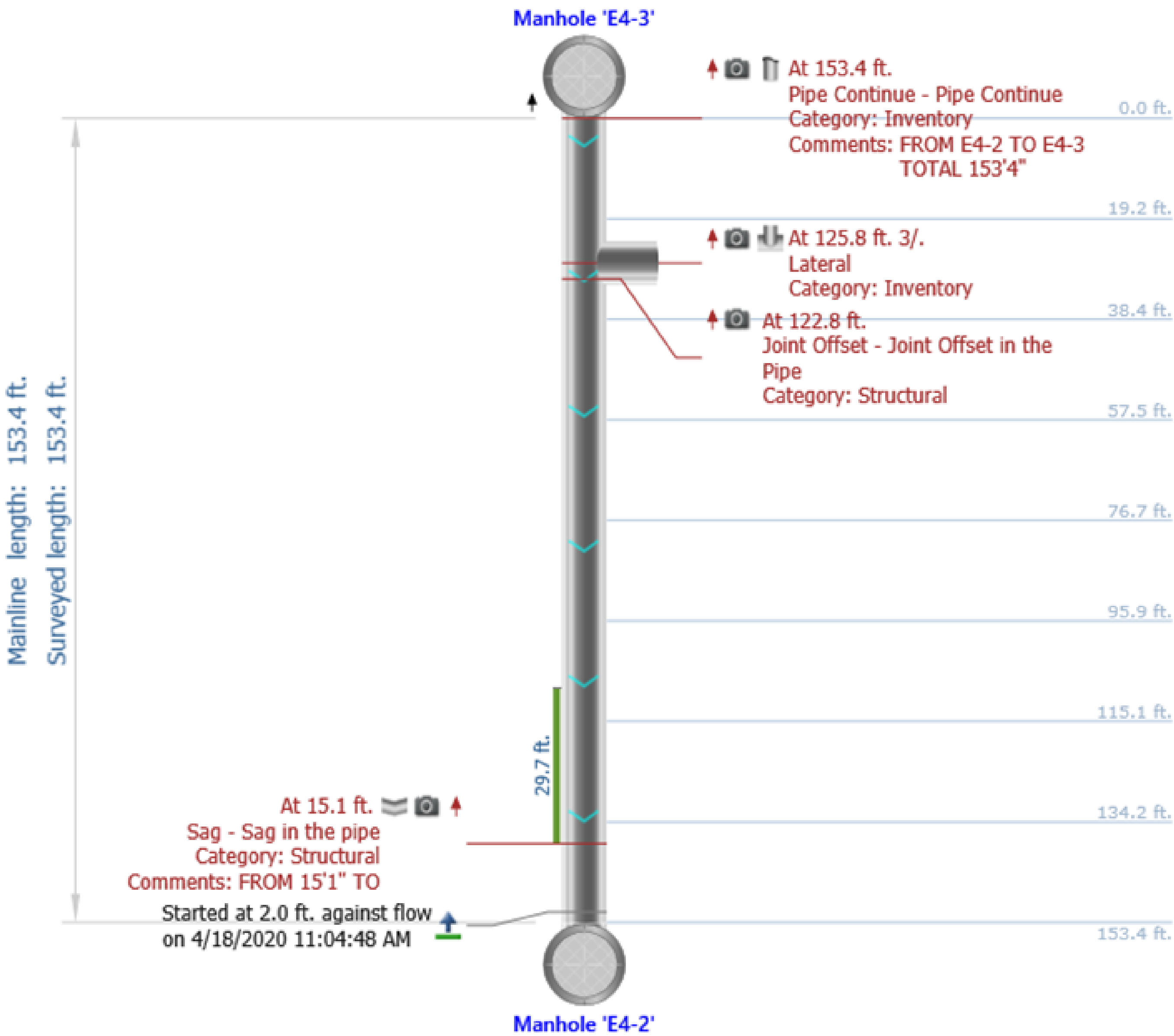
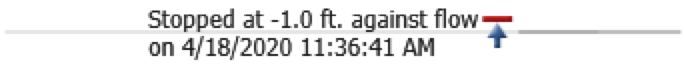
Main Inspections Pipe Run with Anomaly Probability

Project name:	Mainline ID:	City:	Address:
CITY OF HERMISTON	**E4-2-2**	**HERMISTON E4-2 TO E4-3**	**E CORNELL PL**
Start date/time:	Direction:	Weather:	Surface condition:
5/15/2020 7:23 AM	**Against the flow**	**Dry**	**Asphalt**
Pipe shape:	Pipe material:	Pipe height:	Pipe width:
	Concrete	**6.0 in.**	**6.0 in.**



Some observations have distance greater than the pipe length

This report may contain 'false' positives due to the detection of anomalies other than voids.



Stopped at -1.0 ft. against flow
on 4/18/2020 11:36:41 AM

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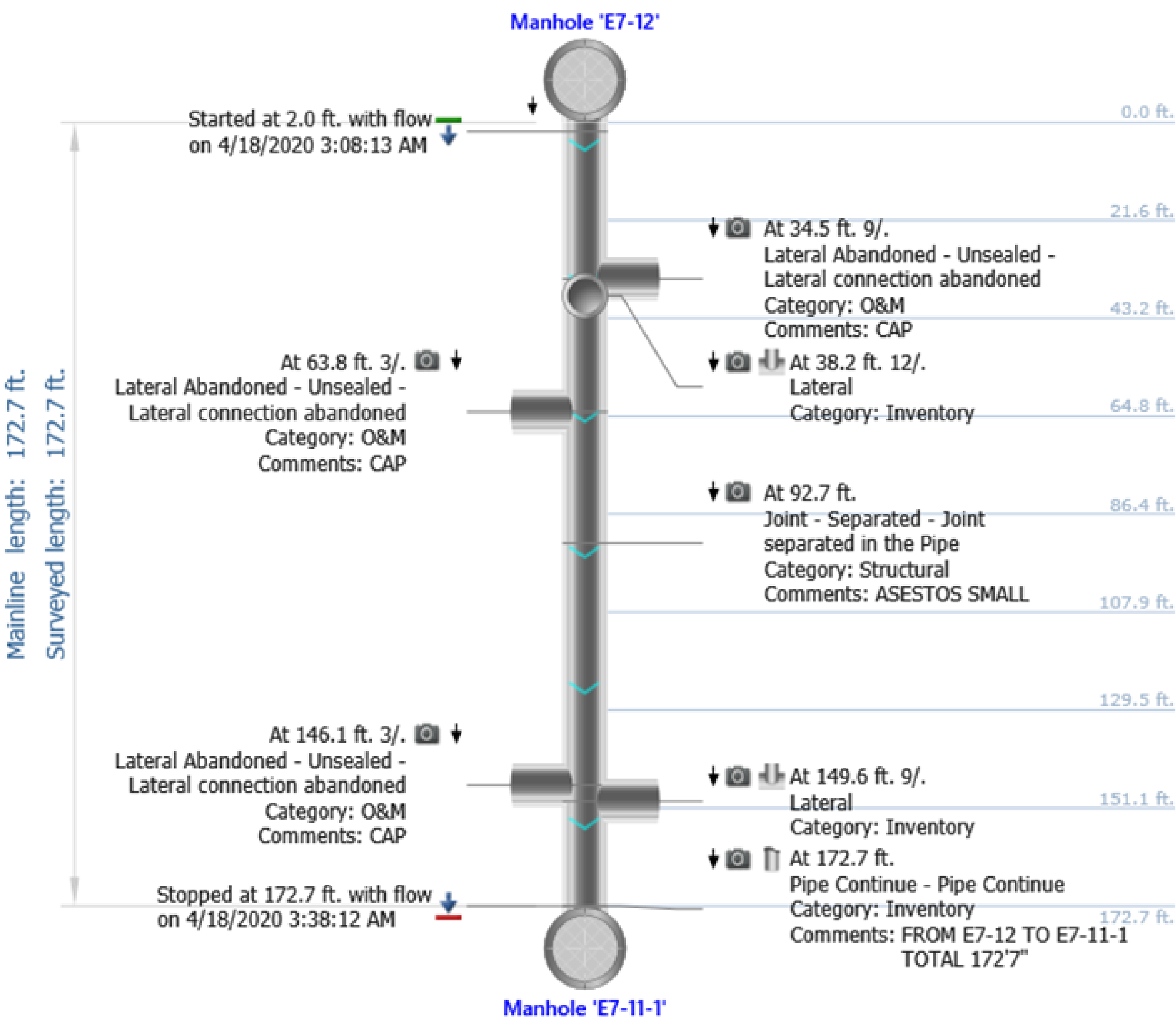
Main Inspections Pipe Run with Anomaly Probability

Project name:	Mainline ID:	City:	Address:
CITY OF HERMISTON	**E7-12**	**HERMISTON E7-12 TO E7-11-1**	**E DOFWOOD AVE ALLY**
Start date/time:	Direction:	Weather:	Surface condition:
5/14/2020 12:30 AM	**With the flow**	**Dry**	
Pipe shape:	Pipe material:	Pipe height:	Pipe width:
	Cement	**8.0 in.**	**8.0 in.**



This report may contain 'false' positives due to the detection of anomalies other than voids.

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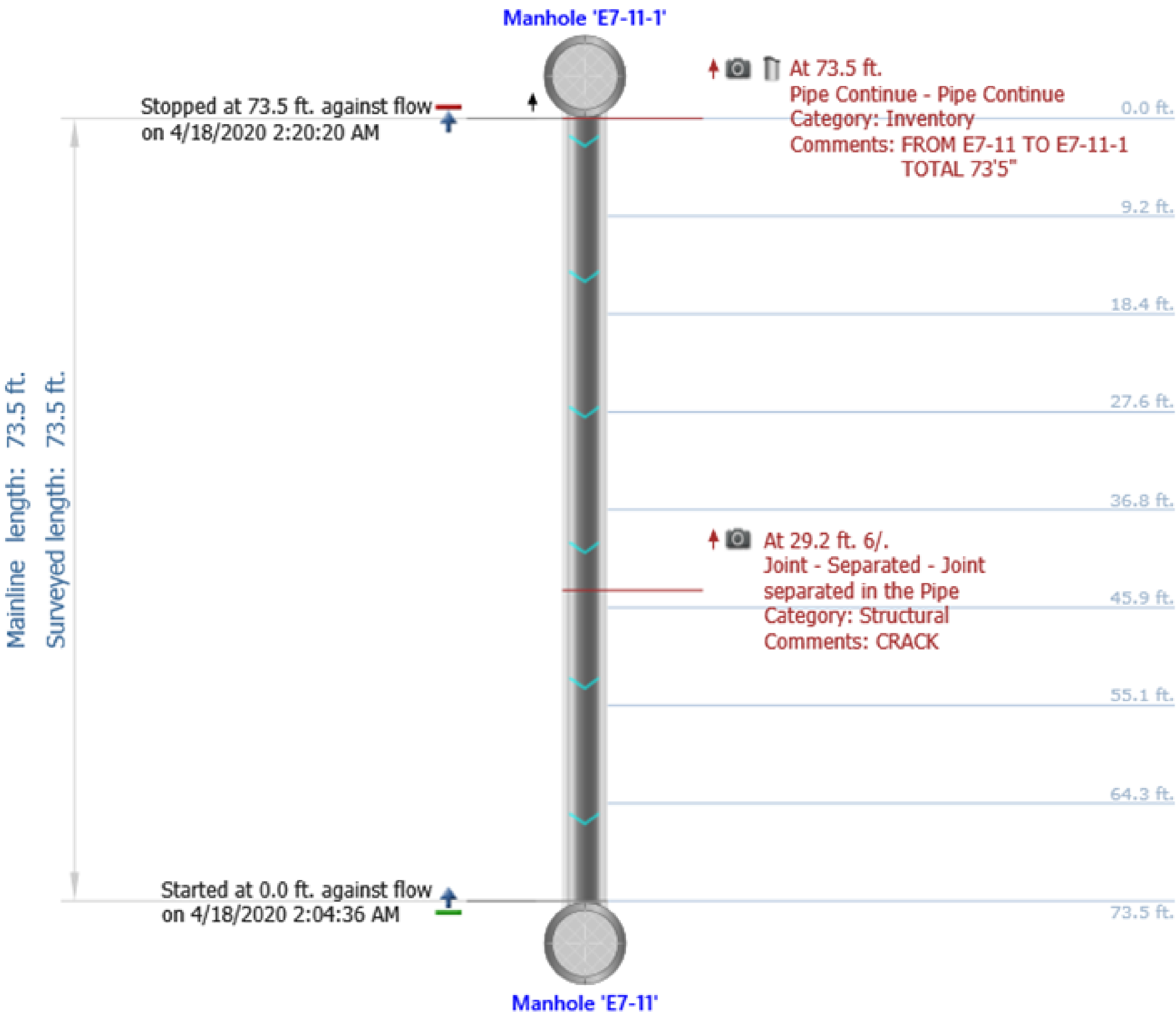
Main Inspections Pipe Run with Anomaly Probability

Project name:	Mainline ID:	City:	Address:
CITY OF HERMISTON	**E7-11**	**HERMISTON FROM E7-11 TO E7-11-1**	**E DOGWOOD AVE- ALLY**
Start date/time:	Direction:	Weather:	Surface condition:
5/14/2020 10:30 AM	**Against the flow**	**Dry**	**Asphalt**
Pipe shape:	Pipe material:	Pipe height:	Pipe width:
	Cement	**8.0 in.**	**8.0 in.**



This report may contain 'false' positives due to the detection of anomalies other than voids.

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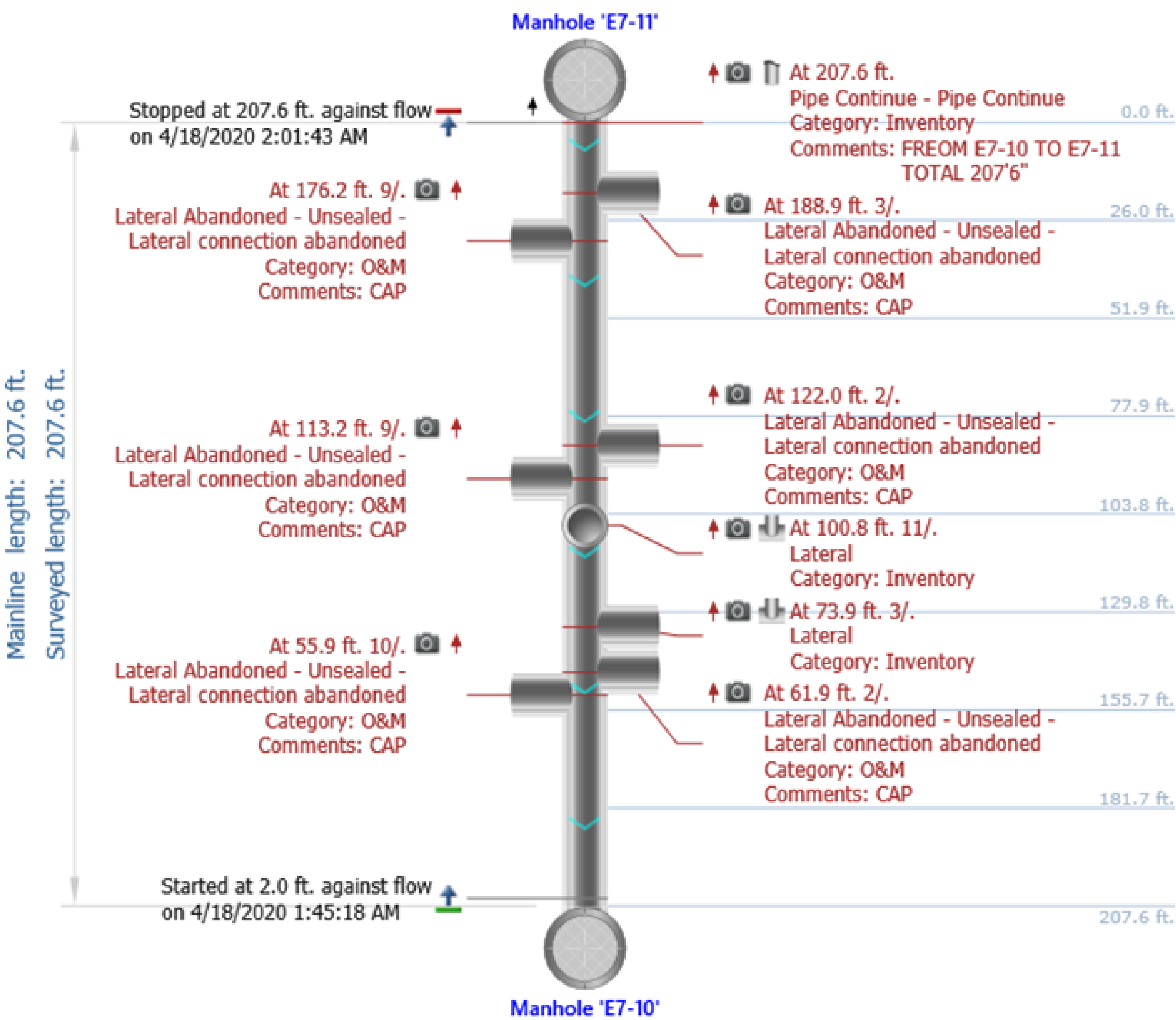
Main Inspections Pipe Run with Anomaly Probability

Project name:	Mainline ID:	City:	Address:
CITY OF HERMISTON	E7-10	HERMISTON FROM E7-11 TO E7-10	E DOGWOOD AVE- ALLY
Start date/time:	Direction:	Weather:	Surface condition:
5/14/2020 10:11 AM	Against the flow	Dry	Asphalt
Pipe shape:	Pipe material:	Pipe height:	Pipe width:
	Concrete	8.0 in.	8.0 in.



This report may contain 'false' positives due to the detection of anomalies other than voids.

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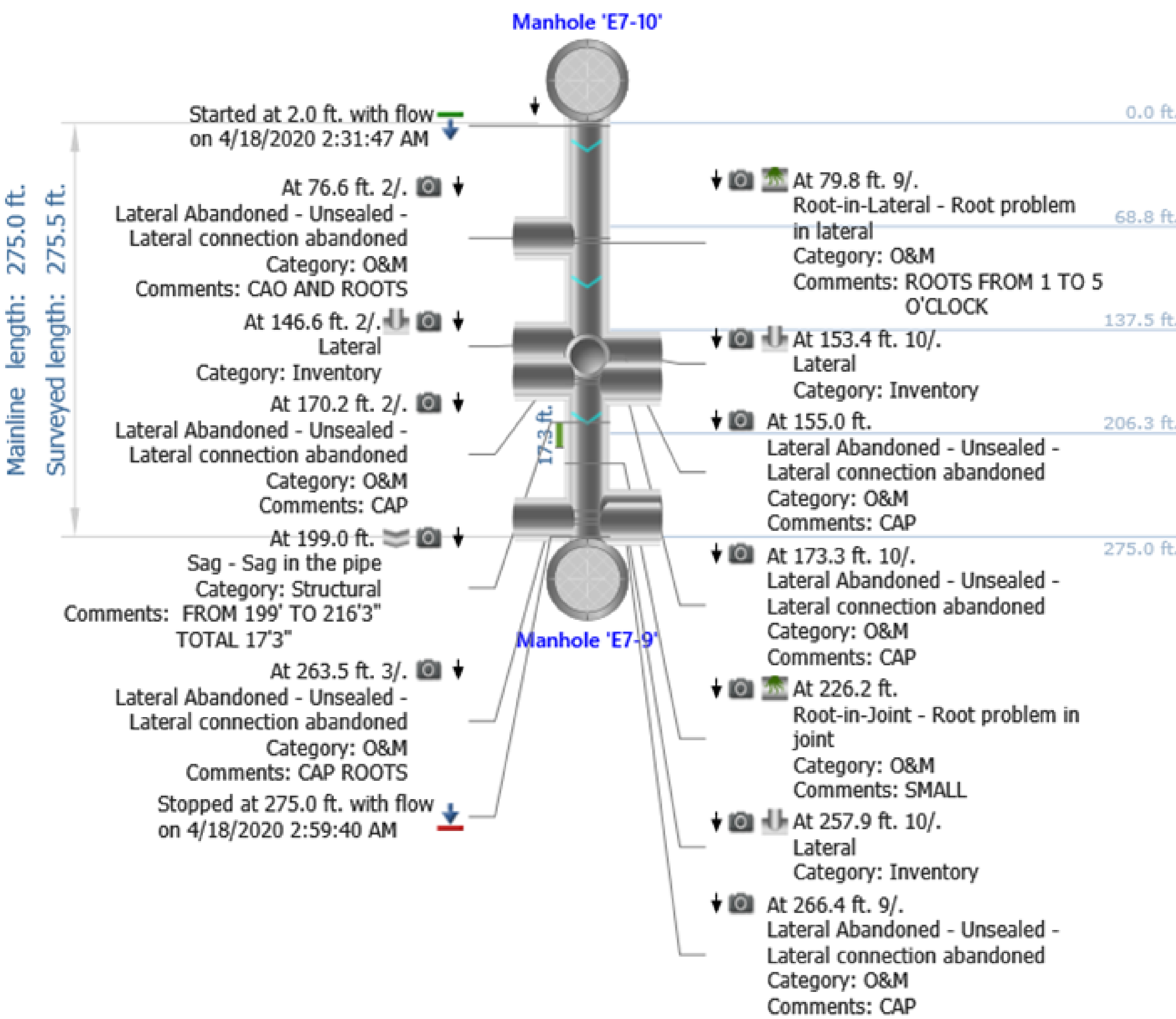
Main Inspections Pipe Run with Anomaly Probability

Project name:	Mainline ID:	City:	Address:
CITY OF HERMISTON	**E7-10-1**	**HERMISTON E7-10 TO E7-9**	**E DOGWOOD AVR ALLY**
Start date/time:	Direction:	Weather:	Surface condition:
5/14/2020 11:00 AM	**With the flow**	**Dry**	**Garden**
Pipe shape:	Pipe material:	Pipe height:	Pipe width:
	Concrete	**8.0 in.**	**8.0 in.**



Some observations have distance greater than the pipe length

This report may contain 'false' positives due to the detection of anomalies other than voids.

At 275.4 ft. 3/.
Root-in-Lateral - Root problem in lateral
Category: O&M
Comments: ROOTS IN LINE 2' IN

At 275.5 ft.
Pipe Continue - Pipe Continue
Category: Inventory
Comments: LATERAL LINE IN MAIN STOP HERE

This report may contain 'false' positives due to the detection of anomalies other than voids.

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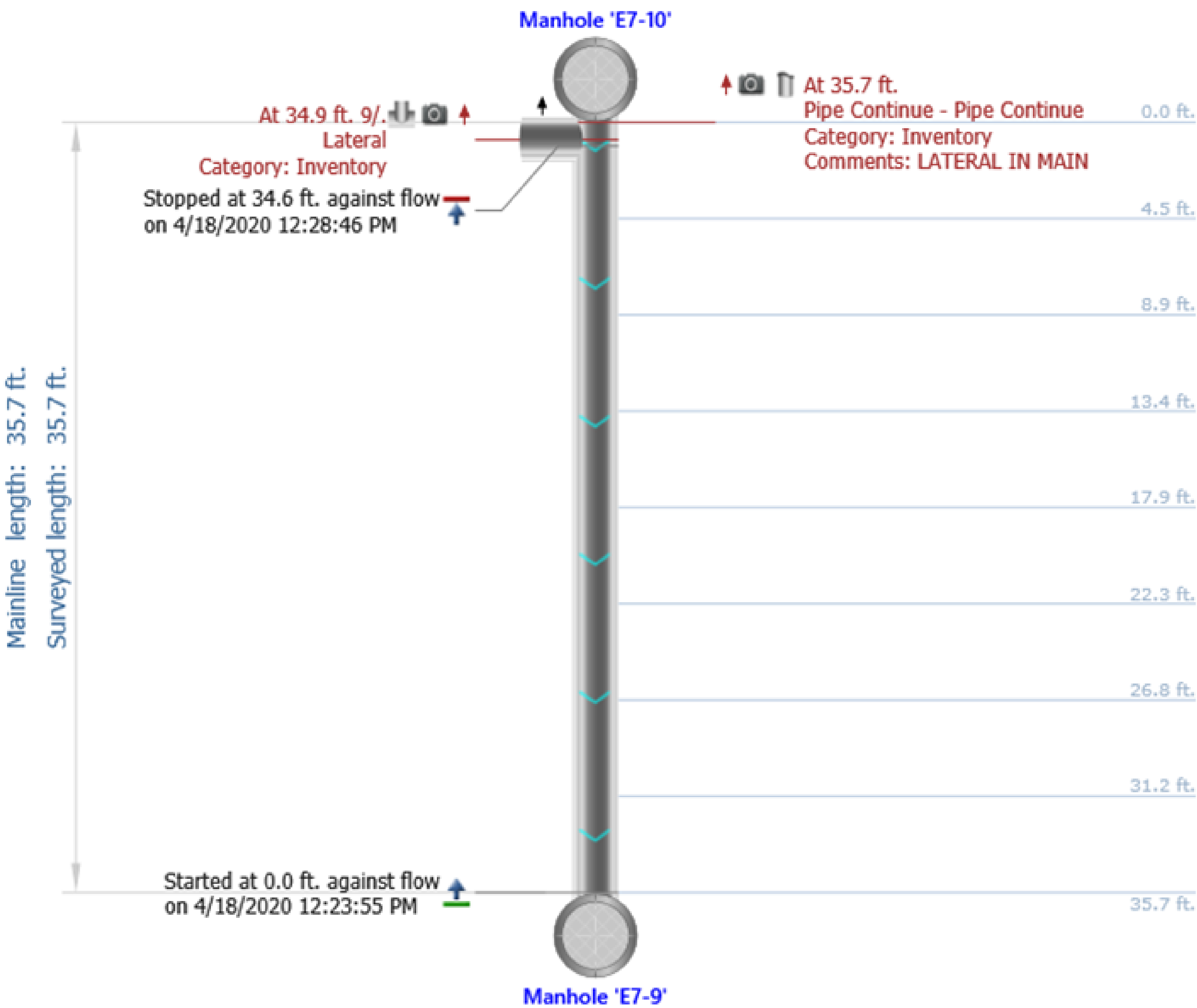
Main Inspections Pipe Run with Anomaly Probability

Project name:	Mainline ID:	City:	Address:
CITY OF HERMISTON	**E7-9**	**HERMISTON FROM E7-9 TO E7-10 TO LATERAL IN MAIN**	**E FOURTH ST ALLY**
Start date/time:	Direction:	Weather:	Surface condition:
5/15/2020 8:40 AM	**Against the flow**	**Dry**	**Garden**
Pipe shape:	Pipe material:	Pipe height:	Pipe width:
	PVC	**8.0 in.**	**8.0 in.**



This report may contain 'false' positives due to the detection of anomalies other than voids.

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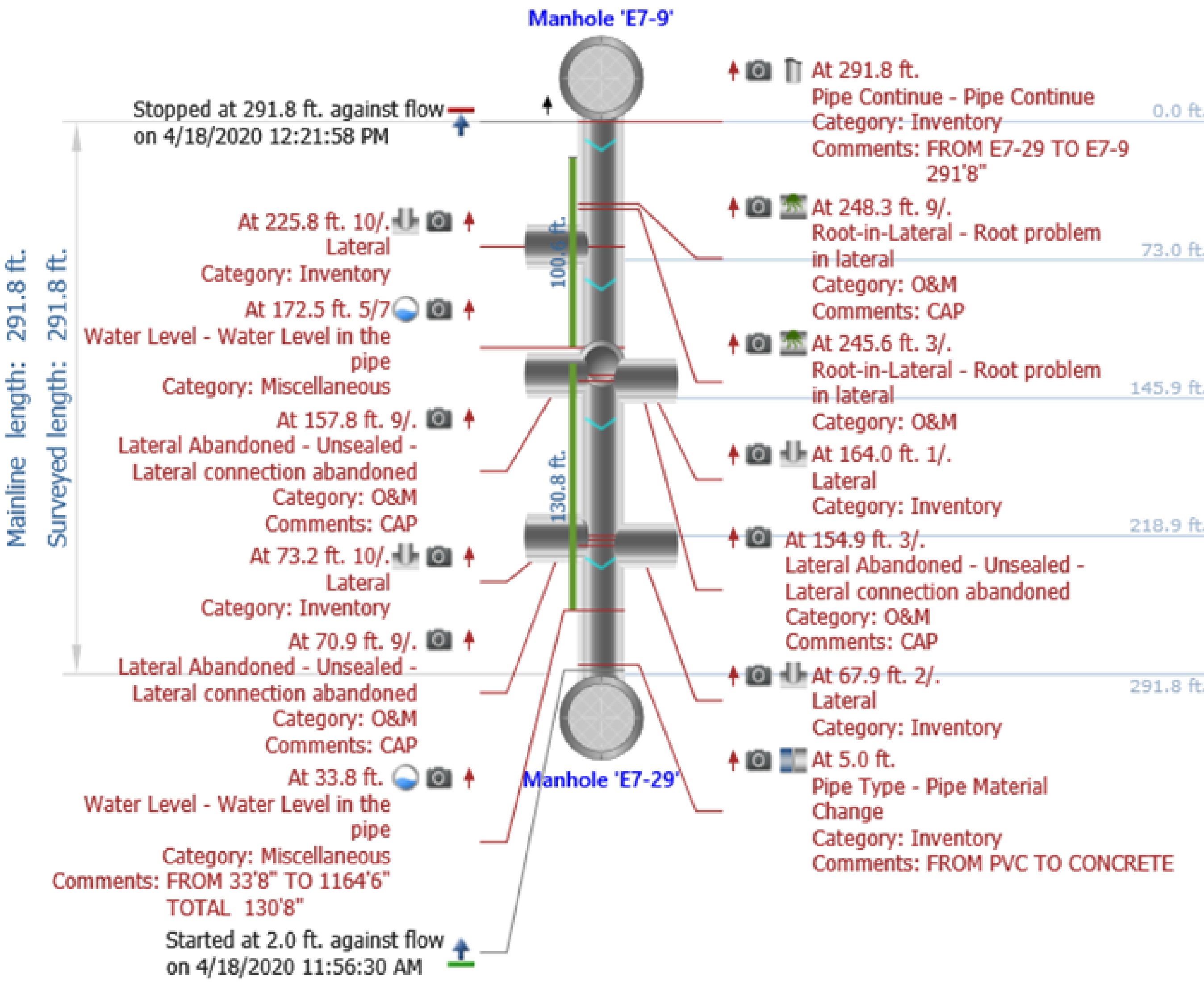
Main Inspections Pipe Run with Anomaly Probability

Project name:	Mainline ID:	City:	Address:
CITY OF HERMISTON	**E7-29**	**HERMISTON FROM E7-29 TO E7-9**	**E FOURTH ST ALLY**
Start date/time:	Direction:	Weather:	Surface condition:
5/15/2020 8:16 AM	**Against the flow**	**Dry**	**Garden**
Pipe shape:	Pipe material:	Pipe height:	Pipe width:
	PVC	**8.0 in.**	**8.0 in.**



This report may contain 'false' positives due to the detection of anomalies other than voids.

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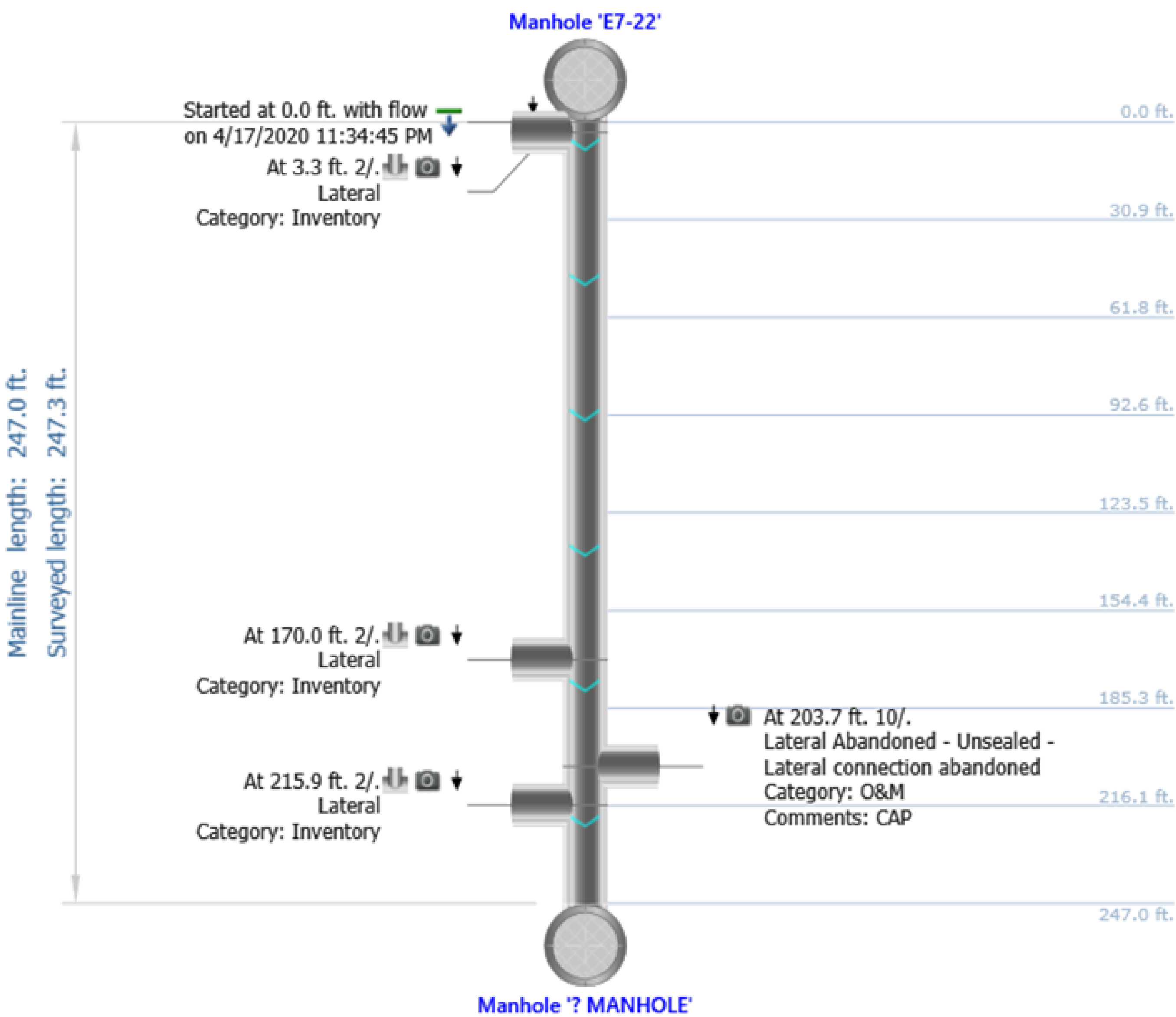
Main Inspections Pipe Run with Anomaly Probability

Project name:	Mainline ID:	City:	Address:
CITY OF HERMISTON	**E7-22**	**HERMISTON E7-22 TO ? MANHOLE**	**E DOGWOOD AVE**
Start date/time:	Direction:	Weather:	Surface condition:
5/14/2020 8:00 AM	**With the flow**	**Dry**	**Asphalt**
Pipe shape:	Pipe material:	Pipe height:	Pipe width:
	Concrete	**8.0 in.**	**8.0 in.**



Some observations have distance greater than the pipe length

This report may contain ‘false’ positives due to the detection of anomalies other than voids.

Stopped at 247.3 ft. with flow
on 4/17/2020 11:51:58 PM

At 247.3 ft.
Pipe Continue - Pipe Continue
Category: Inventory
Comments: FROM E7-22 TO ?
MANHOLE 247'3"

This report may contain 'false' positives due to the detection of anomalies other than voids.

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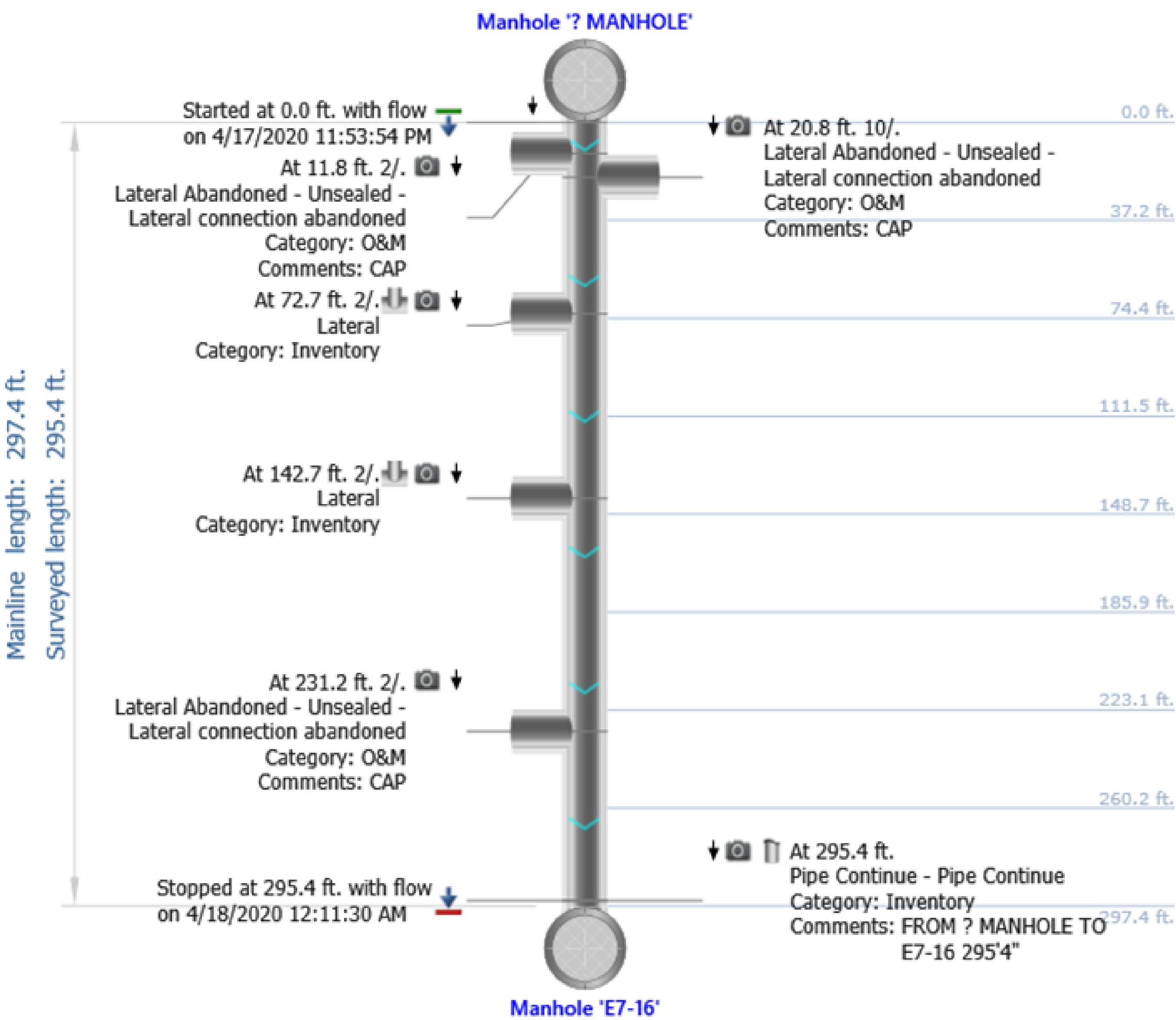
Main Inspections Pipe Run with Anomaly Probability

Project name:	Mainline ID:	City:	Address:
CITY OF HERMISTON	**? MANHOLE-1**	**HERMISTON FROM 1-MANHOLE TO E7-16**	**E DOGWOOD AVE**
Start date/time:	Direction:	Weather:	Surface condition:
5/14/2020 8:20 AM	**With the flow**	**Dry**	**Asphalt**
Pipe shape:	Pipe material:	Pipe height:	Pipe width:
	Concrete	**8.0 in.**	**8.0 in.**



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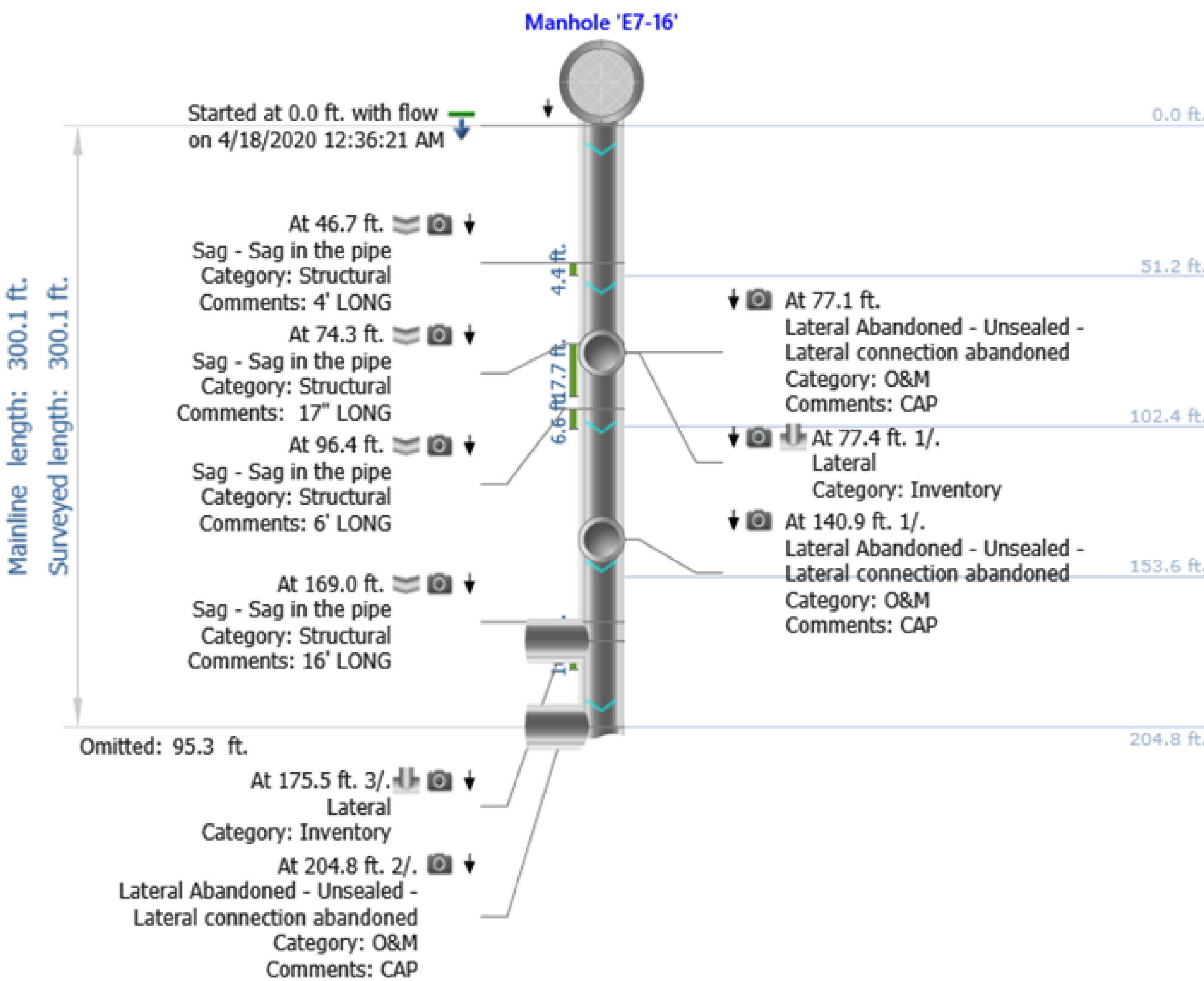
Main Inspections Pipe Run with Anomaly Probability

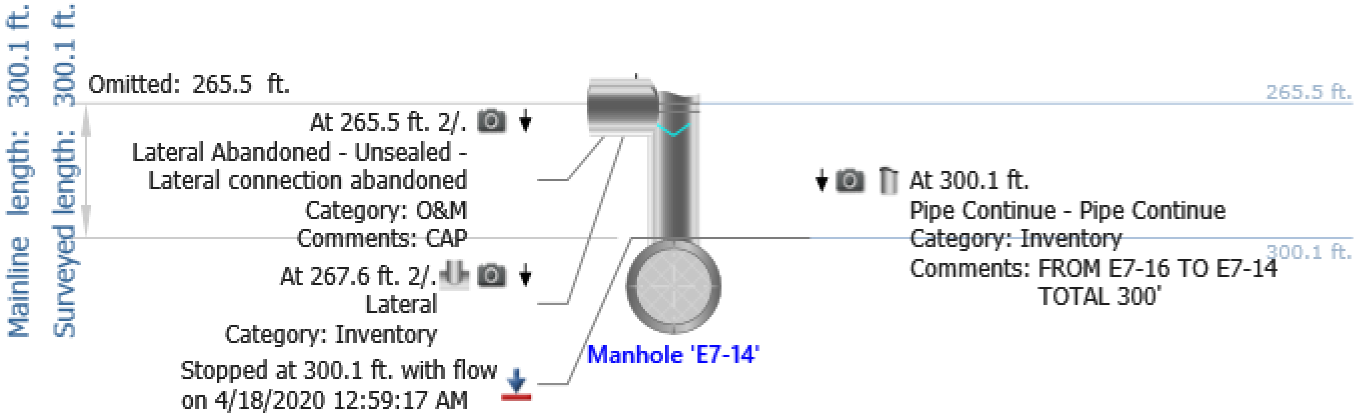
Project name:	Mainline ID:	City:	Address:
CITY OF HERMISTON	**E7-16**	**HERMISTON FROM E7-16 TO E7-14**	**E DOGWOOD AVE**
Start date/time:	Direction:	Weather:	Surface condition:
5/14/2020 9:00 AM	**With the flow**	**Dry**	**Asphalt**
Pipe shape:	Pipe material:	Pipe height:	Pipe width:
	Concrete	**8.0 in.**	**8.0 in.**



This report may contain 'false' positives due to the detection of anomalies other than voids.

Project name:	Mainline ID:	Start date/time:	Direction:
CITY OF HERMISTON	**E7-16**	**5/14/2020 9:00 AM**	**With the flow**

Weather:
Dry



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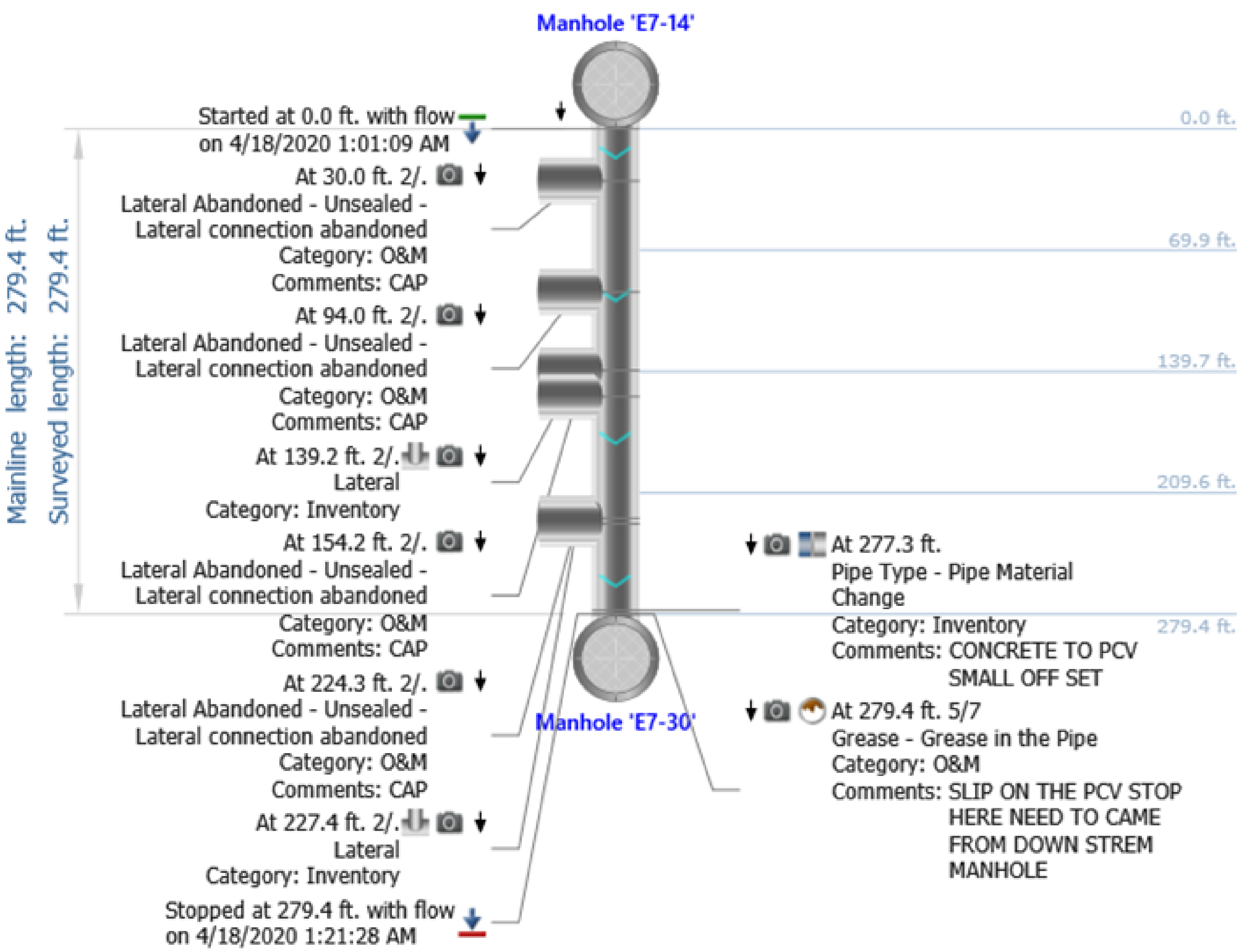
Main Inspections Pipe Run with Anomaly Probability

Project name:	Mainline ID:	City:	Address:
CITY OF HERMISTON	E7-14	HERMISTON FROM E7-14 TO E7-30	E DOGWOOD AVE
Start date/time:	Direction:	Weather:	Surface condition:
5/14/2020 9:30 AM	With the flow	Dry	Asphalt
Pipe shape:	Pipe material:	Pipe height:	Pipe width:
	Concrete	8.0 in.	8.0 in.



This report may contain 'false' positives due to the detection of anomalies other than voids.

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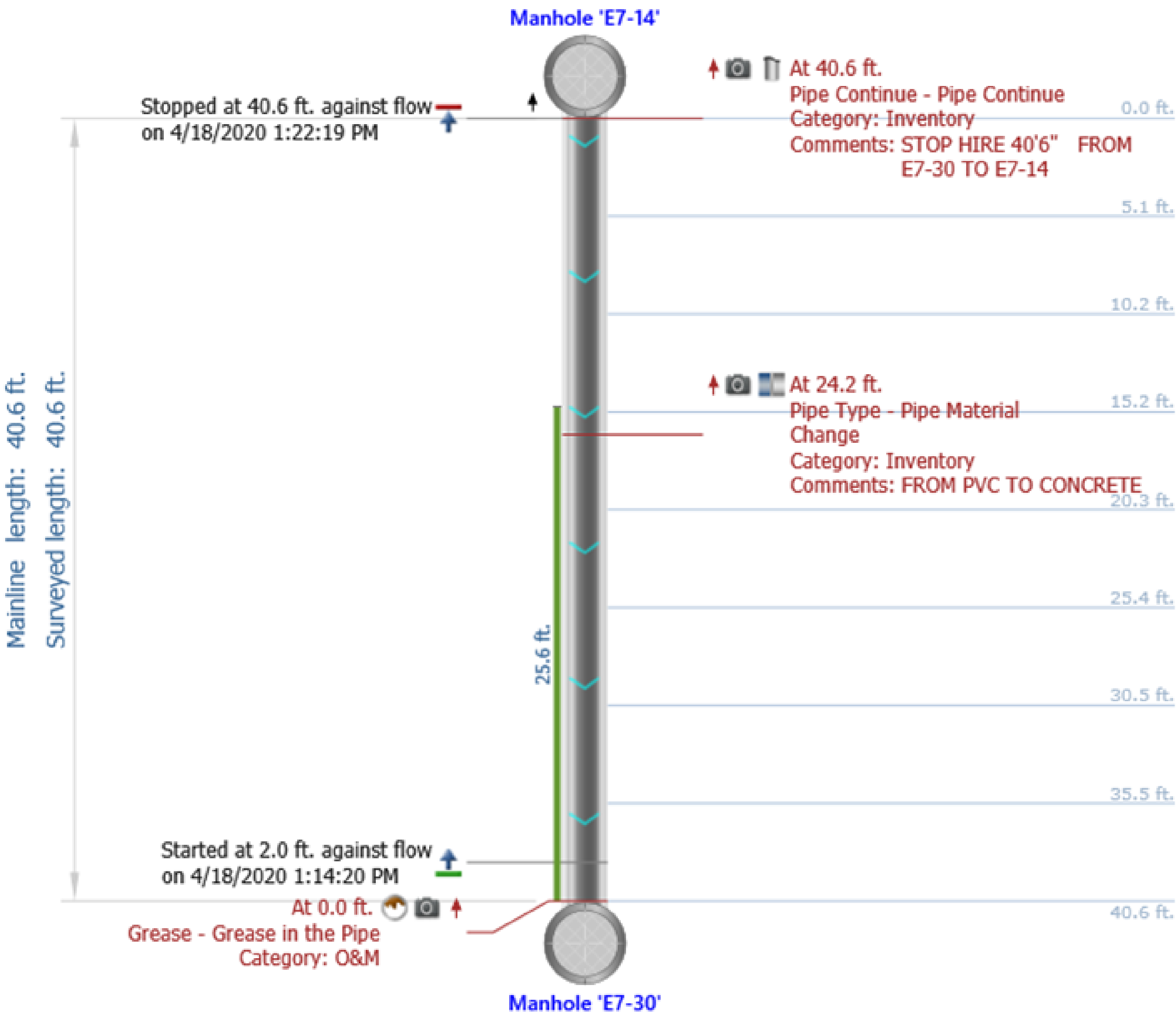
Main Inspections Pipe Run with Anomaly Probability

Project name:	Mainline ID:	City:	Address:
CITY OF HERMISTON	**E7-30**	**HERMISTON FROM E7-30 TO E7-14**	**E FOURTH AND DOGWOOD**
Start date/time:	Direction:	Weather:	Surface condition:
5/15/2020 9:30 AM	**Against the flow**	**Dry**	**Asphalt**
Pipe shape:	Pipe material:	Pipe height:	Pipe width:
	PVC	**8.0 in.**	**8.0 in.**



This report may contain 'false' positives due to the detection of anomalies other than voids.

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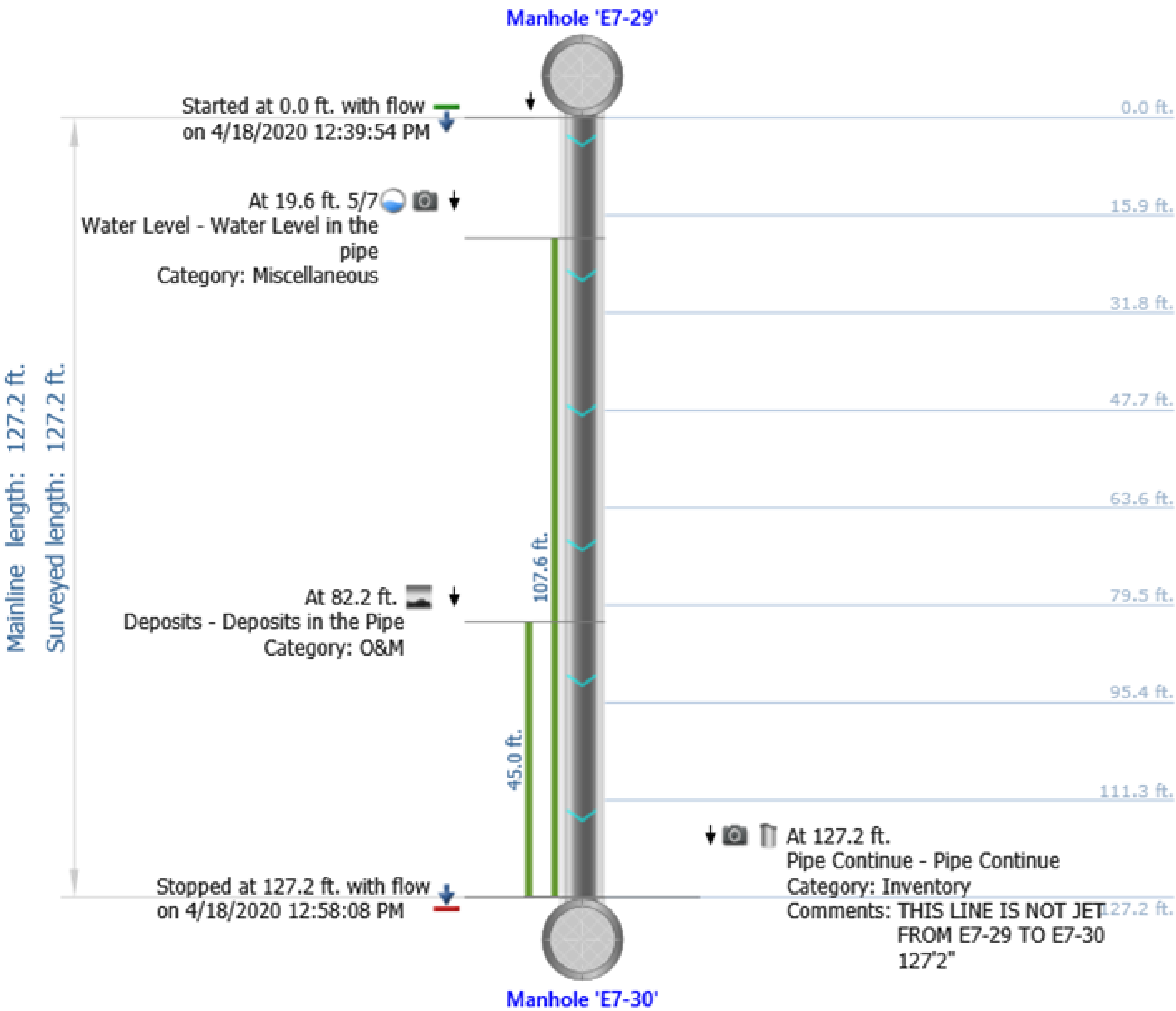
Portland, OR 97220
(503) 252-6144 Office

Main Inspections Pipe Run with Anomaly Probability

Project name:	Mainline ID:	City:	Address:
CITY OF HERMISTON	**E7-29-1**	**HERMISTON FROM E7-29-1 TO E7-30**	**E FOURTH ST**
Start date/time:	Direction:	Weather:	Surface condition:
5/15/2020 9:00 AM	**With the flow**	**Dry**	**Asphalt**
Pipe shape:	Pipe material:	Pipe height:	Pipe width:
	PVC	**8.0 in.**	**8.0 in.**



This report may contain 'false' positives due to the detection of anomalies other than voids.

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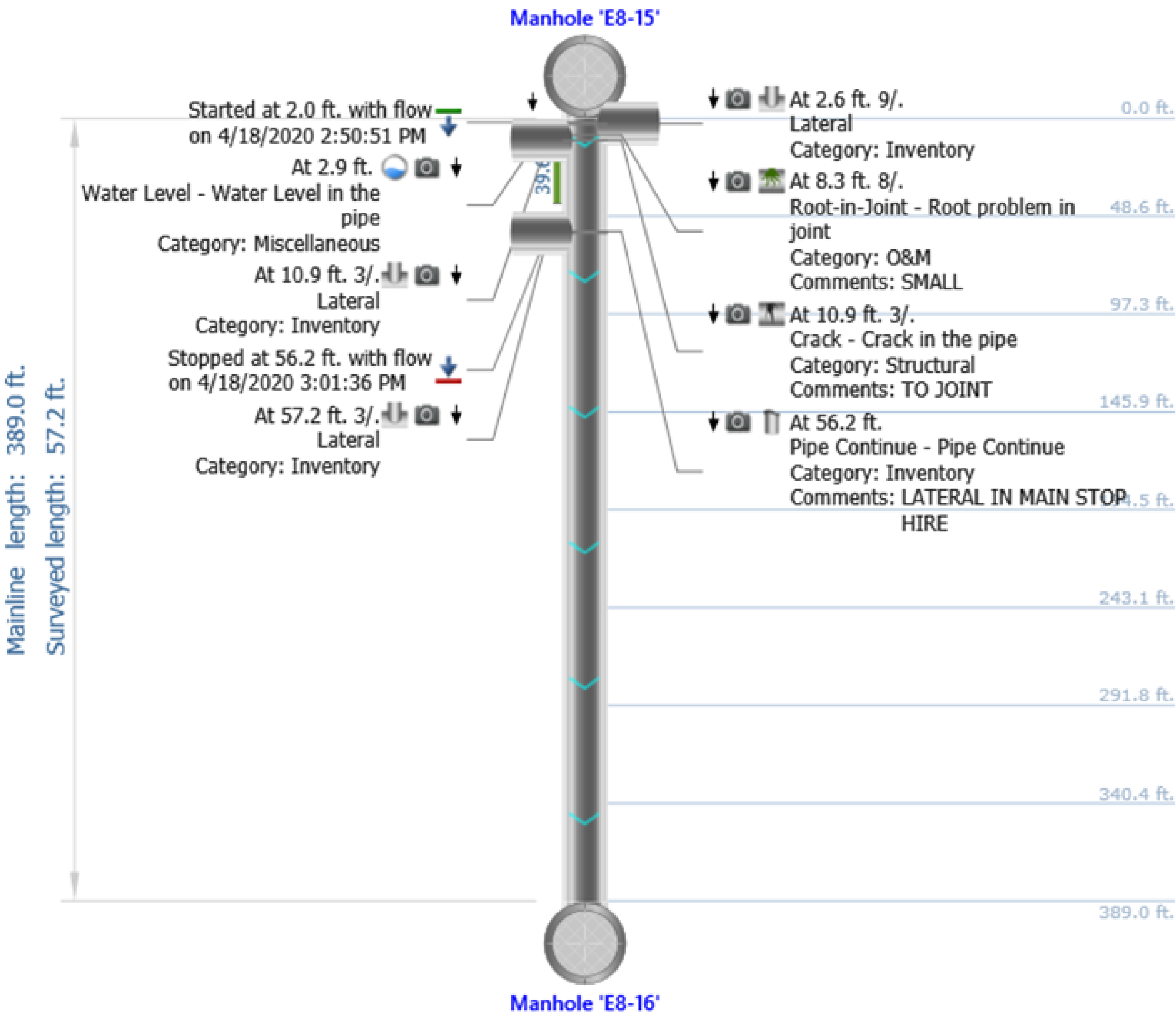
Main Inspections Pipe Run with Anomaly Probability

Project name:	Mainline ID:	City:	Address:
CITY OF HERMISTON	**E8-15**	**HHERMISTON E8-15 TO E8-16**	**E CATHREINE ALLY**
Start date/time:	Direction:	Weather:	Surface condition:
5/15/2020 11:10 AM	**With the flow**	**Dry**	**Dirt**
Pipe shape:	Pipe material:	Pipe height:	Pipe width:
	Concrete	**6.0 in.**	**6.0 in.**



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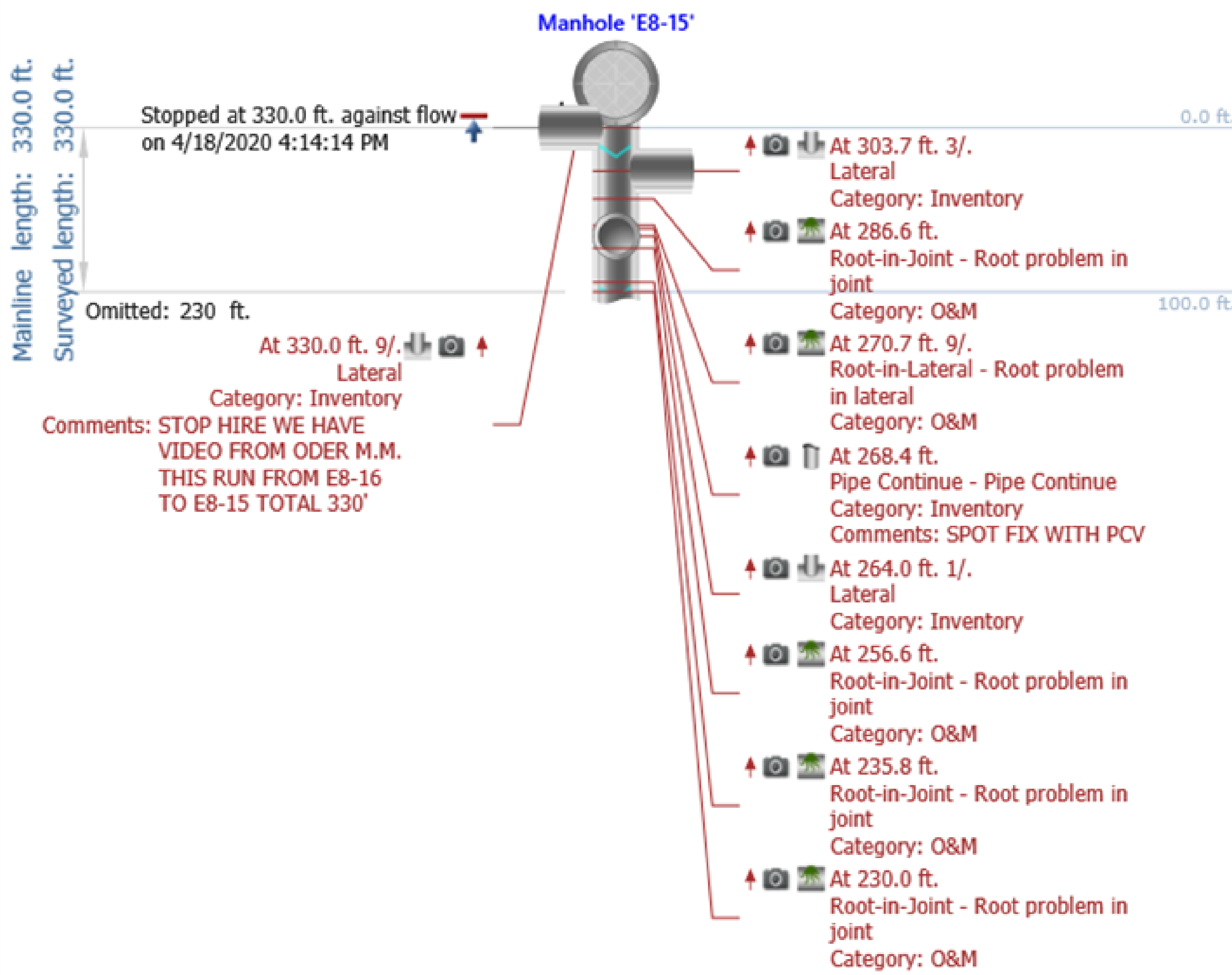
Main Inspections Pipe Run with Anomaly Probability

Project name:	Mainline ID:	City:	Address:
CITY OF HERMISTON	**E8-16**	**HERMISTON E8-16 TO E8-15**	**E CATHELINE AVE**
Start date/time:	Direction:	Weather:	Surface condition:
5/15/2020 11:50 AM	**Against the flow**	**Dry**	**Dirt**
Pipe shape:	Pipe material:	Pipe height:	Pipe width:
	Concrete	**6.0 in.**	**6.0 in.**



This report may contain 'false' positives due to the detection of anomalies other than voids.

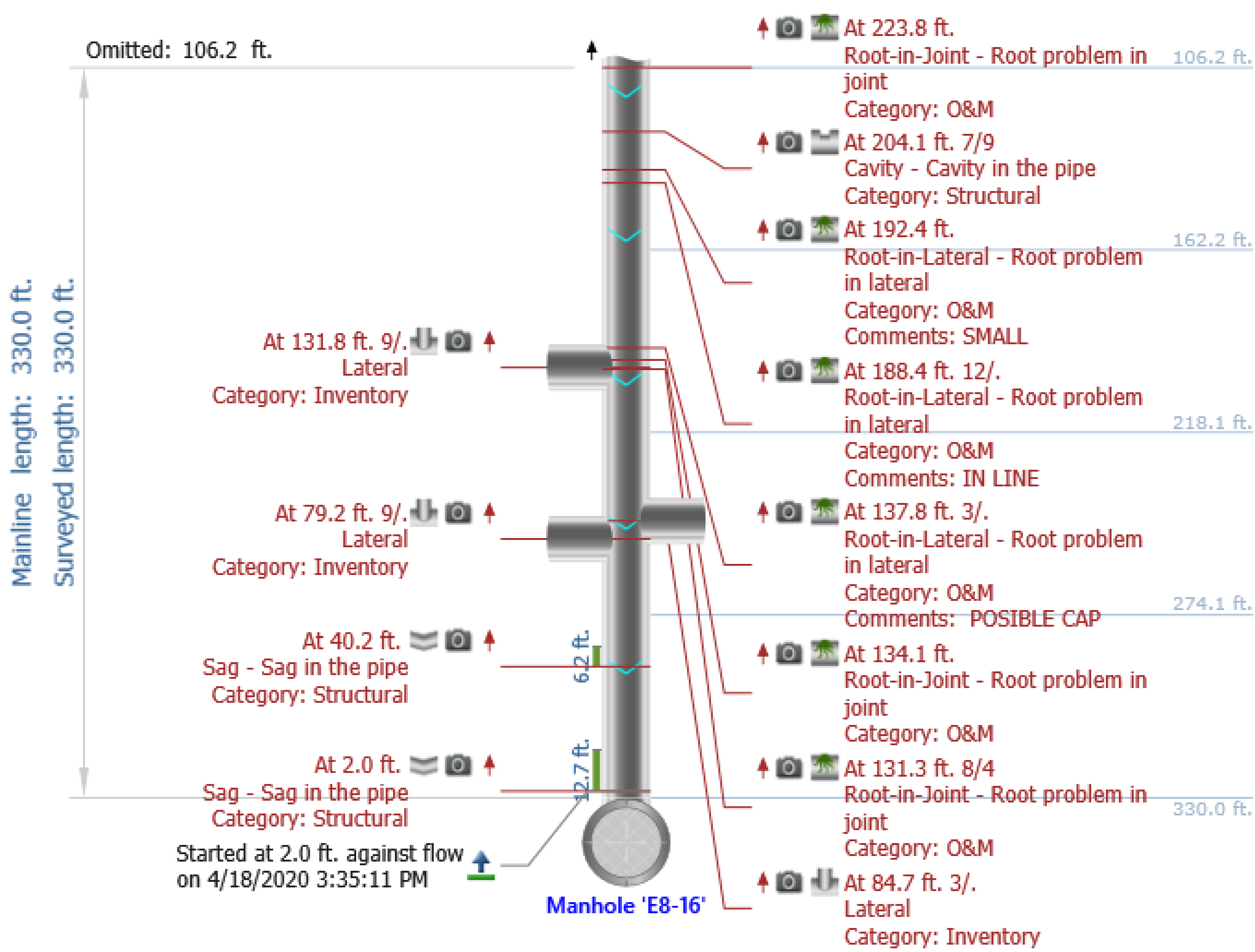
Project name: **CITY OF HERMISTON**

Mainline ID: **E8-16**

Start date/time: **5/15/2020 11:50 AM**

Direction: **Against the flow**

Weather: **Dry**



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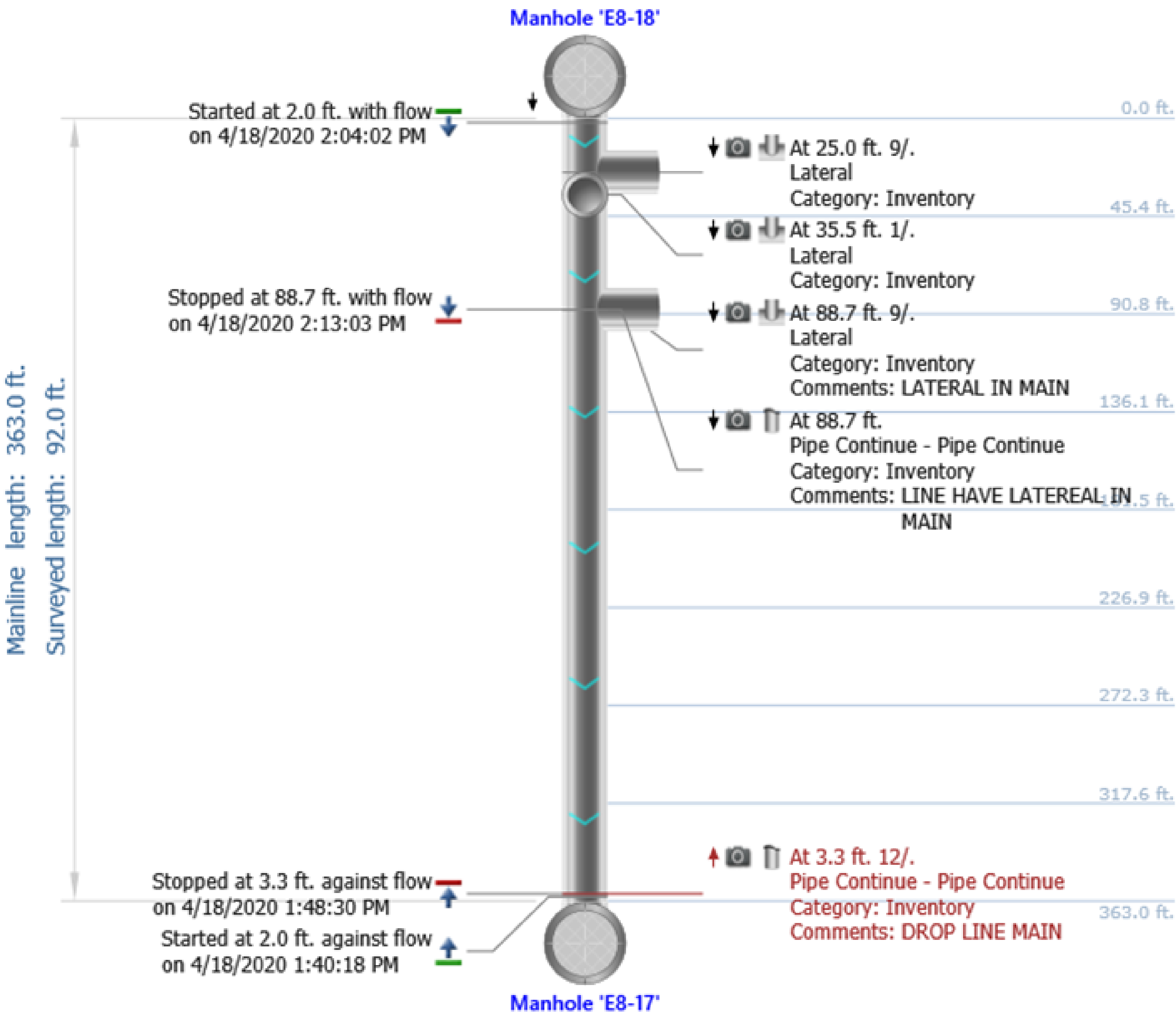
Main Inspections Pipe Run with Anomaly Probability

Project name:	Mainline ID:	City:	Address:
CITY OF HERMISTON	**E8-18**	**HERMISTON E8-18 TO E8-17**	**E CATHERINE ALLY**
Start date/time:	Direction:	Weather:	Surface condition:
5/15/2020 10:00 AM	**With the flow**	**Dry**	**Dirt**
Pipe shape:	Pipe material:	Pipe height:	Pipe width:
	Concrete	**6.0 in.**	**6.0 in.**



This report may contain 'false' positives due to the detection of anomalies other than voids.

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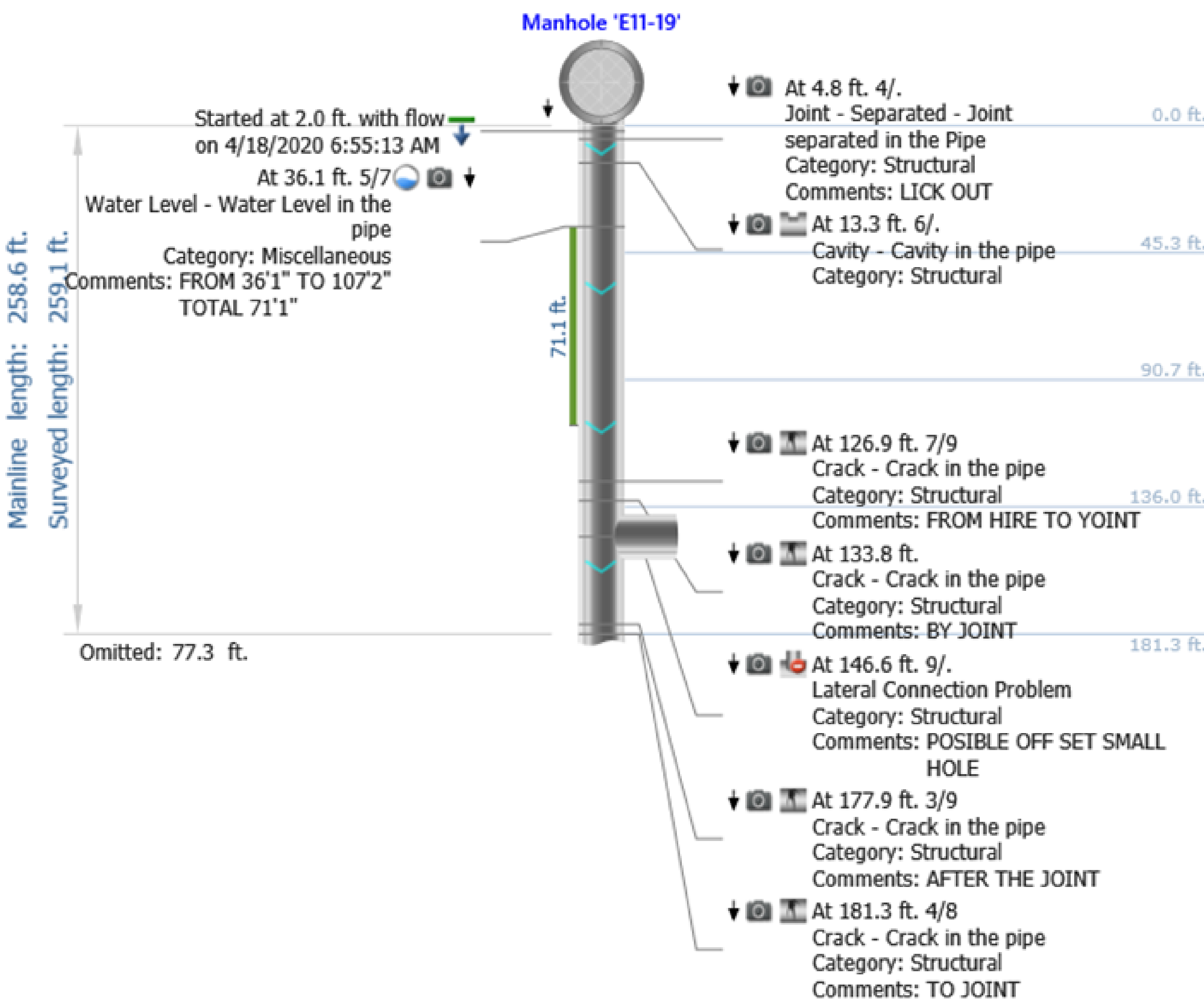
Main Inspections Pipe Run with Anomaly Probability

Project name:	Mainline ID:	City:	Address:
CITY OF HERMISTON	E11-19	HERMISTON FROM E11-19 TO E11-1	E 7TH ST
Start date/time:	Direction:	Weather:	Surface condition:
5/14/2020 6:15 PM	With the flow	Dry	Asphalt
Pipe shape:	Pipe material:	Pipe height:	Pipe width:
	Clay Tile	6.0 in.	6.0 in.



This report may contain 'false' positives due to the detection of anomalies other than voids.

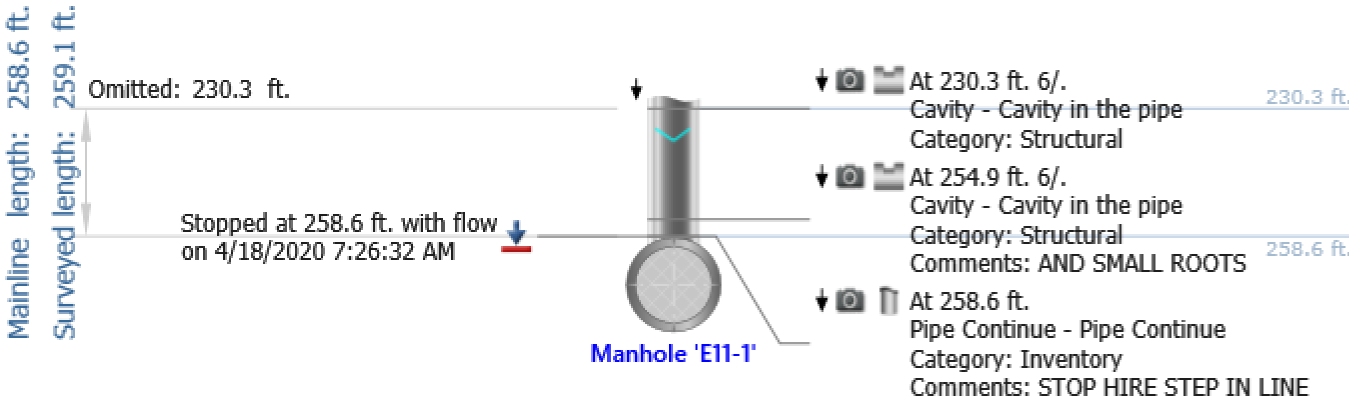
Project name: **CITY OF HERMISTON**

Mainline ID: **E11-19**

Start date/time: **5/14/2020 6:15 PM**

Direction: **With the flow**

Weather: **Dry**



Some observations have distance greater than the pipe length

This report may contain ‘false’ positives due to the detection of anomalies other than voids.

At 259.1 ft.
Pipe Size - Pipe Diameter Change
Category: Inventory
Comments: FROM 6 COMCRETE TO 8 PVC

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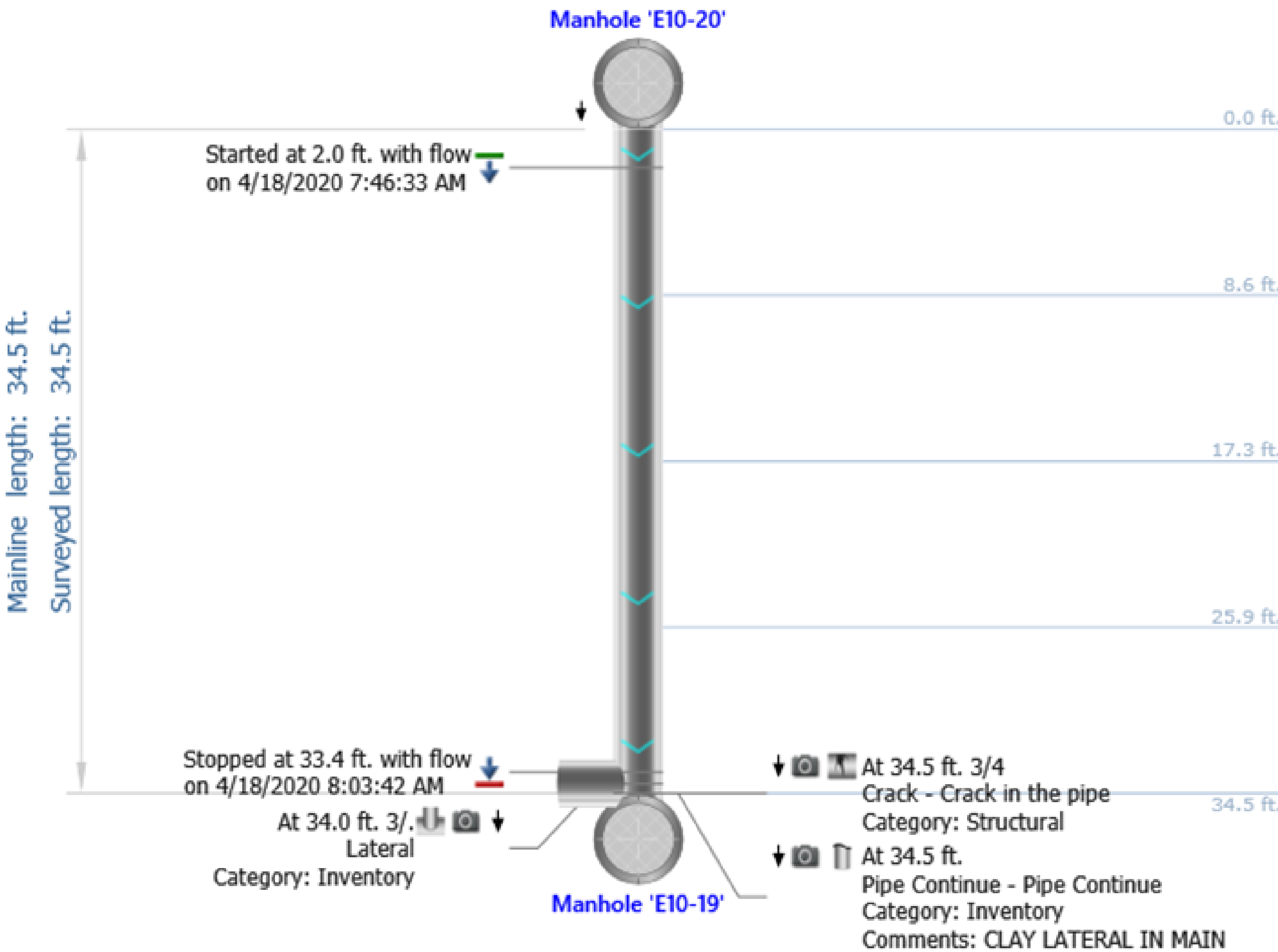
Main Inspections Pipe Run with Anomaly Probability

Project name:	Mainline ID:	City:	Address:
CITY OF HERMISTON	**E10-20**	**HERMISTON FROM E10-20 TO E10-19**	**NE 7TH ST ALLY**
Start date/time:	Direction:	Weather:	Surface condition:
5/14/2020 7:11 PM	**With the flow**	**Dry**	**Garden**
Pipe shape:	Pipe material:	Pipe height:	Pipe width:
	Concrete	**6.0 in.**	**6.0 in.**



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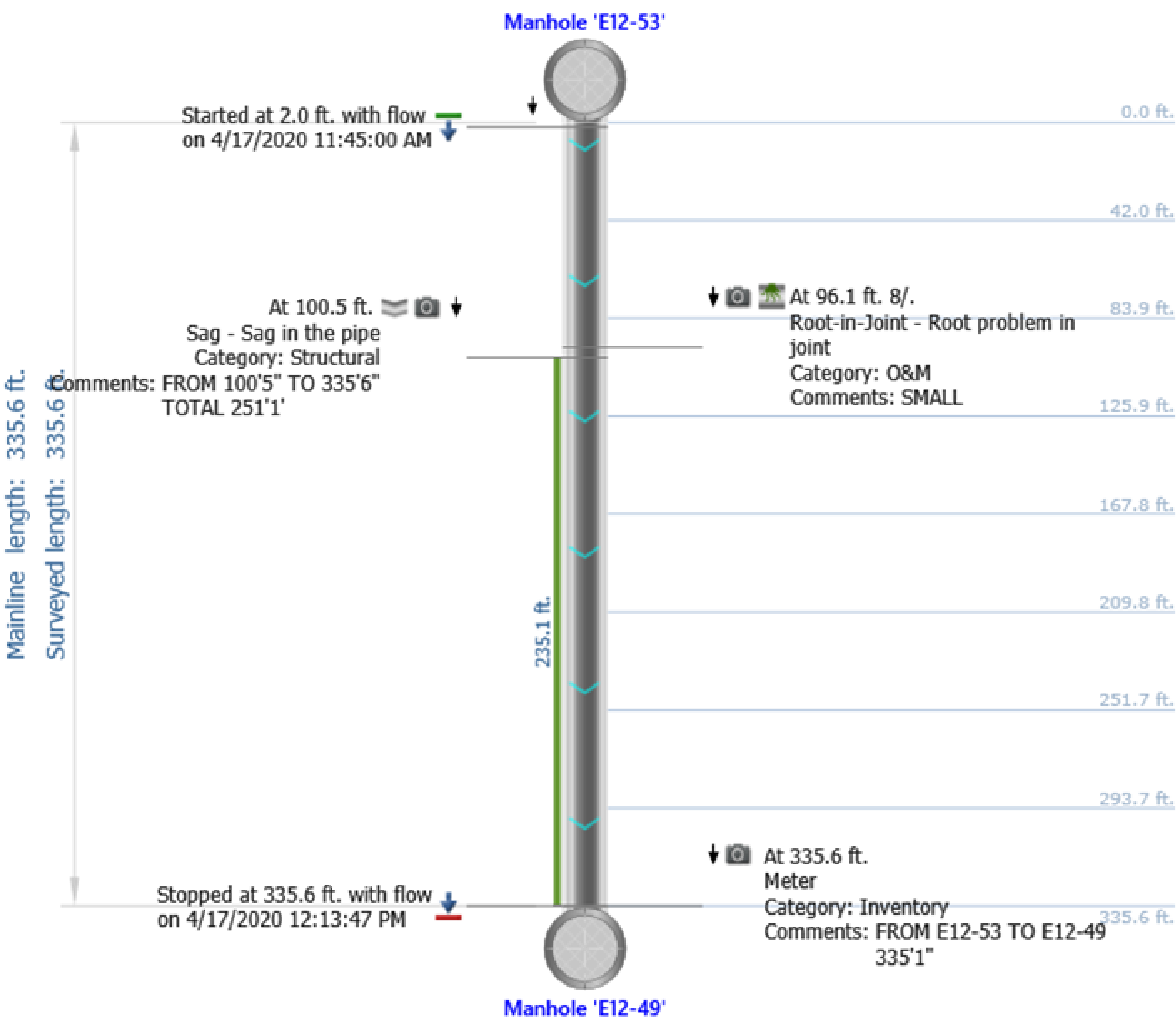
Main Inspections Pipe Run with Anomaly Probability

Project name:	Mainline ID:	City:	Address:
CITY OF HERMISTON	**E12-53**	**HERMISTON E12-53 TO E12-49**	**NE 5TH ST AND E NEWPORT AVE**
Start date/time:	Direction:	Weather:	Surface condition:
5/7/2020 7:46 PM	**With the flow**	**Dry**	**Asphalt**
Pipe shape:	Pipe material:	Pipe height:	Pipe width:
	Clay Tile	**8.0 in.**	**8.0 in.**



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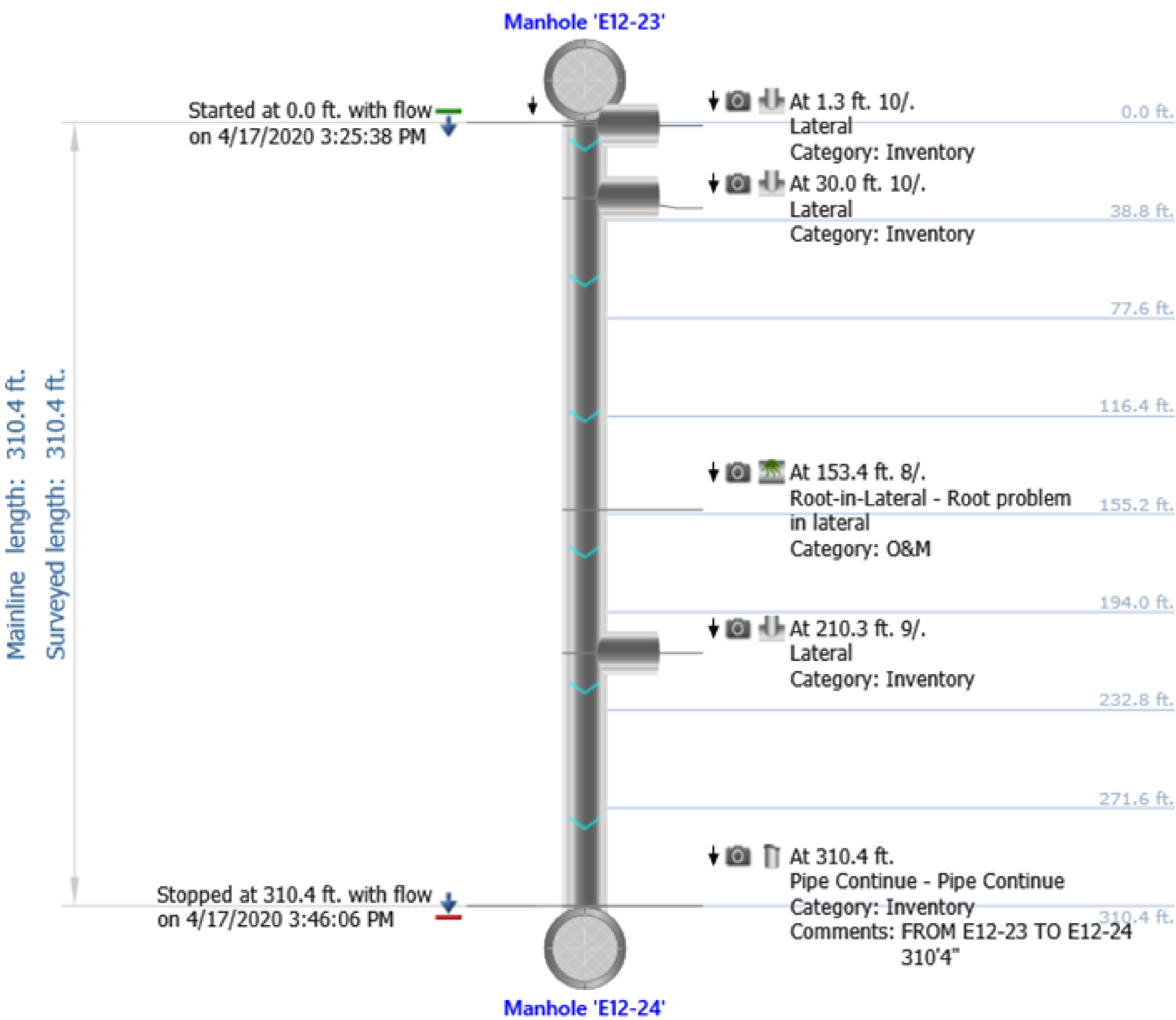
Main Inspections Pipe Run with Anomaly Probability

Project name:	Mainline ID:	City:	Address:
CITY OF HERMISTON	**E12-23**	**HERMISTON E12-23 TO E12-24**	**HWY 395 BY SAFEWAY**
Start date/time:	Direction:	Weather:	Surface condition:
5/8/2020 5:42 AM	**With the flow**	**Dry**	**Asphalt**
Pipe shape:	Pipe material:	Pipe height:	Pipe width:
	Concrete	**8.0 in.**	**8.0 in.**



This report may contain 'false' positives due to the detection of anomalies other than voids.

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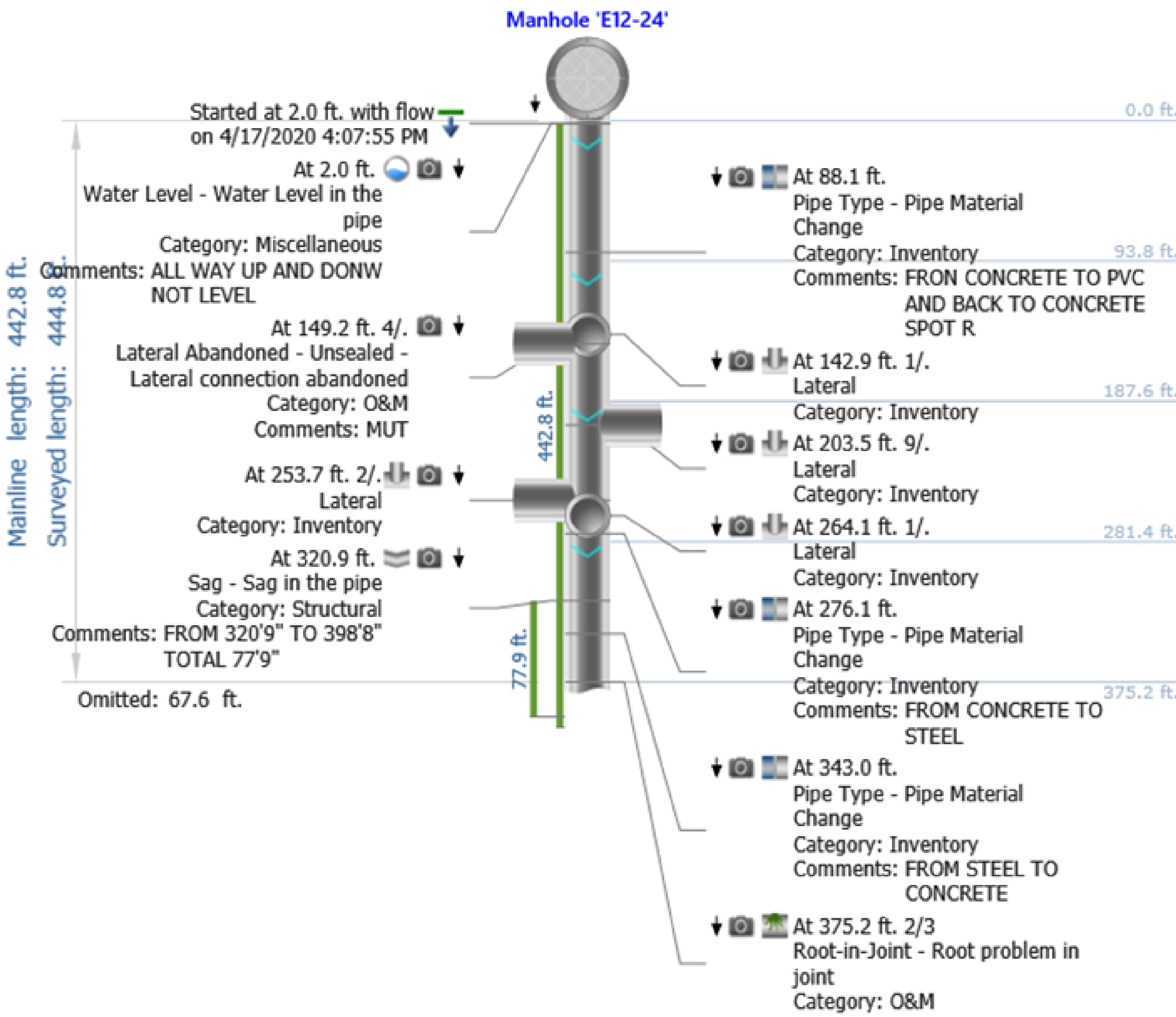
Main Inspections Pipe Run with Anomaly Probability

Project name:	Mainline ID:	City:	Address:
CITY OF HERMISTON	**E12-24**	**HERMISTON E12-24 TO E12-39**	**HYW 395 BY SAFEWAY**
Start date/time:	Direction:	Weather:	Surface condition:
5/8/2020 7:23 AM	**With the flow**	**Dry**	**Asphalt**
Pipe shape:	Pipe material:	Pipe height:	Pipe width:
	Concrete	**8.0 in.**	**8.0 in.**

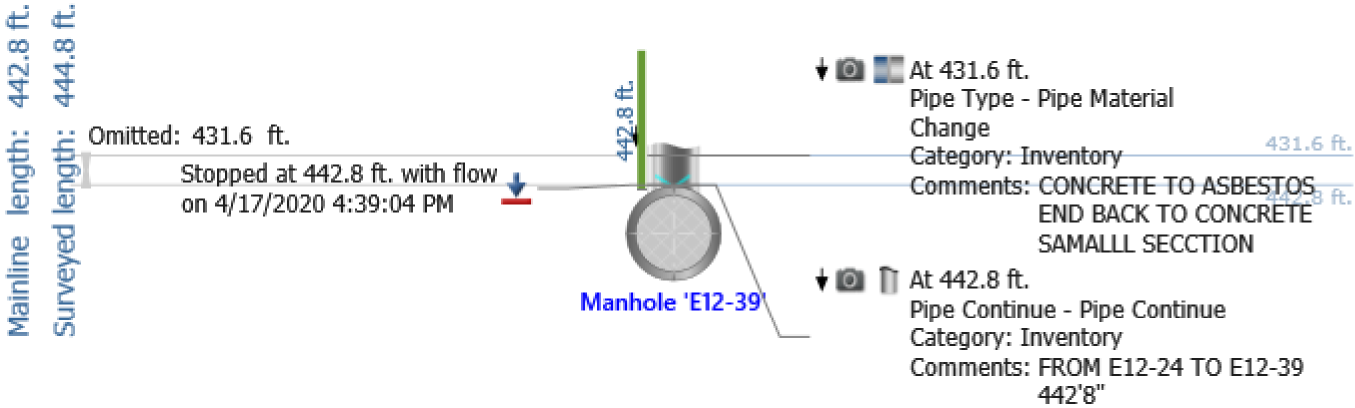


This report may contain 'false' positives due to the detection of anomalies other than voids.

Project name:	Mainline ID:	Start date/time:	Direction:
CITY OF HERMISTON	**E12-24**	**5/8/2020 7:23 AM**	**With the flow**

Weather:

Dry



This report may contain 'false' positives due to the detection of anomalies other than voids.

River City Environmental
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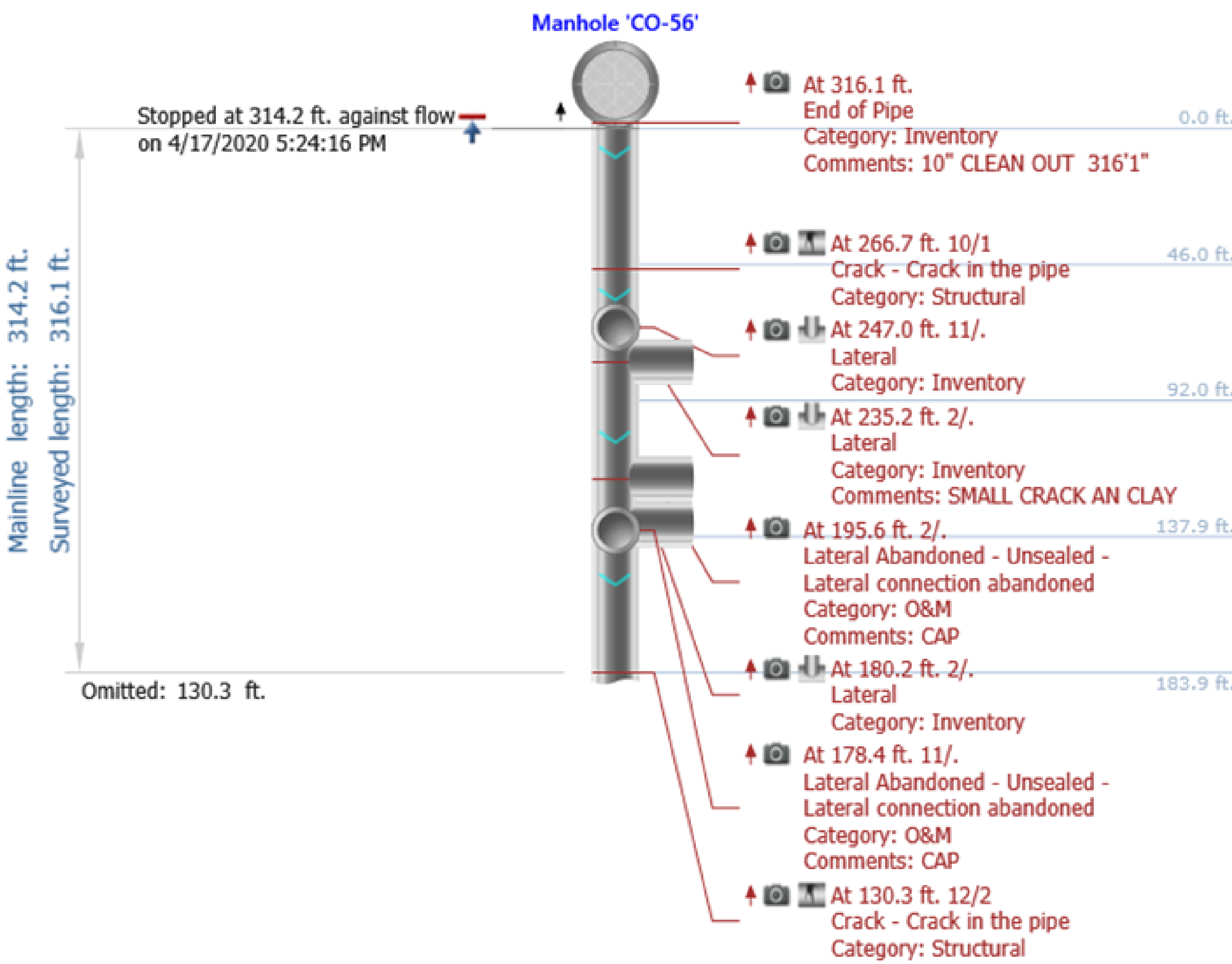
Portland, OR 97220
(503) 252-6144 Office

Main Inspections Pipe Run with Anomaly Probability

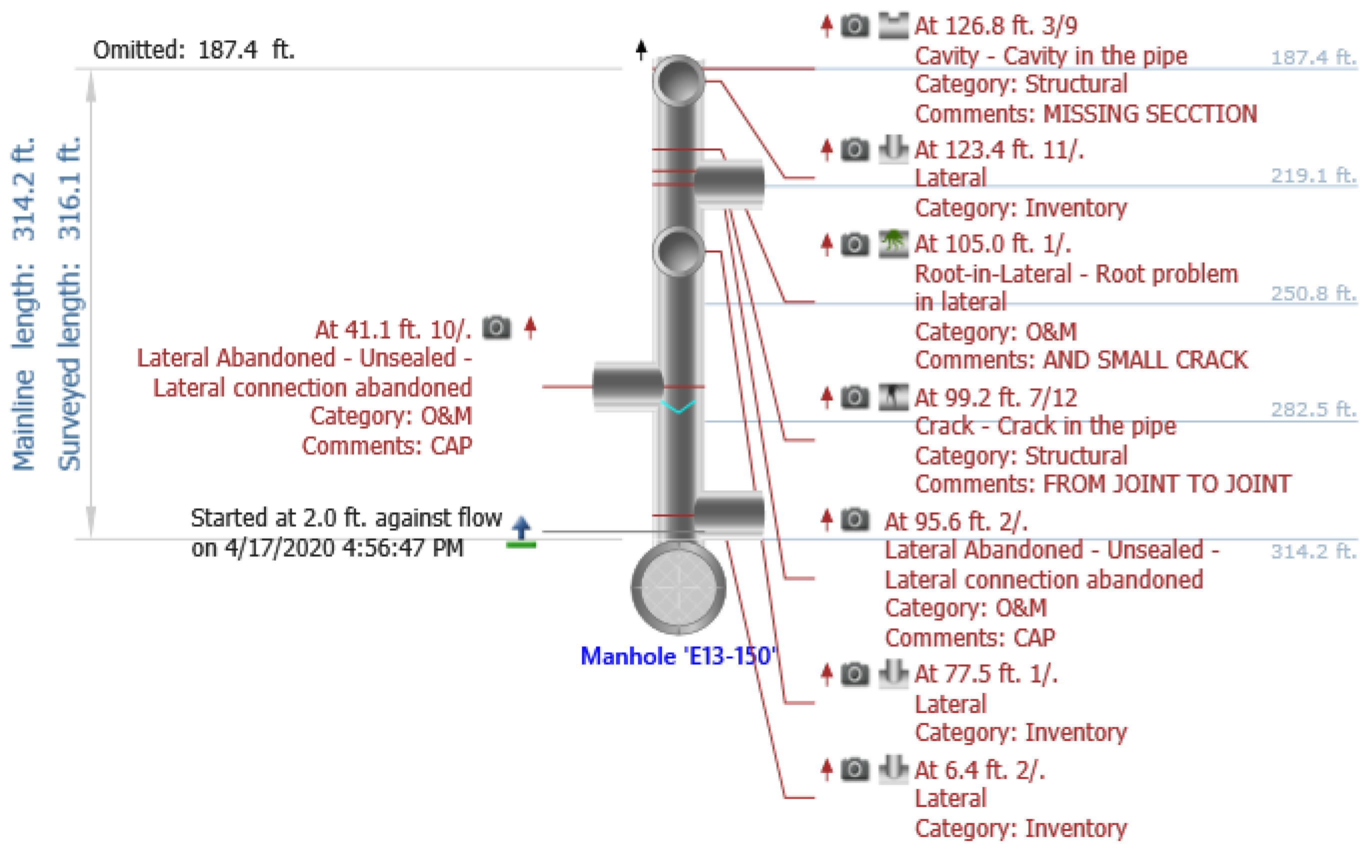
Project name:	Mainline ID:	City:	Address:
CITY OF HERMISTON	**E13-150**	**HERMISTON E13-150 TO CO-56**	**E NEWPORT AND SE 7TH ST**
Start date/time:	Direction:	Weather:	Surface condition:
5/8/2020 8:49 AM	**Against the flow**	**Dry**	**Asphalt**
Pipe shape:	Pipe material:	Pipe height:	Pipe width:
	Clay	**10.0 in.**	**10.0 in.**



This report may contain ‘false’ positives due to the detection of anomalies other than voids.

Project name:	Mainline ID:	Start date/time:	Direction:
CITY OF HERMISTON	**E13-150**	**5/8/2020 8:49 AM**	**Against the flow**

Weather:
Dry



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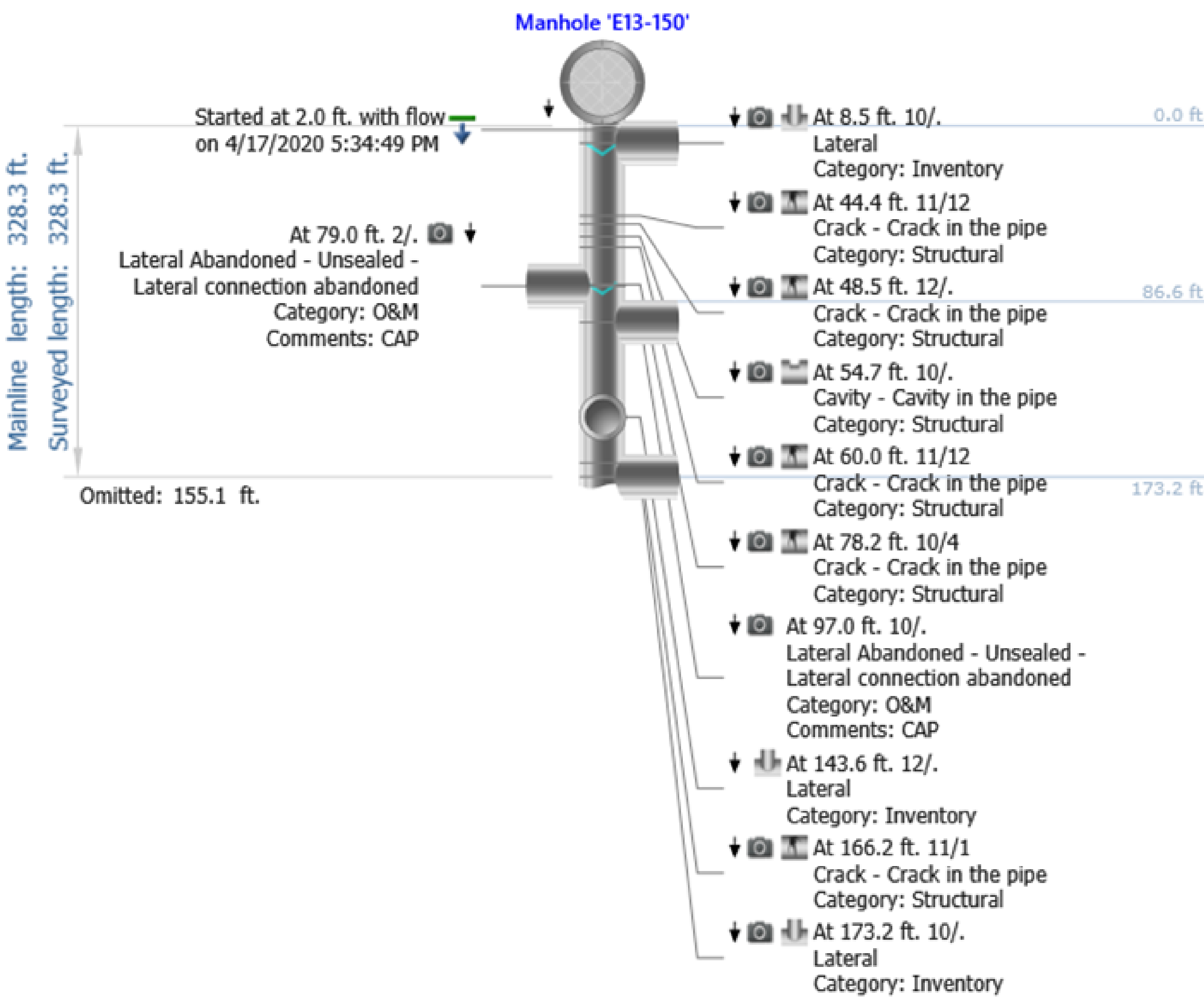
Main Inspections Pipe Run with Anomaly Probability

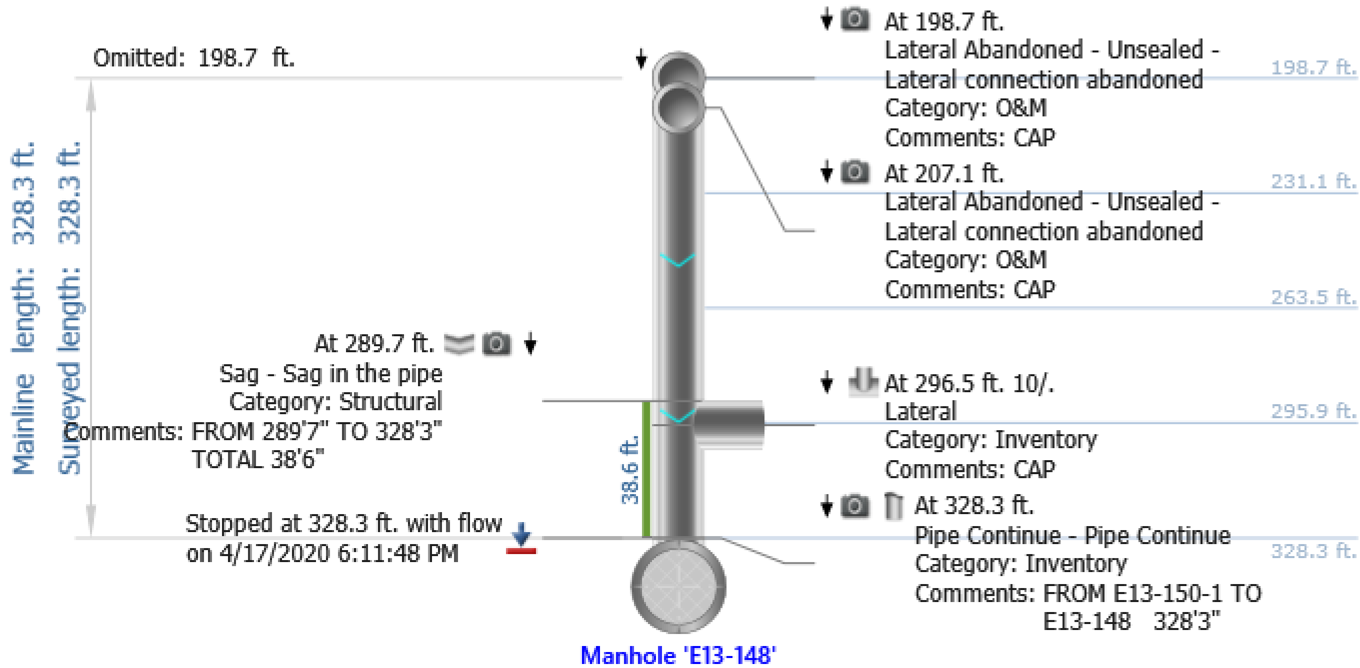
Project name:	Mainline ID:	City:	Address:
CITY OF HERMISTON	**E13-150-1**	**HERMISTON E13-150-1 TO E13-148**	**E NEWPORT AVE AND SE 7TH ST**
Start date/time:	Direction:	Weather:	Surface condition:
5/8/2020 9:27 AM	**With the flow**	**Dry**	**Asphalt**
Pipe shape:	Pipe material:	Pipe height:	Pipe width:
	Clay	**10.0 in.**	**10.0 in.**



This report may contain ‘false’ positives due to the detection of anomalies other than voids.

Project name:	Mainline ID:	Start date/time:	Direction:
CITY OF HERMISTON	**E13-150-1**	**5/8/2020 9:27 AM**	**With the flow**

Weather:
Dry



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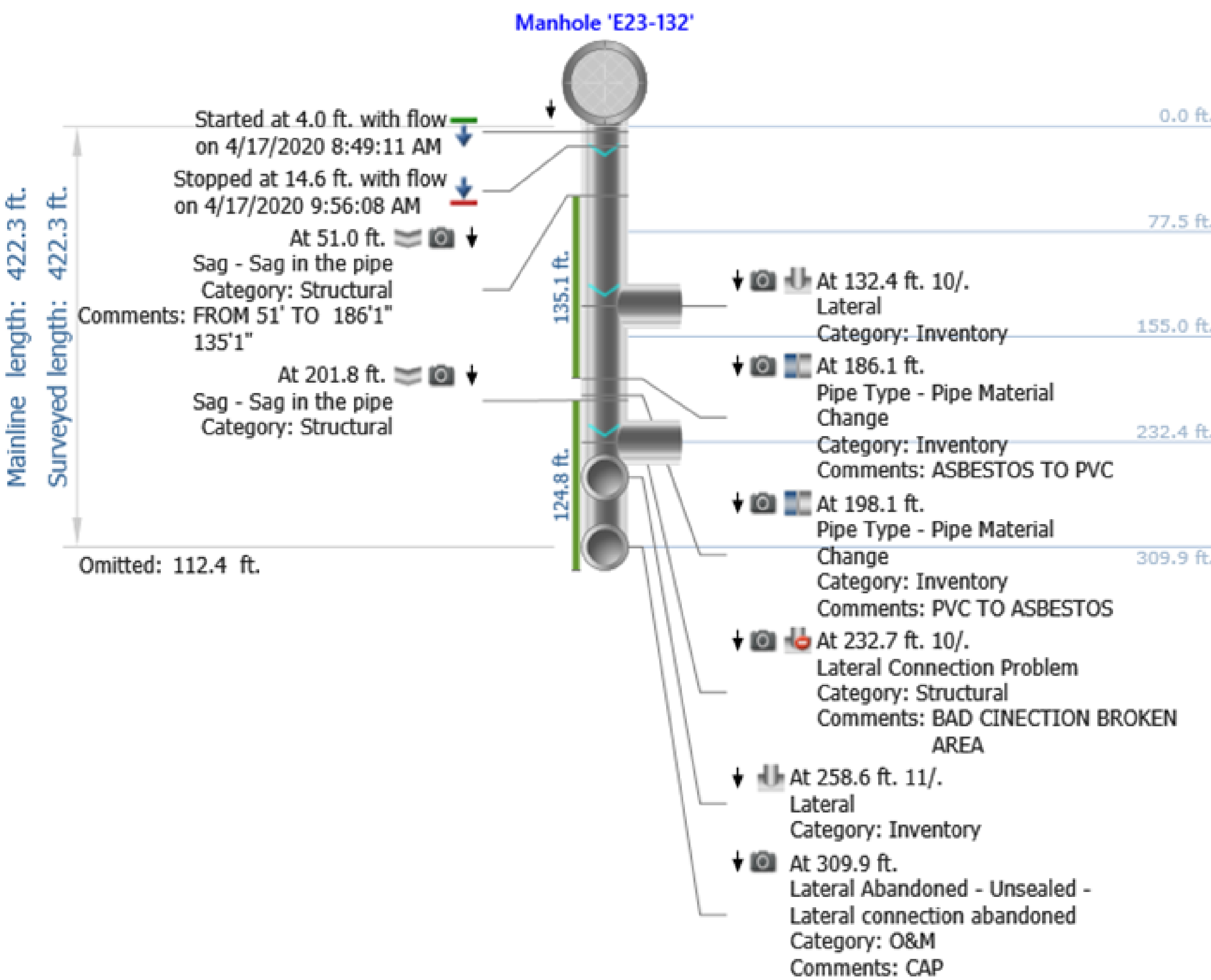
Main Inspections Pipe Run with Anomaly Probability

Project name:	Mainline ID:	City:	Address:
CITY OF HERMISTON	**E13-132**	**HERMISTON E17-132 TO E13-99**	**SE 6TH ST**
Start date/time:	Direction:	Weather:	Surface condition:
5/7/2020 4:49 AM	**With the flow**	**Dry**	**Asphalt**
Pipe shape:	Pipe material:	Pipe height:	Pipe width:
	Concrete	**8.0 in.**	**8.0 in.**

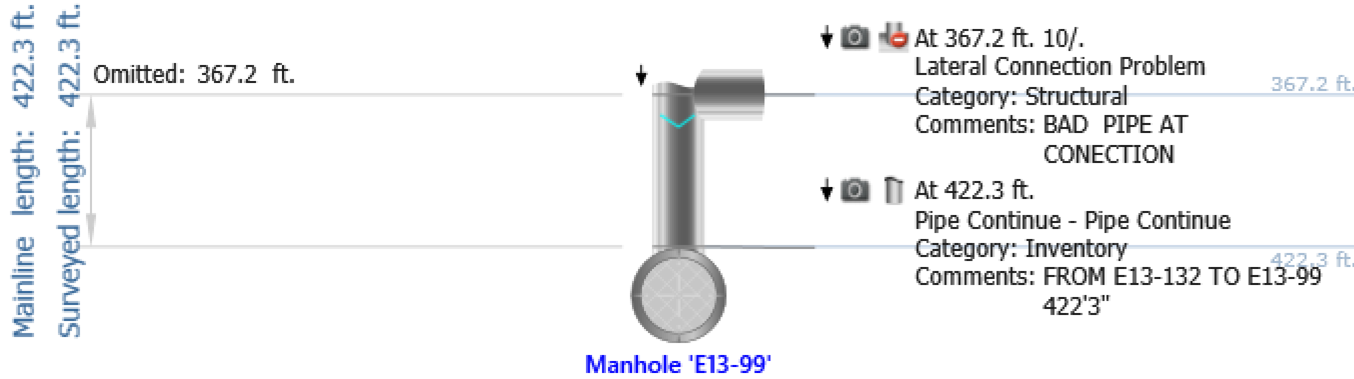


This report may contain ‘false’ positives due to the detection of anomalies other than voids.

Project name:	Mainline ID:	Start date/time:	Direction:
CITY OF HERMISTON	**E13-132**	**5/7/2020 4:49 AM**	**With the flow**

Weather:

Dry



This report may contain 'false' positives due to the detection of anomalies other than voids.

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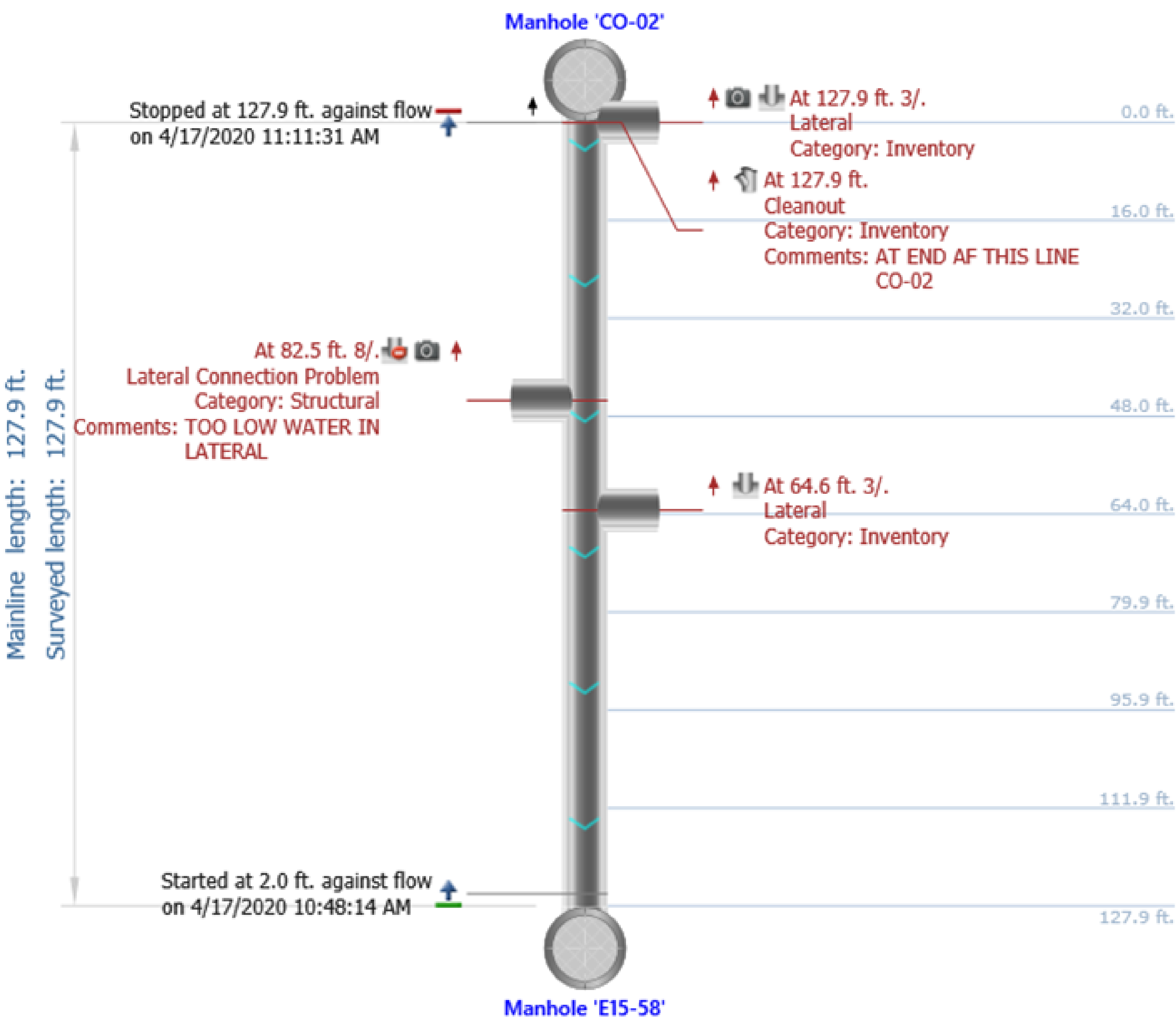
Main Inspections Pipe Run with Anomaly Probability

Project name:	Mainline ID:	City:	Address:
CITY OF HERMISTON	**E15-58-1**	**HERMISTON W15-58 TO C0-02**	**NE 9TH ST AND N GLADYS AVE**
Start date/time:	Direction:	Weather:	Surface condition:
5/7/2020 6:49 PM	**Against the flow**	**Dry**	**Asphalt**
Pipe shape:	Pipe material:	Pipe height:	Pipe width:
	Steel	**6.0 in.**	**6.0 in.**



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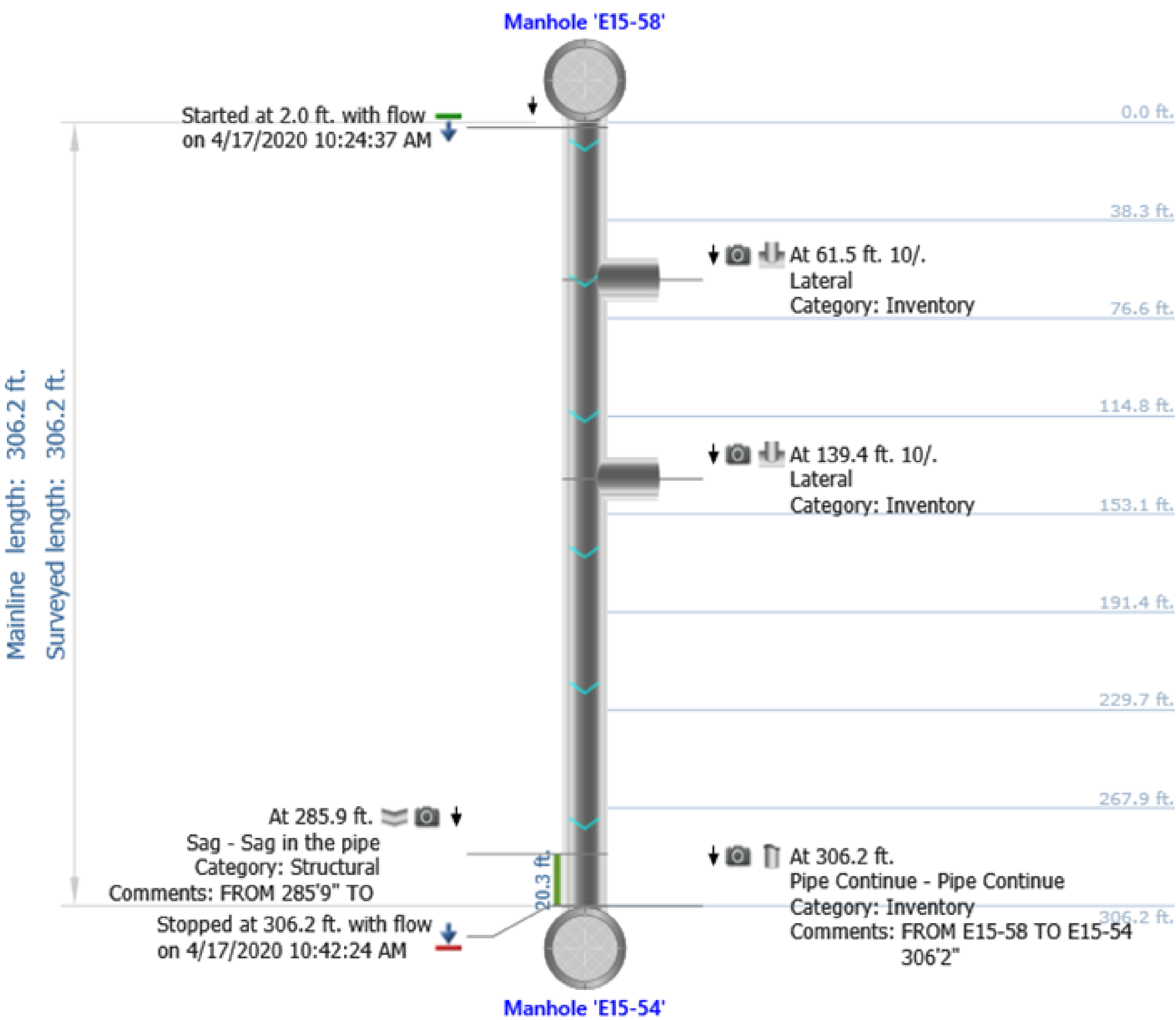
Main Inspections Pipe Run with Anomaly Probability

Project name:	Mainline ID:	City:	Address:
CITY OF HERMISTON	**E15-58**	**HERMISTON E15-58 TO E15-54**	**NE 9TH ST AND E GLADYS AV**
Start date/time:	Direction:	Weather:	Surface condition:
5/7/2020 6:00 PM	**With the flow**	**Dry**	**Asphalt**
Pipe shape:	Pipe material:	Pipe height:	Pipe width:
	Steel	**8.0 in.**	**8.0 in.**



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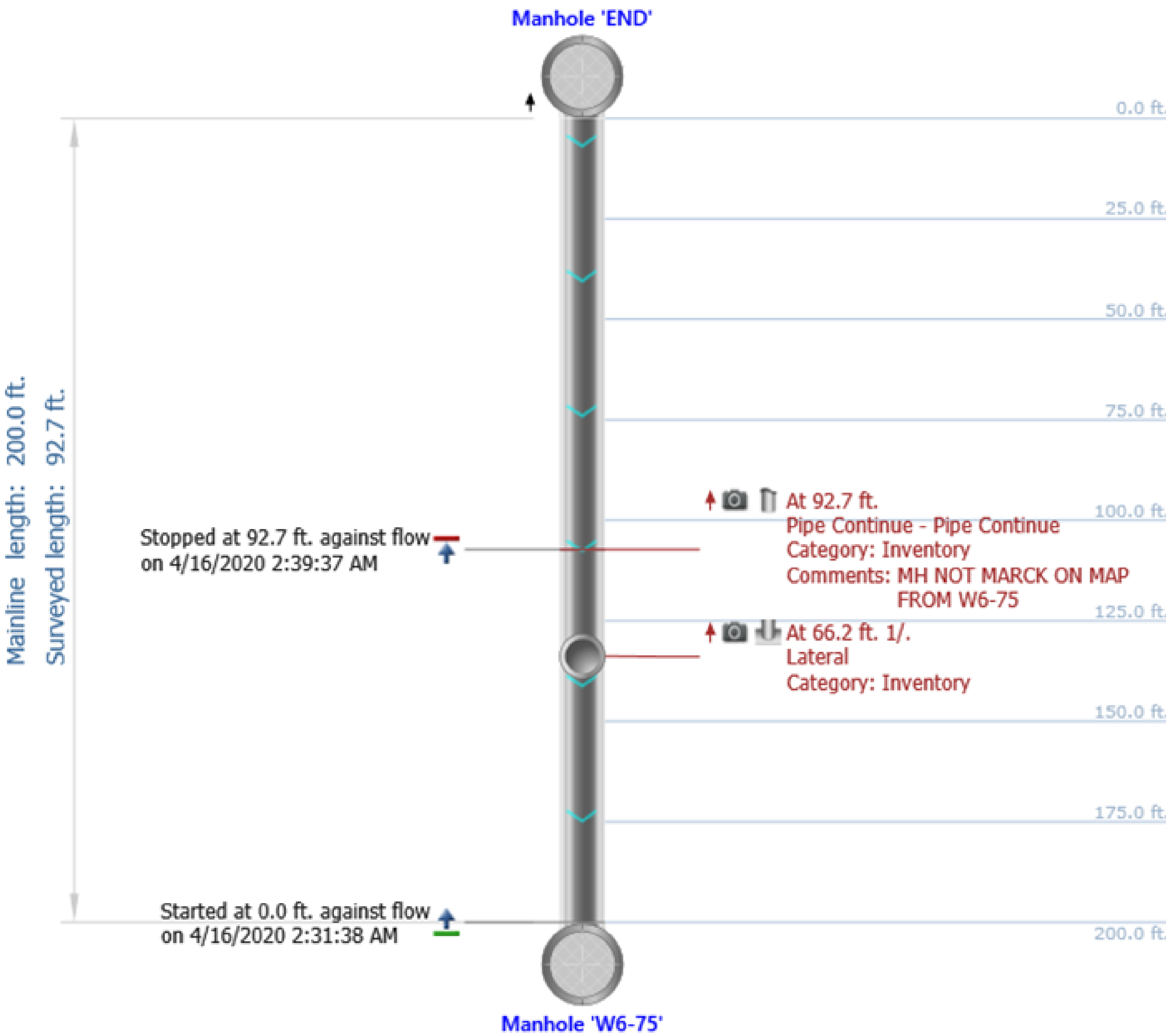
Main Inspections Pipe Run with Anomaly Probability

Project name:	Mainline ID:	City:	Address:
CITY OF HERMISTON	**W6-75**	**HERMISTON W6-75**	**W HIGHLAND**
Start date/time:	Direction:	Weather:	Surface condition:
5/5/2020 6:01 PM	**Against the flow**	**Dry**	**Asphalt**
Pipe shape:	Pipe material:	Pipe height:	Pipe width:
	PVC	**8.0 in.**	**8.0 in.**



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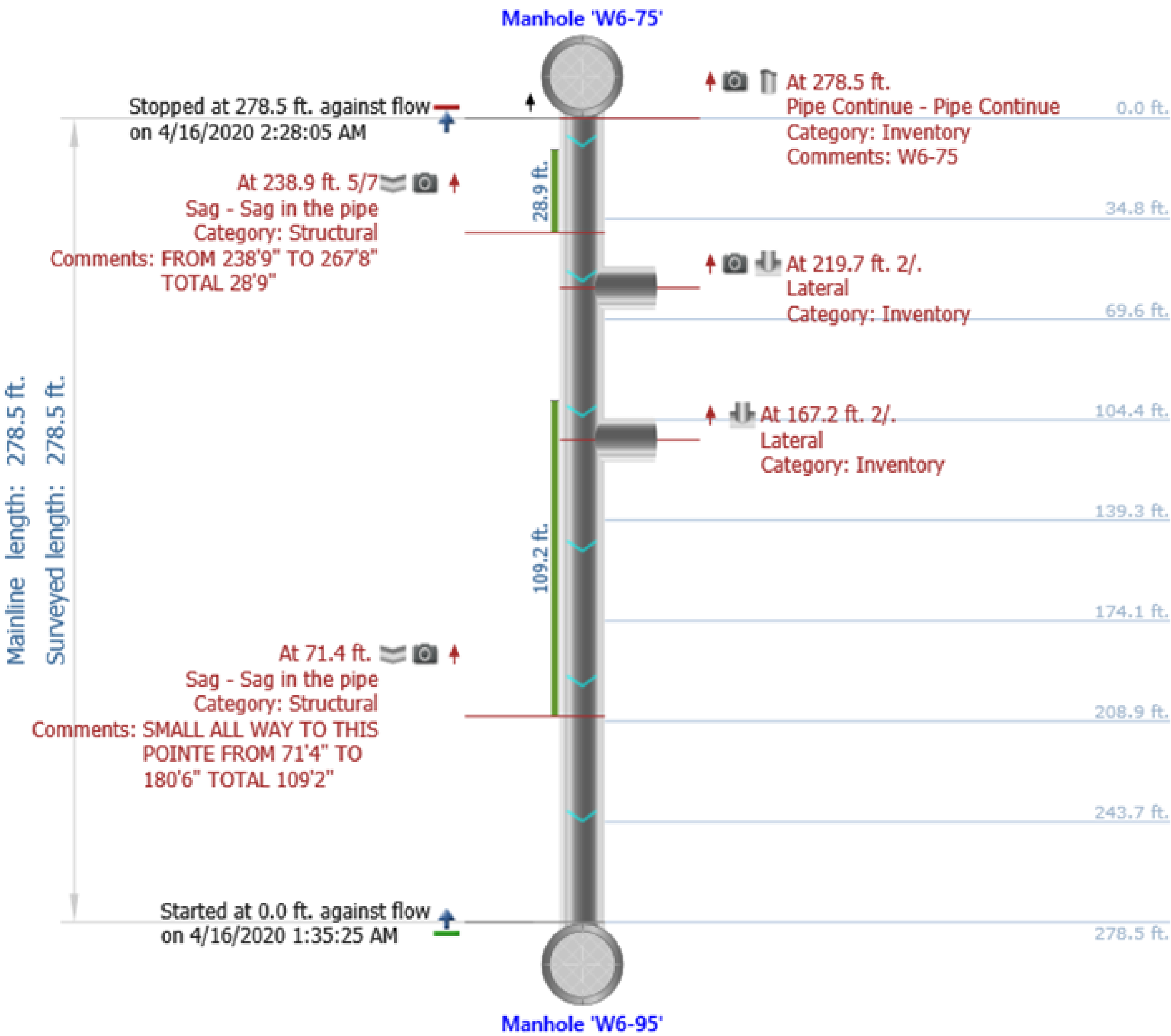
Main Inspections Pipe Run with Anomaly Probability

Project name:	Mainline ID:	City:	Address:
CITY OF HERMISTON	**W6-95**	**HERMISTON W6-95**	**W HIGHLAN AVE**
Start date/time:	Direction:	Weather:	Surface condition:
5/5/2020 5:03 PM	**Against the flow**	**Dry**	**Asphalt**
Pipe shape:	Pipe material:	Pipe height:	Pipe width:
	PVC		



This report may contain 'false' positives due to the detection of anomalies other than voids.

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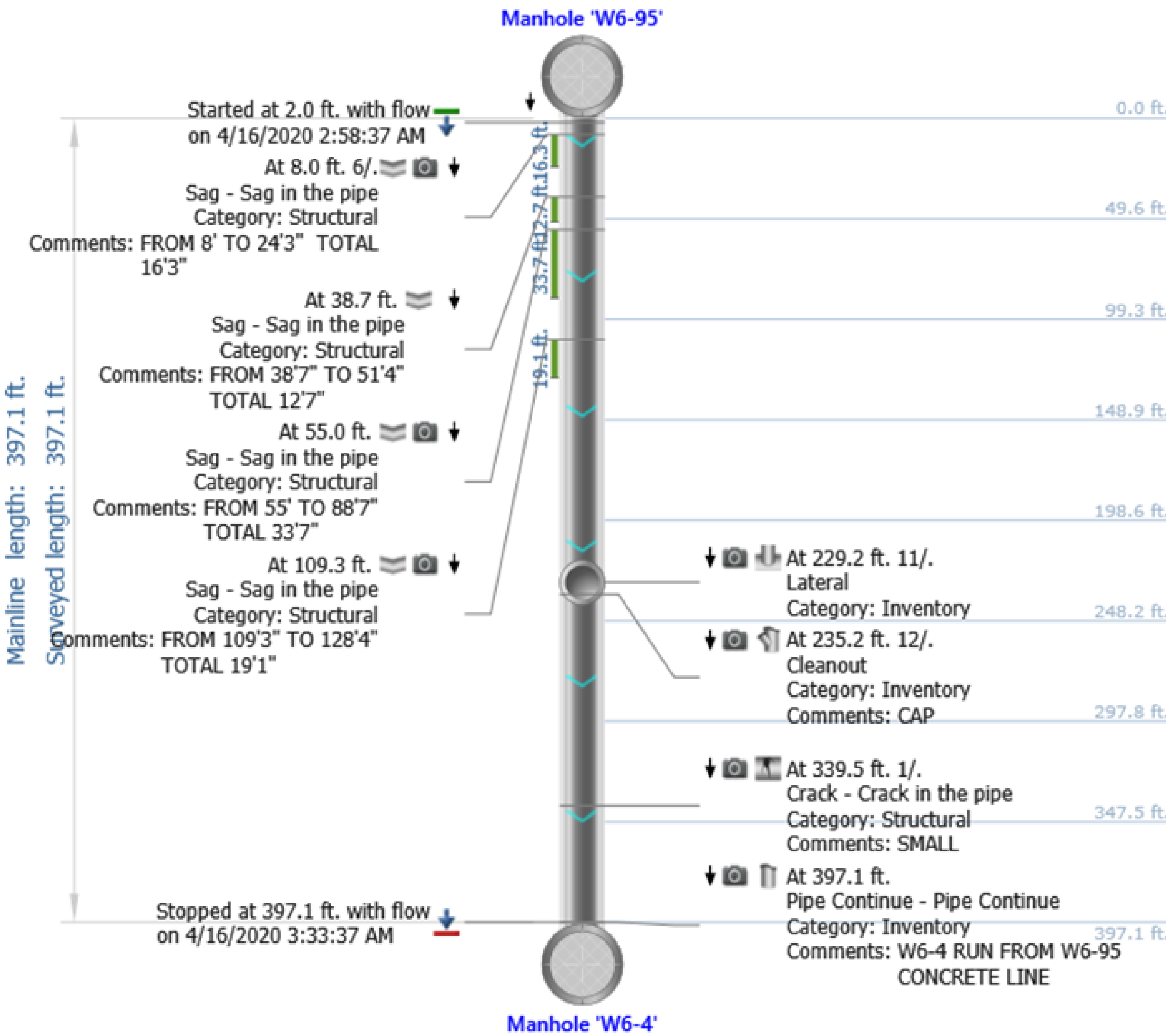
Main Inspections Pipe Run with Anomaly Probability

Project name:	Mainline ID:	City:	Address:
CITY OF HERMISTON	**W6-95**	**HERMISTON W6-95**	**W HIGHLAN AVE**
Start date/time:	Direction:	Weather:	Surface condition:
5/5/2020 6:25 PM	**With the flow**	**Dry**	**Asphalt**
Pipe shape:	Pipe material:	Pipe height:	Pipe width:
	PVC	**8.0 in.**	**8.0 in.**



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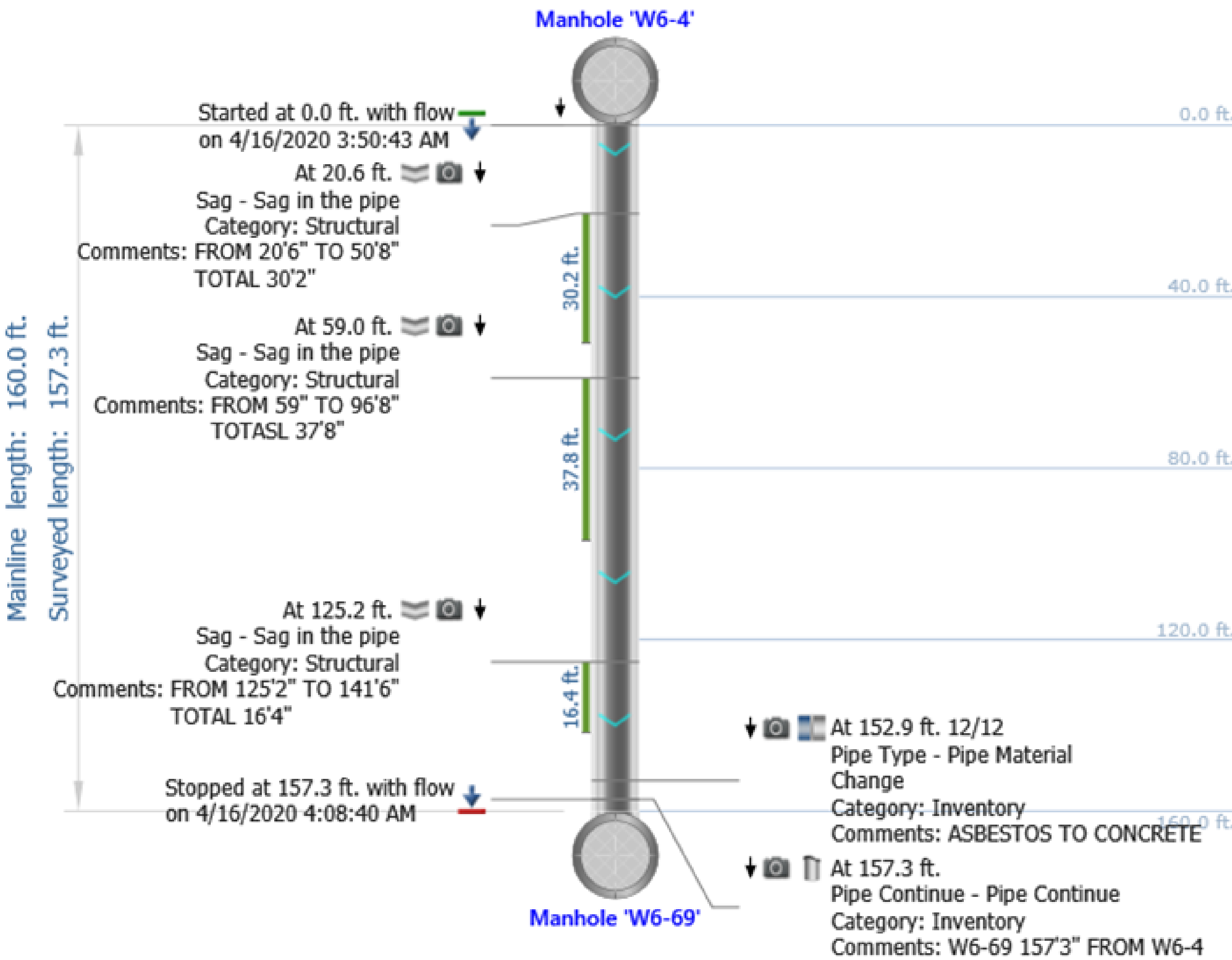
Main Inspections Pipe Run with Anomaly Probability

Project name:	Mainline ID:	City:	Address:
CITY OF HERMISTON	**W6-4**	**HERMISTON W6-4**	**W HIGHLAND AVE**
Start date/time:	Direction:	Weather:	Surface condition:
5/5/2020 7:18 PM	**With the flow**	**Dry**	**Asphalt**
Pipe shape:	Pipe material:	Pipe height:	Pipe width:
	Concrete	**8.0 in.**	**8.0 in.**



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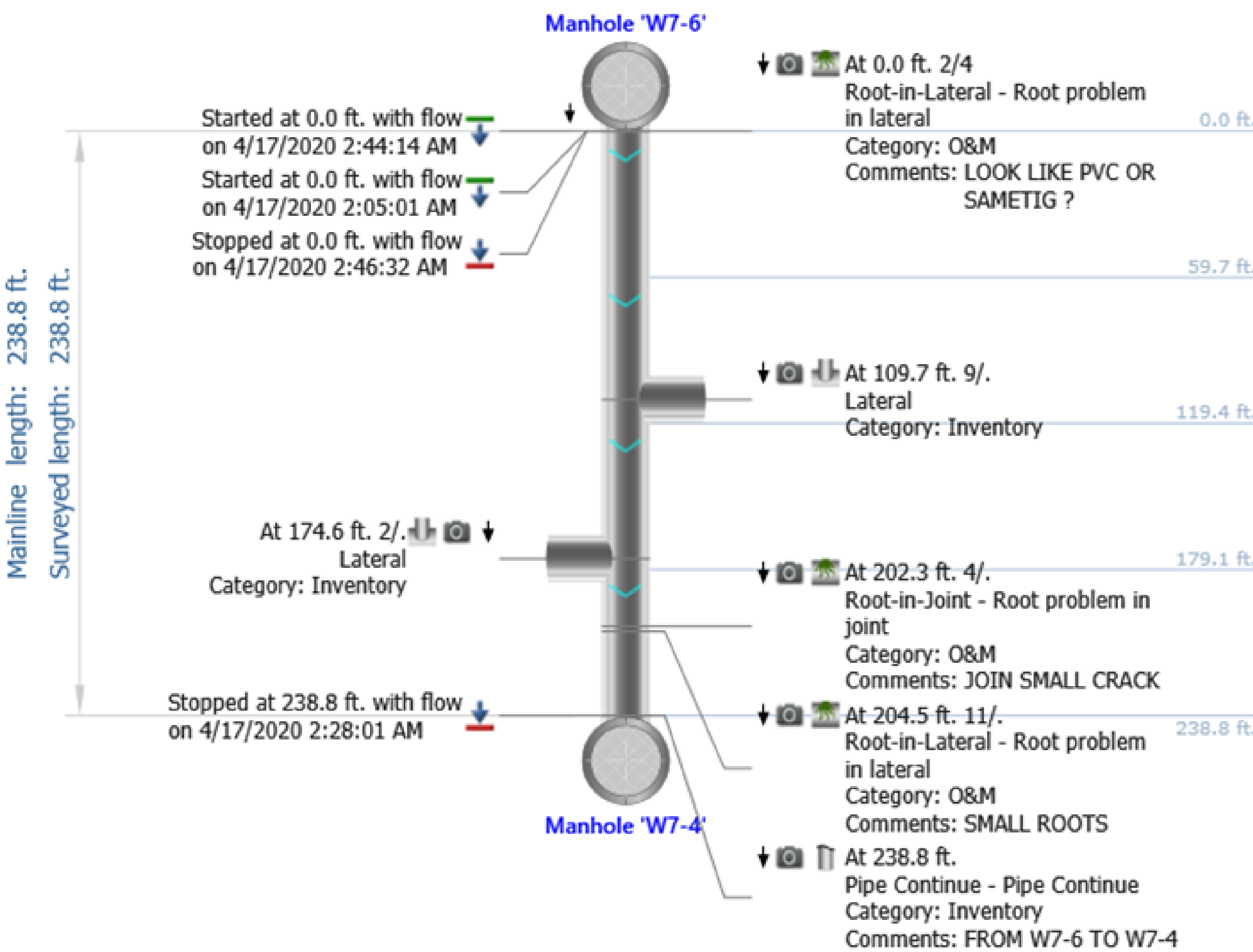
Main Inspections Pipe Run with Anomaly Probability

Project name:	Mainline ID:	City:	Address:
CITY OF HERMISTON	**W7-6**	**HERMISTON W7-6 TO W7-4**	**W HIGHLAND AND SW BIRCH DR**
Start date/time:	Direction:	Weather:	Surface condition:
5/7/2020 10:06 AM	**With the flow**	**Dry**	**Asphalt**
Pipe shape:	Pipe material:	Pipe height:	Pipe width:
	Concrete	**6.0 in.**	**6.0 in.**



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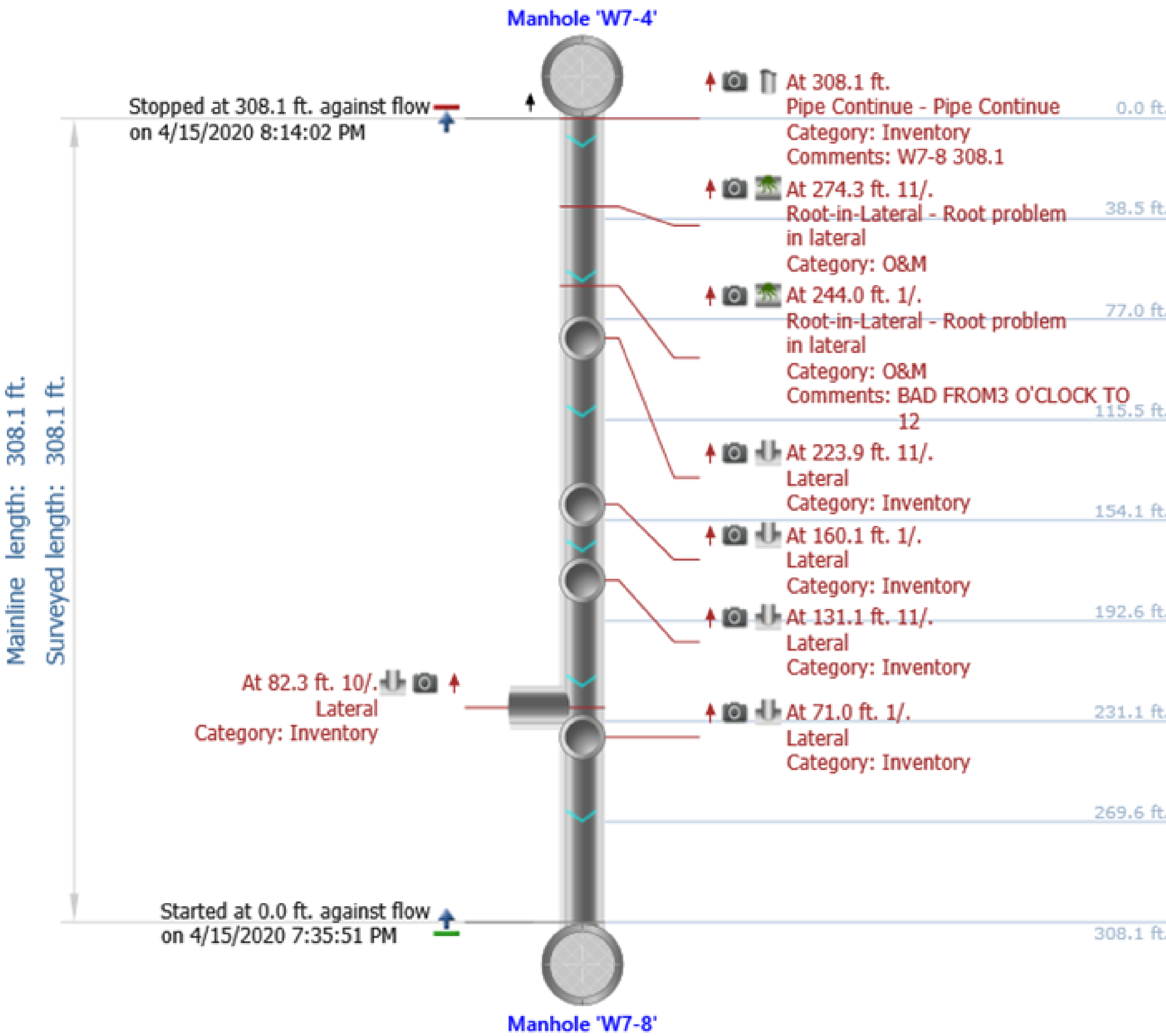
Main Inspections Pipe Run with Anomaly Probability

Project name:	Mainline ID:	City:	Address:
CITY OF HERMISTON	**W7-8**	**HERMISTON W7-8**	**SW BIRCH DR**
Start date/time:	Direction:	Weather:	Surface condition:
5/5/2020 11:05 AM	**Against the flow**	**Dry**	
Pipe shape:	Pipe material:	Pipe height:	Pipe width:
	Concrete	**8.0 in.**	**8.0 in.**



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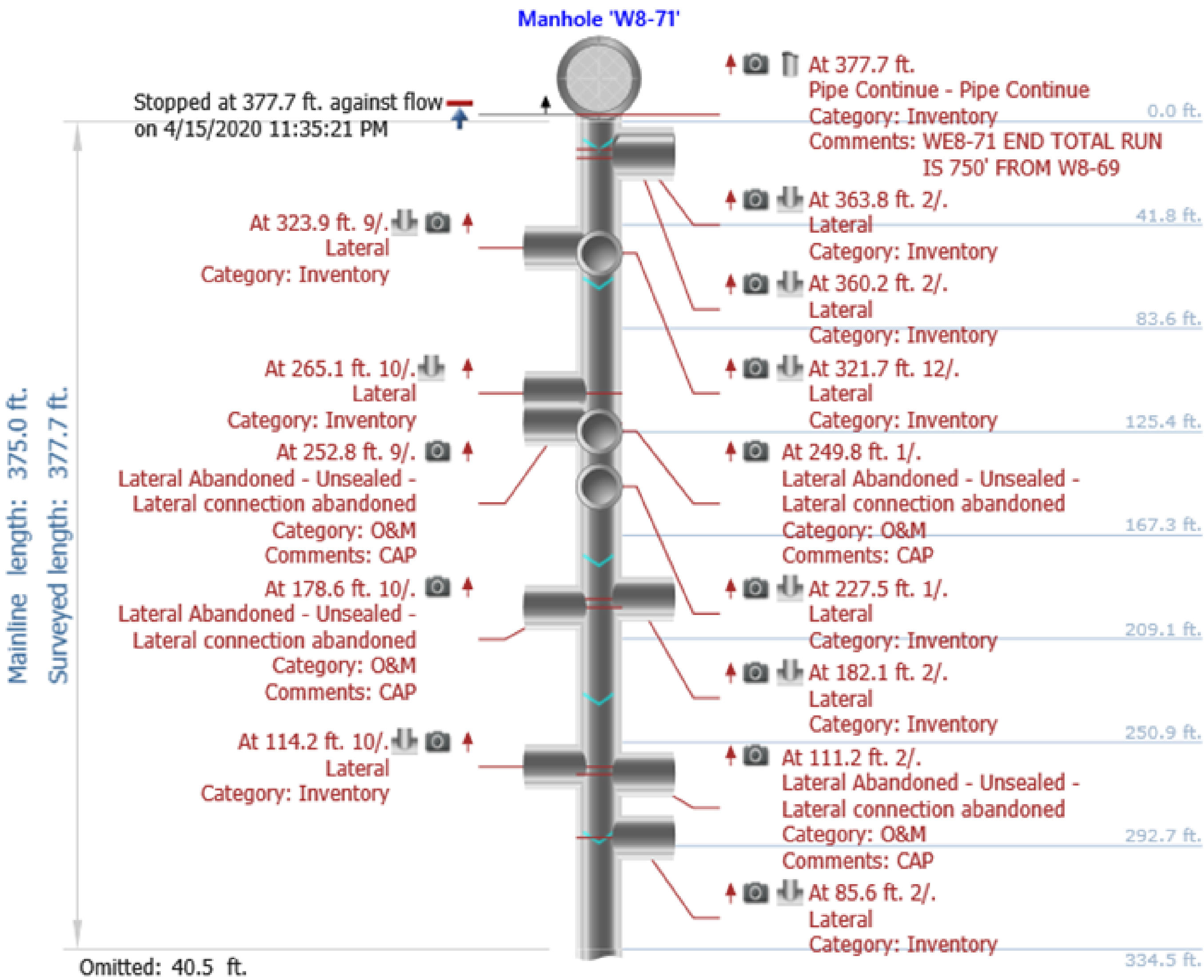
Main Inspections Pipe Run with Anomaly Probability

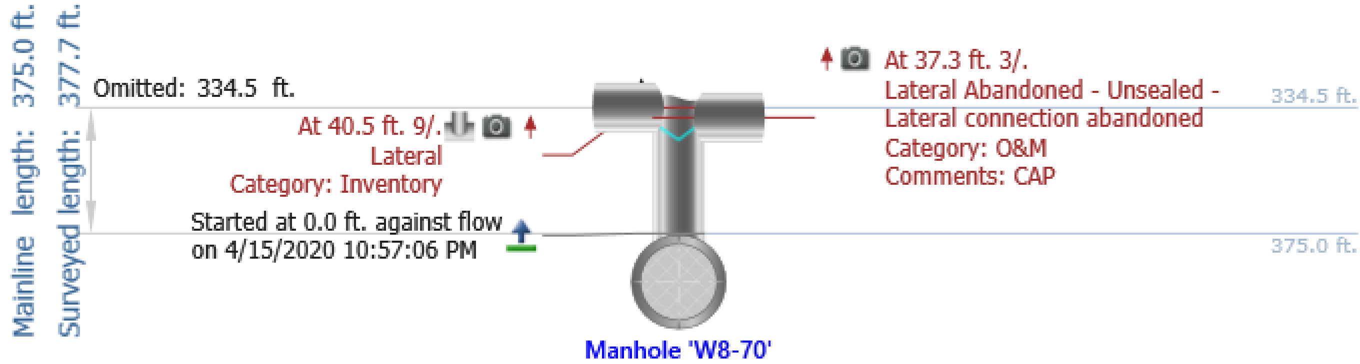
Project name:	Mainline ID:	City:	Address:
CITY OF HERMISTON	**W8-70**	**HERMISTON W8-70**	**SW 10TH PL**
Start date/time:	Direction:	Weather:	Surface condition:
5/5/2020 2:24 PM	**Against the flow**	**Dry**	**Garden**
Pipe shape:	Pipe material:	Pipe height:	Pipe width:
	Concrete	**8.0 in.**	**8.0 in.**



This report may contain 'false' positives due to the detection of anomalies other than voids.

Project name:	Mainline ID:	Start date/time:	Direction:
CITY OF HERMISTON	**W8-70**	**5/5/2020 2:24 PM**	**Against the flow**

Weather:
Dry



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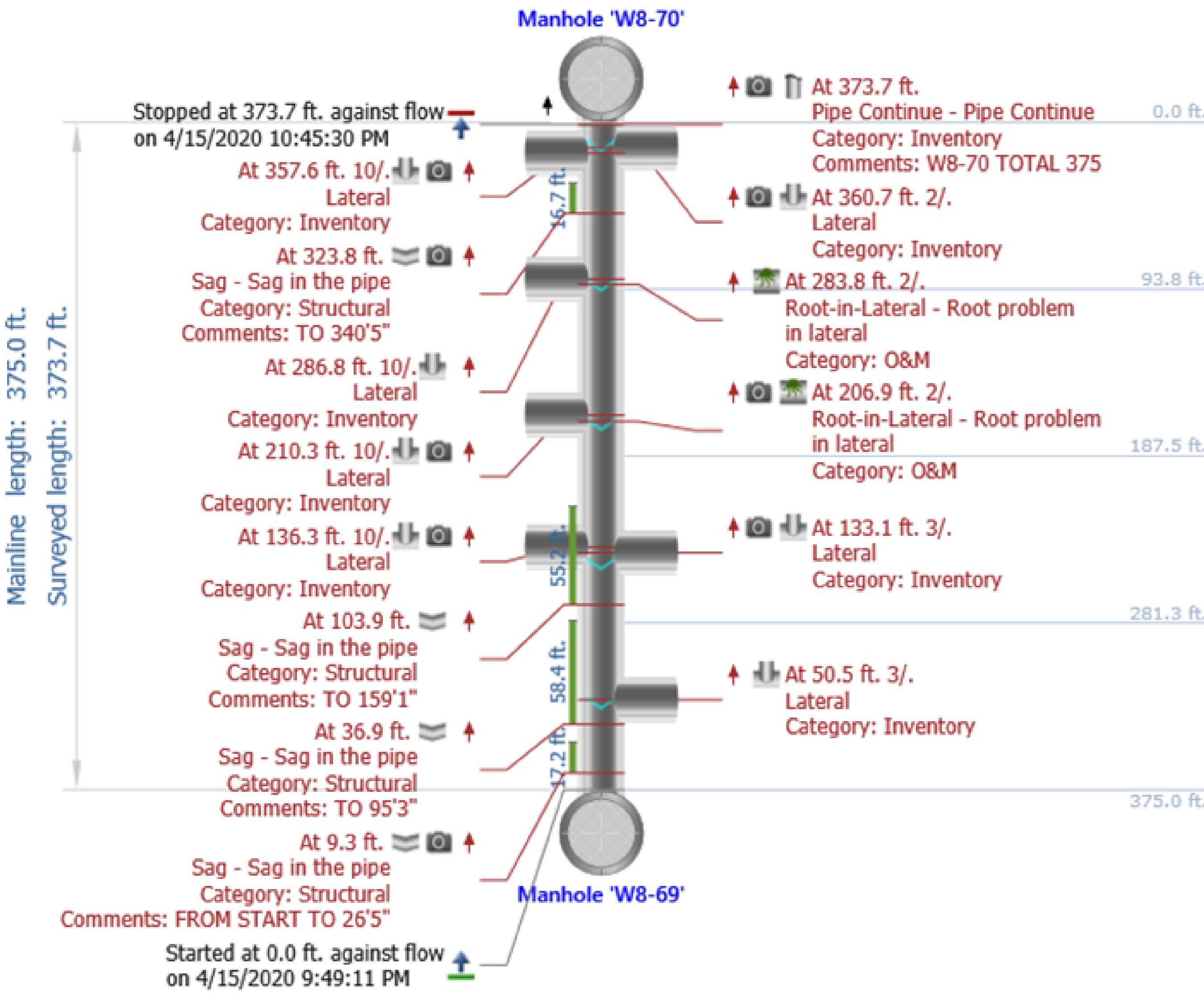
Main Inspections Pipe Run with Anomaly Probability

Project name:	Mainline ID:	City:	Address:
CITY OF HERMISTON	**W8-69**	**HERMISTON W8-69**	**SW 10TH PL**
Start date/time:	Direction:	Weather:	Surface condition:
5/5/2020 1:21 PM	**Against the flow**	**Dry**	
Pipe shape:	Pipe material:	Pipe height:	Pipe width:
	Concrete	**8.0 in.**	**8.0 in.**



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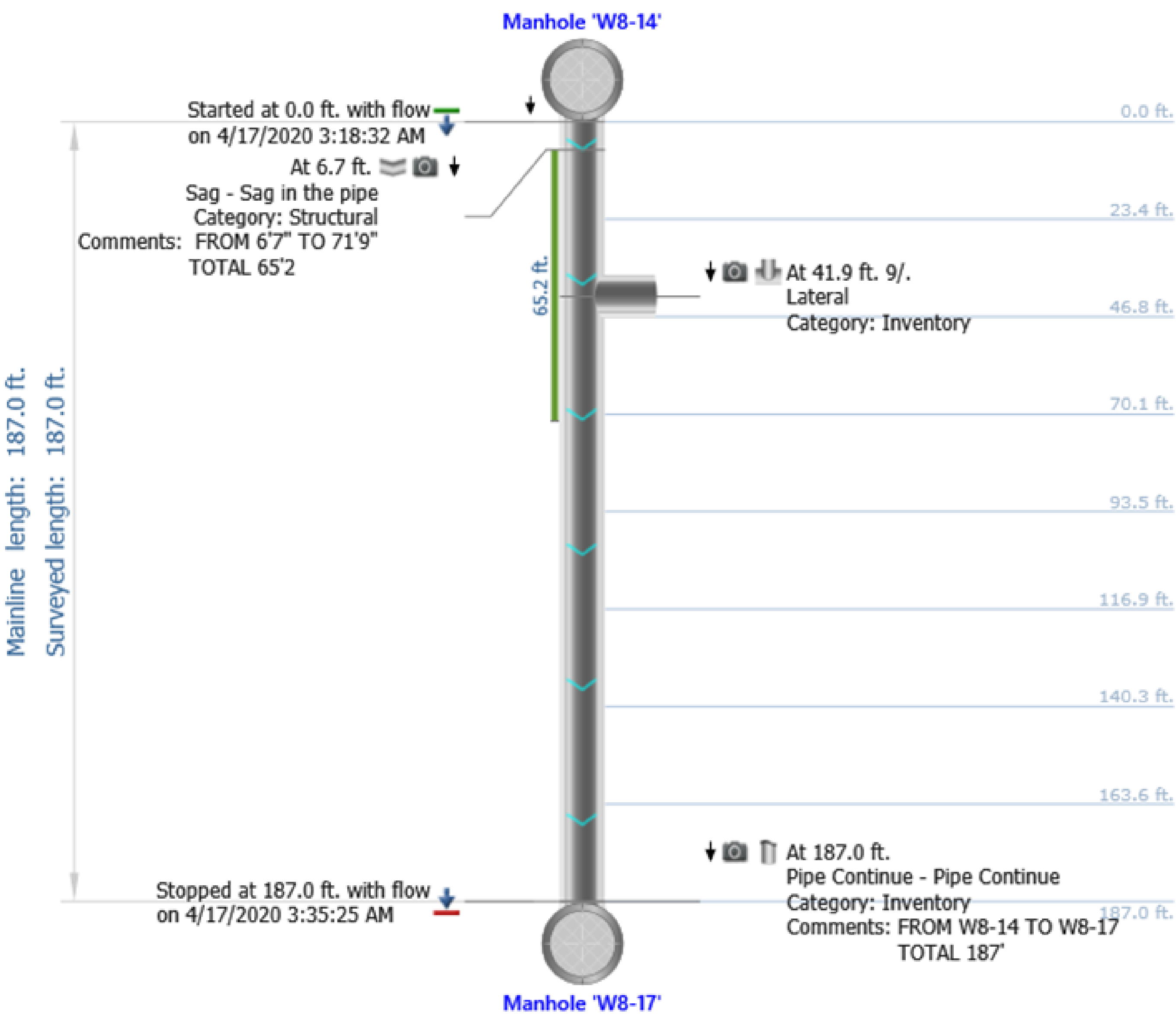
Main Inspections Pipe Run with Anomaly Probability

Project name:	Mainline ID:	City:	Address:
CITY OF HERMISTON	**W8-14**	**HERMISTON FROM W8-14 TO W8-17**	**SW 9TH ST AND W JOHNS AV**
Start date/time:	Direction:	Weather:	Surface condition:
5/7/2020 11:20 AM	**With the flow**	**Dry**	**Asphalt**
Pipe shape:	Pipe material:	Pipe height:	Pipe width:
	Concrete	**8.0 in.**	**8.0 in.**



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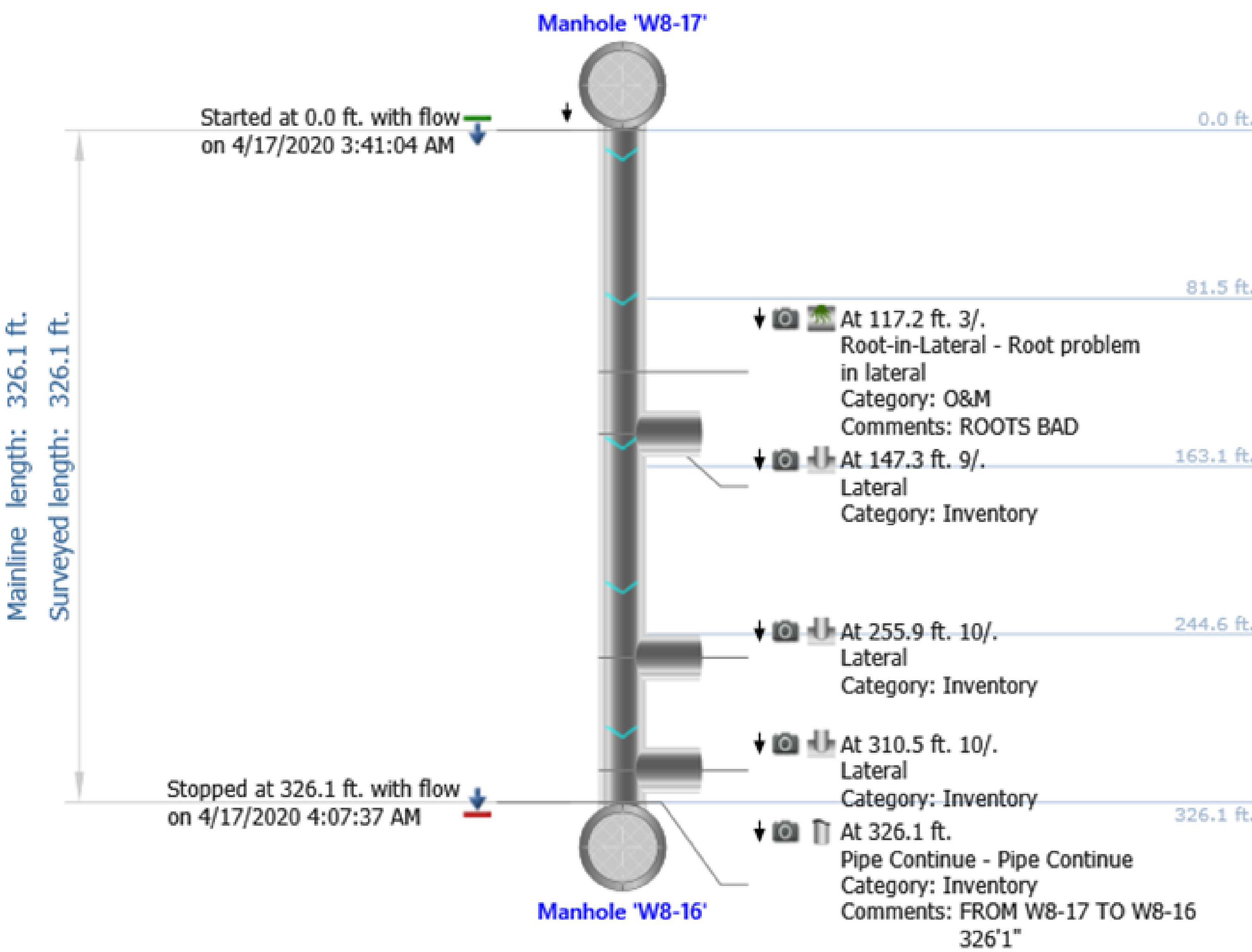
Main Inspections Pipe Run with Anomaly Probability

Project name:	Mainline ID:	City:	Address:
CITY OF HERMISTON	**W8-17**	**HERMISTON W8-17 TO W8-16**	**SW 9TH ST AND W JOHNS AV**
Start date/time:	Direction:	Weather:	Surface condition:
5/7/2020 11:41 AM	**With the flow**	**Dry**	**Sidewalk**
Pipe shape:	Pipe material:	Pipe height:	Pipe width:
	Concrete	**8.0 in.**	**8.0 in.**



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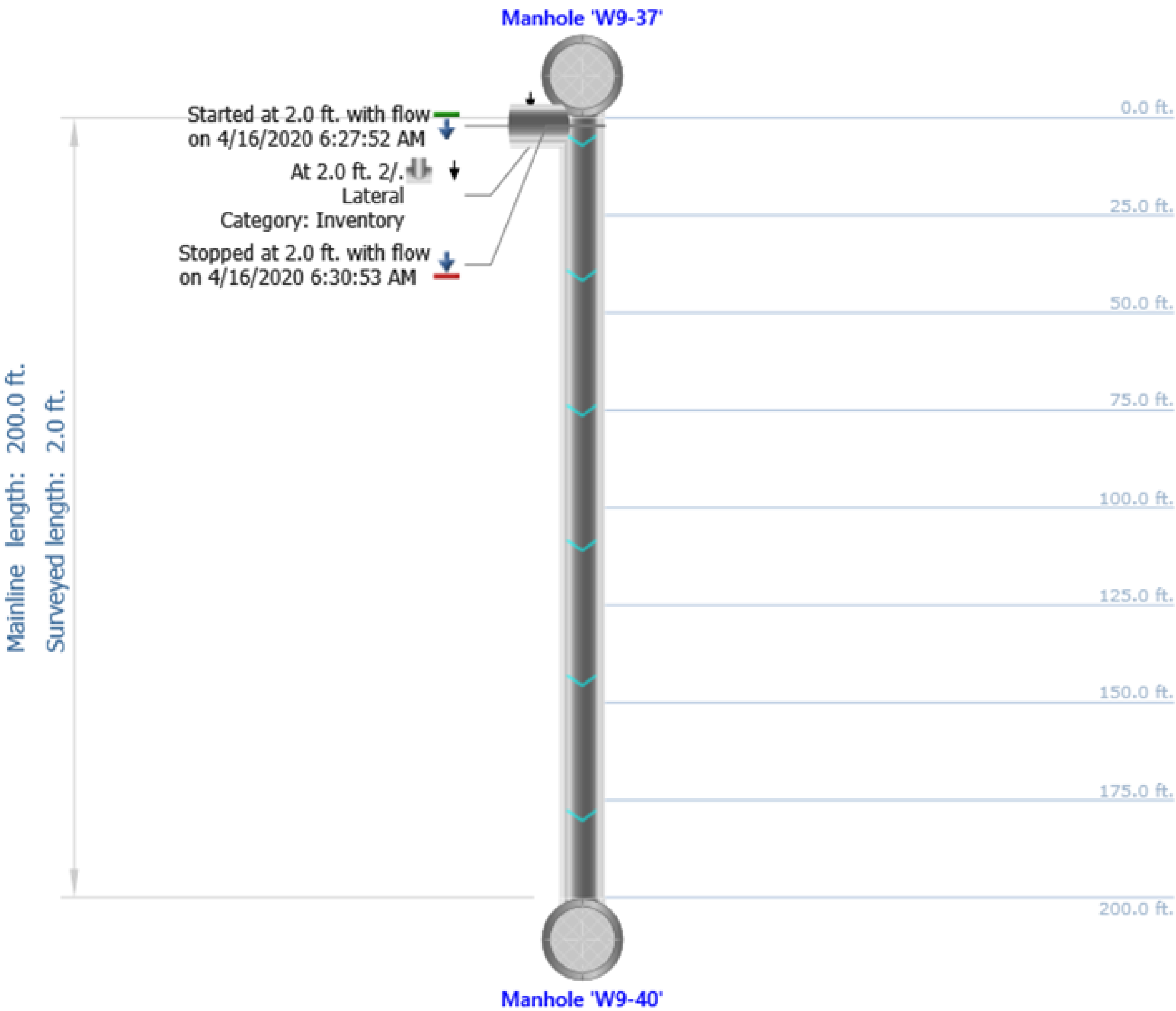
Main Inspections Pipe Run with Anomaly Probability

Project name:	Mainline ID:	City:	Address:
CITY OF HERMISTON	W9-37	HERMISTON W9-37 TO W9-40	W MADRINA AVE
Start date/time:	Direction:	Weather:	Surface condition:
5/5/2020 9:55 PM	With the flow	Dry	Asphalt
Pipe shape:	Pipe material:	Pipe height:	Pipe width:
	Concrete		



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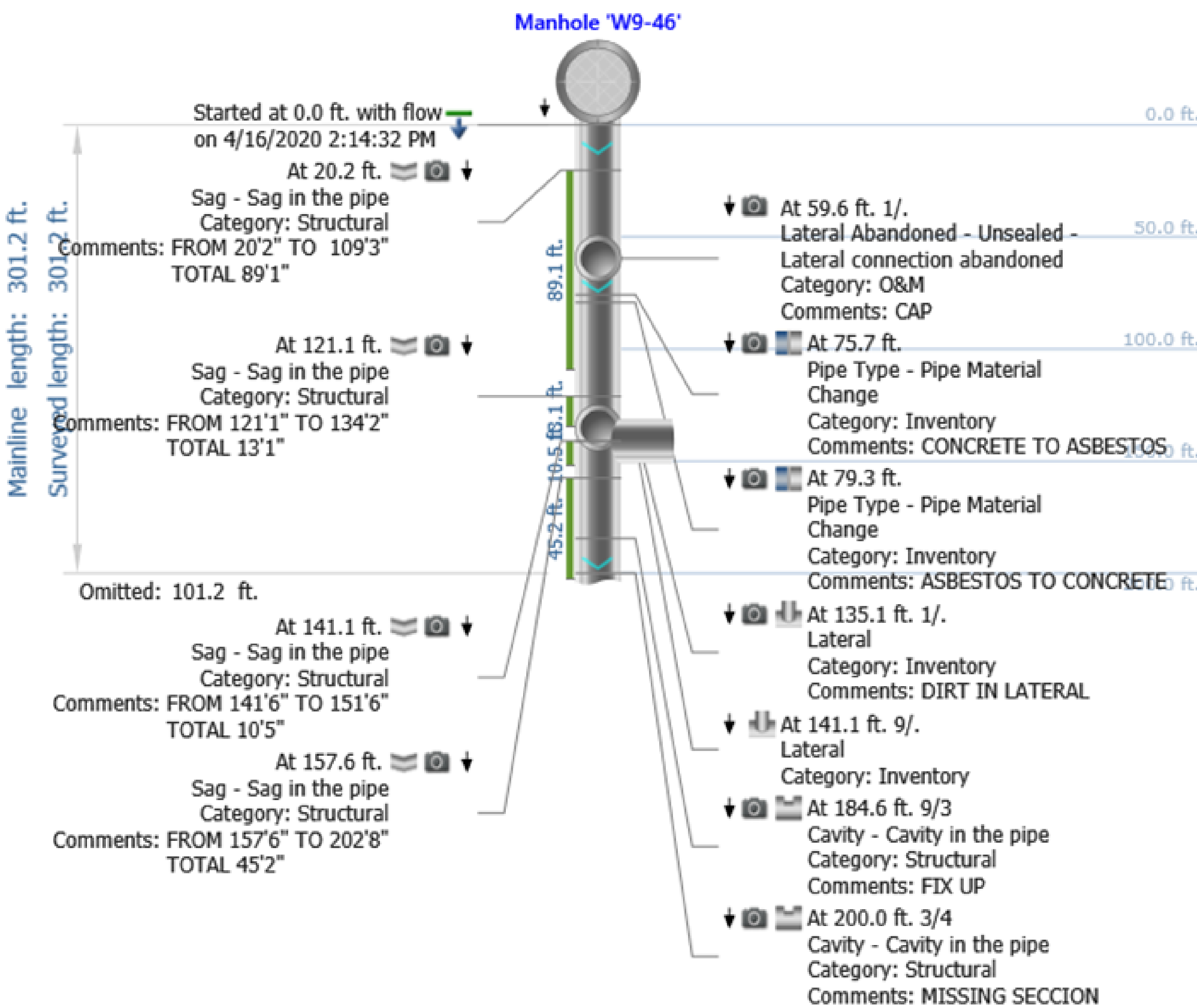
Main Inspections Pipe Run with Anomaly Probability

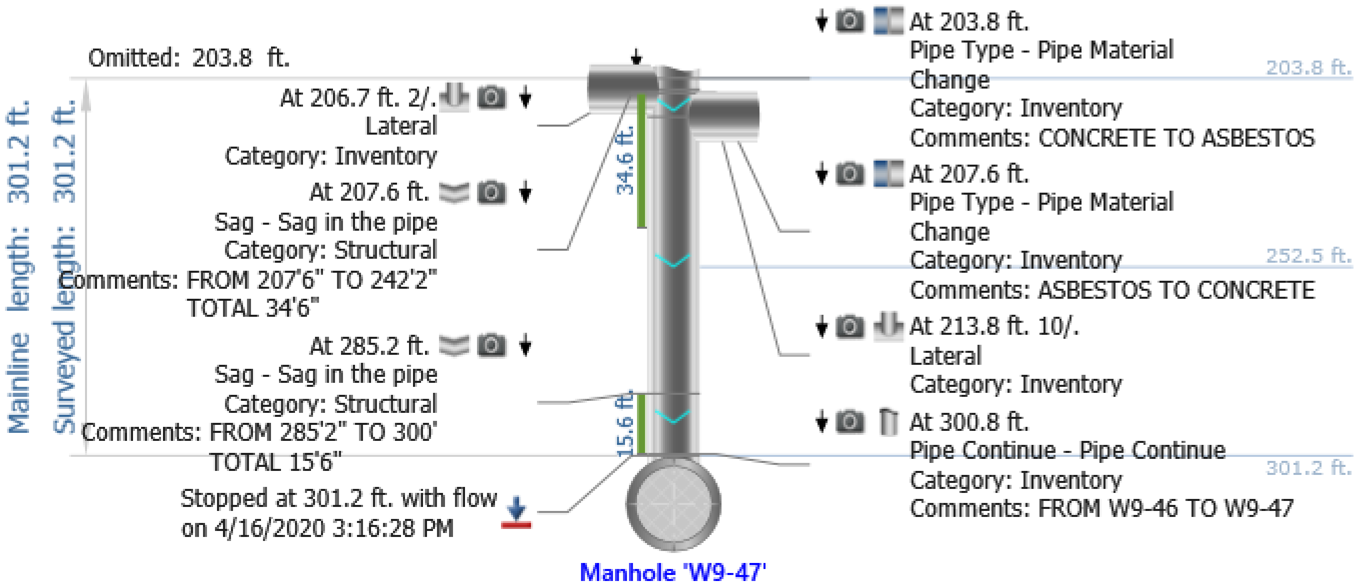
Project name:	Mainline ID:	City:	Address:
CITY OF HERMISTON	**W9-46**	**HERMISTON W9-46 TO W9-47**	**SW HERMISTON ANS 10 TH PL**
Start date/time:	Direction:	Weather:	Surface condition:
5/6/2020 12:27 PM	**With the flow**	**Light Rain**	**Garden**
Pipe shape:	Pipe material:	Pipe height:	Pipe width:
	Concrete	**8.0 in.**	**8.0 in.**



This report may contain 'false' positives due to the detection of anomalies other than voids.

Project name: **CITY OF HERMISTON** | Mainline ID: **W9-46** | Start date/time: **5/6/2020 12:27 PM** | Direction: **With the flow**

Weather: **Light Rain**



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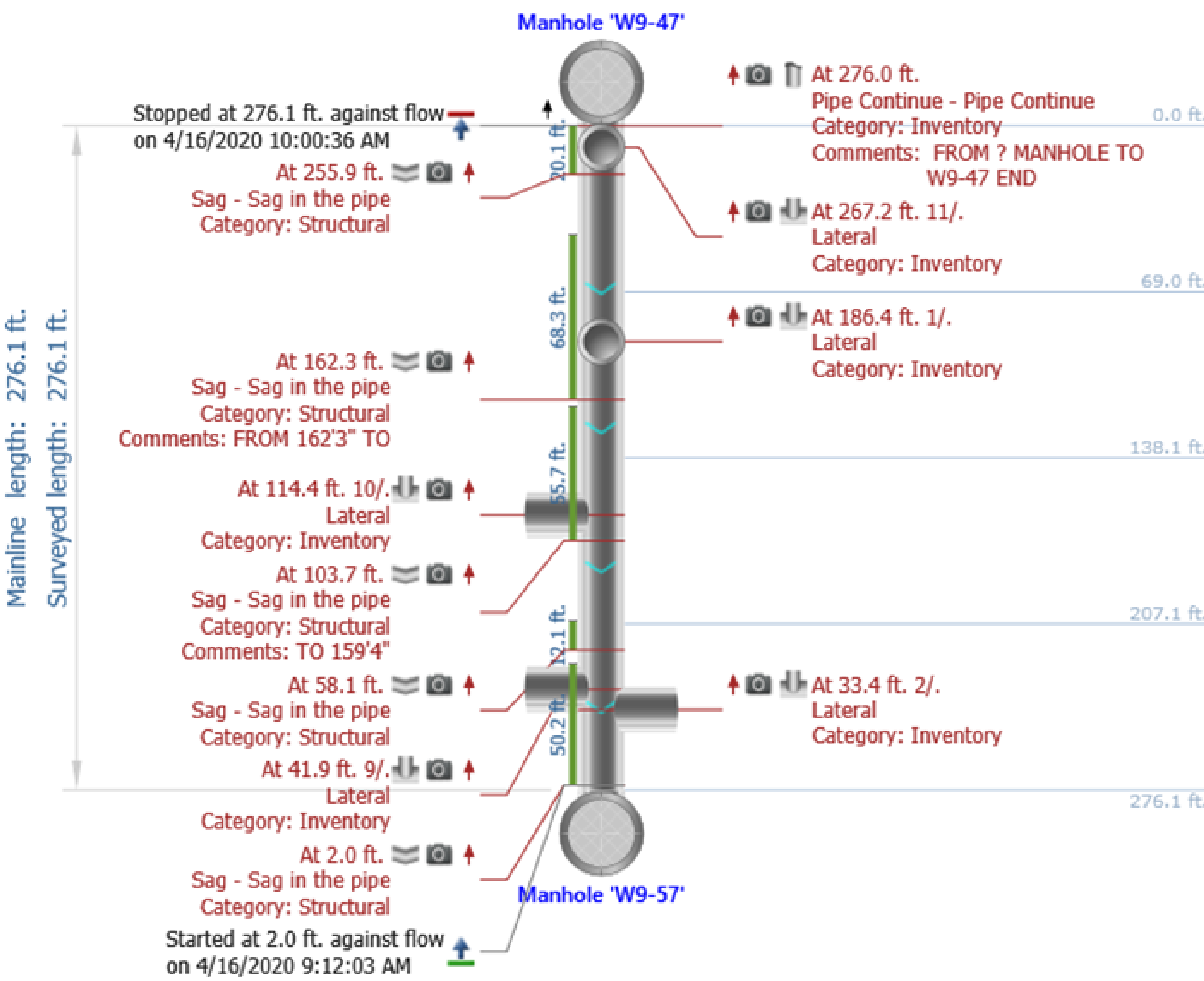
Main Inspections Pipe Run with Anomaly Probability

Project name:	Mainline ID:	City:	Address:
CITY OF HERMISTON	**W9-57**	**HERMISTON W9-57 TO W9-47**	**SW ORCHARD AND 11TH**
Start date/time:	Direction:	Weather:	Surface condition:
5/6/2020 6:00 AM	**Against the flow**	**Light Rain**	**Garden**
Pipe shape:	Pipe material:	Pipe height:	Pipe width:
	Concrete	**8.0 in.**	**8.0 in.**



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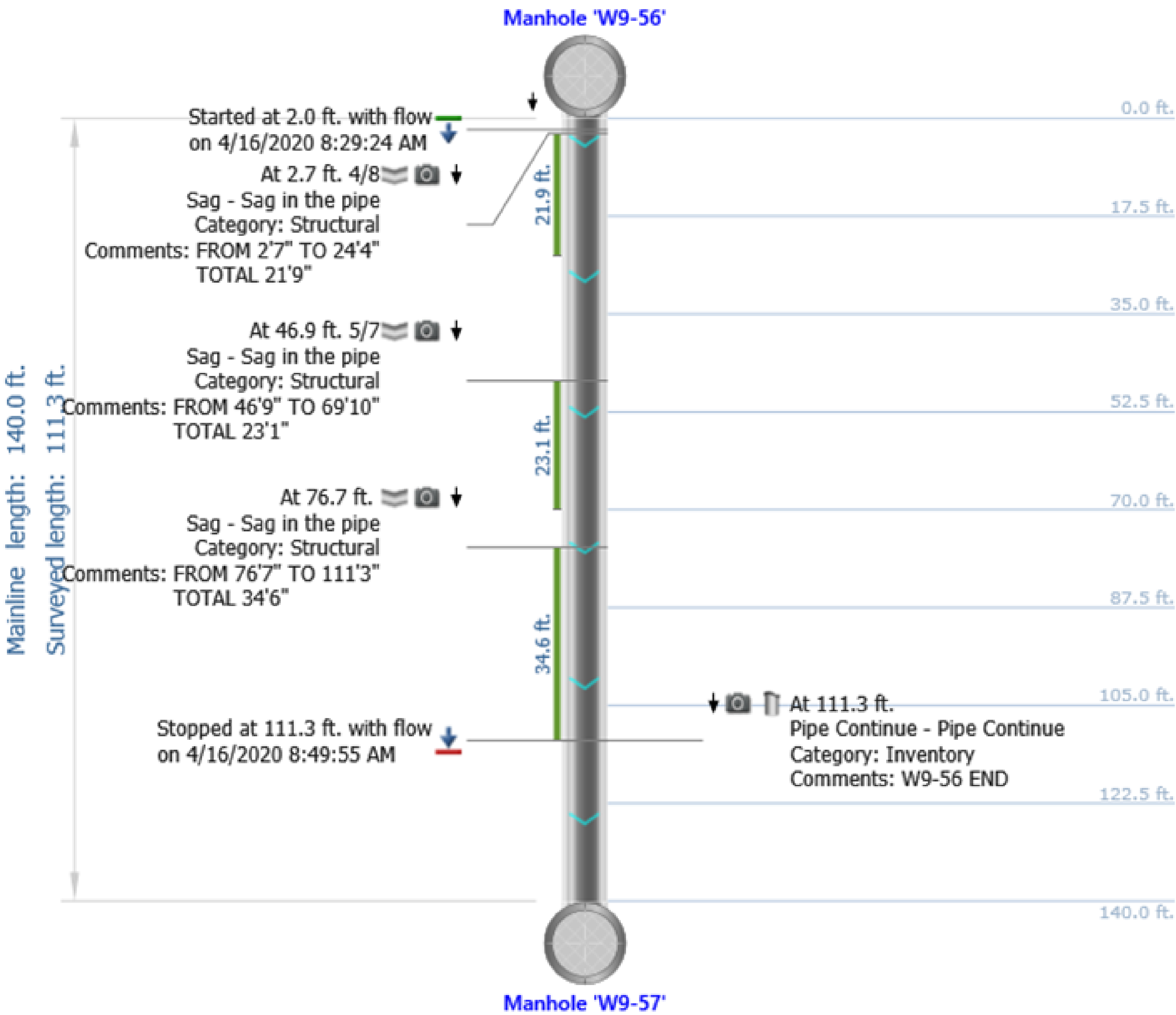
Main Inspections Pipe Run with Anomaly Probability

Project name:	Mainline ID:	City:	Address:
CITY OF HERMISTON	**W9-57**	**HERMISTON W9-57 TO W9-56**	**W ORCHARD AND SW 11TH**
Start date/time:	Direction:	Weather:	Surface condition:
5/6/2020 6:18 AM	**With the flow**	**Light Rain**	
Pipe shape:	Pipe material:	Pipe height:	Pipe width:
	Concrete	**8.0 in.**	**8.0 in.**



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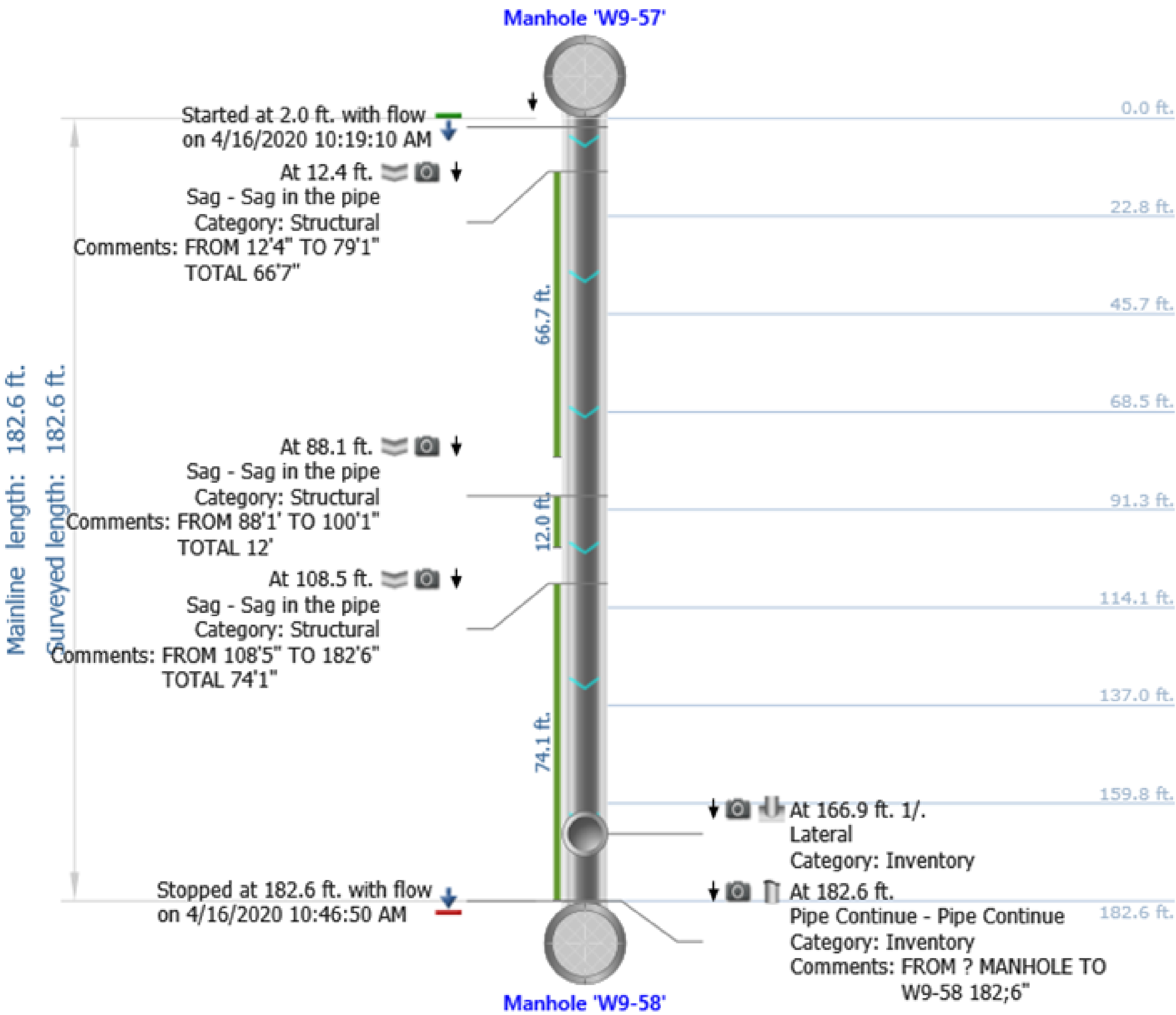
Main Inspections Pipe Run with Anomaly Probability

Project name:	Mainline ID:	City:	Address:
CITY OF HERMISTON	**W9-57**	**HERMISTON FROM W9-57 TO W9-58**	**SW ORCHARD AND 11 TH**
Start date/time:	Direction:	Weather:	Surface condition:
5/6/2020 8:05 AM	**With the flow**	**Dry**	**Asphalt**
Pipe shape:	Pipe material:	Pipe height:	Pipe width:
	Concrete	**8.0 in.**	**8.0 in.**



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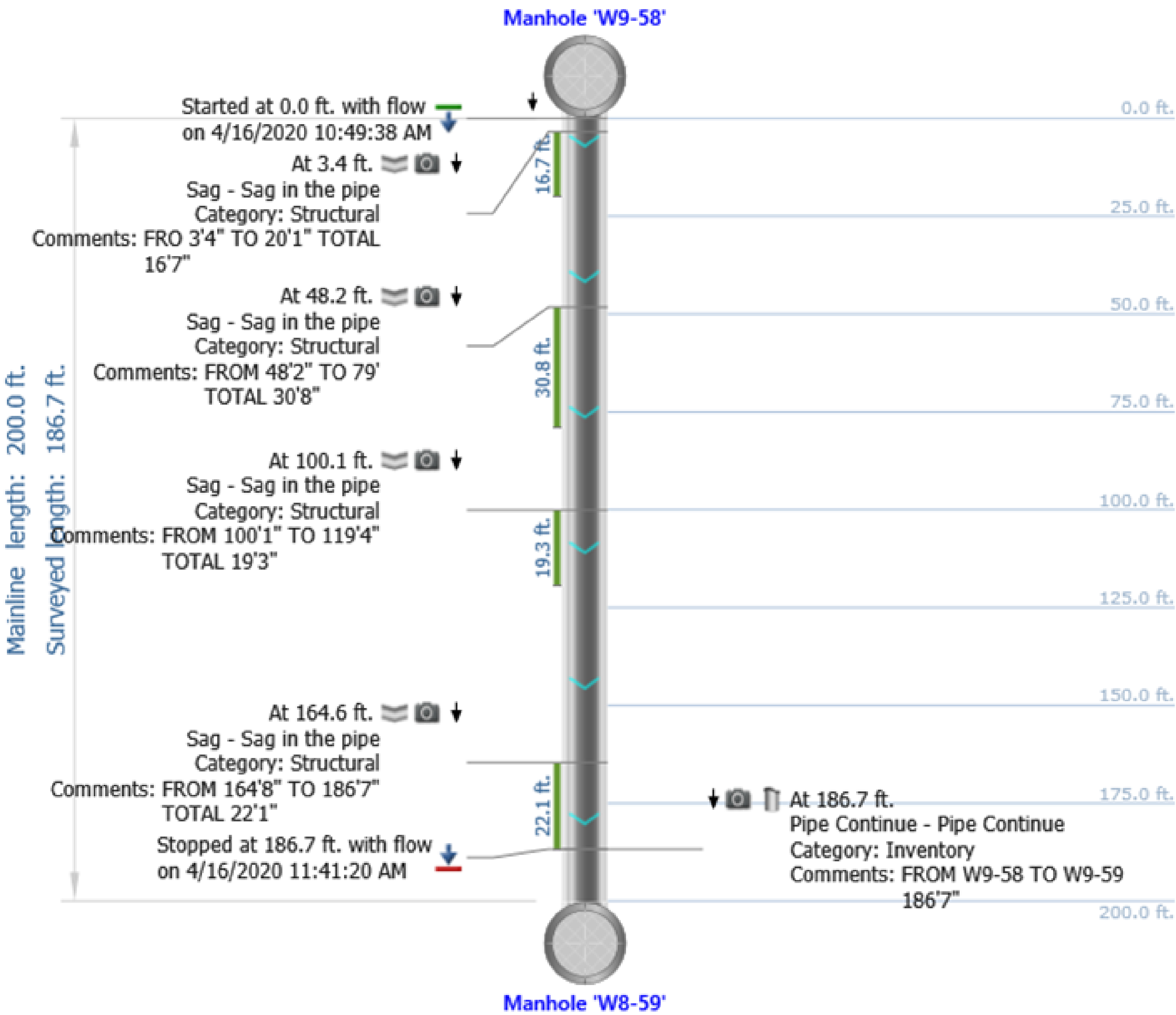
Main Inspections Pipe Run with Anomaly Probability

Project name:	Mainline ID:	City:	Address:
CITY OF HERMISTON	**W9-58**	**HERMIATO FROM W9-58 TO W9-59**	**SW ORCHARD AVEAVE**
Start date/time:	Direction:	Weather:	Surface condition:
5/6/2020 8:38 AM	**With the flow**	**Light Rain**	**Asphalt**
Pipe shape:	Pipe material:	Pipe height:	Pipe width:
	Concrete	**8.0 in.**	**8.0 in.**



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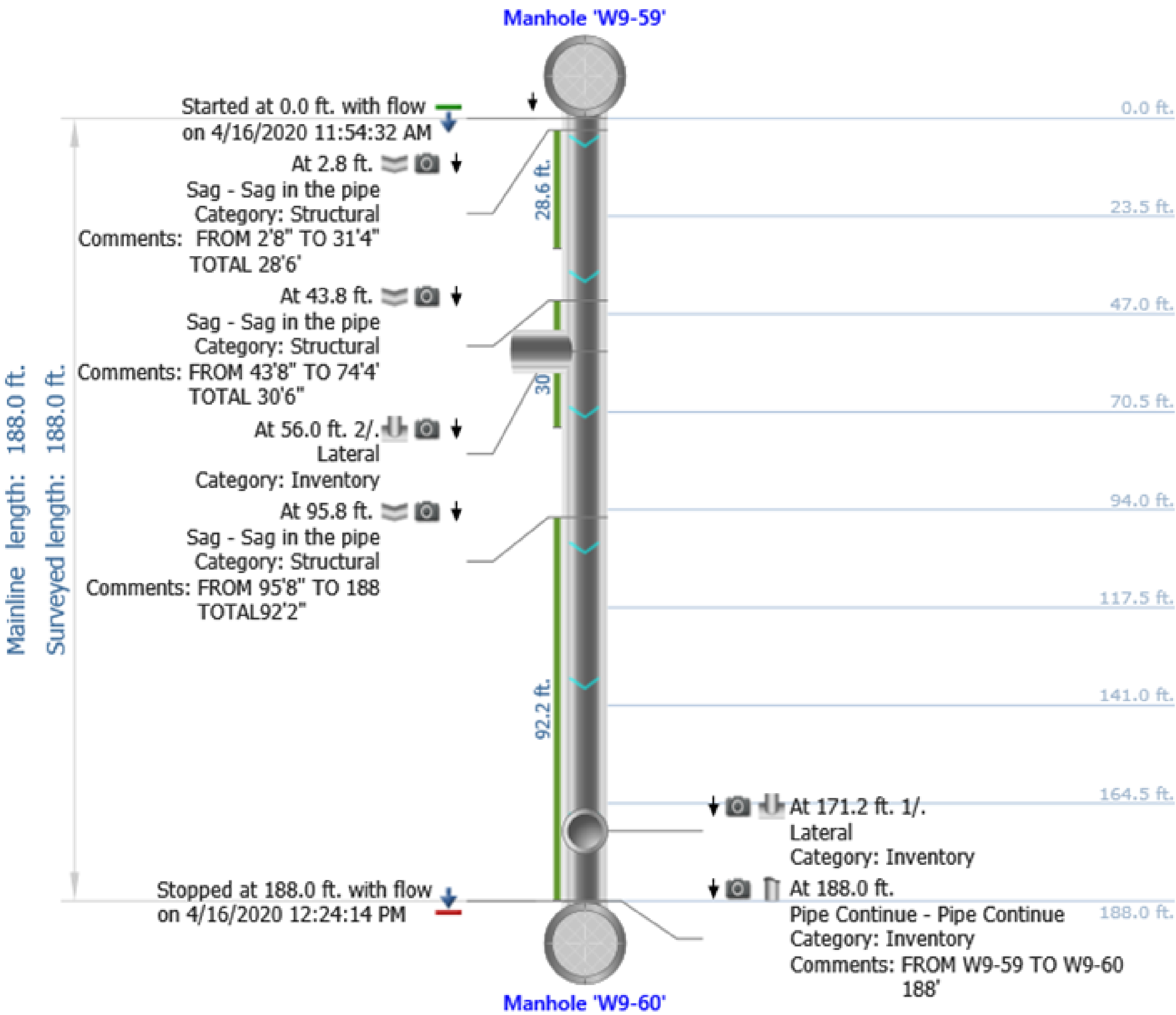
Main Inspections Pipe Run with Anomaly Probability

Project name:	Mainline ID:	City:	Address:
CITY OF HERMISTON	**W9-59**	**HERMISTON FROM W9-59 TO W9-60**	**SW ORCRARD**
Start date/time:	Direction:	Weather:	Surface condition:
5/6/2020 9:42 AM	**With the flow**	**Light Rain**	**Asphalt**
Pipe shape:	Pipe material:	Pipe height:	Pipe width:
	Concrete	**8.0 in.**	**8.0 in.**



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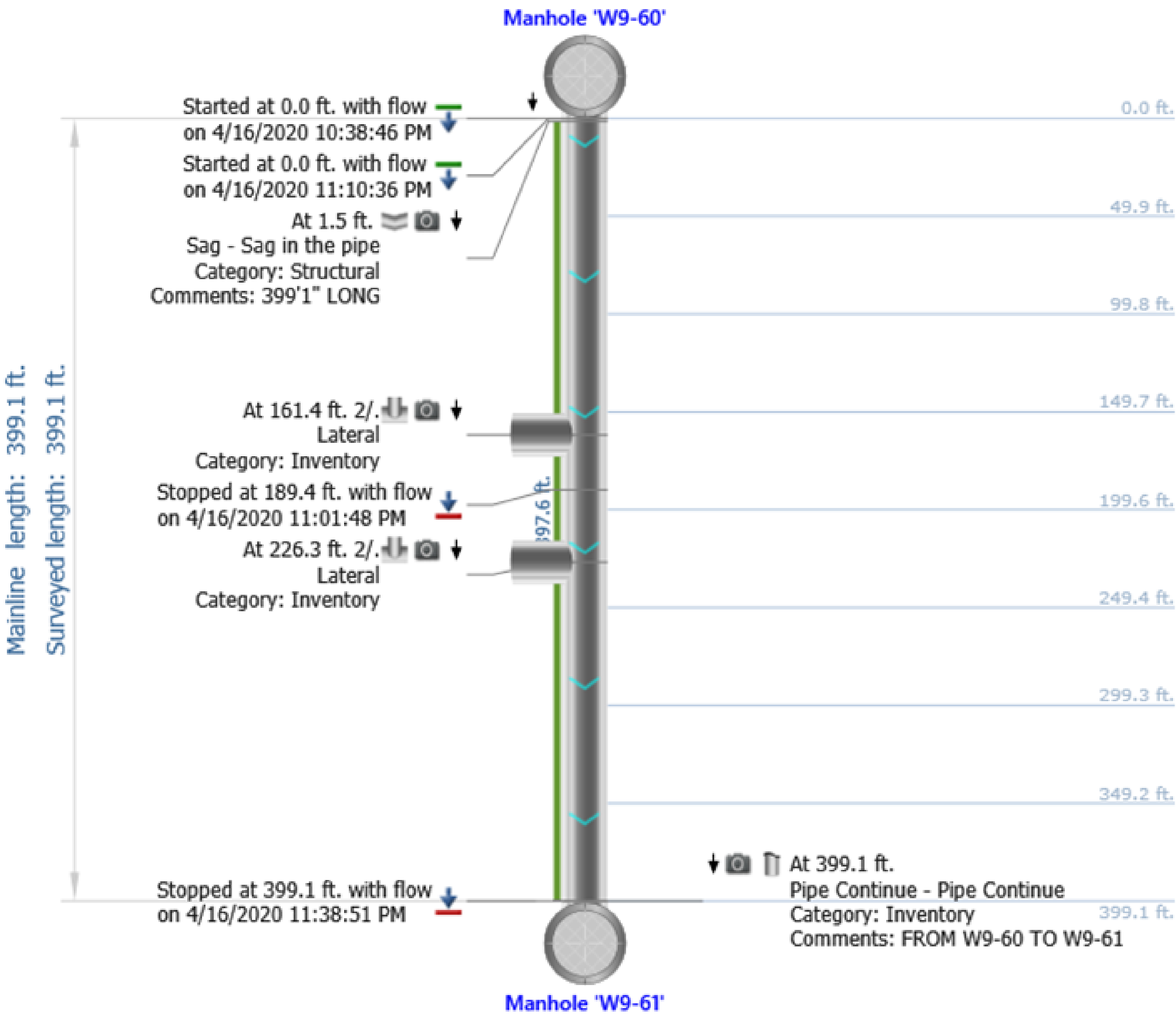
Main Inspections Pipe Run with Anomaly Probability

Project name:	Mainline ID:	City:	Address:
CITY OF HERMISTON	**W9-60**	**HERMISTON W9-60 TO W9-61**	**SW ORCHARD AND SW 10TH**
Start date/time:	Direction:	Weather:	Surface condition:
5/7/2020 7:09 AM	**With the flow**	**Dry**	**Asphalt**
Pipe shape:	Pipe material:	Pipe height:	Pipe width:
	Concrete	**8.0 in.**	**8.0 in.**



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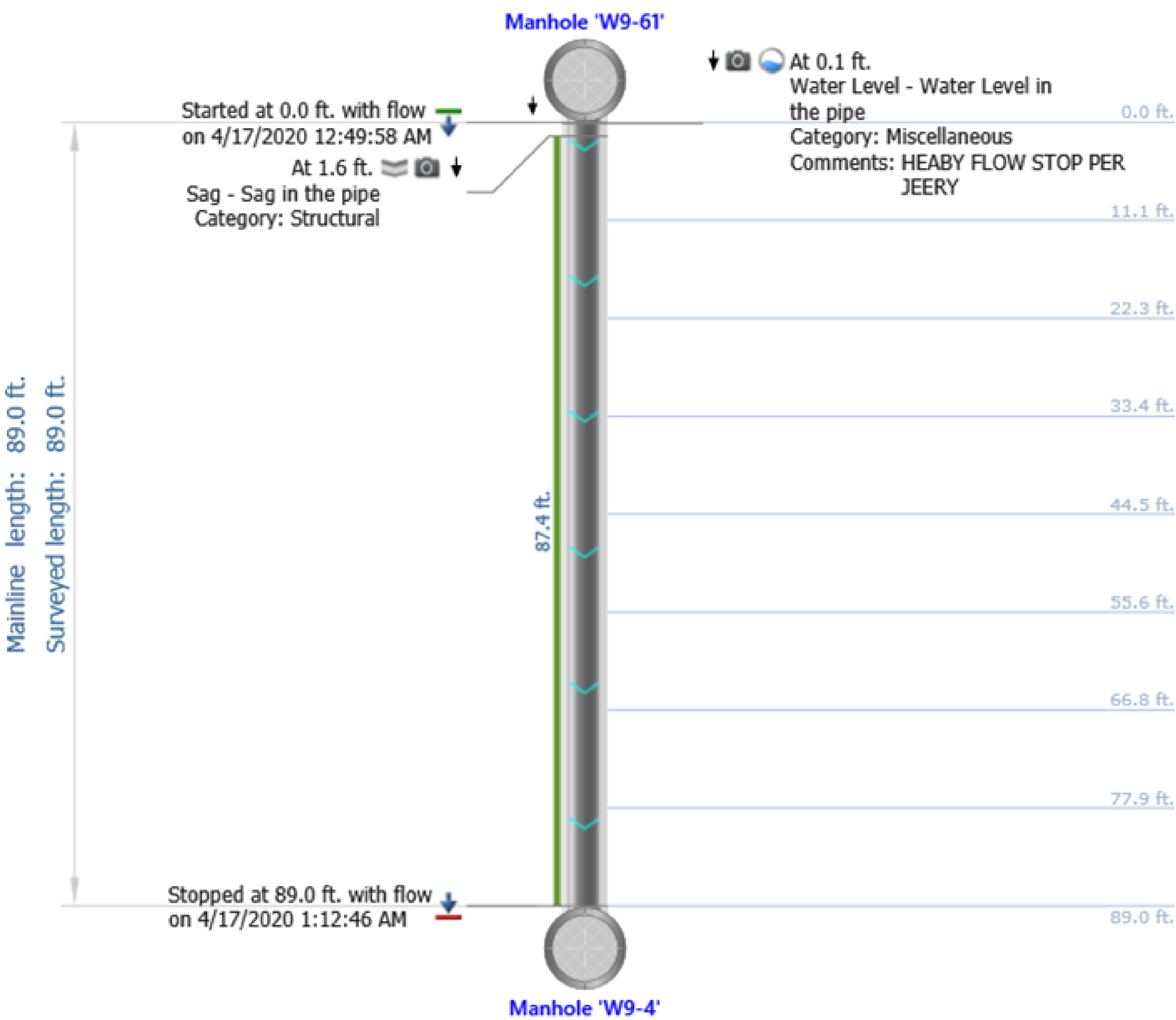
Main Inspections Pipe Run with Anomaly Probability

Project name:	Mainline ID:	City:	Address:
CITY OF HERMISTON	**W9-61**	**HERMISTON W9-61 TO W9-4**	**SW ORCHARD AVE AND SW 9THST**
Start date/time:	Direction:	Weather:	Surface condition:
5/7/2020 8:50 AM	**With the flow**	**Dry**	**Asphalt**
Pipe shape:	Pipe material:	Pipe height:	Pipe width:
	Concrete	**10.0 in.**	**10.0 in.**



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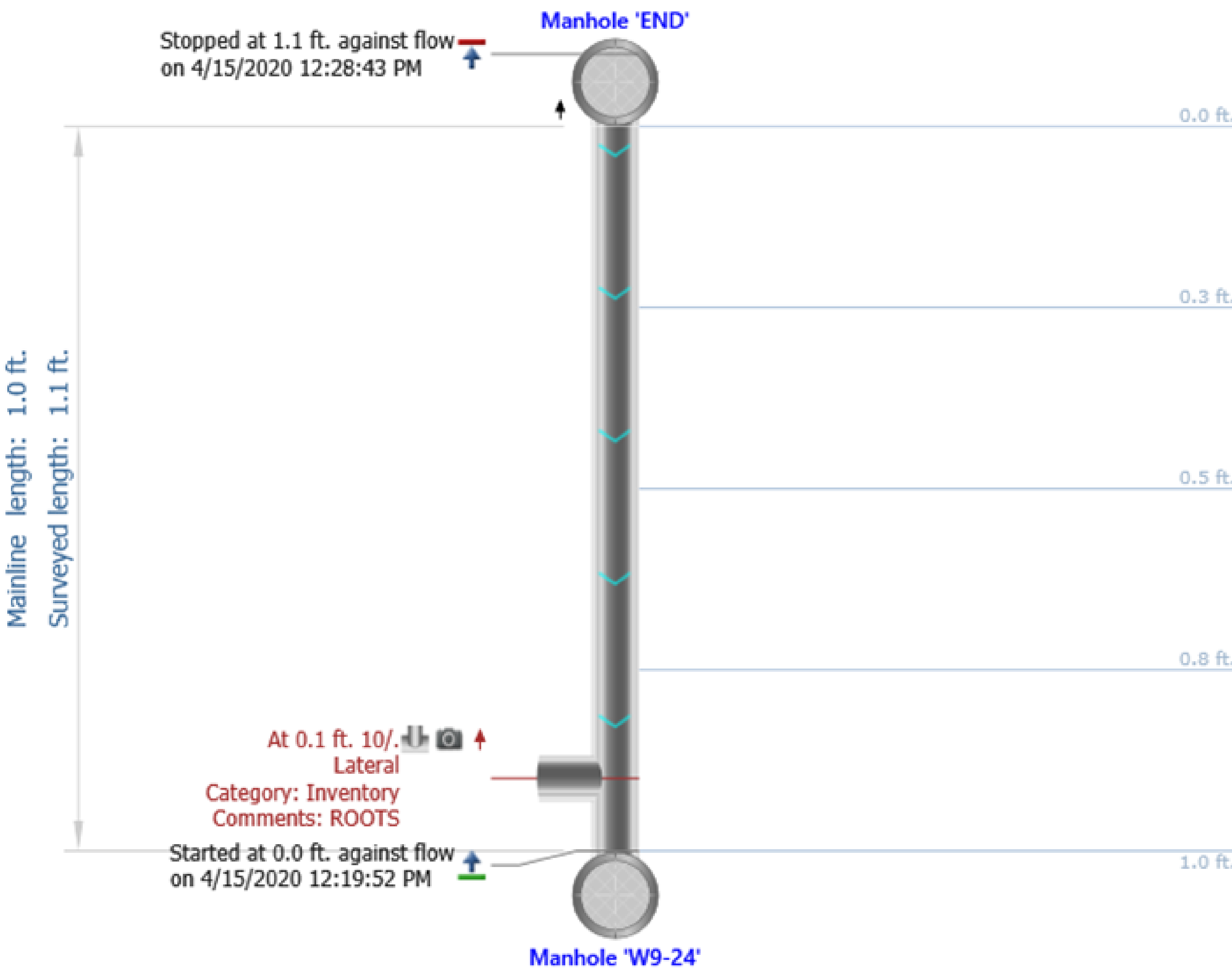
Main Inspections Pipe Run with Anomaly Probability

Project name:	Mainline ID:	City:	Address:
CITY OF HERMISTON	**W9-24**	**HERMISTON W9-24 TO END OF RUN HAVE 45 IN THIS AREA**	**NW 9TH ST**
Start date/time:	Direction:	Weather:	Surface condition:
5/4/2020 5:42 PM	**Against the flow**	**Dry**	
Pipe shape:	Pipe material:	Pipe height:	Pipe width:
	Concrete	**6.0 in.**	**6.0 in.**



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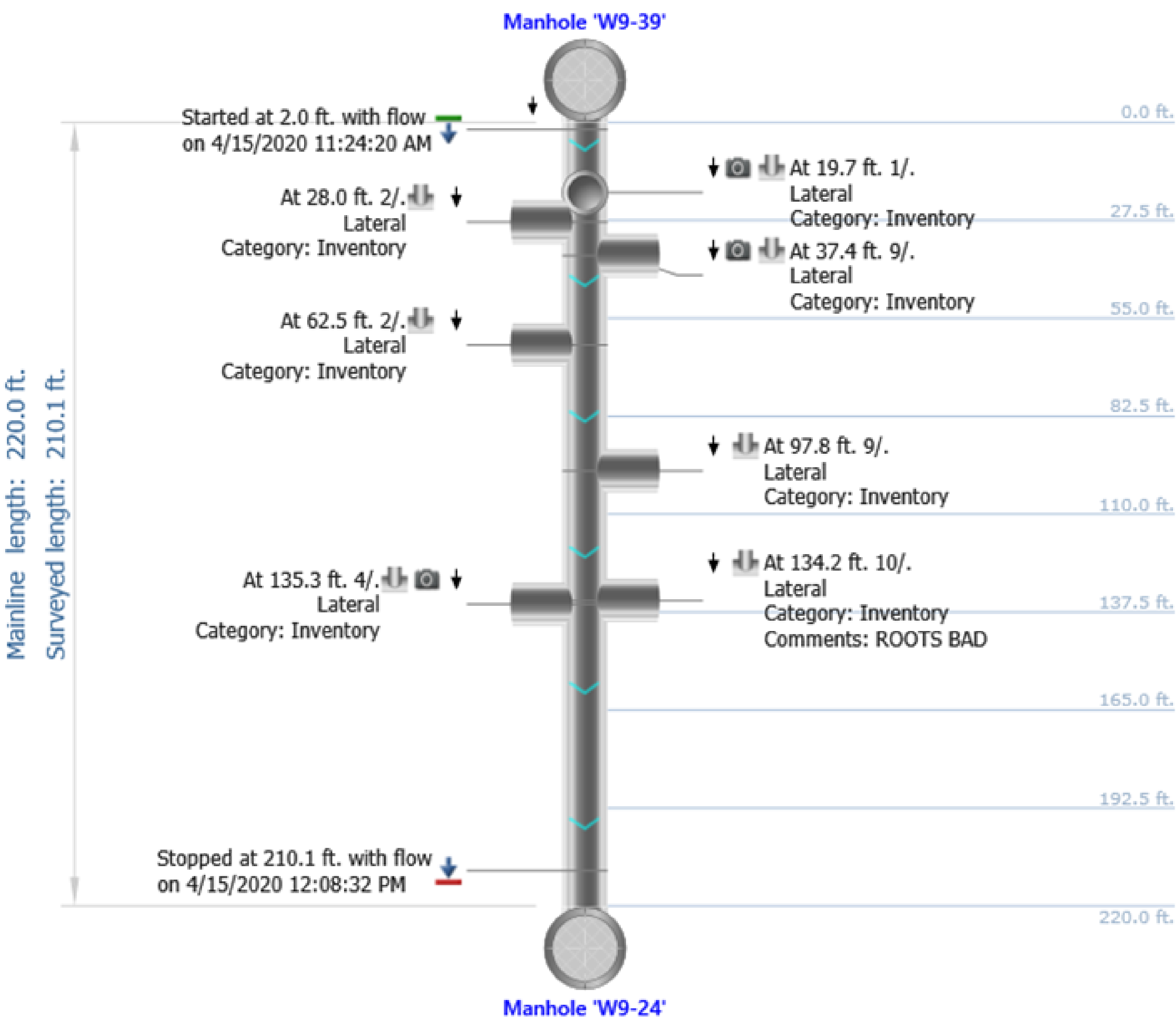
Main Inspections Pipe Run with Anomaly Probability

Project name:	Mainline ID:	City:	Address:
CITY OF HERMISTON	**W9-39**	**HERMISTON W9-39 TO W9-24**	**NW 9TH ST**
Start date/time:	Direction:	Weather:	Surface condition:
5/4/2020 4:46 PM	**With the flow**	**Dry**	
Pipe shape:	Pipe material:	Pipe height:	Pipe width:
	Concrete	**6.0 in.**	**6.0 in.**



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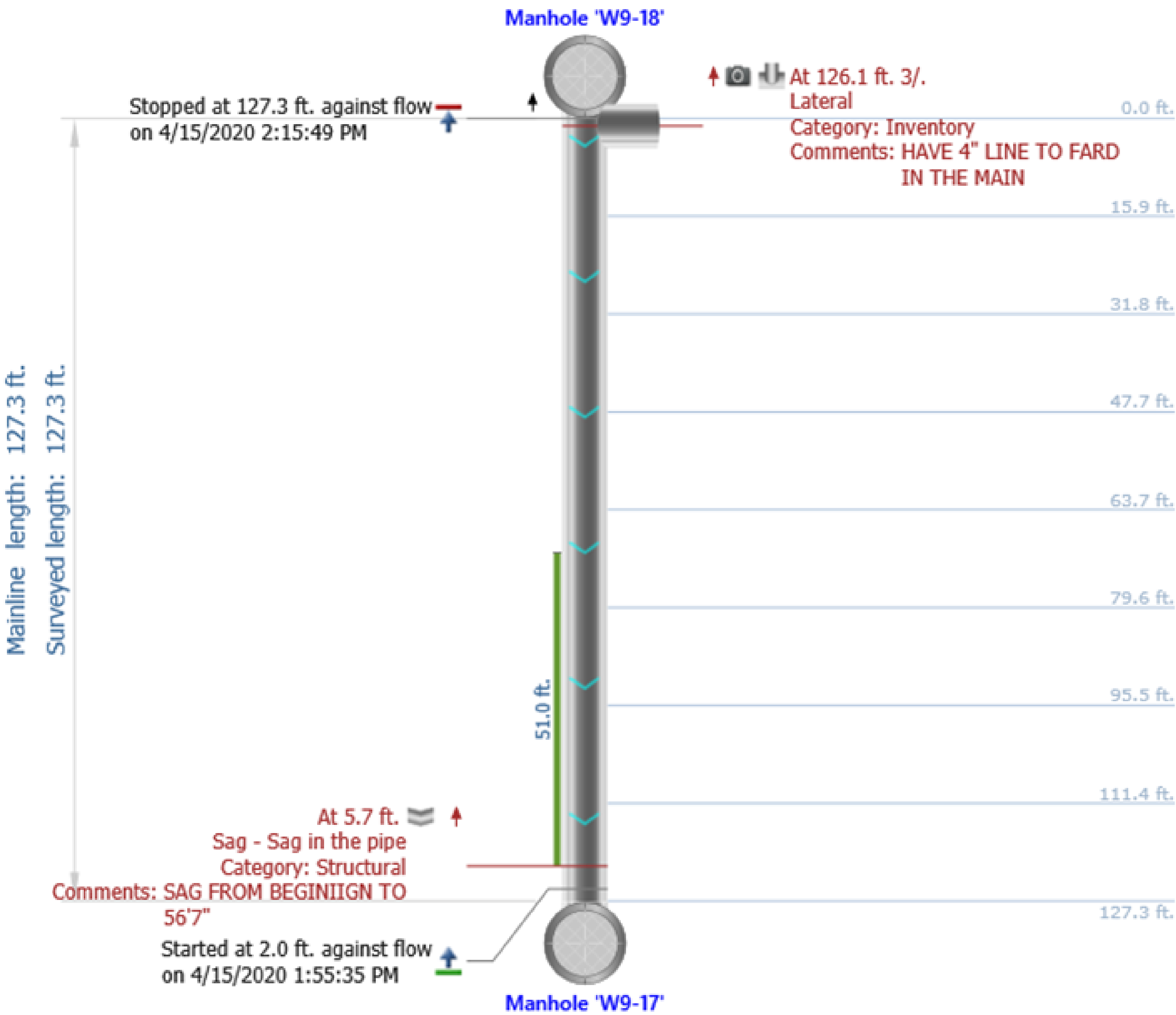
Main Inspections Pipe Run with Anomaly Probability

Project name:	Mainline ID:	City:	Address:
CITY OF HERMISTON	**W9-17**	**HERMISTON W9-17 TO W9-18**	**NW LOGAN DR AND MADRONA AVE**
Start date/time:	Direction:	Weather:	Surface condition:
5/4/2020 7:19 PM	**Against the flow**	**Dry**	**Dirt**
Pipe shape:	Pipe material:	Pipe height:	Pipe width:
	Concrete		



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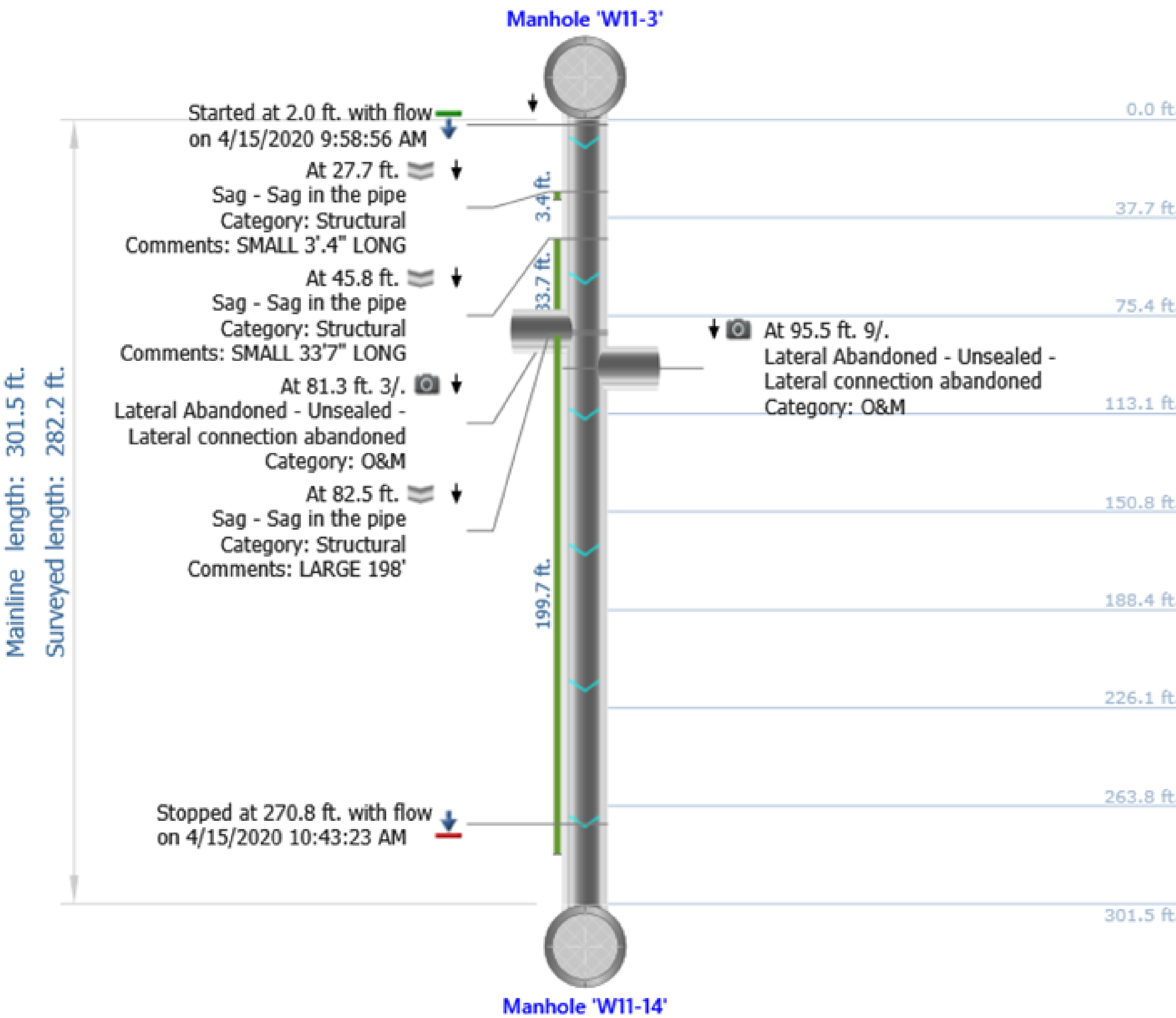
Main Inspections Pipe Run and Map

Project name:	Mainline ID:	City:	Address:
CITY OF HERMISTON	**W11-3**	**HERMISTON W11-3 TO W11-14**	**NW 7TH ST**
Start date/time:	Direction:	Weather:	Surface condition:
5/4/2020 2:52 PM	**With the flow**	**Dry**	
Pipe shape:	Pipe material:	Pipe height:	Pipe width:
	Concrete	**8.0 in.**	**8.0 in.**



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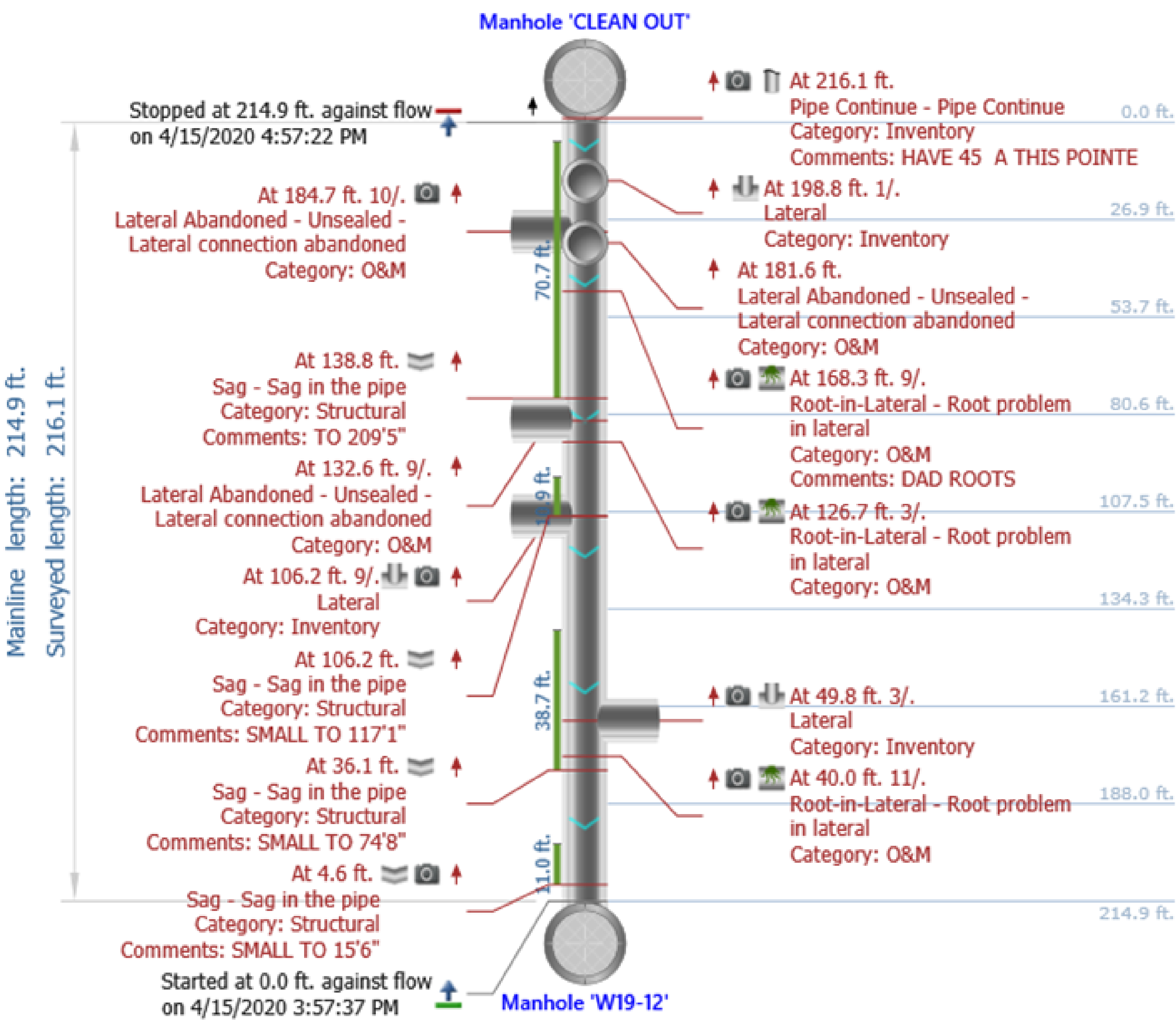
Main Inspections Pipe Run with Anomaly Probability

Project name:	Mainline ID:	City:	Address:
CITY OF HERMISTON	**W19-12**	**HERMISTON W14-12 TO END**	**SW 7TH AND OAK**
Start date/time:	Direction:	Weather:	Surface condition:
5/5/2020 7:30 AM	**Against the flow**	**Dry**	**Asphalt**
Pipe shape:	Pipe material:	Pipe height:	Pipe width:
	Concrete	**6.0 in.**	**6.0 in.**



This report may contain 'false' positives due to the detection of anomalies other than voids.

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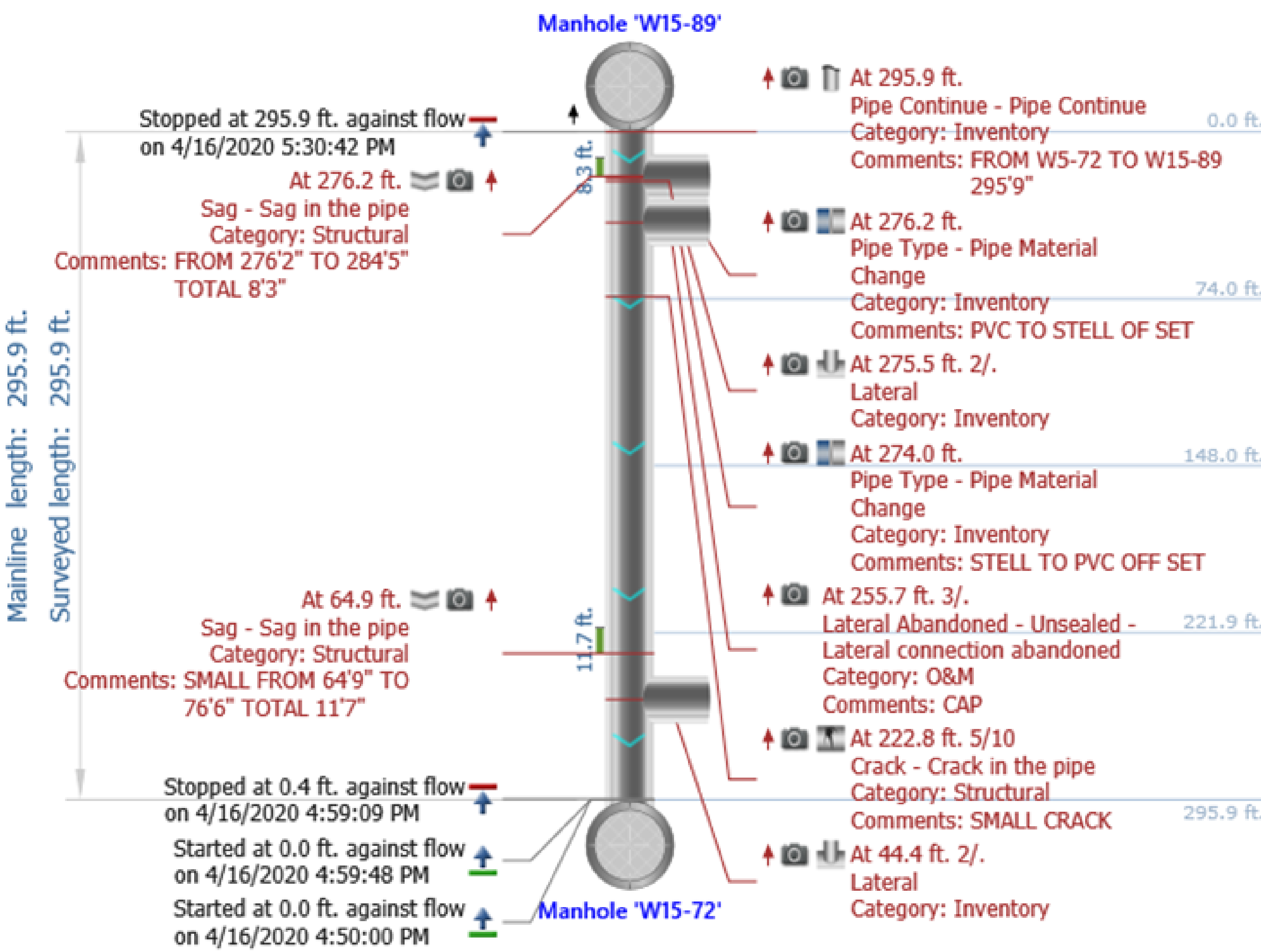
Main Inspections Pipe Run with Anomaly Probability

Project name:	Mainline ID:	City:	Address:
CITY OF HERMISTON	**W17-72**	**HERMISTON W15-72 TO W15-89**	**SW FRIST AND HIGHLANDAVE**
Start date/time:	Direction:	Weather:	Surface condition:
5/6/2020 3:01 PM	**Against the flow**	**Dry**	**Asphalt**
Pipe shape:	Pipe material:	Pipe height:	Pipe width:
	Steel	**8.0 in.**	**8.0 in.**



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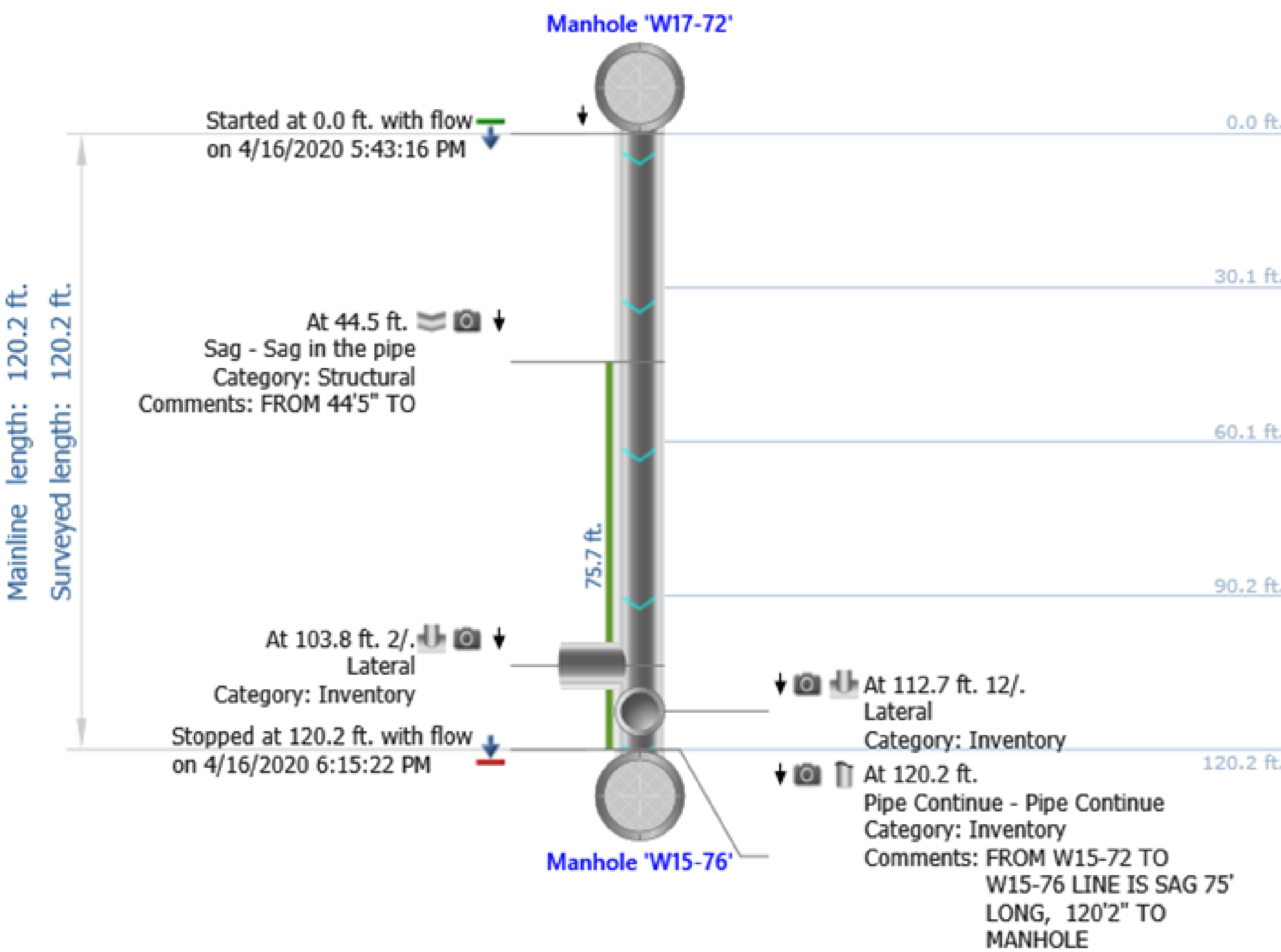
Main Inspections Pipe Run with Anomaly Probability

Project name:	Mainline ID:	City:	Address:
CITY OF HERMISTON	**W17-72 1**	**HERMISTON W15-72 TO W15-76**	**SW 1ST AND W HIGHLAN AVE**
Start date/time:	Direction:	Weather:	Surface condition:
5/6/2020 3:54 PM	**With the flow**	**Dry**	**Garden**
Pipe shape:	Pipe material:	Pipe height:	Pipe width:
	Concrete	**8.0 in.**	**8.0 in.**



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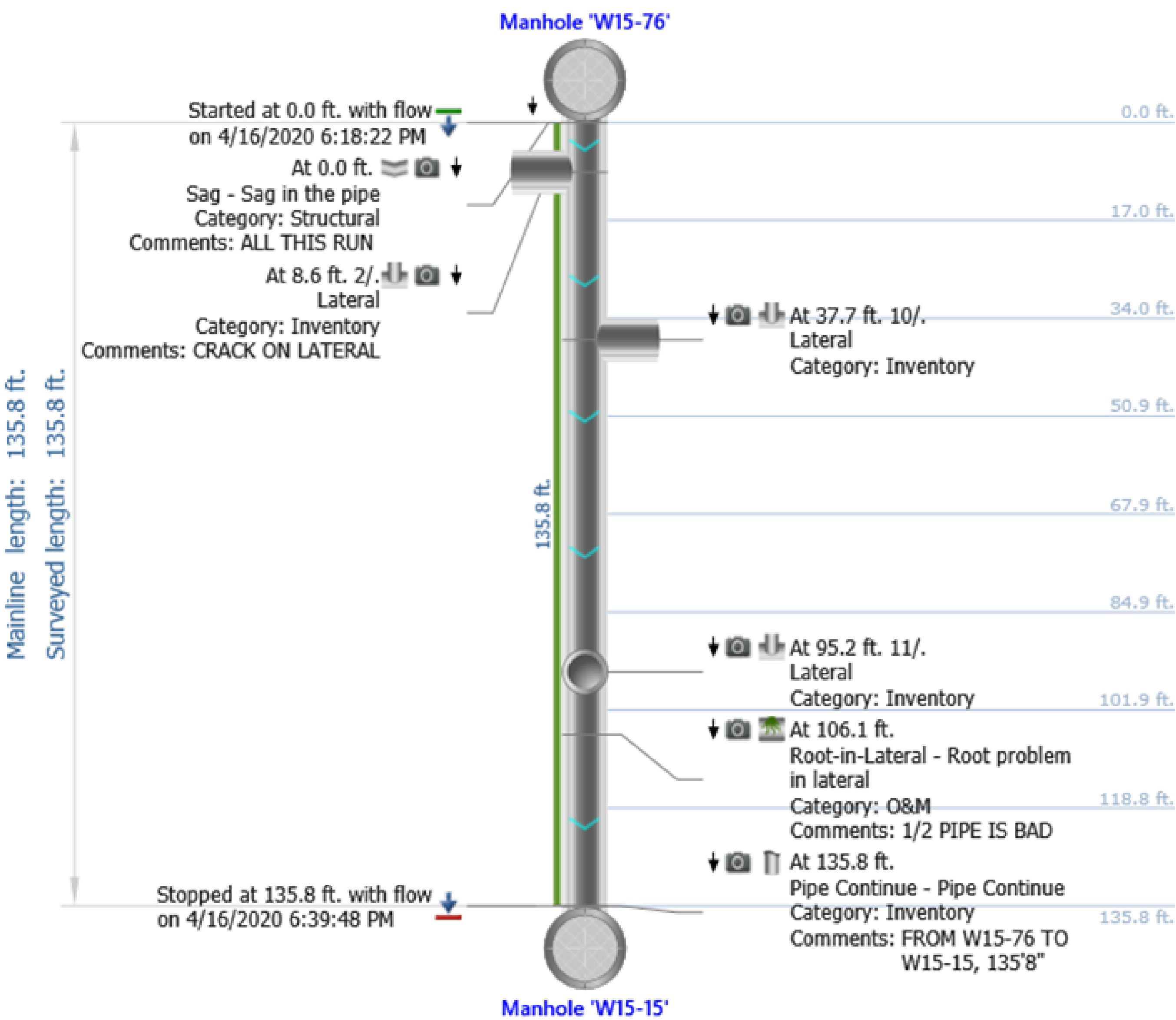
Main Inspections Pipe Run with Anomaly Probability

Project name:	Mainline ID:	City:	Address:
CITY OF HERMISTON	W15-76	HERMISTON W15-76 TO W15-15	SW 1ST AND W HIGHLAND AVE
Start date/time:	Direction:	Weather:	Surface condition:
5/6/2020 4:30 PM	With the flow	Light Rain	Garden
Pipe shape:	Pipe material:	Pipe height:	Pipe width:
	Concrete	8.0 in.	8.0 in.



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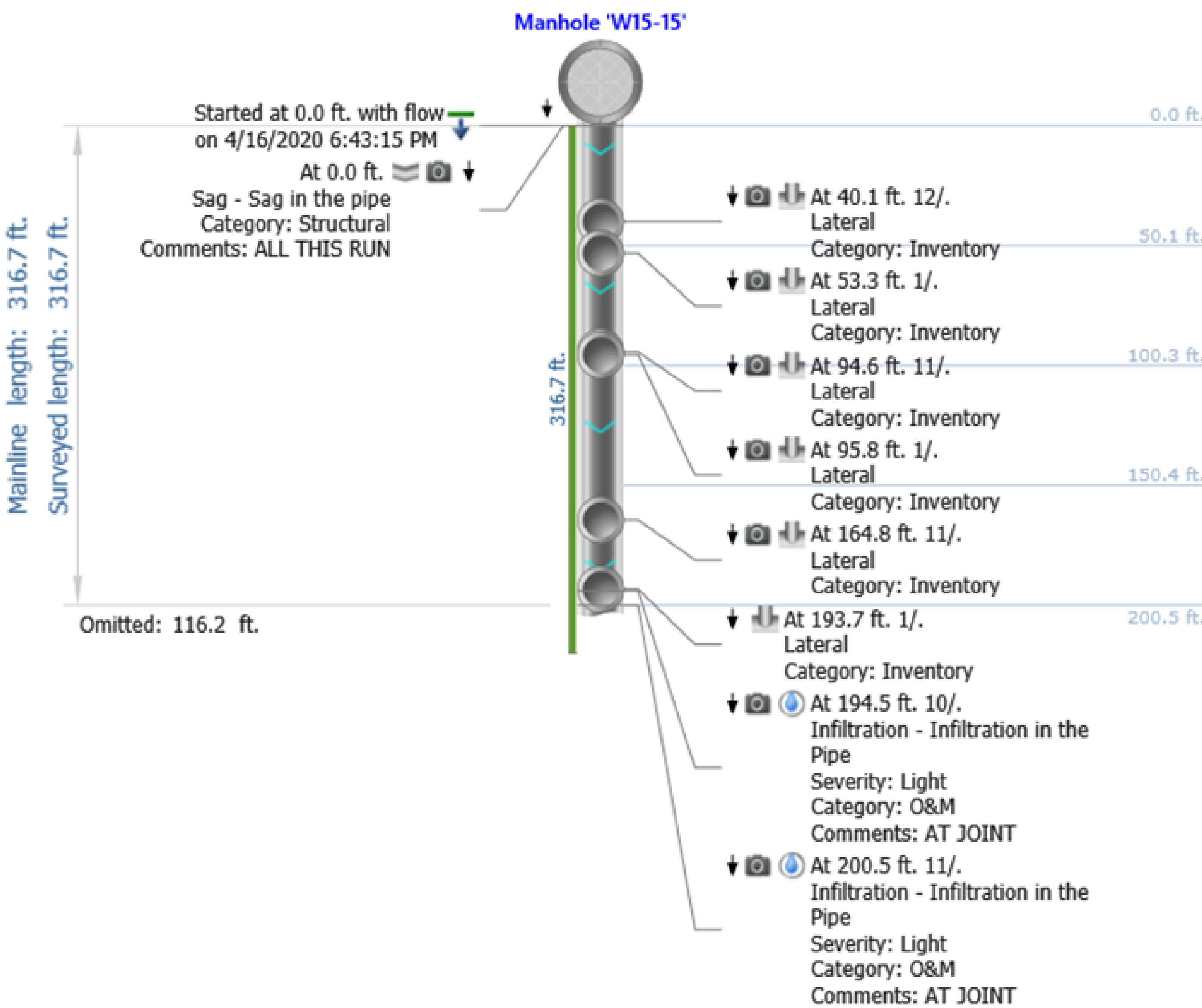
Main Inspections Pipe Run with Anomaly Probability

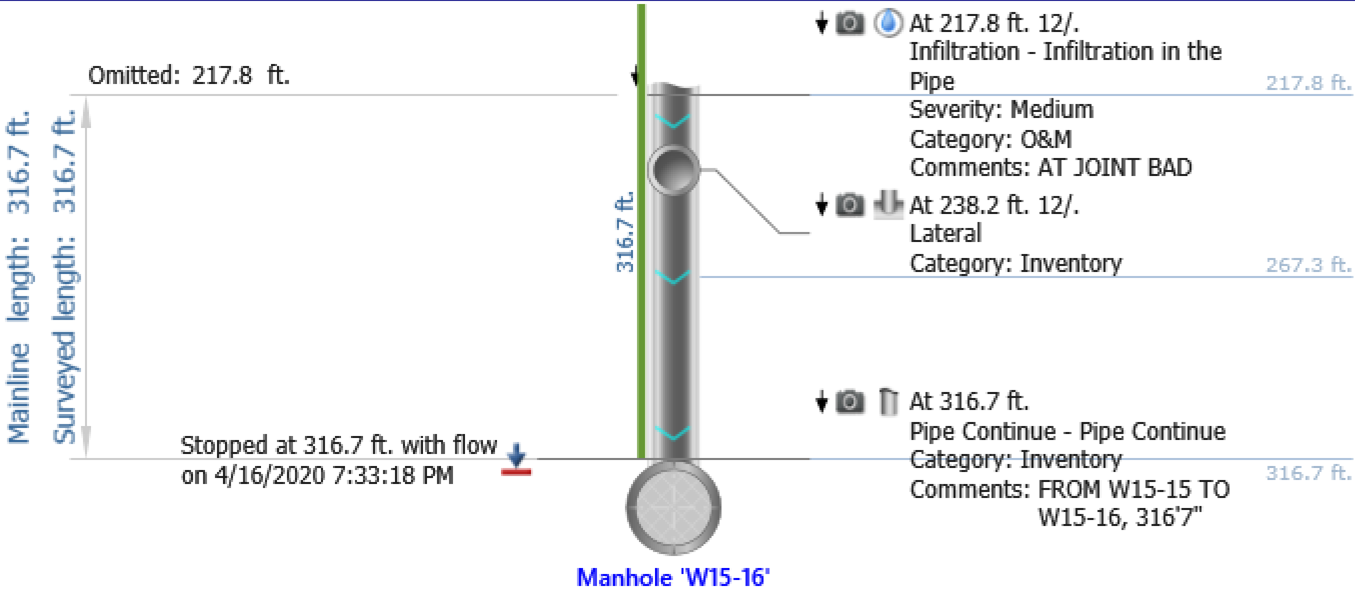
Project name:	Mainline ID:	City:	Address:
CITY OF HERMISTON	**W15-15**	**HERMISTON W15-15 TO W15-16**	**SW 1ST AND W HIGHLAND AVE**
Start date/time:	Direction:	Weather:	Surface condition:
5/6/2020 4:54 PM	**With the flow**	**Dry**	**Asphalt**
Pipe shape:	Pipe material:	Pipe height:	Pipe width:
	Concrete	**8.0 in.**	**8.0 in.**



This report may contain ‘false’ positives due to the detection of anomalies other than voids.

Project name:	Mainline ID:	Start date/time:	Direction:
CITY OF HERMISTON	**W15-15**	**5/6/2020 4:54 PM**	**With the flow**

Weather:
Dry



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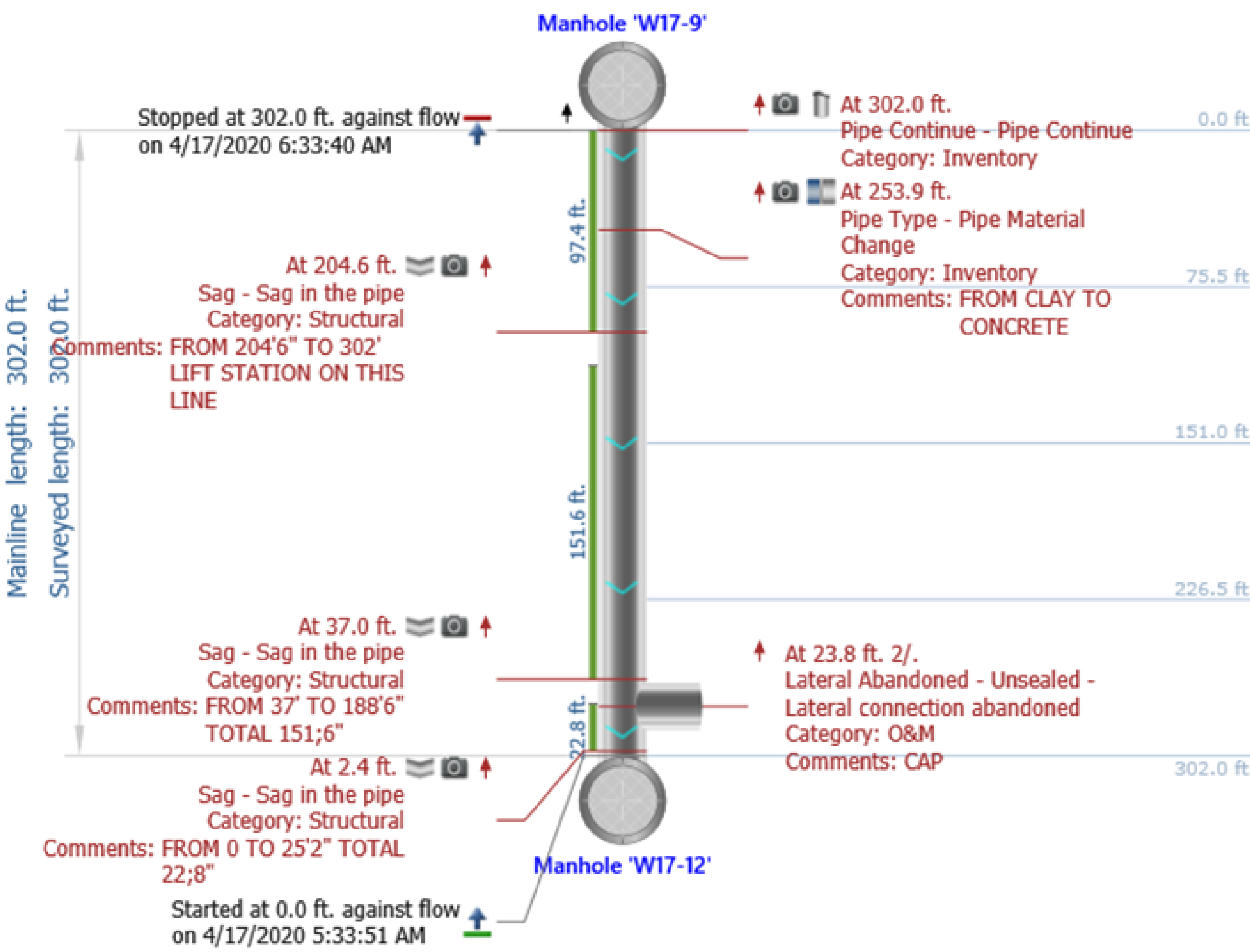
Main Inspections Pipe Run with Anomaly Probability

Project name: **CITY OF HERMISTON**	Mainline ID: **W17-12**	City: **HERMISTON W17-12 TO W17-9**	Address: **S FRIST AND W HERMISTON**
Start date/time: **5/7/2020 1:39 PM**	Direction: **Against the flow**	Weather: **Dry**	Surface condition: **Asphalt**
Pipe shape:	Pipe material: **Clay Tile**	Pipe height: **8.0 in.**	Pipe width: **8.0 in.**



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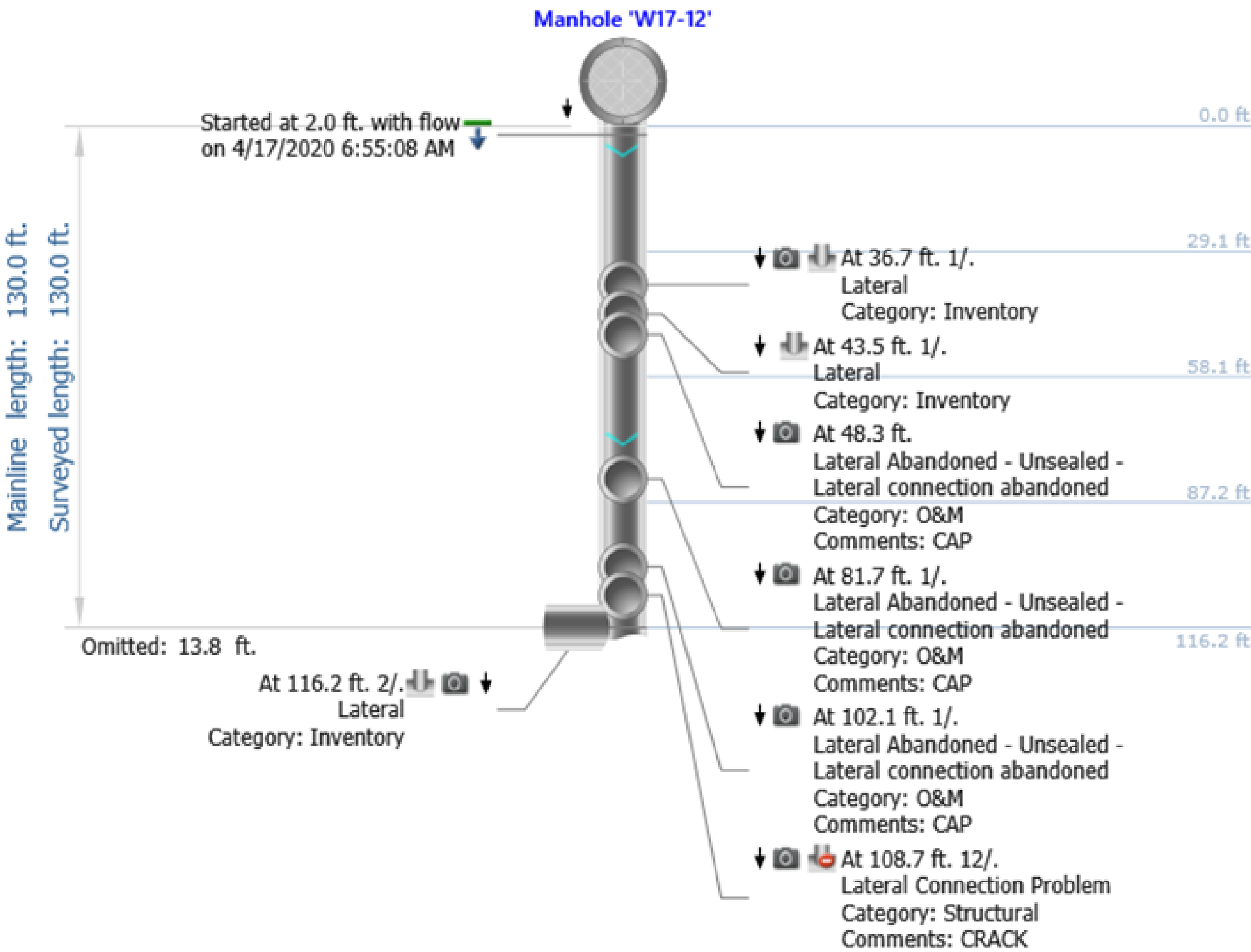
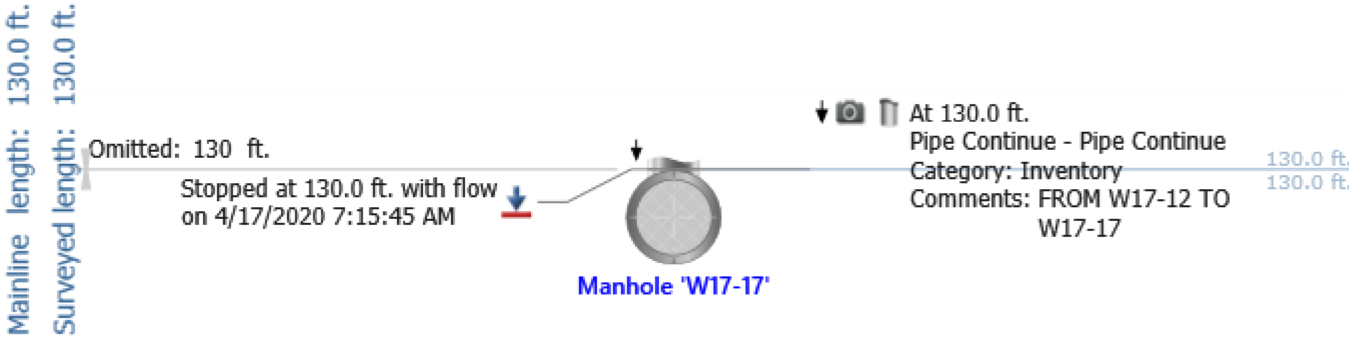
Main Inspections Pipe Run with Anomaly Probability

Project name:	Mainline ID:	City:	Address:
CITY OF HERMISTON	**W17-12-1**	**HERMISTON W17-12 TO W17-17**	**S FRIST PL TO W HERMISTON**
Start date/time:	Direction:	Weather:	Surface condition:
5/7/2020 2:56 PM	**With the flow**	**Dry**	
Pipe shape:	Pipe material:	Pipe height:	Pipe width:
	Clay Tile	**8.0 in.**	**8.0 in.**



This report may contain ‘false’ positives due to the detection of anomalies other than voids.

Project name:	Mainline ID:	Start date/time:	Direction:
CITY OF HERMISTON	**W17-12-1**	**5/7/2020 2:56 PM**	**With the flow**
Weather:			
Dry			



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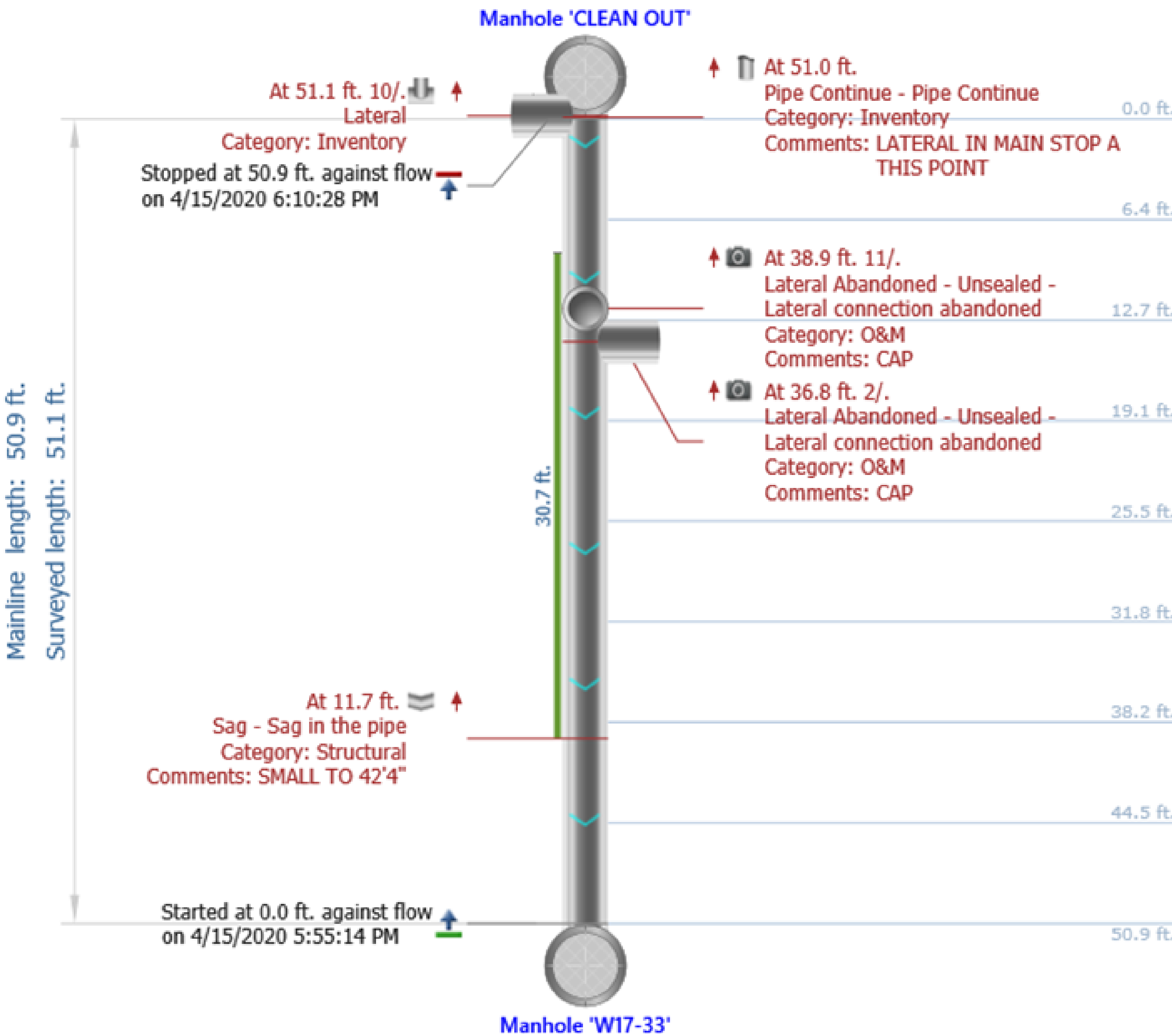
Main Inspections Pipe Run with Anomaly Probability

Project name:	Mainline ID:	City:	Address:
CITY OF HERMISTON	**W17-33**	**HERMISTON W17-33**	**SW 5TH AND LOCUST**
Start date/time:	Direction:	Weather:	Surface condition:
5/5/2020 9:26 AM	**Against the flow**	**Dry**	**Asphalt**
Pipe shape:	Pipe material:	Pipe height:	Pipe width:
	Concrete	**8.0 in.**	**8.0 in.**



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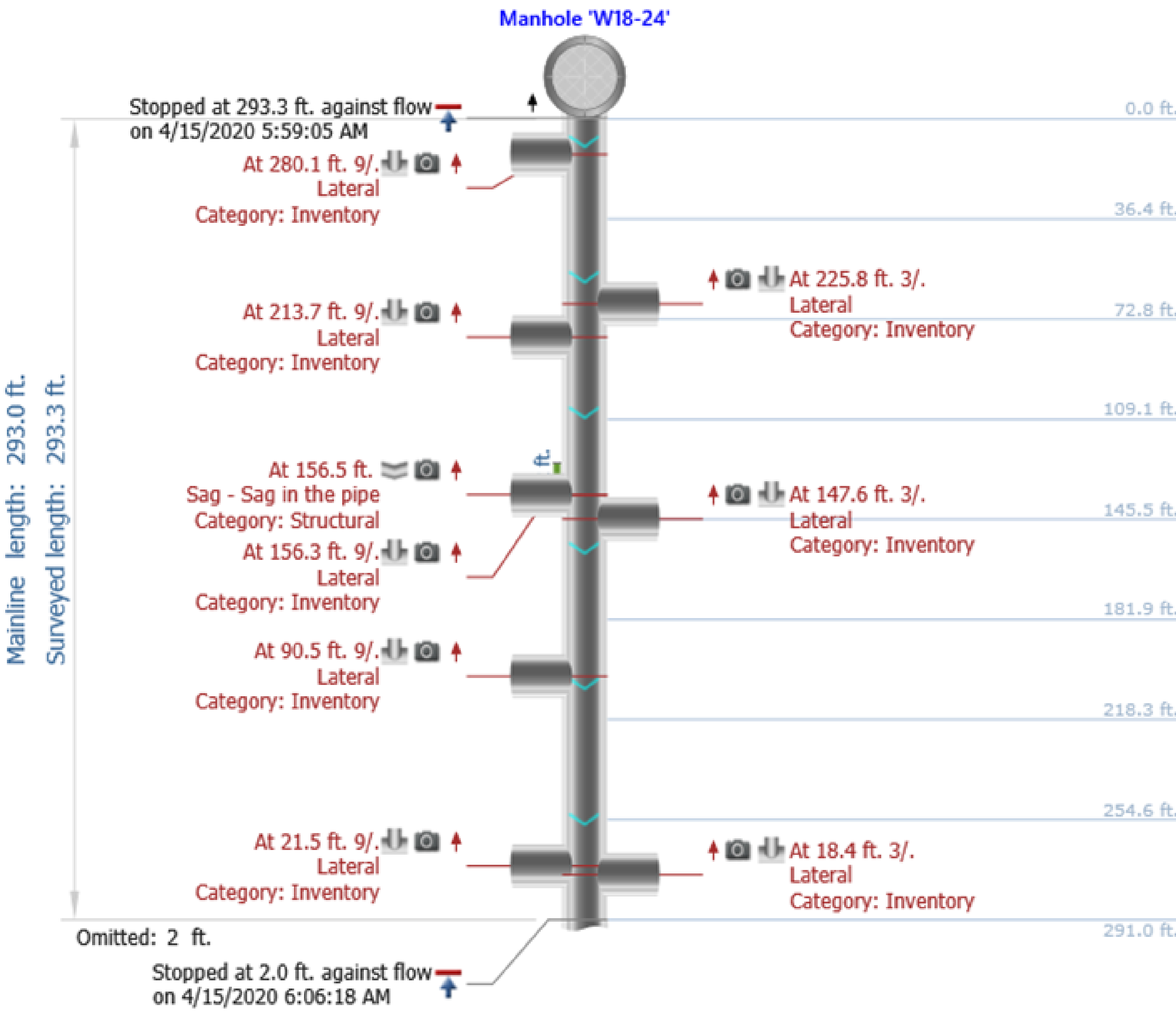
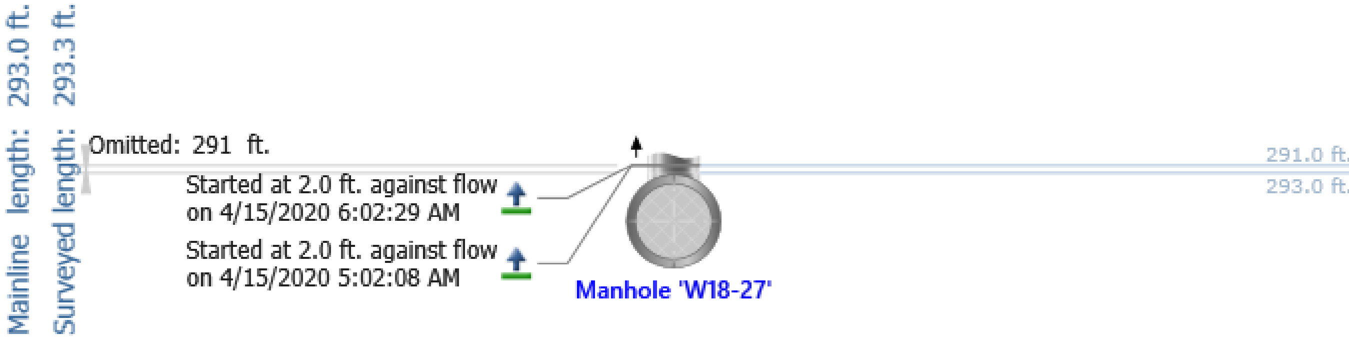
Main Inspections Pipe Run with Anomaly Probability

Project name:	Mainline ID:	City:	Address:
CITY OF HERMISTON	**W18-27**		**NW STOCKTON AND ELM**
Start date/time:	Direction:	Weather:	Surface condition:
5/4/2020 9:21 AM	**Against the flow**	**Dry**	**Garden**
Pipe shape:	Pipe material:	Pipe height:	Pipe width:
	Concrete	**8.0 in.**	**8.0 in.**



This report may contain 'false' positives due to the detection of anomalies other than voids.

Project name:	Mainline ID:	Start date/time:	Direction:
CITY OF HERMISTON	**W18-27**	**5/4/2020 9:21 AM**	**Against the flow**
Weather:			
Dry			



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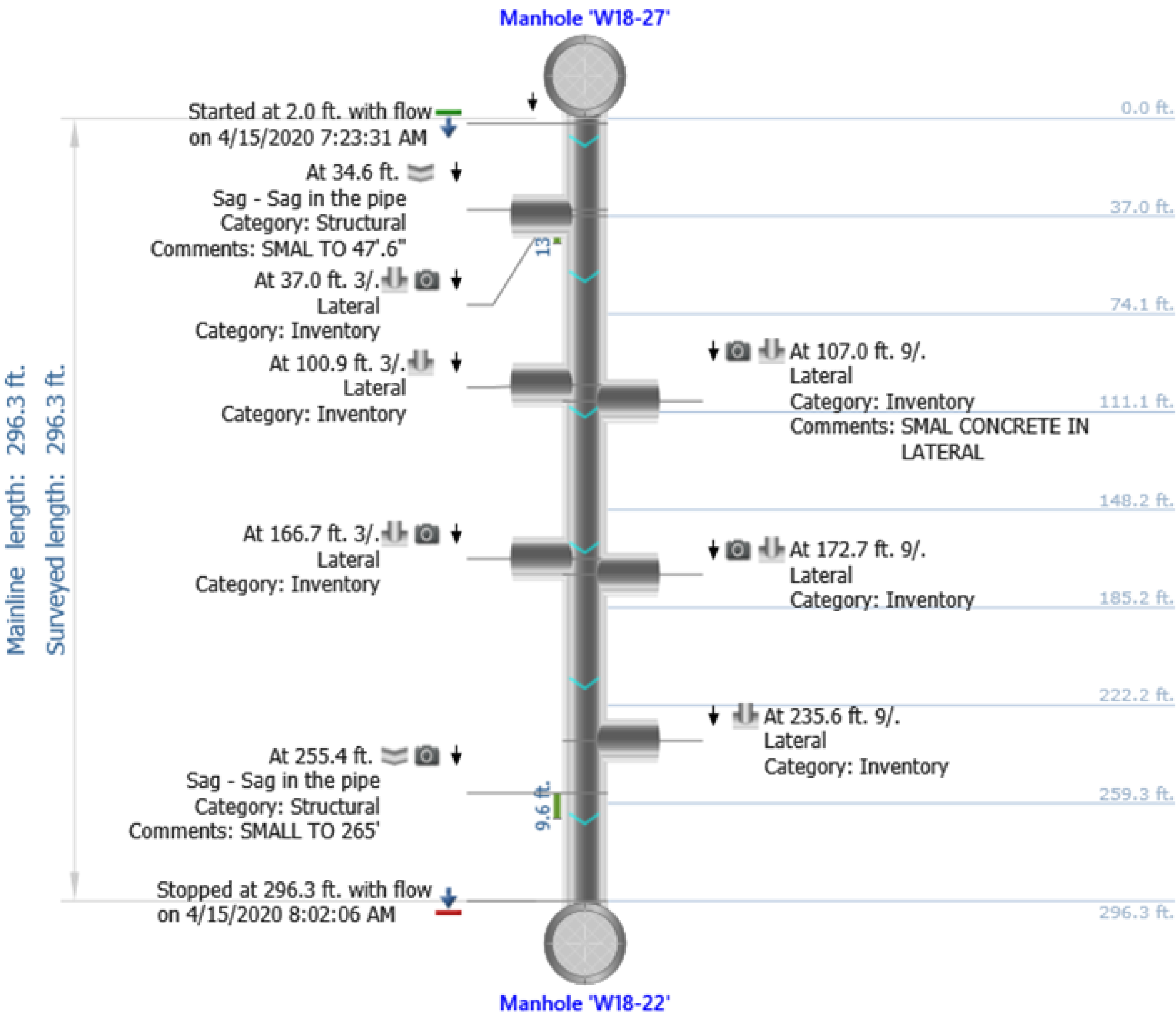
Main Inspections Pipe Run with Anomaly Probability

Project name:	Mainline ID:	City:	Address:
CITY OF HERMISTON	**W18-27**	**HERMISTON W18-27 TO W18-22**	**NW STOCKTON AND ELM**
Start date/time:	Direction:	Weather:	Surface condition:
5/4/2020 11:40 AM	**With the flow**	**Dry**	**Garden**
Pipe shape:	Pipe material:	Pipe height:	Pipe width:
	Concrete	**8.0 in.**	**8.0 in.**



This report may contain 'false' positives due to the detection of anomalies other than voids.

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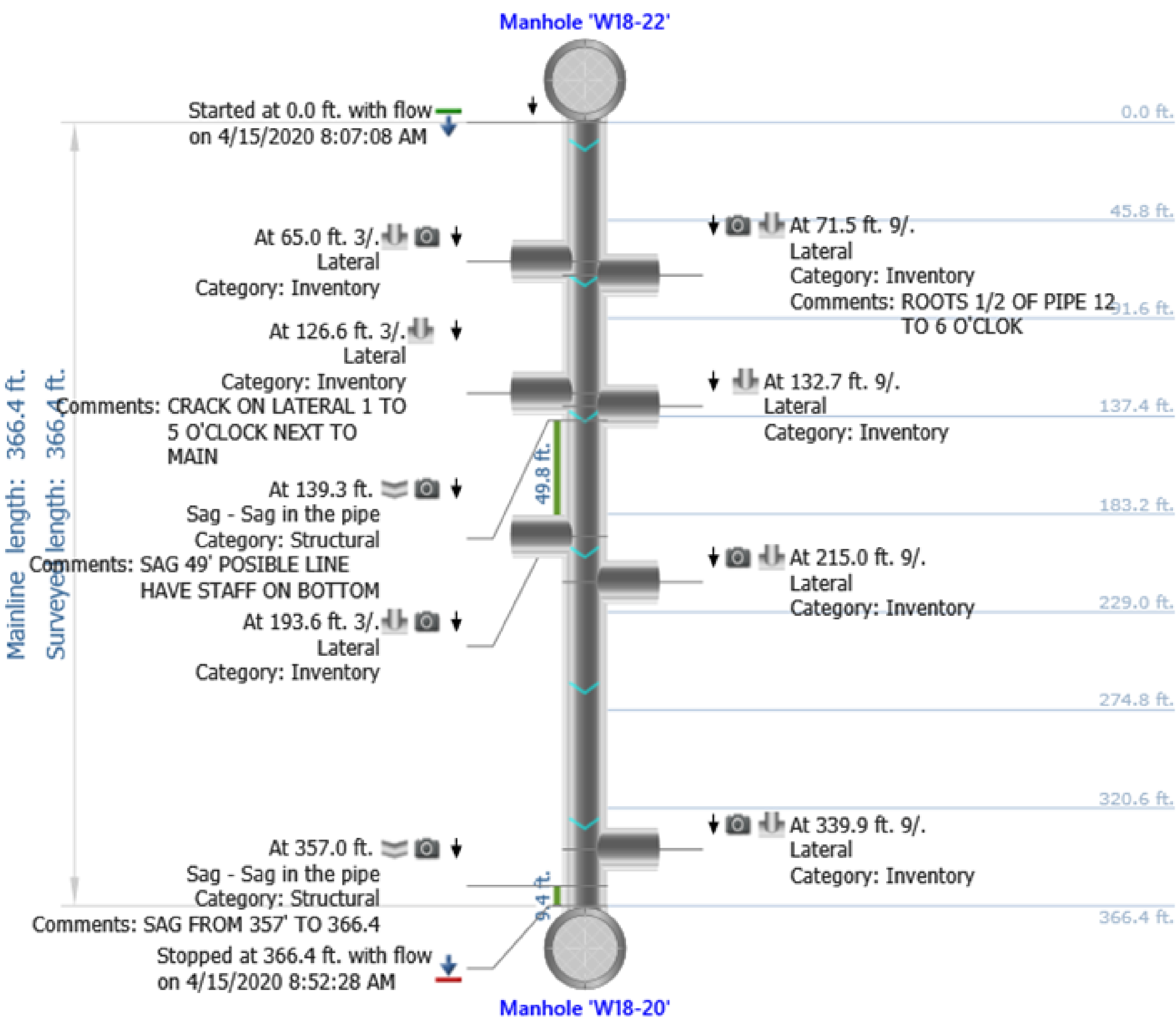
Main Inspections Pipe Run with Anomaly Probability

Project name:	Mainline ID:	City:	Address:
CITY OF HERMISTON	**W18-22**	**HERMISTON W18-22 TO W18-20**	**STOCKTON AND ELM**
Start date/time:	Direction:	Weather:	Surface condition:
5/4/2020 12:24 PM	**With the flow**	**Dry**	**Garden**
Pipe shape:	Pipe material:	Pipe height:	Pipe width:
Circular	**Concrete**	**8.0 in.**	**8.0 in.**



This report may contain 'false' positives due to the detection of anomalies other than voids.

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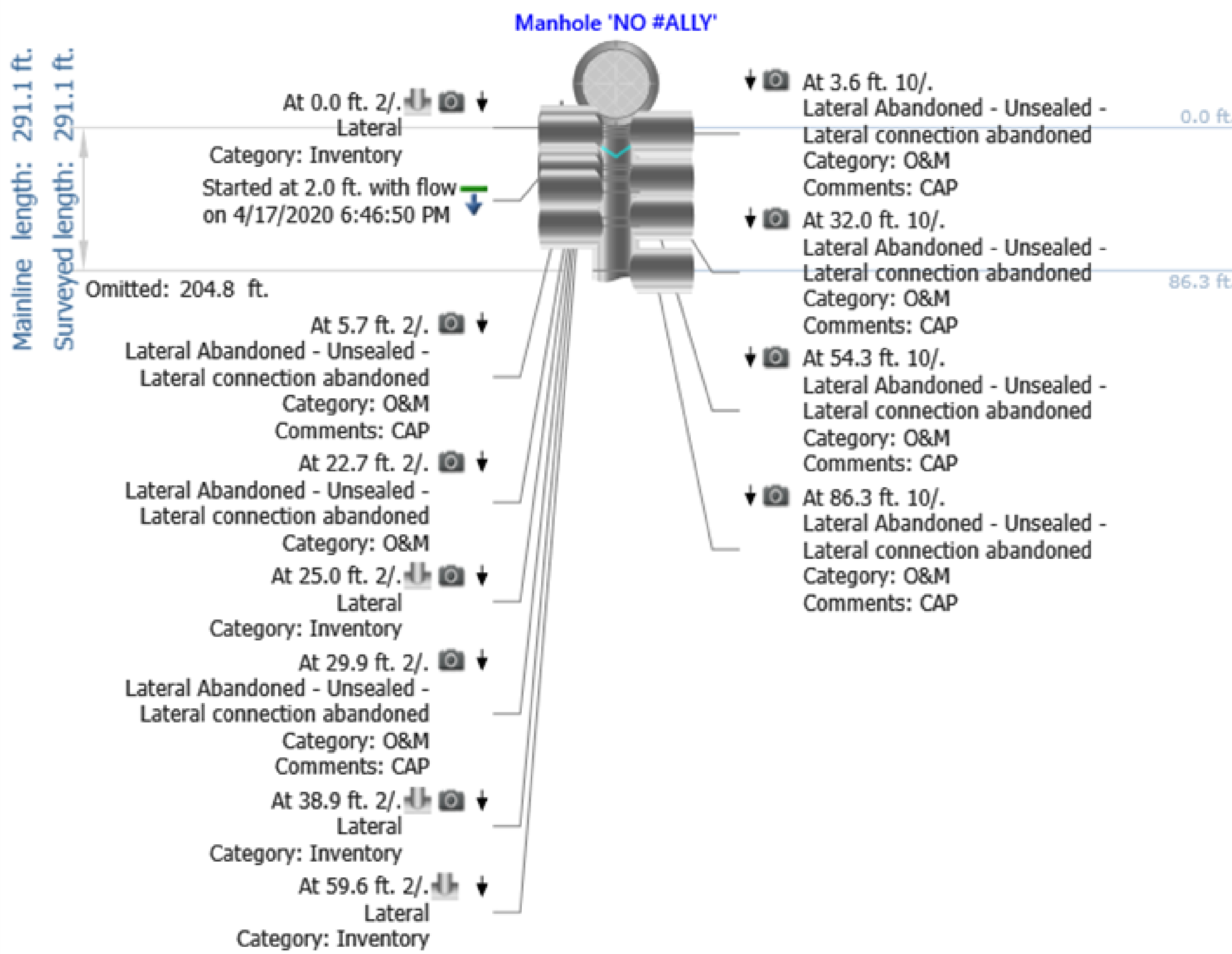
Main Inspections Pipe Run with Anomaly Probability

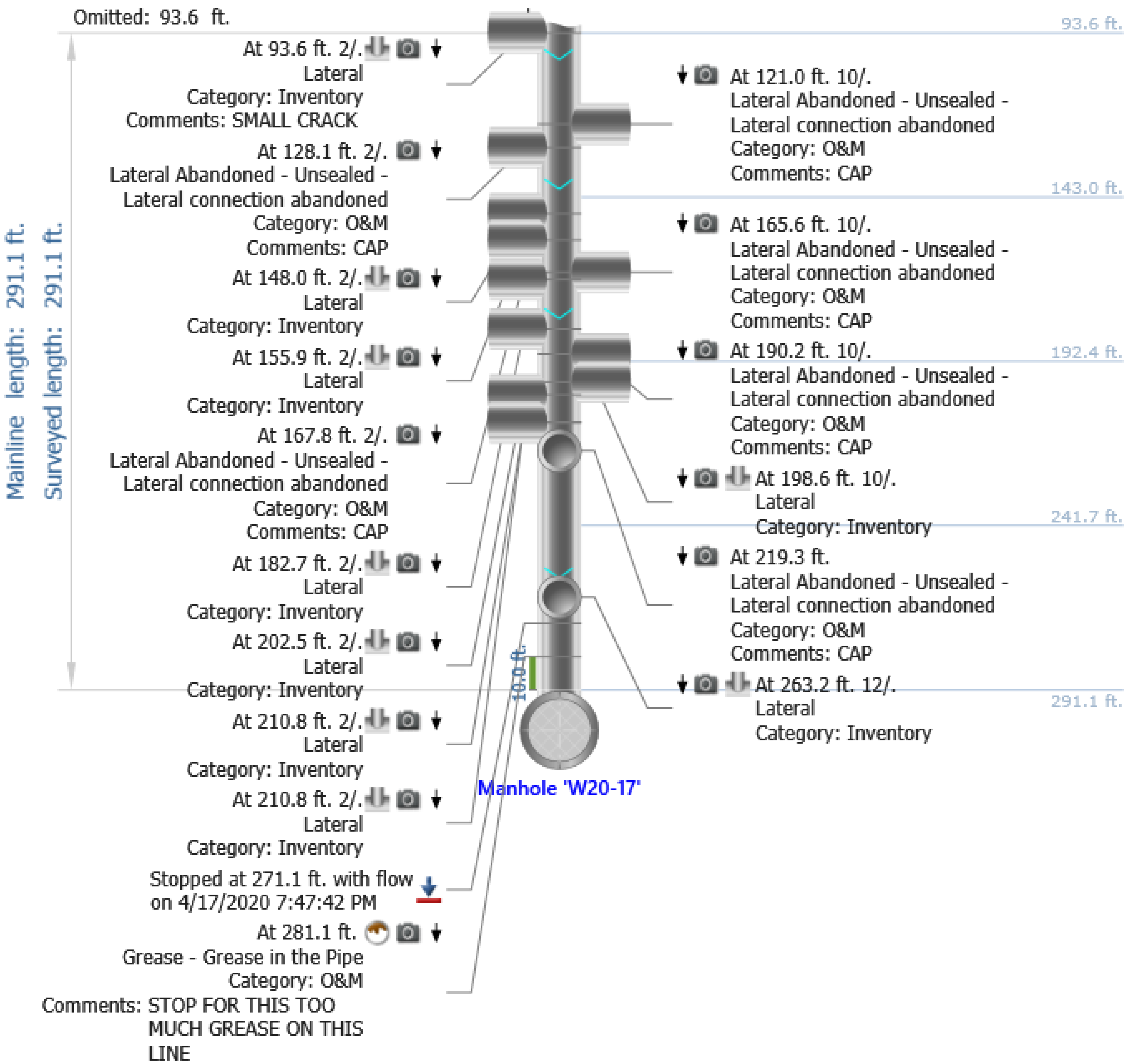
Project name:	Mainline ID:	City:	Address:
CITY OF HERMISTON	**NO # ALLY**	**HERMISTON NO # BY ALLY TO W20-17**	
Start date/time:	Direction:	Weather:	Surface condition:
5/8/2020 12:01 PM	**With the flow**	**Dry**	
Pipe shape:	Pipe material:	Pipe height:	Pipe width:
	Clay	**8.0 in.**	**8.0 in.**



This report may contain 'false' positives due to the detection of anomalies other than voids.

Project name: **CITY OF HERMISTON** | Mainline ID: **NO # ALLY** | Start date/time: **5/8/2020 12:01 PM** | Direction: **With the flow**

Weather: **Dry**



This report may contain 'false' positives due to the detection of anomalies other than voids.

APPENDIX F
Television Inspection Photos

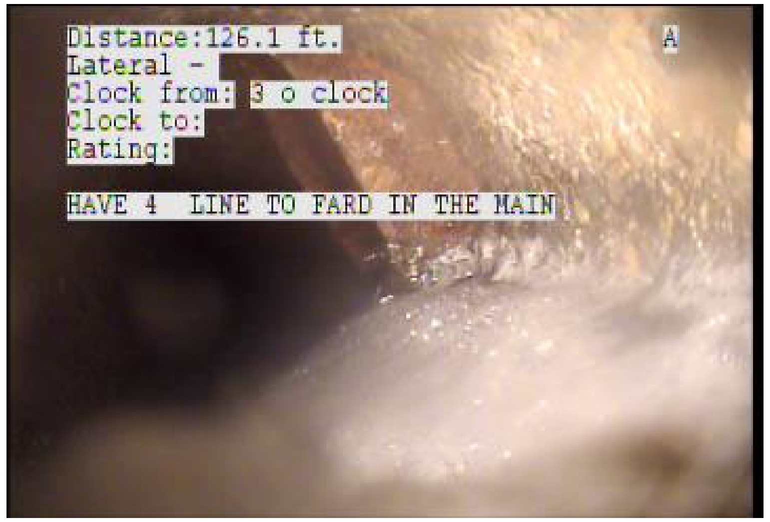


Photo 1: Protruding lateral (Basin W9).

Photo 2: Horizontal bend in pipe (Basin W9).

Photo 3: Structural damage (Basin W9).

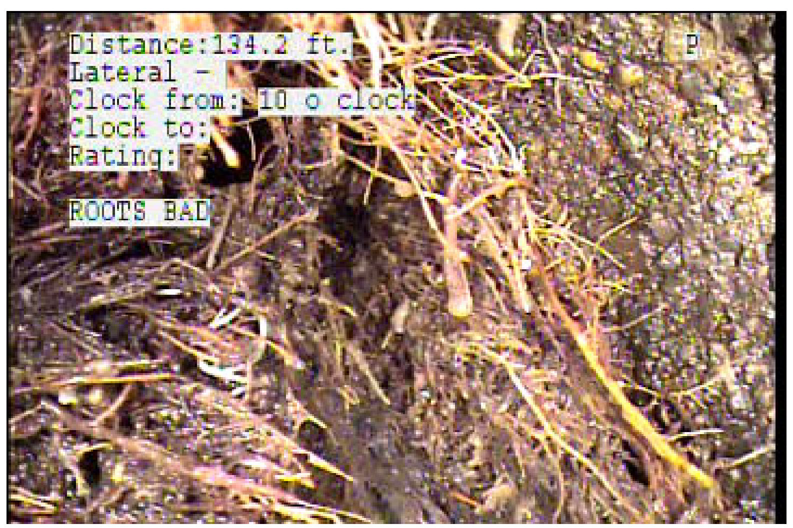


Photo 4: Root intrusion in lateral (Basin W9).

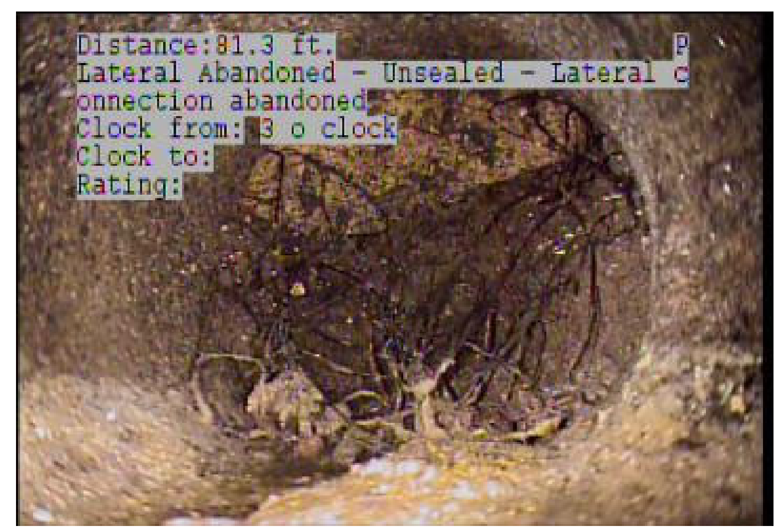


Photo 5: Root intrusion in unsealed, abandoned lateral (Basin W11).

Photo 6: Pipe sag (Basin W11).

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SANITARY SEWER COLLECTION SYSTEM STUDY

TELEVISION INSPECTION PHOTOS

APPENDIX F

Photo 7: Root intrusion (Basin W18).

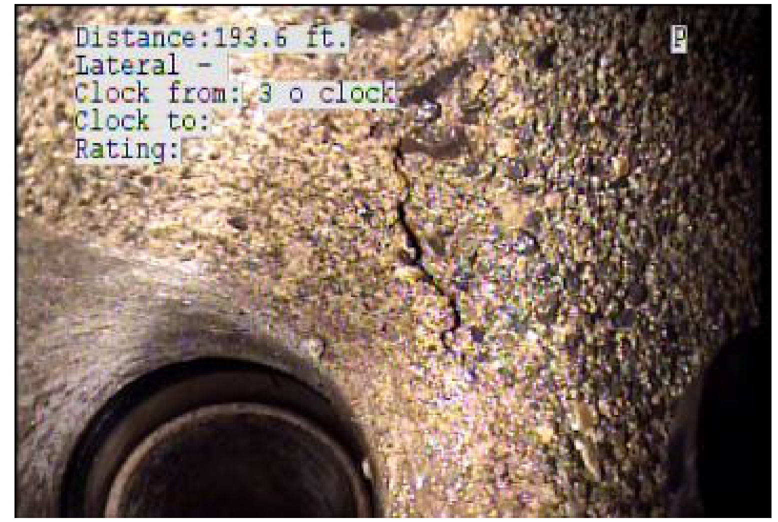

Photo 8: Structural damage (crack) (Basin W18).

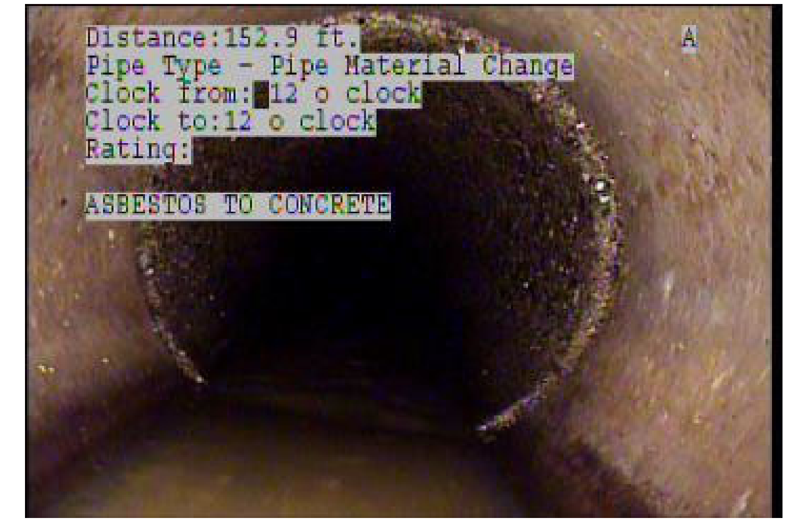

Photo 9: Pipe material change (Basin W6).

Photo 10: Pipe sag (Basin W6).

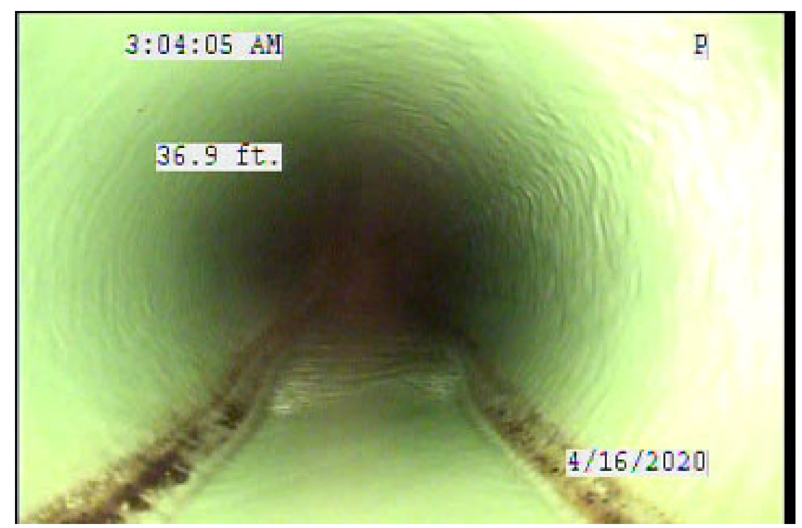

Photo 11: Pipe sag (Basin W6).

Photo 12: Pipe material change (Basin W6).

Photo 13: Structural damage (Basin W6).

Photo 14: Root intrusion in lateral (Basin W7).

Photo 15: Root intrusion in lateral (Basin W7).

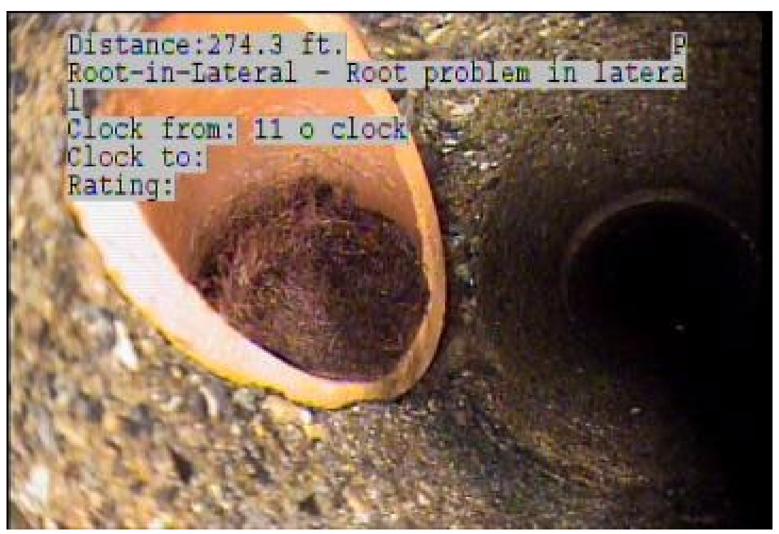

Photo 16: Root intrusion in lateral (Basin W7).

Photo 17: Root intrusion in lateral (Basin W8).

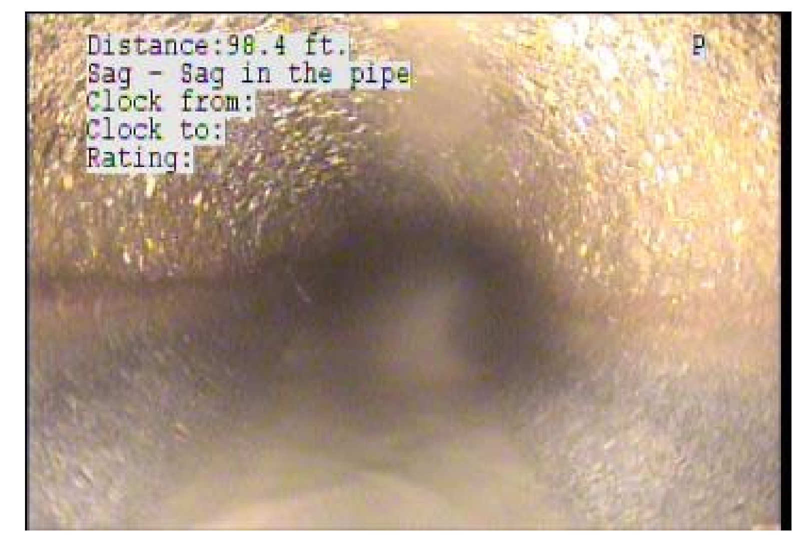

Photo 18: Pipe sag (Basin W9).

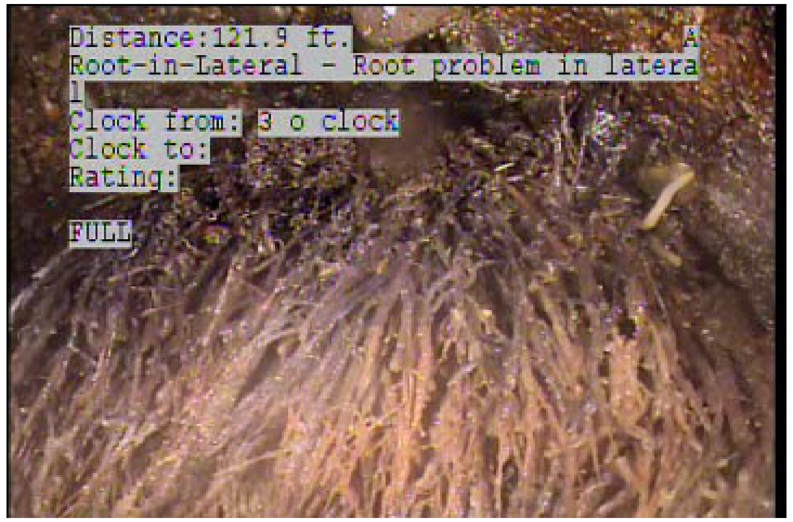

Photo 19: Root intrusion in lateral (Basin W9).

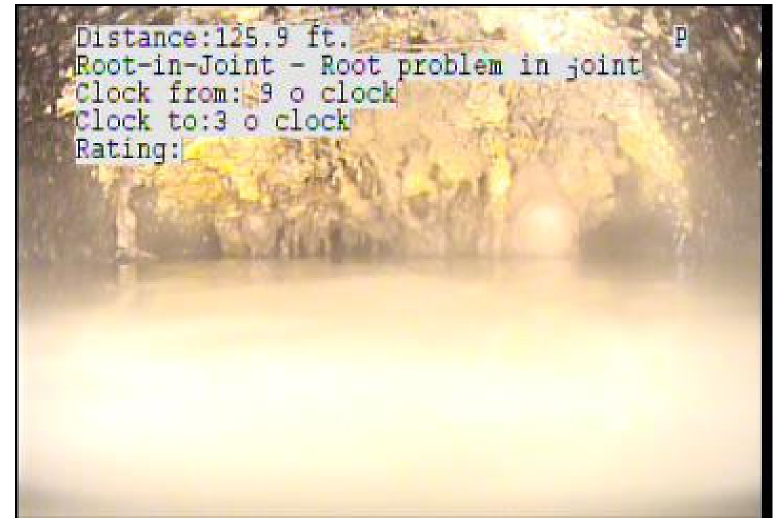

Photo 20: Root intrusion (Basin W9).

Photo 21: Protruding lateral (Basin W17).

Photo 22: Root intrusion in lateral (Basin W14).

Photo 23: Horizontal bend in pipe Basin W14).

Photo 24: Pipe sag (Basin W9).

Photo 25: Pipe sag (Basin W9).

Photo 26: Structural damage (hole in pipe) (Basin W9).

Photo 27: Pipe material change (Basin W9).

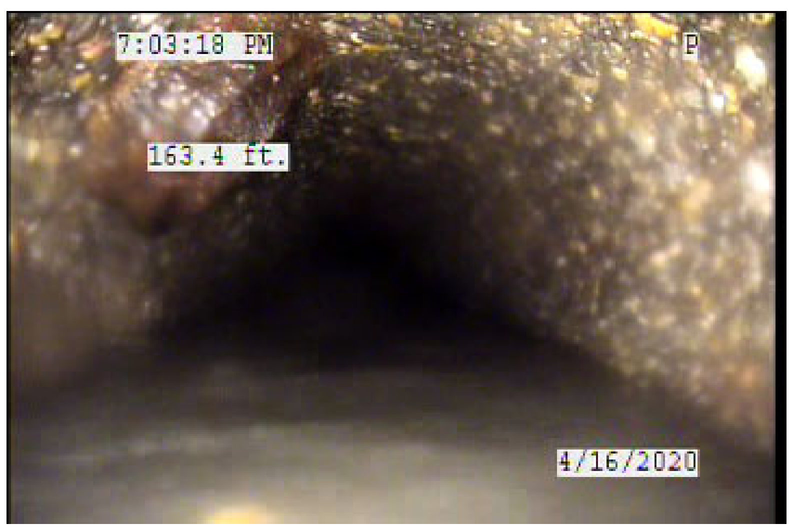

Photo 28: Protruding lateral (Basin W15).

Photo 29: Infiltration (Basin W15).

Photo 30: Structural damage (crack) (Basin W15).

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SANITARY SEWER COLLECTION SYSTEM STUDY

TELEVISION INSPECTION PHOTOS

APPENDIX F

Photo 31: Structural damage (crack) (Basin W15).

Photo 32: Pipe material change. Structural damage (offset joint) (Basin E12).

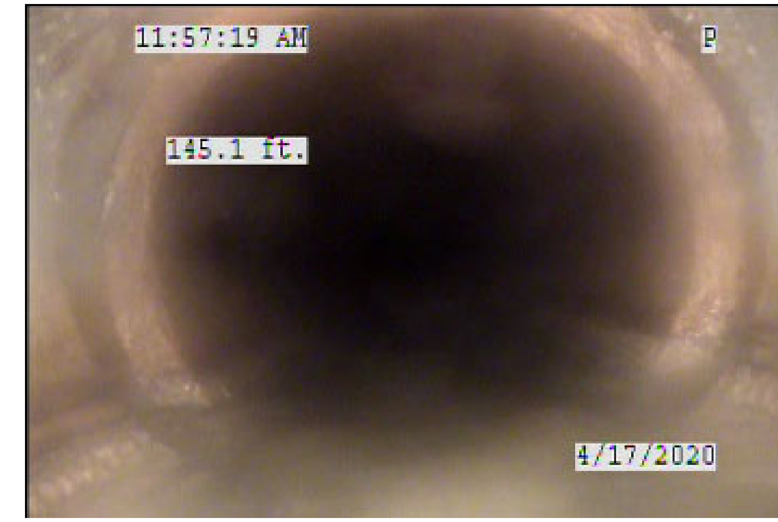

Photo 33: Pipe material change. Structural damage (offset joint) (Basin E12).

Photo 34: Pipe material change (Basin E13).

Photo 35: Pipe material change (Basin E13).

Photo 36: Structural damage (crack with root intrusion) (Basin E13).

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SANITARY SEWER COLLECTION SYSTEM STUDY

TELEVISION INSPECTION PHOTOS

APPENDIX F

Photo 37: Structural damage (deformed lateral) (Basin E13).

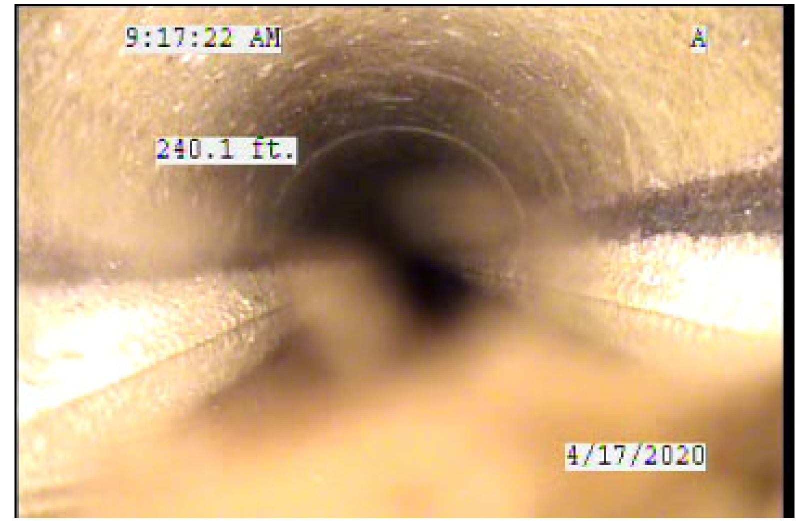

Photo 38: Pipe sag (Basin E13).

Photo 39: Structural damage (lining deterioration) (Basin E15).

Photo 40: Pipe sag (Basin E15).

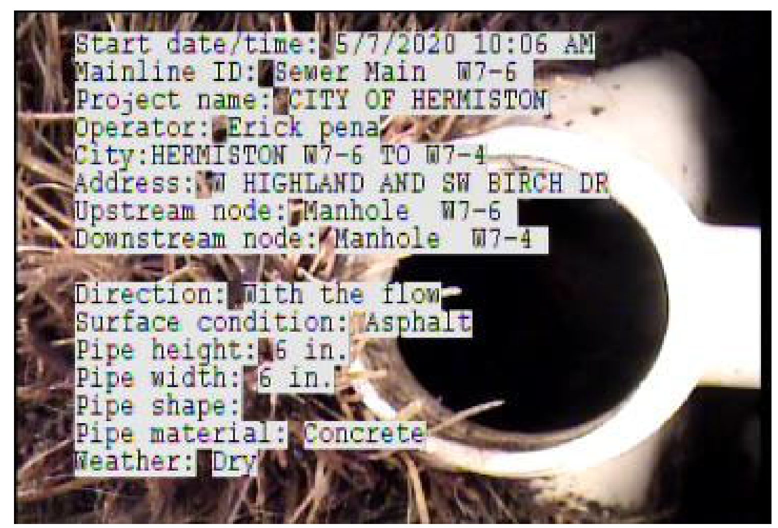

Photo 41: Root intrusion (Basin W7).

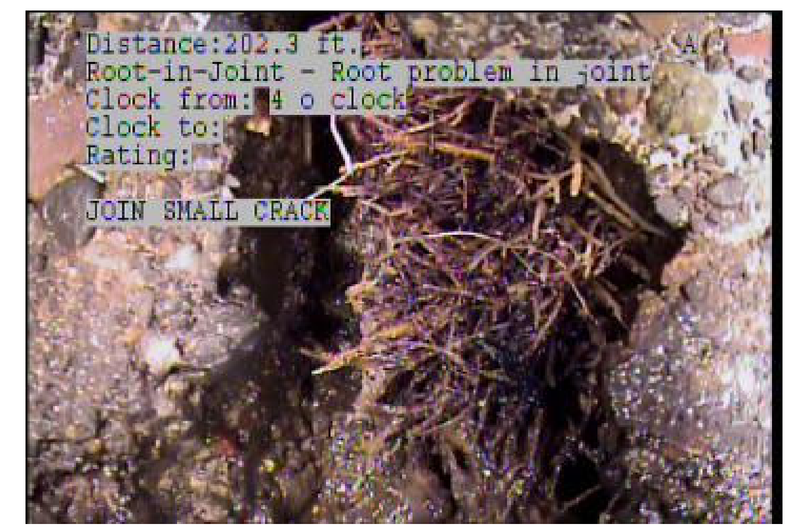

Photo 42: Root intrusion in damaged joint (Basin W7).

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HERMISTON, OREGON
SANITARY SEWER COLLECTION SYSTEM STUDY

TELEVISION INSPECTION PHOTOS

APPENDIX F

Photo 43: Root intrusion in lateral (Basin W8).

Photo 44: Protruding lateral (Basin W8).

Photo 45: Pipe sag (Basin W9).

Photo 46: Pipe sag (Basin W9).

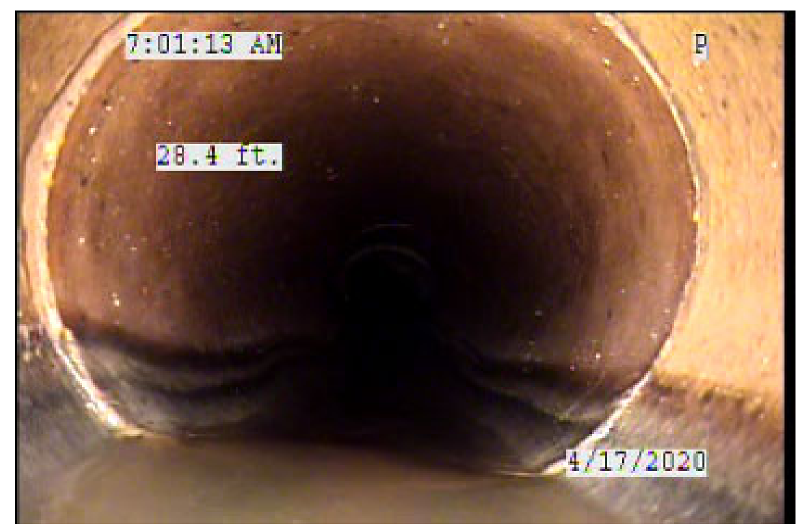

Photo 47: Pipe sag (Basin W17).

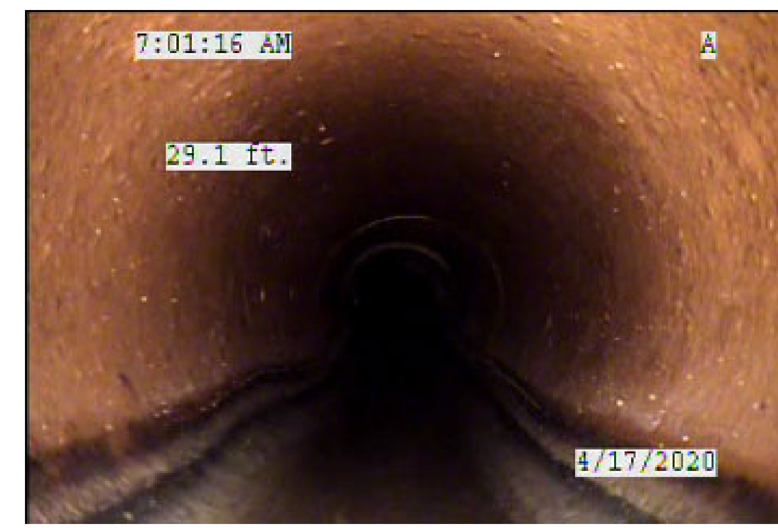

Photo 48: Pipe sag (Basin W17).

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CITY OF
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SANITARY SEWER COLLECTION SYSTEM STUDY

TELEVISION INSPECTION PHOTOS

APPENDIX F

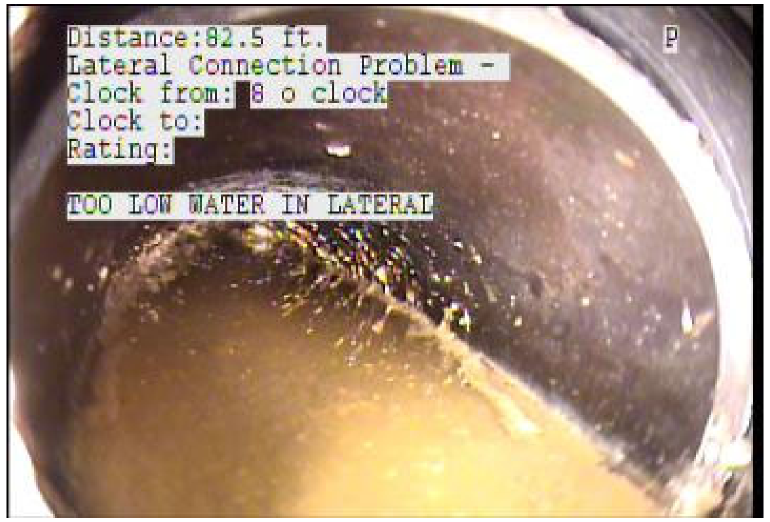

Photo 49: Standing water in lateral (Basin E15).

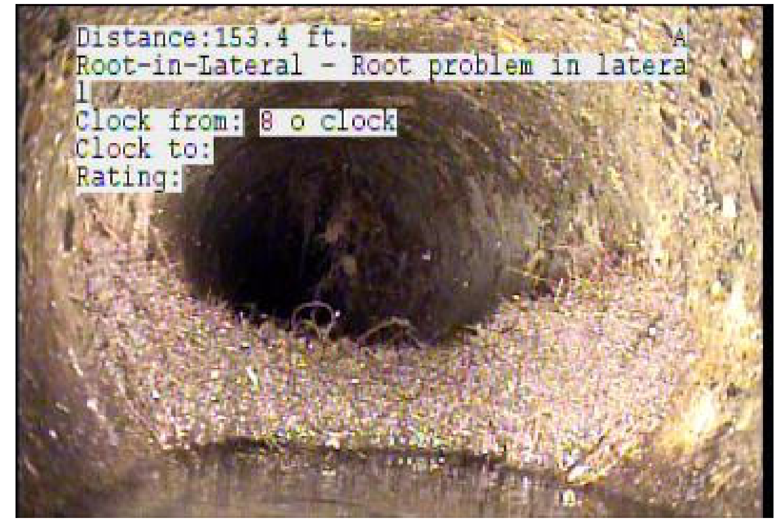

Photo 50: Root intrusion in lateral (Basin E12).

Photo 51: Structural damage (Basin E13).

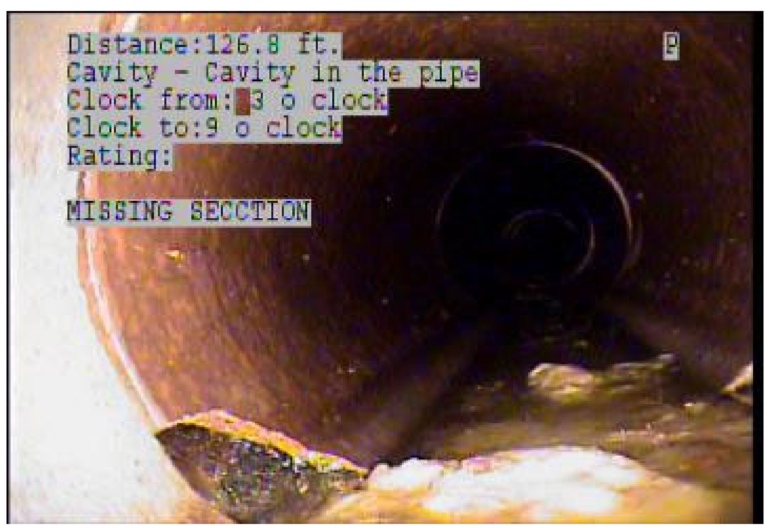

Photo 52: Structural damage (Basin E13).

Photo 53: Pipe sag (Basin E13).

Photo 54: Structural damage (Basin E13).

Photo 55: Structural damage (crack) (Basin E13).

Photo 56: Protruding lateral (Basin W20).

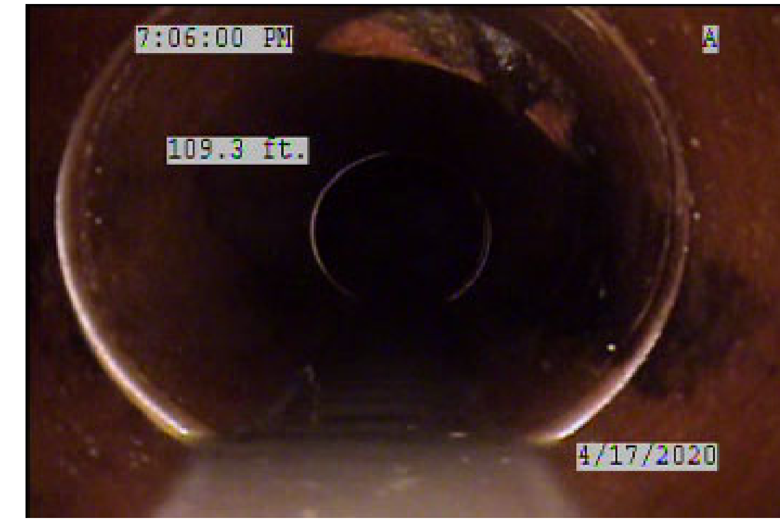

Photo 57: Protruding lateral (Basin W20).

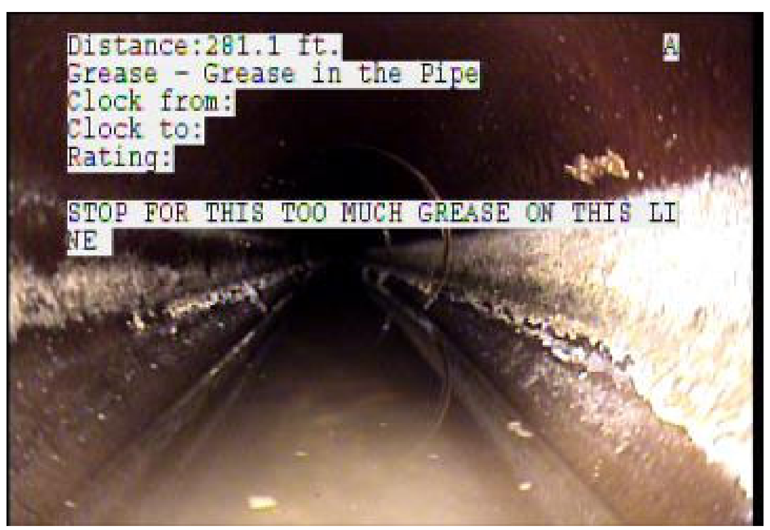

Photo 58: Grease in pipe (Basin W20).

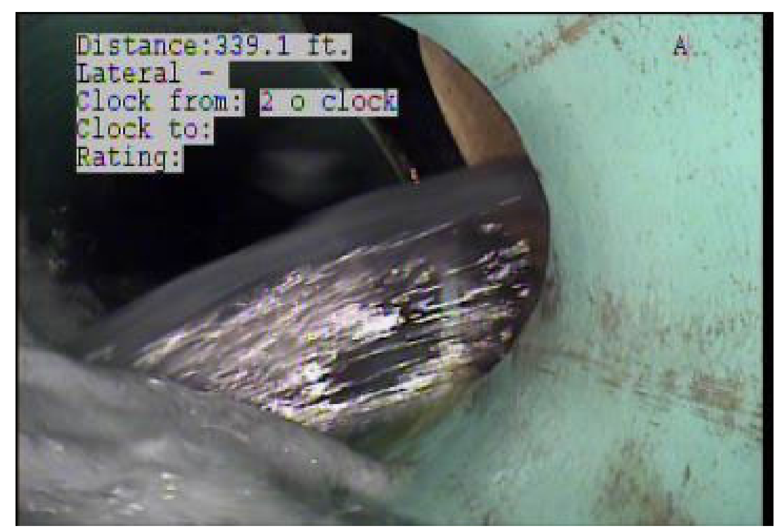

Photo 59: Lateral with high flow (Basin E3).

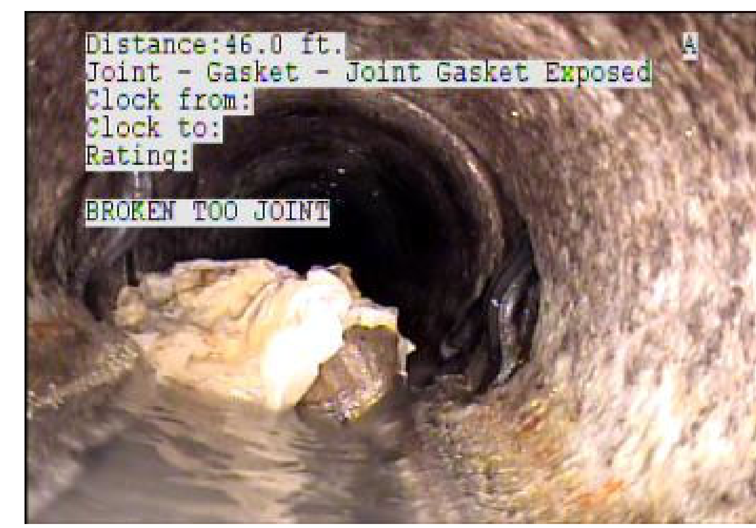

Photo 60: Structural damage (exposed gasket) (Basin E4).

Photo 61: Structural damage (crack in pipe) (Basin E4).

Photo 62: Structural damage (pipe deterioration) (Basin E4).

Photo 63: Protruding lateral (Basin E4).

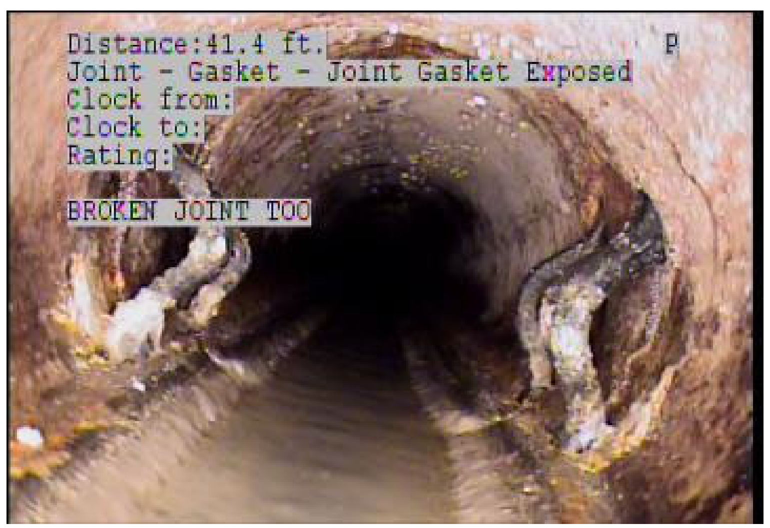

Photo 64: Structural damage (exposed gasket) (Basin E4).

Photo 65: Structural damage (hole in pipe) (Basin E4).

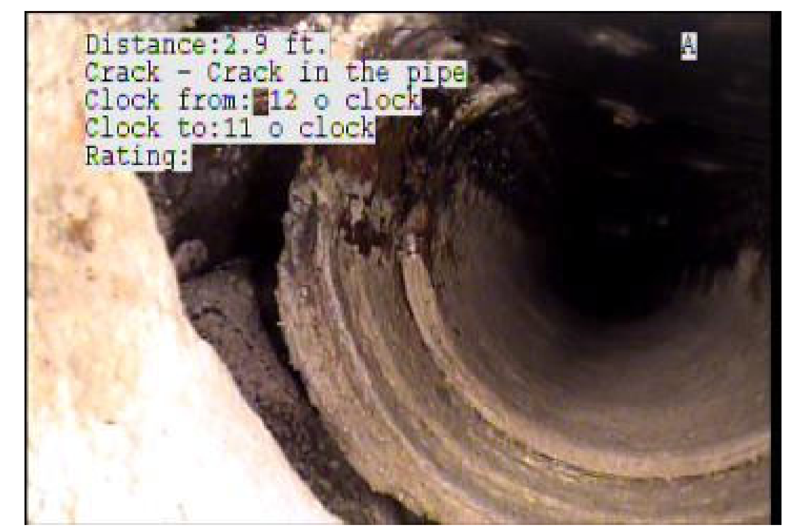

Photo 66: Structural damage (hole in pipe) (Basin E4).

Photo 67: Protruding lateral (Basin E7).

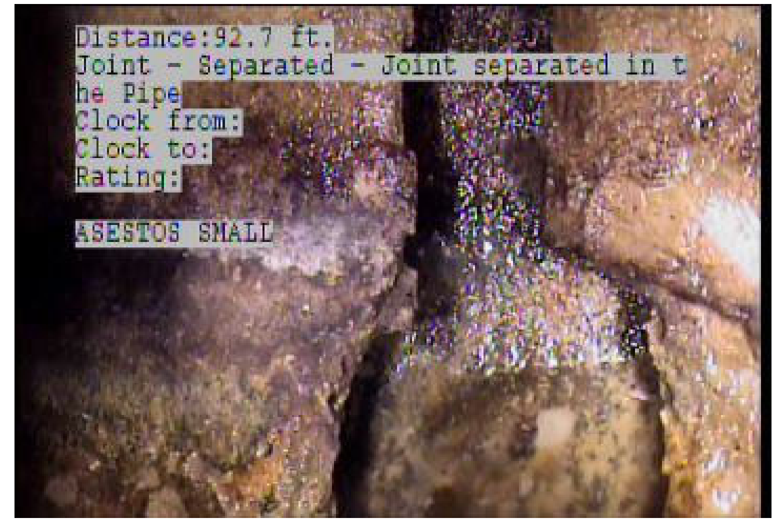

Photo 68: Structural damage (separated joint) (Basin E7).

Photo 69: Large solids deposit at lateral (Basin E7).

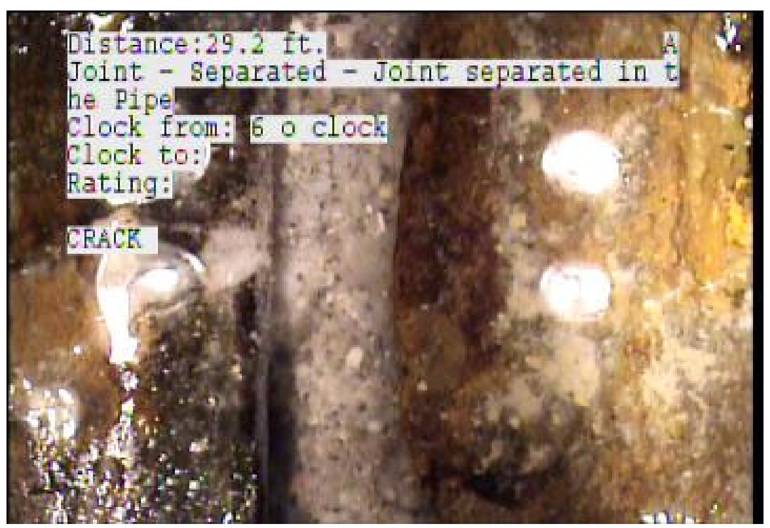

Photo 70: Structural damage (separated joint) (Basin E7).

Photo 71: Pipe material change and offset joint (Basin E7).

Photo 72: Structural damage (crack in pipe) (Basin E10).

Photo 73: Protruding lateral (Basin E10).

Photo 74: Structural damage (Basin E10).

Photo 75: Structural damage (hole in lateral) (Basin E10).

Photo 76: Structural damage (crack in pipe) (Basin E10).

Photo 77: Structural damage (hole in pipe and root intrusion) (Basin E10).

Photo 78: Pipe material change (Basin E10).

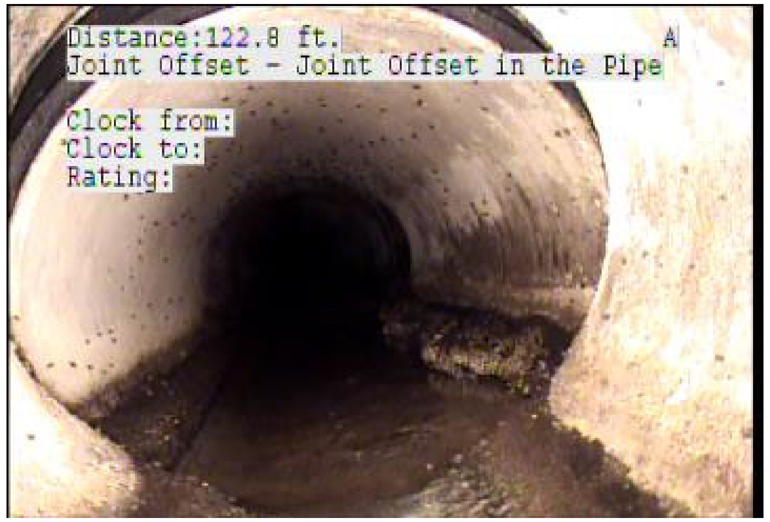

Photo 79: Structual damage (offset joint) (Basin E4).

Photo 80: Root intrusion (Basin E8).

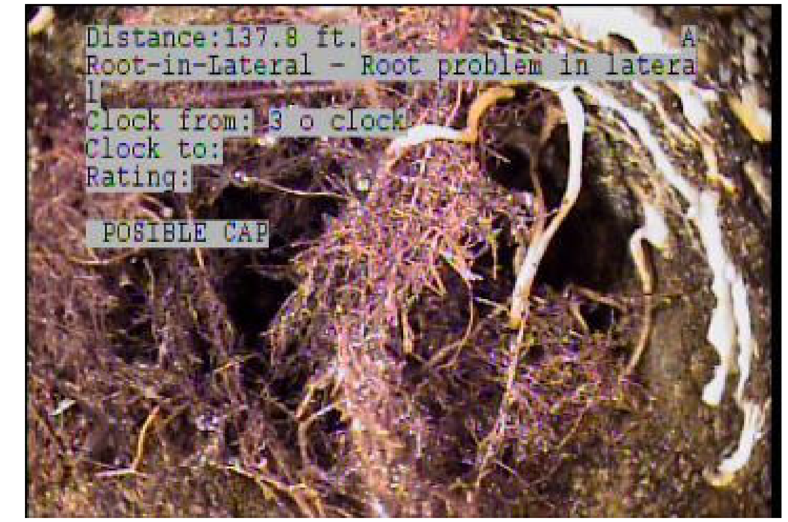

Photo 81: Root intrusion in lateral (Basin E8).

Photo 82: Structural damage (Basin E8).

Photo 83: Root intrusion in lateral (Basin E8).

Photo 84: Protruding lateral (Basin E8).

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CITY OF
HERMISTON, OREGON
SANITARY SEWER COLLECTION SYSTEM STUDY

TELEVISION INSPECTION PHOTOS

APPENDIX F

Photo 85: Structural damage (crack) (Basin E8).

Photo 86: Protruding lateral (Basin E8).

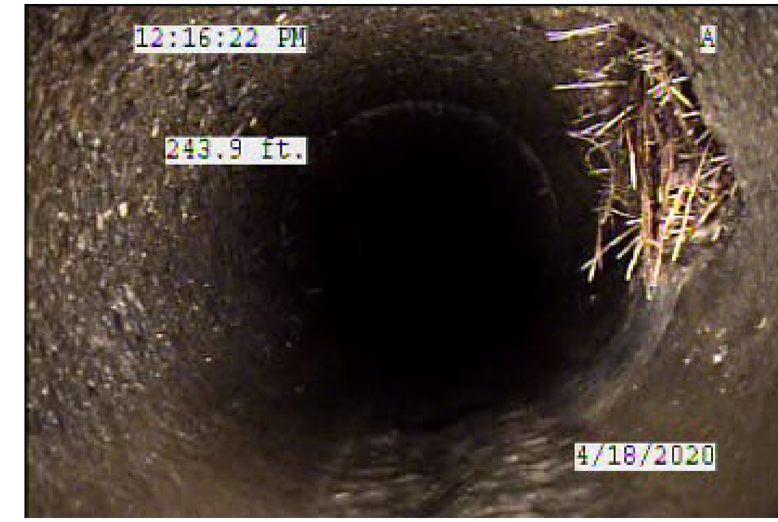


Photo 87: Root intrusion (Basin E7).

Photo 88: Sedimentation in pipe (Basin E7).

Photo 89: Grease buildup in pipe (Basin E7).

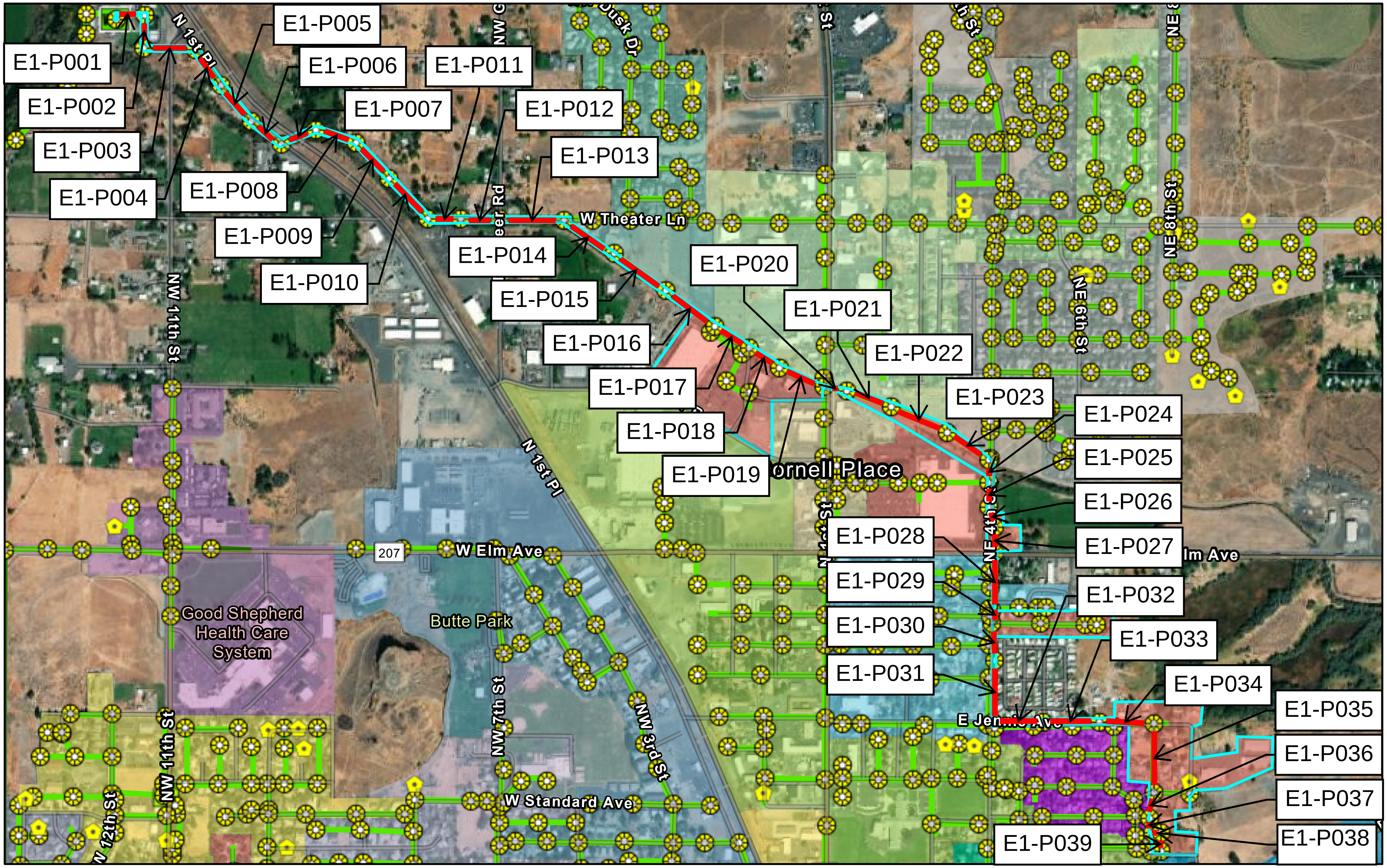
APPENDIX G
Trunkline Analyses Summary

Basin E1

Pipe Capacity											Existing Conditions			Future Conditions		
Facility ID	Material	Diameter D	Slope	Min Slope S_{min}	Manning's n	Depth d	Area A	Hyd. Radius R_h	Flow Capacity Q_{cap}		Flow Q_{EX}	Peak Hourly Flow $Q_{EX,P}$	Capacity Utilization	Flow Q_{FT}	Peak Hourly Flow $Q_{EX,P}$	Capacity Utilization
-	-	(in)	(ft/ft)	(ft/ft)	-	(in)	(in^2)	(in)	(gpm)	(gpd)	(gpd)	(gpm)	-	(gpd)	(gpm)	-
E1-P039	Reinforced Concrete	15"	0.0409	N/A	0.013	12.0	151.6	4.6	5,730	8,251,901	306,599	574.9	0.11 - OK	952,260	1,719.4	0.31 - OK
E1-P038	Reinforced Concrete	15"	0.0519	N/A	0.013	12.0	151.6	4.6	6,456	9,296,109	306,599	574.9	0.09 - OK	952,260	1,719.4	0.27 - OK
E1-P037	Reinforced Concrete	15"	0.0783	N/A	0.013	12.0	151.6	4.6	7,929	11,418,343	306,599	574.9	0.08 - OK	952,260	1,719.4	0.22 - OK
E1-P036	Reinforced Concrete	15"	0.0783	N/A	0.013	12.0	151.6	4.6	7,929	11,418,343	306,599	574.9	0.08 - OK	952,260	1,719.4	0.22 - OK
E1-P035	Reinforced Concrete	27"		0.0007	0.013	21.6	491.0	8.2	3,595	5,176,569	306,599	574.9	0.16 - OK	952,260	1,719.4	0.48 - OK
E1-P034	Reinforced Concrete	27"		0.0007	0.013	21.6	491.0	8.2	3,595	5,176,569	314,605	589.9	0.17 - OK	977,673	1,765.2	0.5 - OK
E1-P033	Reinforced Concrete	27"		0.0007	0.013	21.6	491.0	8.2	3,595	5,176,569	314,605	589.9	0.17 - OK	977,673	1,765.2	0.5 - OK
E1-P032	Reinforced Concrete	27"		0.0007	0.013	21.6	491.0	8.2	3,595	5,176,569	314,605	589.9	0.17 - OK	977,673	1,765.2	0.5 - OK
E1-P031	Reinforced Concrete	36"		0.0005	0.013	28.8	873.0	11.0	6,543	9,422,105	404,746	758.9	0.12 - OK	1,067,814	1,928.0	0.3 - OK
E1-P030	Reinforced Concrete	36"		0.0005	0.013	28.8	873.0	11.0	6,543	9,422,105	404,746	758.9	0.12 - OK	1,067,814	1,928.0	0.3 - OK
E1-P029	Reinforced Concrete	36"		0.0005	0.013	28.8	873.0	11.0	6,543	9,422,105	411,254	771.1	0.12 - OK	1,074,322	1,939.7	0.3 - OK
E1-P028	Reinforced Concrete	36"		0.0005	0.013	28.8	873.0	11.0	6,543	9,422,105	411,254	771.1	0.12 - OK	1,074,322	1,939.7	0.3 - OK
E1-P027	Reinforced Concrete	36"		0.0005	0.013	28.8	873.0	11.0	6,543	9,422,105	411,254	771.1	0.12 - OK	1,115,644	2,014.4	0.31 - OK
E1-P026	Reinforced Concrete	36"		0.0005	0.013	28.8	873.0	11.0	6,543	9,422,105	411,254	771.1	0.12 - OK	1,115,644	2,014.4	0.31 - OK
E1-P025	Reinforced Concrete	36"		0.0005	0.013	28.8	873.0	11.0	6,543	9,422,105	411,254	771.1	0.12 - OK	1,115,644	2,014.4	0.31 - OK
E1-P024	Reinforced Concrete	36"		0.0005	0.013	28.8	873.0	11.0	6,543	9,422,105	419,957	787.4	0.13 - OK	1,124,347	2,030.1	0.32 - OK
E1-P023	Reinforced Concrete	36"		0.0005	0.013	28.8	873.0	11.0	6,543	9,422,105	478,342	896.9	0.14 - OK	1,182,732	2,135.5	0.33 - OK
E1-P022	Reinforced Concrete	36"		0.0005	0.013	28.8	873.0	11.0	6,543	9,422,105	478,342	896.9	0.14 - OK	1,182,732	2,135.5	0.33 - OK
E1-P021	Reinforced Concrete	36"		0.0005	0.013	28.8	873.0	11.0	6,543	9,422,105	478,342	896.9	0.14 - OK	1,182,732	2,135.5	0.33 - OK
E1-P020	Reinforced Concrete	36"		0.0005	0.013	28.8	873.0	11.0	6,543	9,422,105	478,342	896.9	0.14 - OK	1,182,732	2,135.5	0.33 - OK
E1-P019	Reinforced Concrete	36"		0.0005	0.013	28.8	873.0	11.0	6,543	9,422,105	537,342	1,007.5	0.16 - OK	1,241,733	2,242.0	0.35 - OK
E1-P018	Reinforced Concrete	36"		0.0005	0.013	28.8	873.0	11.0	6,543	9,422,105	537,342	1,007.5	0.16 - OK	1,241,733	2,242.0	0.35 - OK
E1-P017	Reinforced Concrete	36"		0.0005	0.013	28.8	873.0	11.0	6,543	9,422,105	537,342	1,007.5	0.16 - OK	1,241,733	2,242.0	0.35 - OK
E1-P016	Reinforced Concrete	36"		0.0005	0.013	28.8	873.0	11.0	6,543	9,422,105	544,729	1,021.4	0.16 - OK	1,249,119	2,255.4	0.35 - OK
E1-P015	Reinforced Concrete	36"		0.0005	0.013	28.8	873.0	11.0	6,543	9,422,105	544,729	1,021.4	0.16 - OK	1,249,119	2,255.4	0.35 - OK
E1-P014	Reinforced Concrete	36"		0.0005	0.013	28.8	873.0	11.0	6,543	9,422,105	544,729	1,021.4	0.16 - OK	1,249,119	2,255.4	0.35 - OK
E1-P013	Reinforced Concrete	36"		0.0005	0.013	28.8	873.0	11.0	6,543	9,422,105	575,745	1,079.5	0.17 - OK	1,280,135	2,311.4	0.36 - OK
E1-P012	Reinforced Concrete	36"		0.0005	0.013	28.8	873.0	11.0	6,543	9,422,105	575,745	1,079.5	0.17 - OK	1,280,135	2,311.4	0.36 - OK
E1-P011	Reinforced Concrete	36"		0.0005	0.013	28.8	873.0	11.0	6,543	9,422,105	575,745	1,079.5	0.17 - OK	1,280,135	2,311.4	0.36 - OK
E1-P010	Reinforced Concrete	36"		0.0005	0.013	28.8	873.0	11.0	6,543	9,422,105	575,745	1,079.5	0.17 - OK	1,280,135	2,311.4	0.36 - OK
E1-P009	Reinforced Concrete	36"		0.0005	0.013	28.8	873.0	11.0	6,543	9,422,105	575,745	1,079.5	0.17 - OK	1,280,135	2,311.4	0.36 - OK
E1-P008	Reinforced Concrete	36"		0.0005	0.013	28.8	873.0	11.0	6,543	9,422,105	575,745	1,079.5	0.17 - OK	1,280,135	2,311.4	0.36 - OK
E1-P007	Reinforced Concrete	36"		0.0005	0.013	28.8	873.0	11.0	6,543	9,422,105	575,745	1,079.5	0.17 - OK	1,361,747	2,458.7	0.38 - OK
E1-P006	Reinforced Concrete	36"		0.0005	0.013	28.8	873.0	11.0	6,543	9,422,105	575,745	1,079.5	0.17 - OK	1,361,747	2,458.7	0.38 - OK
E1-P005	Reinforced Concrete	36"		0.0005	0.013	28.8	873.0	11.0	6,543	9,422,105	575,745	1,079.5	0.17 - OK	1,361,747	2,458.7	0.38 - OK
E1-P004	Reinforced Concrete	36"		0.0005	0.013	28.8	873.0	11.0	6,543	9,422,105	575,745	1,079.5	0.17 - OK	1,361,747	2,458.7	0.38 - OK
E1-P003	Reinforced Concrete	36"		0.0005	0.013	28.8	873.0	11.0	6,543	9,422,105	575,745	1,079.5	0.17 - OK	1,382,408	2,496.0	0.39 - OK
E1-P002	Reinforced Concrete	36"		0.0005	0.013	28.8	873.0	11.0	6,543	9,422,105	575,745	1,079.5	0.17 - OK	1,382,408	2,496.0	0.39 - OK
E1-P001	Reinforced Concrete	36"		0.0005	0.013	28.8	873.0	11.0	6,543	9,422,105	575,745	1,079.5	0.17 - OK	1,382,408	2,496.0	0.39 - OK

ft/ft = feet per foot
gpd = gallons per day
gpm = gallons per minute
in = inches
in^2 = square inch

Basin E1



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ssCleanOut
ssManhole
ssNetworkStructure
Lift Station
Treatment Plant
ssGravityMain
ssPressurizedMain

ssBasin: E1, E10, E11, E2, E3, E4, E5, E6, E7, E8, E9, W1, W10, W11, W18, W2, W21, W3, W9

1:19,056

0 500 1,000 2,000 ft
0 187.5 375 750 m

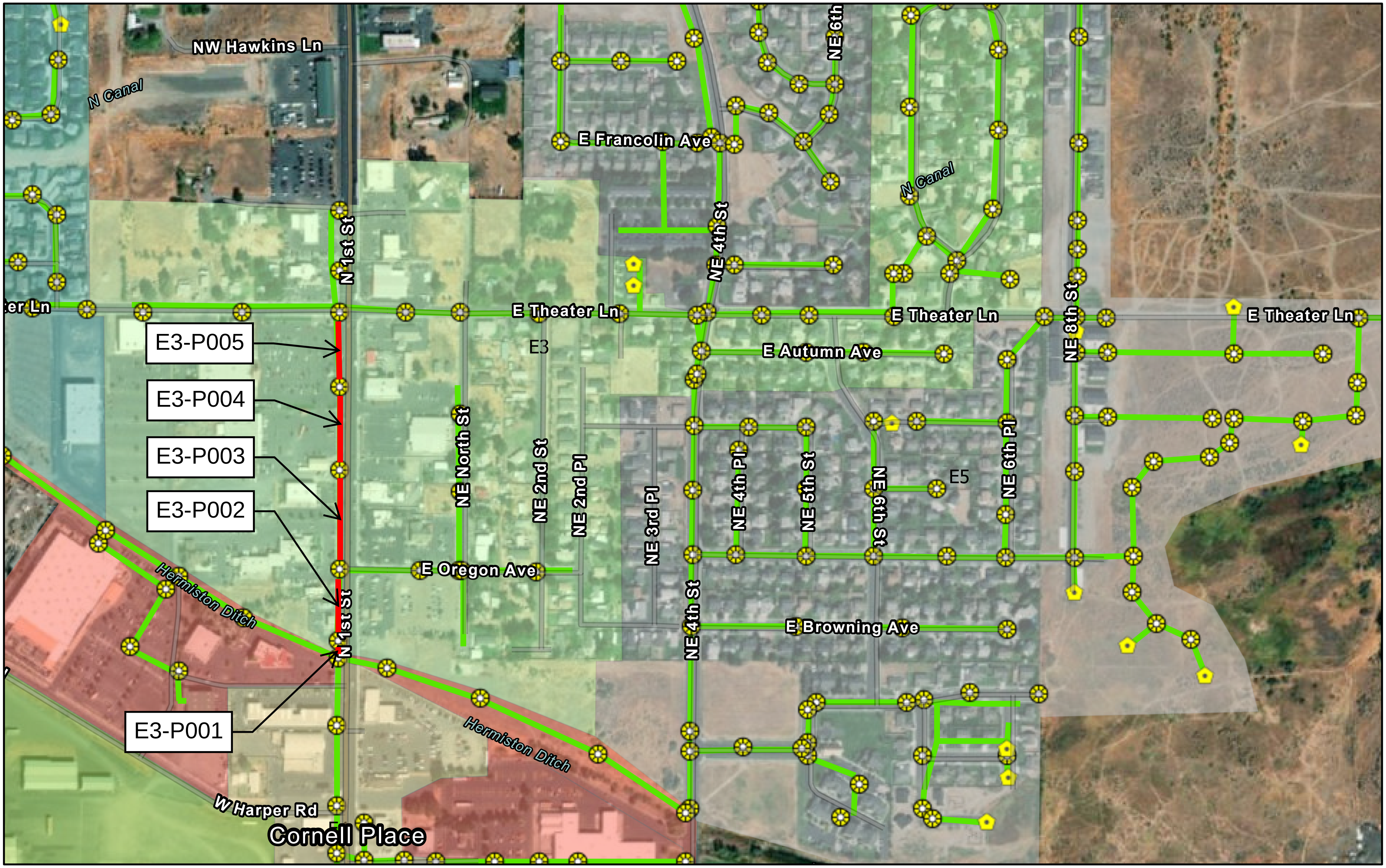
Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA FSA, GeoEye, Maxar, CNES/Airbus DS | Oregon Statewide Imagery Program (OSIP) - Oregon Imagery Framework Implementation Team | Esri Community Maps Contributors, State of Oregon GEO, WA State Parks GIS, Esri, HERE, Garmin, SafeGraph, City of Hermiston

Basin E3

Pipe Capacity											Existing Conditions			Future Conditions		
Facility ID	Material	Diameter, D	Slope	Min Slope, S_{min}	Manning's n	Depth, d	Area, A	Hyd. Radius, Rh	Flow Capacity, Q_{cap}		Flow, Q_{EX}	Peak Hourly Flow, $Q_{EX.P}$	Capacity Utilization	Flow, Q_{FT}	Peak Hourly Flow, $Q_{EX.P}$	Capacity Utilization
-	-	(in)	(ft/ft)	(ft/ft)	-	(in)	(in^2)	(in)	(gpm)	(gpd)	(gpd)	(gpm)	-	(gpd)	(gpm)	-
E3-P005	Asbestos Cement	8"		0.0040	0.012	6.4	43.1	2.4	363	523,064	50,333	94.4	0.26 - OK	103,409	186.7	0.52 - OK
E3-P004	Asbestos Cement	8"		0.0040	0.012	6.4	43.1	2.4	363	523,064	50,333	94.4	0.26 - OK	103,409	186.7	0.52 - OK
E3-P003	Asbestos Cement	8"		0.0040	0.012	6.4	43.1	2.4	363	523,064	50,333	94.4	0.26 - OK	103,409	186.7	0.52 - OK
E3-P002	Asbestos Cement	8"		0.0040	0.012	6.4	43.1	2.4	363	523,064	50,333	94.4	0.26 - OK	103,409	186.7	0.52 - OK
E3-P001	Asbestos Cement	8"		0.0040	0.012	6.4	43.1	2.4	363	523,064	50,333	94.4	0.26 - OK	103,409	186.7	0.52 - OK

ft/ft = feet per foot
gpd = gallons per day
gpm = gallons per minute
in = inches
in^2 = square inch

Basin E3



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ssCleanOut — ssGravityMain — E2 — E5

ssManhole — ssBasin — E3 — E6

E1 — E4 — E8

1:9,028

0 287.5 575 1,150 ft

0 87.5 175 350 m

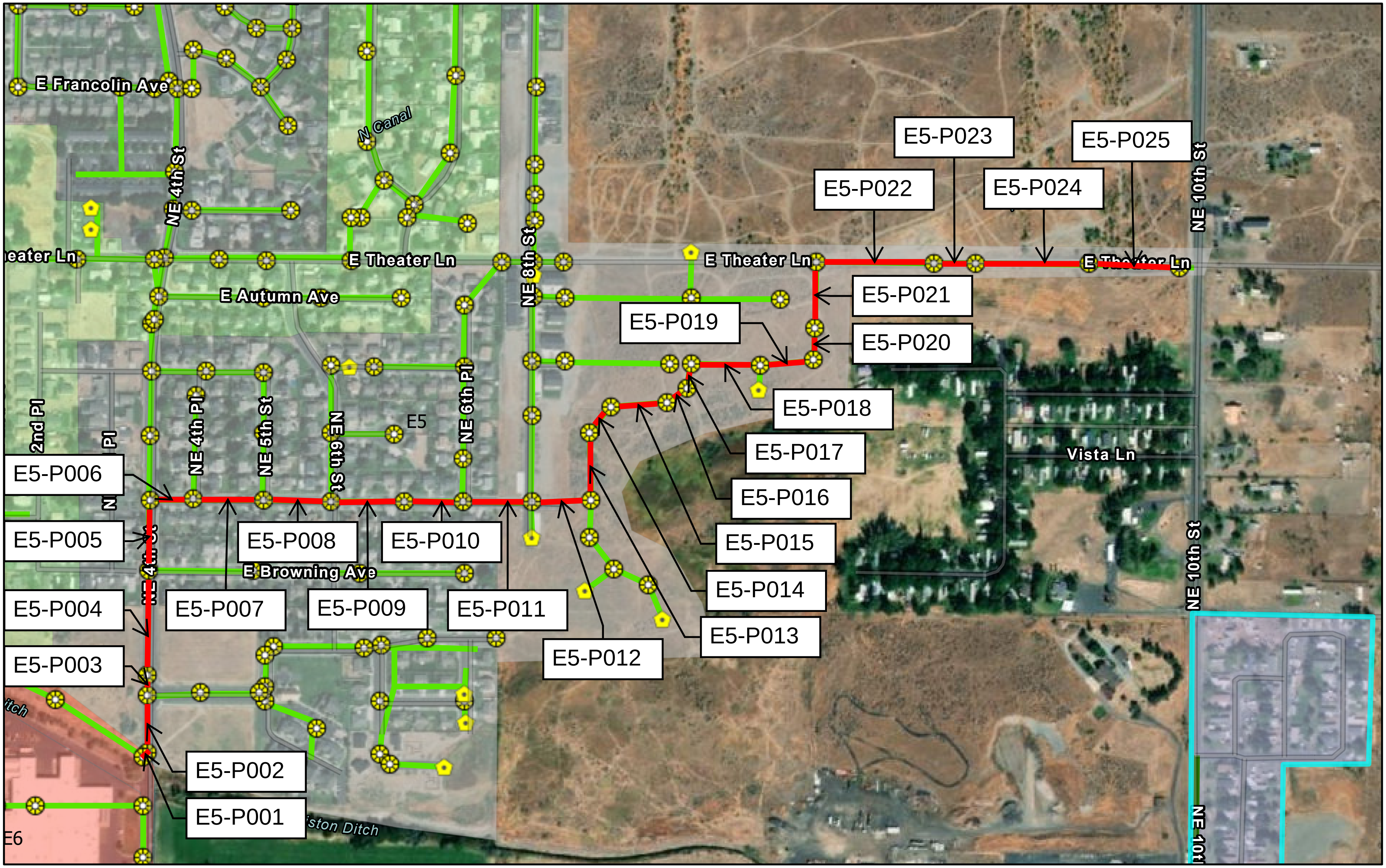
Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA FSA, GeoEye, Maxar, CNES/Airbus DS | Oregon Statewide Imagery Program (OSIP) - Oregon Imagery Framework Implementation Team | Esri Community Maps Contributors, State of Oregon GEO, WA State Parks GIS, BuildingFootprintUSA, Esri, HERE, City of Hermiston

Basin E5

Pipe Capacity											Existing Conditions			Future Conditions		
Facility ID	Material	Diameter, D	Slope	Min Slope, S_{min}	Manning's n	Depth, d	Area, A	Hyd. Radius, Rh	Flow Capacity, Q_{cap}		Flow, Q_{EX}	Peak Hourly Flow, $Q_{EX.P}$	Capacity Utilization	Flow, Q_{FT}	Peak Hourly Flow, $Q_{EX.P}$	Capacity Utilization
-	-	(in)	(ft/ft)	(ft/ft)	-	(in)	(in^2)	(in)	(gpm)	(gpd)	(gpd)	(gpm)	-	(gpd)	(gpm)	-
E5-P025	Polyvinyl Chloride	12"		0.0022	0.013	9.6	97.0	3.7	733	1,055,725	0	0.0	0 - OK	230,455	416.1	0.57 - OK
E5-P024	Polyvinyl Chloride	12"		0.0022	0.013	9.6	97.0	3.7	733	1,055,725	0	0.0	0 - OK	230,455	416.1	0.57 - OK
E5-P023	Polyvinyl Chloride	12"		0.0022	0.013	9.6	97.0	3.7	733	1,055,725	0	0.0	0 - OK	230,455	416.1	0.57 - OK
E5-P022	Polyvinyl Chloride	12"		0.0022	0.013	9.6	97.0	3.7	733	1,055,725	0	0.0	0 - OK	230,455	416.1	0.57 - OK
E5-P021	Polyvinyl Chloride	12"		0.0022	0.013	9.6	97.0	3.7	733	1,055,725	0	0.0	0 - OK	247,445	446.8	0.61 - OK
E5-P020	Polyvinyl Chloride	12"		0.0022	0.013	9.6	97.0	3.7	733	1,055,725	0	0.0	0 - OK	247,445	446.8	0.61 - OK
E5-P019	Polyvinyl Chloride	12"		0.0022	0.013	9.6	97.0	3.7	733	1,055,725	0	0.0	0 - OK	247,445	446.8	0.61 - OK
E5-P018	Polyvinyl Chloride	12"		0.0022	0.013	9.6	97.0	3.7	733	1,055,725	0	0.0	0 - OK	247,445	446.8	0.61 - OK
E5-P017	Polyvinyl Chloride	12"		0.0022	0.013	9.6	97.0	3.7	733	1,055,725	0	0.0	0 - OK	247,445	446.8	0.61 - OK
E5-P016	Polyvinyl Chloride	12"		0.0022	0.013	9.6	97.0	3.7	733	1,055,725	0	0.0	0 - OK	247,445	446.8	0.61 - OK
E5-P015	Polyvinyl Chloride	12"		0.0022	0.013	9.6	97.0	3.7	733	1,055,725	0	0.0	0 - OK	247,445	446.8	0.61 - OK
E5-P014	Polyvinyl Chloride	12"		0.0022	0.013	9.6	97.0	3.7	733	1,055,725	0	0.0	0 - OK	247,445	446.8	0.61 - OK
E5-P013	Polyvinyl Chloride	12"		0.0022	0.013	9.6	97.0	3.7	733	1,055,725	0	0.0	0 - OK	247,445	446.8	0.61 - OK
E5-P012	Polyvinyl Chloride	12"		0.0022	0.013	9.6	97.0	3.7	733	1,055,725	0	0.0	0 - OK	247,445	446.8	0.61 - OK
E5-P011	Polyvinyl Chloride	12"		0.0022	0.013	9.6	97.0	3.7	733	1,055,725	0	0.0	0 - OK	247,445	446.8	0.61 - OK
E5-P010	Polyvinyl Chloride	12"		0.0022	0.013	9.6	97.0	3.7	733	1,055,725	11,446	21.5	0.03 - OK	258,892	467.4	0.64 - OK
E5-P009	Polyvinyl Chloride	12"		0.0022	0.013	9.6	97.0	3.7	733	1,055,725	11,446	21.5	0.03 - OK	258,892	467.4	0.64 - OK
E5-P008	Polyvinyl Chloride	12"		0.0022	0.013	9.6	97.0	3.7	733	1,055,725	17,572	32.9	0.05 - OK	265,018	478.5	0.66 - OK
E5-P007	Polyvinyl Chloride	12"		0.0022	0.013	9.6	97.0	3.7	733	1,055,725	17,572	32.9	0.05 - OK	265,018	478.5	0.66 - OK
E5-P006	Polyvinyl Chloride	12"		0.0022	0.013	9.6	97.0	3.7	733	1,055,725	17,572	32.9	0.05 - OK	265,018	478.5	0.66 - OK
E5-P005	Polyvinyl Chloride	24"		0.0008	0.013	19.2	388.0	7.3	2,807	4,042,325	58,385	109.5	0.04 - OK	329,978	595.8	0.22 - OK
E5-P004	Polyvinyl Chloride	24"		0.0008	0.013	19.2	388.0	7.3	2,807	4,042,325	58,385	109.5	0.04 - OK	329,978	595.8	0.22 - OK
E5-P003	Polyvinyl Chloride	24"		0.0008	0.013	19.2	388.0	7.3	2,807	4,042,325	58,385	109.5	0.04 - OK	329,978	595.8	0.22 - OK
E5-P002	Polyvinyl Chloride	24"		0.0008	0.013	19.2	388.0	7.3	2,807	4,042,325	58,385	109.5	0.04 - OK	329,978	595.8	0.22 - OK
E5-P001	Polyvinyl Chloride	24"		0.0008	0.013	19.2	388.0	7.3	2,807	4,042,325	58,385	109.5	0.04 - OK	329,978	595.8	0.22 - OK

ft/ft = feet per foot
gpd = gallons per day
gpm = gallons per minute
in = inches
in^2 = square inch

Basin E5



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ssCleanOut ssGravityMain ssBasin E3
ssManhole ssPressurizedMain E1 E5
E15 E6

1:9,028

0 287.5 575 1,150 ft

0 87.5 175 350 m

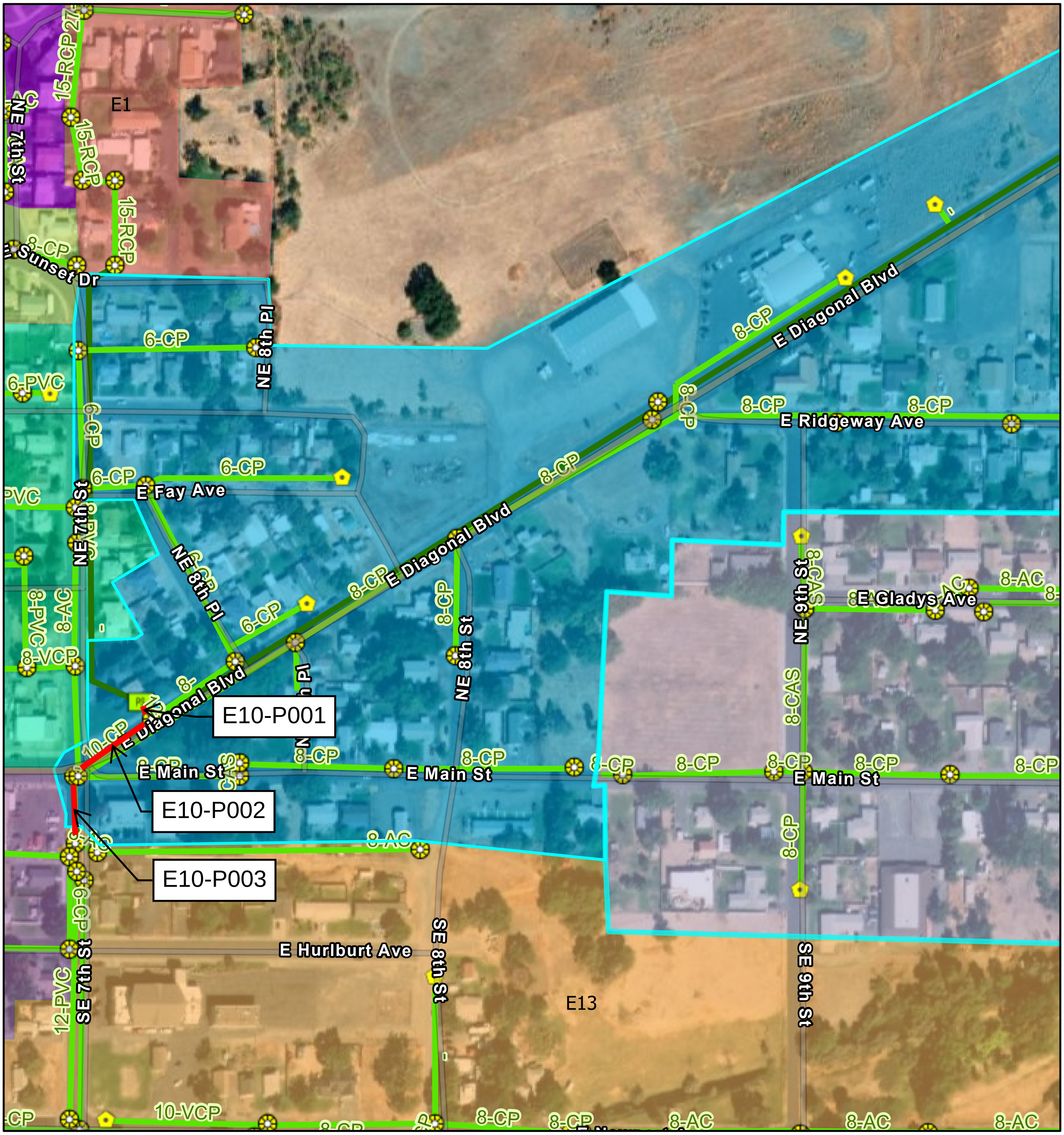
Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA FSA, GeoEye, Maxar, CNES/Airbus DS | Oregon Statewide Imagery Program (OSIP) - Oregon Imagery Framework Implementation Team | Esri Community Maps Contributors, State of Oregon GEO, WA State Parks GIS, BuildingFootprintUSA, Esri, HERE, City of Hermiston

Basin E10

Pipe Capacity											Existing Conditions			Future Conditions		
Facility ID	Material	Diameter, D	Slope	Min Slope, S_{min}	Manning's n	Depth, d	Area, A	Hyd. Radius, Rh	Flow Capacity, Q_{cap}		Flow, Q_{EX}	Peak Hourly Flow, $Q_{EX.P}$	Capacity Utilization	Flow, Q_{FT}	Peak Hourly Flow, $Q_{EX.P}$	Capacity Utilization
-	-	(in)	(ft/ft)	(ft/ft)	-	(in)	(in^2)	(in)	(gpm)	(gpd)	(gpd)	(gpm)	-	(gpd)	(gpm)	-
E10-P003	Concrete Pipe	10"		0.0028	0.015	8.0	67.4	3.0	441	634,776	207,120	388.4	0.89 - OK	475,715	858.9	1.95 - NG
E10-P002	Concrete Pipe	10"		0.0028	0.015	8.0	67.4	3.0	441	634,776	207,120	388.4	0.89 - OK	475,715	858.9	1.95 - NG
E10-P001	Polyvinyl Chloride	12"		0.0022	0.013	9.6	97.0	3.7	733	1,055,725	306,599	574.9	0.79 - OK	952,260	1,719.4	2.35 - NG

ft/ft = feet per foot
gpd = gallons per day
gpm = gallons per minute
in = inches
in^2 = square inch
NG = Not Good
= assumed pipe material

Basin E10



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ssCleanOut
ssManhole
ssNetworkStructure
Lift Station
ssGravityMain
ssPressurizedMain
ssBasin
E1
E10
E11
E12
E13
E15
E8
E9

1:4,514

0 145 290 580 ft

0 40 80 160 m

Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community, Sources: Esri, HERE, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community

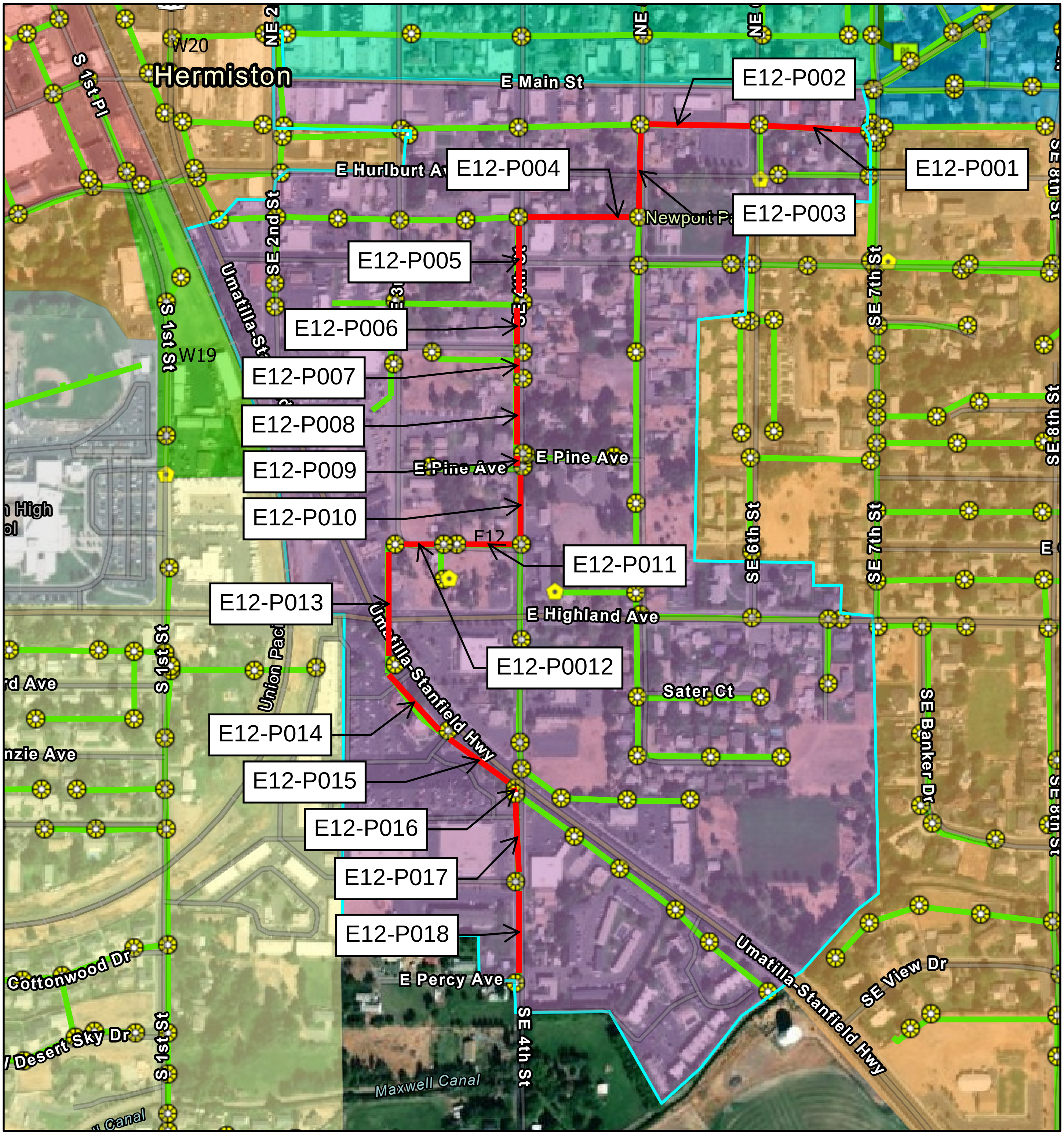
City of Hermiston
USDA FSA, GeoEye, Maxar | Oregon Statewide Imagery Program (OSIP) - Oregon Imagery Framework Implementation Team | Esri Community Maps Contributors, State of Oregon GEO, WA State

Basin E12

Pipe Capacity											Existing Conditions			Future Conditions		
Facility ID	Material	Diameter, D	Slope	Min Slope, S_{min}	Manning's n	Depth, d	Area, A	Hyd. Radius, Rh	Flow Capacity, Q_{cap}		Flow, Q_{EX}	Peak Hourly Flow, $Q_{EX.P}$	Capacity Utilization	Flow, Q_{FT}	Peak Hourly Flow, $Q_{EX.P}$	Capacity Utilization
-	-	(in)	(ft/ft)	(ft/ft)	-	(in)	(in^2)	(in)	(gpm)	(gpd)	(gpd)	(gpm)	-	(gpd)	(gpm)	-
E12-P018	Polyvinyl Chloride	8"		0.0040	0.013	6.4	43.1	2.4	335	482,829	16,260	30.5	0.1 - OK	112,335	202.8	0.61 - OK
E12-P017	Polyvinyl Chloride	8"		0.0040	0.013	6.4	43.1	2.4	335	482,829	16,260	30.5	0.1 - OK	112,335	202.8	0.61 - OK
E12-P016	Polyvinyl Chloride	8"		0.0040	0.013	6.4	43.1	2.4	335	482,829	16,260	30.5	0.1 - OK	112,335	202.8	0.61 - OK
E12-P015	Concrete Pipe	8"		0.0040	0.015	6.4	43.1	2.4	291	418,451	16,260	30.5	0.11 - OK	112,335	202.8	0.7 - OK
E12-P014	Concrete Pipe	8"		0.0040	0.015	6.4	43.1	2.4	291	418,451	16,260	30.5	0.11 - OK	112,335	202.8	0.7 - OK
E12-P013	Concrete Pipe	8"		0.0040	0.015	6.4	43.1	2.4	291	418,451	16,260	30.5	0.11 - OK	112,335	202.8	0.7 - OK
E12-P012	Concrete Pipe	8"		0.0040	0.015	6.4	43.1	2.4	291	418,451	16,260	30.5	0.11 - OK	112,335	202.8	0.7 - OK
E12-P011	Vitrified Clay	8"		0.0040	0.013	6.4	43.1	2.4	335	482,829	16,260	30.5	0.1 - OK	112,335	202.8	0.61 - OK
E12-P010	Vitrified Clay	8"		0.0040	0.013	6.4	43.1	2.4	335	482,829	39,019	73.2	0.22 - OK	135,093	243.9	0.73 - OK
E12-P009	Vitrified Clay	8"		0.0040	0.013	6.4	43.1	2.4	335	482,829	39,019	73.2	0.22 - OK	135,093	243.9	0.73 - OK
E12-P008	Vitrified Clay	8"		0.0040	0.013	6.4	43.1	2.4	335	482,829	39,019	73.2	0.22 - OK	135,093	243.9	0.73 - OK
E12-P007	Vitrified Clay	8"		0.0040	0.013	6.4	43.1	2.4	335	482,829	39,019	73.2	0.22 - OK	135,093	243.9	0.73 - OK
E12-P006	Vitrified Clay	8"		0.0040	0.013	6.4	43.1	2.4	335	482,829	39,019	73.2	0.22 - OK	135,093	243.9	0.73 - OK
E12-P005	Vitrified Clay	8"		0.0040	0.013	6.4	43.1	2.4	335	482,829	39,019	73.2	0.22 - OK	135,093	243.9	0.73 - OK
E12-P004	Vitrified Clay	8"		0.0040	0.013	6.4	43.1	2.4	335	482,829	39,019	73.2	0.22 - OK	135,093	243.9	0.73 - OK
E12-P003	Vitrified Clay	8"		0.0040	0.013	6.4	43.1	2.4	335	482,829	66,374	124.5	0.38 - OK	162,448	293.3	0.88 - OK
E12-P002	Vitrified Clay	8"		0.0040	0.013	6.4	43.1	2.4	335	482,829	66,374	124.5	0.38 - OK	162,448	293.3	0.88 - OK
E12-P001	Vitrified Clay	8"		0.0040	0.013	6.4	43.1	2.4	335	482,829	66,374	124.5	0.38 - OK	162,448	293.3	0.88 - OK

ft/ft = feet per foot
gpd = gallons per day
gpm = gallons per minute
in = inches
in^2 = square inch

Basin E12



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ssCleanOut
ssManhole
ssNetworkStructure
Lift Station
ssGravityMain
ssPressurizedMain
ssBasin
E10
E11
E12
E13
W1
W15
W16
W17
W19
W20

1:9,028

0 287.5 575 1,150 ft

0 87.5 175 350 m

Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community, Sources: Esri, HERE, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community

City of Hermiston

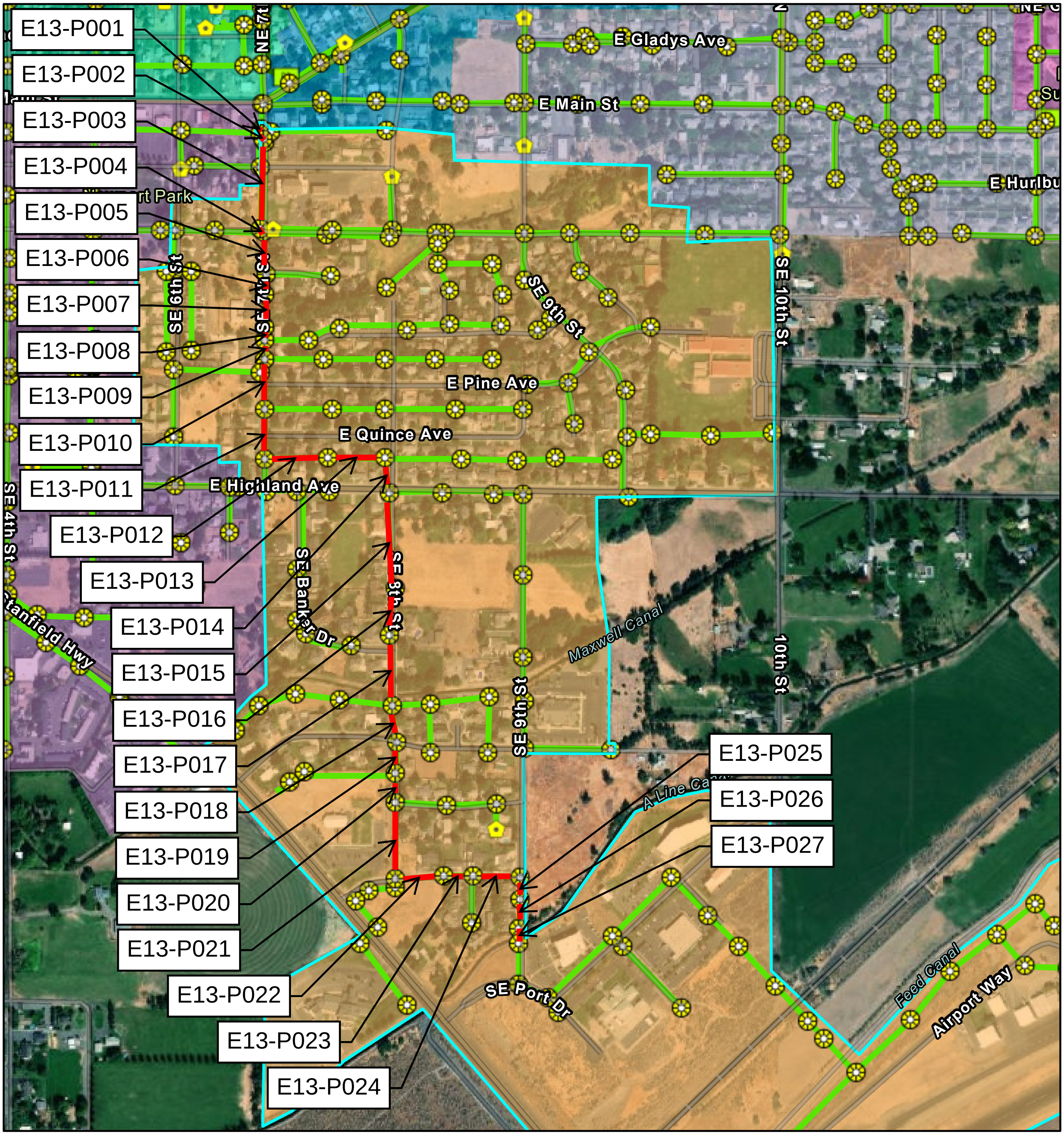
USDA FSA, GeoEye, Maxar, CNES/Airbus DS | Oregon Statewide Imagery Program (OSIP) - Oregon Imagery Framework Implementation Team | Esri Community Maps Contributors, State of Oregon

Basin E13

Pipe Capacity											Existing Conditions			Future Conditions		
Facility ID	Material	Diameter, D	Slope	Min Slope, S_{min}	Manning's n	Depth, d	Area, A	Hyd. Radius, R_h	Flow Capacity, Q_{cap}		Flow, Q_{EX}	Peak Hourly Flow, $Q_{EX.P}$	Capacity Utilization	Flow, Q_{FT}	Peak Hourly Flow, $Q_{EX.P}$	Capacity Utilization
-	-	(in)	(ft/ft)	(ft/ft)	-	(in)	(in^2)	(in)	(gpm)	(gpd)	(gpd)	(gpm)	-	(gpd)	(gpm)	-
E13-P027	Asbestos Cement	10"		0.0028	0.012	8.0	67.4	3.0	551	793,470	40,000	75.0	0.14 - OK	40,000	72.2	0.14 - OK
E13-P026	Asbestos Cement	10"		0.0028	0.012	8.0	67.4	3.0	551	793,470	40,000	75.0	0.14 - OK	40,000	72.2	0.14 - OK
E13-P025	Asbestos Cement	10"		0.0028	0.012	8.0	67.4	3.0	551	793,470	40,000	75.0	0.14 - OK	40,000	72.2	0.14 - OK
E13-P024	Asbestos Cement	10"		0.0028	0.012	8.0	67.4	3.0	551	793,470	43,099	80.8	0.15 - OK	43,099	77.8	0.15 - OK
E13-P023	Asbestos Cement	10"		0.0028	0.012	8.0	67.4	3.0	551	793,470	43,099	80.8	0.15 - OK	43,099	77.8	0.15 - OK
E13-P022	Asbestos Cement	10"		0.0028	0.012	8.0	67.4	3.0	551	793,470	43,099	80.8	0.15 - OK	43,099	77.8	0.15 - OK
E13-P021	Asbestos Cement	10"		0.0028	0.012	8.0	67.4	3.0	551	793,470	46,198	86.6	0.16 - OK	46,198	83.4	0.16 - OK
E13-P020	Asbestos Cement	10"		0.0028	0.012	8.0	67.4	3.0	551	793,470	48,399	90.7	0.17 - OK	48,399	87.4	0.16 - OK
E13-P019	Asbestos Cement	10"		0.0028	0.012	8.0	67.4	3.0	551	793,470	50,155	94.0	0.18 - OK	50,155	90.6	0.17 - OK
E13-PP018	Asbestos Cement	10"		0.0028	0.012	8.0	67.4	3.0	551	793,470	50,155	94.0	0.18 - OK	50,155	90.6	0.17 - OK
E13-P017	Asbestos Cement	10"		0.0028	0.012	8.0	67.4	3.0	551	793,470	56,043	105.1	0.2 - OK	56,043	101.2	0.19 - OK
E13-P016	Asbestos Cement	10"		0.0028	0.012	8.0	67.4	3.0	551	793,470	56,043	105.1	0.2 - OK	56,043	101.2	0.19 - OK
E13-P015	Asbestos Cement	10"		0.0028	0.012	8.0	67.4	3.0	551	793,470	56,043	105.1	0.2 - OK	56,043	101.2	0.19 - OK
E13-P014	Concrete Pipe	10"		0.0028	0.015	8.0	67.4	3.0	441	634,776	62,448	117.1	0.27 - OK	75,878	137.0	0.32 - OK
E13-P013	Concrete Pipe	10"		0.0028	0.015	8.0	67.4	3.0	441	634,776	65,640	123.1	0.28 - OK	79,070	142.8	0.33 - OK
E13-P012	Concrete Pipe	10"		0.0028	0.015	8.0	67.4	3.0	441	634,776	65,640	123.1	0.28 - OK	79,070	142.8	0.33 - OK
E13-P011	Concrete Pipe	10"		0.0028	0.015	8.0	67.4	3.0	441	634,776	73,905	138.6	0.32 - OK	87,335	157.7	0.36 - OK
E13-P010	Concrete Pipe	10"		0.0028	0.015	8.0	67.4	3.0	441	634,776	77,645	145.6	0.34 - OK	91,074	164.4	0.38 - OK
E13-P009	Concrete Pipe	10"		0.0028	0.015	8.0	67.4	3.0	441	634,776	81,033	151.9	0.35 - OK	94,463	170.6	0.39 - OK
E13-P008	Concrete Pipe	12"		0.0022	0.015	9.6	97.0	3.7	635	914,962	84,452	158.3	0.25 - OK	97,882	176.7	0.28 - OK
E13-P007	Concrete Pipe	12"		0.0022	0.015	9.6	97.0	3.7	635	914,962	84,452	158.3	0.25 - OK	97,882	176.7	0.28 - OK
E13-P006	Concrete Pipe	12"		0.0022	0.015	9.6	97.0	3.7	635	914,962	84,452	158.3	0.25 - OK	97,882	176.7	0.28 - OK
E13-P005	Concrete Pipe	12"		0.0022	0.015	9.6	97.0	3.7	635	914,962	84,452	158.3	0.25 - OK	97,882	176.7	0.28 - OK
E13-P004A	Polyvinyl Chloride	12"		0.0022	0.013	9.6	97.0	3.7	733	1,055,725	138,017	258.8	0.36 - OK	214,463	387.2	0.53 - OK
E13-P003A	Polyvinyl Chloride	12"		0.0022	0.013	9.6	97.0	3.7	733	1,055,725	138,017	258.8	0.36 - OK	214,463	387.2	0.53 - OK
E13-P002	Polyvinyl Chloride	12"		0.0022	0.013	9.6	97.0	3.7	733	1,055,725	138,017	258.8	0.36 - OK	214,463	387.2	0.53 - OK
E13-P001	Polyvinyl Chloride	12"		0.0022	0.013	9.6	97.0	3.7	733	1,055,725	204,390	383.2	0.53 - OK	376,911	680.5	0.93 - OK

ft/ft = feet per foot
gpd = gallons per day
gpm = gallons per minute
in = inches
in^2 = square inch

Basin E13



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ssCleanOut	ssGravityMain	E11	
ssManhole	ssPressurizedMain	E12	
ssNetworkStructure	ssBasin	E13	
Lift Station	E10	E15	
		E16	

1:12,500

0 400 800 1,600 ft

0 120 240 480 m

Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community, Sources: Esri, HERE, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community

City of Hermiston

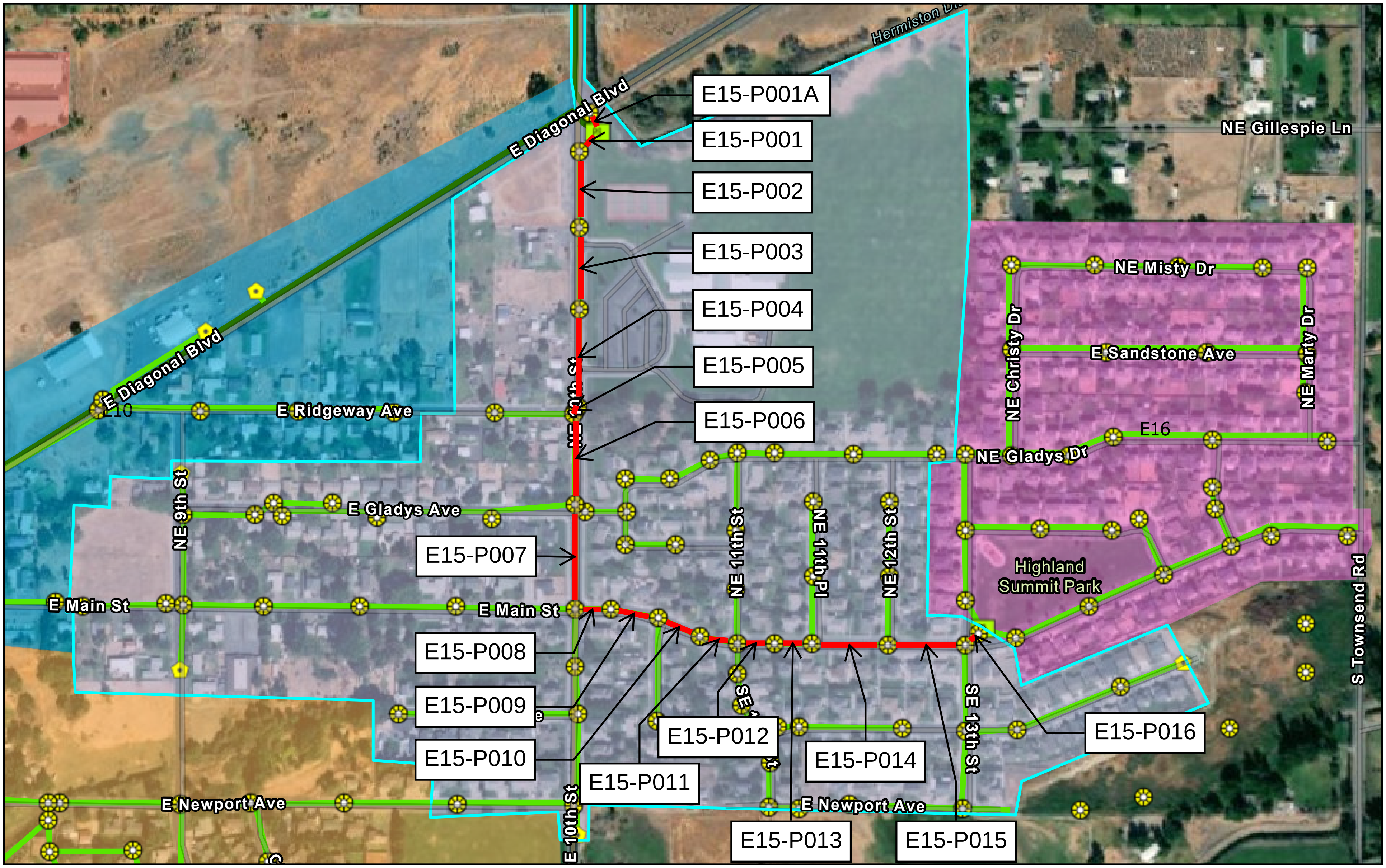
USDA FSA, GeoEye, Maxar, CNES/Airbus DS | Oregon Statewide Imagery Program (OSIP) - Oregon Imagery Framework Implementation Team | Esri Community Maps Contributors, State of Oregon

Basin E15

Pipe Capacity											Existing Conditions			Future Conditions		
Facility ID	Material	Diameter, D	Slope	Min Slope, S_{min}	Manning's n	Depth, d	Area, A	Hyd. Radius, Rh	Flow Capacity, Q_{cap}		Flow, Q_{EX}	Peak Hourly Flow, $Q_{EX.P}$	Capacity Utilization	Flow, Q_{FT}	Peak Hourly Flow, $Q_{EX.P}$	Capacity Utilization
-	-	(in)	(ft/ft)	(ft/ft)	-	(in)	(in^2)	(in)	(gpm)	(gpd)	(gpd)	(gpm)	-	(gpd)	(gpm)	-
E15-P016	Polyvinyl Chloride	8"		0.0040	0.013	6.4	43.1	2.4	335	482,829	19,163	35.9	0.11 - OK	82,180	148.4	0.45 - OK
E15-P015	Polyvinyl Chloride	8"		0.0040	0.013	6.4	43.1	2.4	335	482,829	23,295	43.7	0.14 - OK	187,552	338.6	1.01 - NG
E15-P014	Polyvinyl Chloride	8"		0.0040	0.013	6.4	43.1	2.4	335	482,829	25,553	47.9	0.15 - OK	189,809	342.7	1.03 - NG
E15-P013	Polyvinyl Chloride	8"		0.0040	0.013	6.4	43.1	2.4	335	482,829	27,330	51.2	0.16 - OK	191,586	345.9	1.04 - NG
E15-P012	Polyvinyl Chloride	8"		0.0040	0.013	6.4	43.1	2.4	335	482,829	27,330	51.2	0.16 - OK	191,586	345.9	1.04 - NG
E15-P011	Polyvinyl Chloride	8"		0.0040	0.013	6.4	43.1	2.4	335	482,829	31,204	58.5	0.18 - OK	195,460	352.9	1.06 - NG
E15-P010	Polyvinyl Chloride	8"		0.0040	0.013	6.4	43.1	2.4	335	482,829	31,204	58.5	0.18 - OK	195,460	352.9	1.06 - NG
E15-P009	Polyvinyl Chloride	8"		0.0040	0.013	6.4	43.1	2.4	335	482,829	33,321	62.5	0.19 - OK	197,577	356.7	1.07 - NG
E15-P008	Polyvinyl Chloride	8"		0.0040	0.013	6.4	43.1	2.4	335	482,829	33,321	62.5	0.19 - OK	197,577	356.7	1.07 - NG
E15-P007	Concrete Pipe	8"		0.0040	0.015	6.4	43.1	2.4	291	418,451	47,588	89.2	0.31 - OK	211,844	382.5	1.32 - NG
E15-P006	Concrete Pipe	8"		0.0040	0.015	6.4	43.1	2.4	291	418,451	55,439	103.9	0.36 - OK	219,695	396.7	1.37 - NG
E15-P005	Polyvinyl Chloride	18"		0.0012	0.013	14.4	218.2	5.5	1,596	2,298,830	55,439	103.9	0.07 - OK	219,695	396.7	0.25 - OK
E15-P004	Polyvinyl Chloride	18"		0.0012	0.013	14.4	218.2	5.5	1,596	2,298,830	60,346	113.1	0.08 - OK	224,602	405.5	0.26 - OK
E15-P003	Polyvinyl Chloride	18"		0.0012	0.013	14.4	218.2	5.5	1,596	2,298,830	65,253	122.3	0.08 - OK	229,509	414.4	0.26 - OK
E15-P002	Polyvinyl Chloride	18"		0.0012	0.013	14.4	218.2	5.5	1,596	2,298,830	70,160	131.6	0.09 - OK	234,416	423.3	0.27 - OK
E15-P001	Polyvinyl Chloride	18"		0.0012	0.013	14.4	218.2	5.5	1,596	2,298,830	75,067	140.8	0.09 - OK	239,323	432.1	0.28 - OK
E15-P001A	Polyvinyl Chloride	10"		0.0028	0.013	8.0	67.4	3.0	509	732,434	6,405	12.0	0.03 - OK	219,215	395.8	0.78 - OK

ft/ft = feet per foot
gpd = gallons per day
gpm = gallons per minute
in = inches
in^2 = square inch
NG = Not Good

Basin E15



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ssCleanOut ssNetworkStructure ssGravityMain ssBasin E13
ssManhole Lift Station ssPressurizedMain E1 E15
E10 E16

1:8,000

0 255 510 1,020 ft

0 75 150 300 m

Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, City of Hermiston

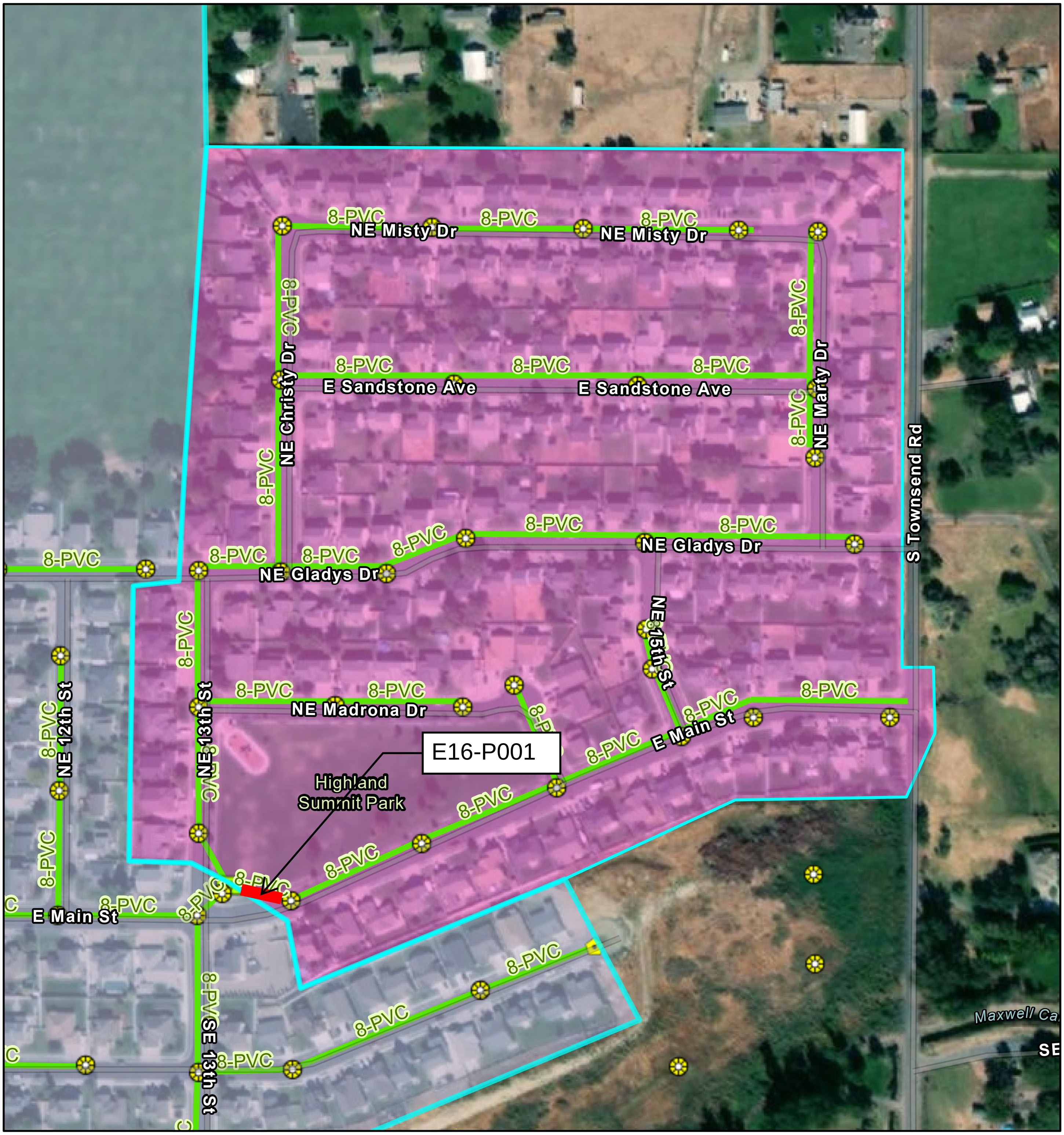
USDA FSA, GeoEye, Maxar, CNES/Airbus DS | Oregon Statewide Imagery Program (OSIP) - Oregon Imagery Framework Implementation Team | Esri Community Maps Contributors, State of Oregon GEO, WA State Parks GIS, BuildingFootprintUSA, Esri, HERE,

Basin E16

Pipe Capacity											Existing Conditions and Demand			Future Conditions and Demand		
Facility ID	Material	Diameter, D	Slope	Min Slope, S_{min}	Manning's n	Depth, d	Area, A	Hyd. Radius, Rh	Flow Capacity, Q_{cap}		Flow, Q_{EX}	Peak Hourly Flow, $Q_{EX.P}$	Capacity Utilization	Flow, Q_{FT}	Peak Hourly Flow, $Q_{EX.P}$	Capacity Utilization
-	-	(in)	(ft/ft)	(ft/ft)	-	(in)	(in^2)	(in)	(gpm)	(gpd)	(gpd)	(gpm)	-	(gpd)	(gpm)	-
E16-P001	Polyvinyl Chloride	8"		0.0040	0.013	6.4	43.1	2.4	335	482,829	17,451	32.7	0.1 - OK	80,467	145.3	0.44 - OK

ft/ft = feet per foot
gpd = gallons per day
gpm = gallons per minute
in = inches
in^2 = square inch

Basin E16



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1:4,514

0 145 290 580 ft

0 40 80 160 m

ssCleanOut

ssPressurizedMain

ssManhole

ssBasin

E15

ssNetworkStructure

E16

Lift Station

ssGravityMain

Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community, Sources: Esri, HERE, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community

City of Hermiston

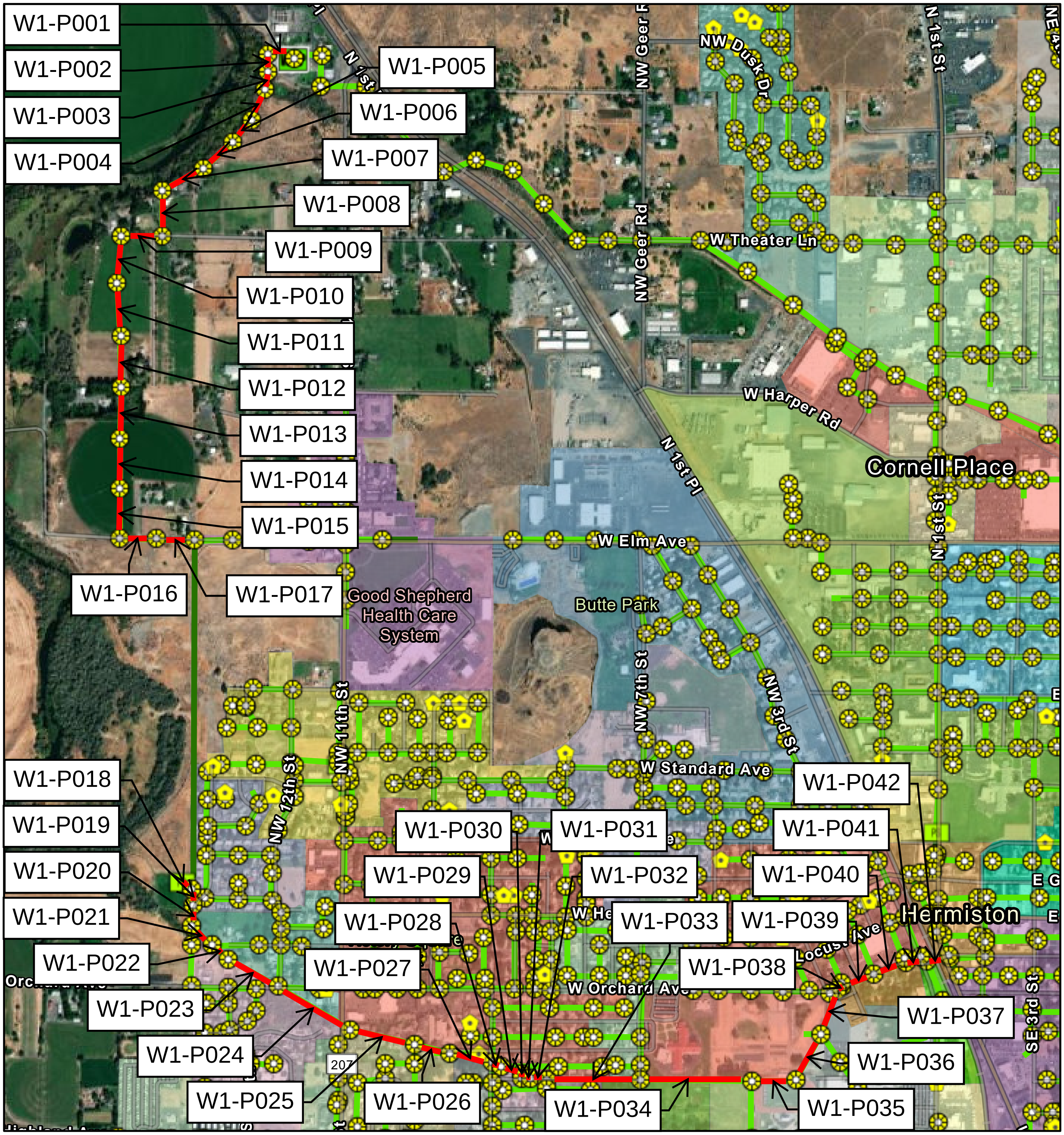
USDA FSA, GeoEye, Maxar | Oregon Statewide Imagery Program (OSIP) - Oregon Imagery Framework Implementation Team | Esri Community Maps Contributors, State of Oregon GEO, WA State

Basin W1

		Pipe Capacity									Existing Conditions			Future Conditions		
Facility ID	Material	Diameter, D	Slope	Min Slope, S_{min}	Manning's n	Depth, d	Area, A	Hyd. Radius, Rh	Flow Capacity, Q_{cap}		Flow, Q_{EX}	Peak Hourly Flow, $Q_{EX.P}$	Capacity Utilization	Flow, Q_{FT}	Peak Hourly Flow, $Q_{EX.P}$	Capacity Utilization
-	-	(in)	(ft/ft)	(ft/ft)	-	(in)	(in^2)	(in)	(gpm)	(gpd)	(gpd)	(gpm)	-	(gpd)	(gpm)	-
W1-P042	Reinforced Concrete	18"		0.0012	0.013	14.4	218.2	5.5	1,596	2,298,830	11,883	22.3	0.02 - OK	11,883	21.5	0.02 - OK
W1-P041	Reinforced Concrete	18"		0.0012	0.013	14.4	218.2	5.5	1,596	2,298,830	15,116	28.3	0.02 - OK	15,116	27.3	0.02 - OK
W1-P040	Reinforced Concrete	18"		0.0012	0.013	14.4	218.2	5.5	1,596	2,298,830	75,346	141.3	0.09 - OK	75,346	136.0	0.09 - OK
W1-P039	Reinforced Concrete	18"		0.0012	0.013	14.4	218.2	5.5	1,596	2,298,830	75,346	141.3	0.09 - OK	75,346	136.0	0.09 - OK
W1-P038	Reinforced Concrete	18"		0.0012	0.013	14.4	218.2	5.5	1,596	2,298,830	75,346	141.3	0.09 - OK	75,346	136.0	0.09 - OK
W1-P037	Reinforced Concrete	18"		0.0012	0.013	14.4	218.2	5.5	1,596	2,298,830	75,346	141.3	0.09 - OK	75,346	136.0	0.09 - OK
W1-P036	Reinforced Concrete	18"		0.0012	0.013	14.4	218.2	5.5	1,596	2,298,830	112,471	210.9	0.14 - OK	112,471	203.1	0.13 - OK
W1-P035	Reinforced Concrete	18"		0.0012	0.013	14.4	218.2	5.5	1,596	2,298,830	112,471	210.9	0.14 - OK	112,471	203.1	0.13 - OK
W1-P034	Reinforced Concrete	18"		0.0012	0.013	14.4	218.2	5.5	1,596	2,298,830	203,535	381.6	0.24 - OK	284,630	513.9	0.33 - OK
W1-P033	Reinforced Concrete	18"		0.0012	0.013	14.4	218.2	5.5	1,596	2,298,830	232,981	436.8	0.28 - OK	314,076	567.1	0.36 - OK
W1-P032	Reinforced Concrete	18"		0.0012	0.013	14.4	218.2	5.5	1,596	2,298,830	235,969	442.4	0.28 - OK	317,064	572.5	0.36 - OK
W1-P031	Reinforced Concrete	18"		0.0012	0.013	14.4	218.2	5.5	1,596	2,298,830	235,969	442.4	0.28 - OK	317,064	572.5	0.36 - OK
W1-P030	Reinforced Concrete	18"		0.0012	0.013	14.4	218.2	5.5	1,596	2,298,830	235,969	442.4	0.28 - OK	317,064	572.5	0.36 - OK
W1-P029	Reinforced Concrete	18"		0.0012	0.013	14.4	218.2	5.5	1,596	2,298,830	235,969	442.4	0.28 - OK	317,064	572.5	0.36 - OK
W1-P028	Reinforced Concrete	18"		0.0012	0.013	14.4	218.2	5.5	1,596	2,298,830	235,969	442.4	0.28 - OK	317,064	572.5	0.36 - OK
W1-P027	Reinforced Concrete	18"		0.0012	0.013	14.4	218.2	5.5	1,596	2,298,830	423,442	794.0	0.5 - OK	697,202	1,258.8	0.79 - OK
W1-P026	Reinforced Concrete	18"		0.0012	0.013	14.4	218.2	5.5	1,596	2,298,830	423,442	794.0	0.5 - OK	697,202	1,258.8	0.79 - OK
W1-P025	Reinforced Concrete	18"		0.0012	0.013	14.4	218.2	5.5	1,596	2,298,830	433,542	812.9	0.51 - OK	707,303	1,277.1	0.8 - OK
W1-P024	Reinforced Concrete	18"		0.0012	0.013	14.4	218.2	5.5	1,596	2,298,830	514,307	964.3	0.61 - OK	903,770	1,631.8	1.03 - NG
W1-P023	Reinforced Concrete	18"		0.0012	0.013	14.4	218.2	5.5	1,596	2,298,830	522,823	980.3	0.62 - OK	912,286	1,647.2	1.04 - NG
W1-P022	Reinforced Concrete	18"		0.0012	0.013	14.4	218.2	5.5	1,596	2,298,830	522,823	980.3	0.62 - OK	912,286	1,647.2	1.04 - NG
W1-P021	Reinforced Concrete	18"		0.0012	0.013	14.4	218.2	5.5	1,596	2,298,830	522,823	980.3	0.62 - OK	912,286	1,647.2	1.04 - NG
W1-P020	Reinforced Concrete	24"		0.0008	0.013	19.2	388.0	7.3	2,807	4,042,325	537,087	1,007.0	0.36 - OK	1,031,921	1,863.2	0.67 - OK
W1-P019	Reinforced Concrete	24"		0.0008	0.013	19.2	388.0	7.3	2,807	4,042,325	547,277	1,026.1	0.37 - OK	1,042,112	1,881.6	0.68 - OK
W1-P018	Reinforced Concrete	24"		0.0008	0.013	19.2	388.0	7.3	2,807	4,042,325	547,277	1,026.1	0.37 - OK	1,042,112	1,881.6	0.68 - OK
W1-P017	Reinforced Concrete	24"		0.0008	0.013	19.2	388.0	7.3	2,807	4,042,325	577,860	1,083.5	0.39 - OK	1,171,352	2,114.9	0.76 - OK
W1-P016	Reinforced Concrete	24"		0.0008	0.013	19.2	388.0	7.3	2,807	4,042,325	577,860	1,083.5	0.39 - OK	1,217,168	2,197.7	0.79 - OK
W1-P015	Reinforced Concrete	24"		0.0008	0.013	19.2	388.0	7.3	2,807	4,042,325	577,860	1,083.5	0.39 - OK	1,263,656	2,281.6	0.82 - OK
W1-P014	Reinforced Concrete	24"		0.0008	0.013	19.2	388.0	7.3	2,807	4,042,325	577,860	1,083.5	0.39 - OK	1,263,656	2,281.6	0.82 - OK
W1-P013	Reinforced Concrete	24"		0.0008	0.013	19.2	388.0	7.3	2,807	4,042,325	577,860	1,083.5	0.39 - OK	1,263,656	2,281.6	0.82 - OK
W1-P012	Reinforced Concrete	24"		0.0008	0.013	19.2	388.0	7.3	2,807	4,042,325	577,860	1,083.5	0.39 - OK	1,263,656	2,281.6	0.82 - OK
W1-P011	Reinforced Concrete	24"		0.0008	0.013	19.2	388.0	7.3	2,807	4,042,325	577,860	1,083.5	0.39 - OK	1,263,656	2,281.6	0.82 - OK
W1-P010	Reinforced Concrete	24"		0.0008	0.013	19.2	388.0	7.3	2,807	4,042,325	577,860	1,083.5	0.39 - OK	1,263,656	2,281.6	0.82 - OK
W1-P009	Reinforced Concrete	24"		0.0008	0.013	19.2	388.0	7.3	2,807	4,042,325	577,860	1,083.5	0.39 - OK	1,263,656	2,281.6	0.82 - OK
W1-P008	Reinforced Concrete	24"		0.0008	0.013	19.2	388.0	7.3	2,807	4,042,325	577,860	1,083.5	0.39 - OK	1,276,569	2,304.9	0.83 - OK
W1-P007	Reinforced Concrete	24"		0.0008	0.013	19.2	388.0	7.3	2,807	4,042,325	577,860	1,083.5	0.39 - OK	1,276,569	2,304.9	0.83 - OK
W1-P006	Reinforced Concrete	24"		0.0008	0.013	19.2	388.0	7.3	2,807	4,042,325	577,860	1,083.5	0.39 - OK	1,276,569	2,304.9	0.83 - OK
W1-P005	Reinforced Concrete	24"		0.0008	0.013	19.2	388.0	7.3	2,807	4,042,325	577,860	1,083.5	0.39 - OK	1,276,569	2,304.9	0.83 - OK
W1-P004	Reinforced Concrete	24"		0.0008	0.013	19.2	388.0	7.3	2,807	4,042,325	577,860	1,083.5	0.39 - OK	1,276,569	2,304.9	0.83 - OK
W1-P003	Reinforced Concrete	24"		0.0008	0.013	19.2	388.0	7.3	2,807	4,042,325	577,860	1,083.5	0.39 - OK	1,276,569	2,304.9	0.83 - OK
W1-P002	Reinforced Concrete	24"		0.0008	0.013	19.2	388.0	7.3	2,807	4,042,325	577,860	1,083.5	0.39 - OK	1,276,569	2,304.9	0.83 - OK
W1-P001	Reinforced Concrete	24"		0.0008	0.013	19.2	388.0	7.3	2,807	4,042,325	577,860	1,083.5	0.39 - OK	1,284,059	2,318.4	0.83 - OK

ft/ft = feet per foot
gpd = gallons per day
gpm = gallons per minute
in = inches
in^2 = square inch
NG = Not Good
= assumed pipe material or diameter

Basin W1



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1:21,500

0 500 1,000 2,000 ft

0 210 420 840 m

ssCleanOut
ssManhole
ssNetworkStructure
Lift Station
Treatment Plant
ssGravityMain
ssPressurizedMain

ssBasin: E1, E11, E12, E2, E3, E4, E5, E6, E7, E8, W1, W10, W11, W12, W13, W14, W15, W16, W17, W18, W19, W2, W20, W21, W3, W4, W5, W6, W7, W8, W9

Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community, Sources: Esri, HERE, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community

City of Hermiston
USDA FSA, GeoEye, Maxar, CNES/Airbus DS | Oregon Statewide Imagery Program (OSIP) - Oregon Imagery Framework Implementation Team | Esri Community Maps Contributors, State of Oregon

Basin W2

Pipe Capacity												Existing Conditions			Future Conditions		
Facility ID	Material	Diameter, D	Slope	Min Slope, S_{min}	Manning's n	Depth, d	Area, A	Hyd. Radius, Rh	Flow Capacity, Q_{cap}		Flow, Q_{EX}	Peak Hourly Flow, $Q_{EX.P}$	Capacity Utilization	Flow, Q_{FT}	Peak Hourly Flow, $Q_{EX.P}$	Capacity Utilization
-	-	(in)	(ft/ft)	(ft/ft)	-	(in)	(in^2)	(in)	(gpm)	(gpd)	(gpd)	(gpm)	-	(gpd)	(gpm)	-
W2-P004	Polyvinyl Chloride	12"		0.0022	0.013	9.6	97.0	3.7	733	1,055,725	30,583	57.3	0.08 - OK	129,240	233.4	0.32 - OK
W2-P003	Polyvinyl Chloride	12"		0.0022	0.013	9.6	97.0	3.7	733	1,055,725	30,583	57.3	0.08 - OK	129,240	233.4	0.32 - OK
W2-P002	Polyvinyl Chloride	12"		0.0022	0.013	9.6	97.0	3.7	733	1,055,725	30,583	57.3	0.08 - OK	129,240	233.4	0.32 - OK
W2-P001	Polyvinyl Chloride	12"		0.0022	0.013	9.6	97.0	3.7	733	1,055,725	30,583	57.3	0.08 - OK	129,240	233.4	0.32 - OK

ft/ft = feet per foot

gpd = gallons per day

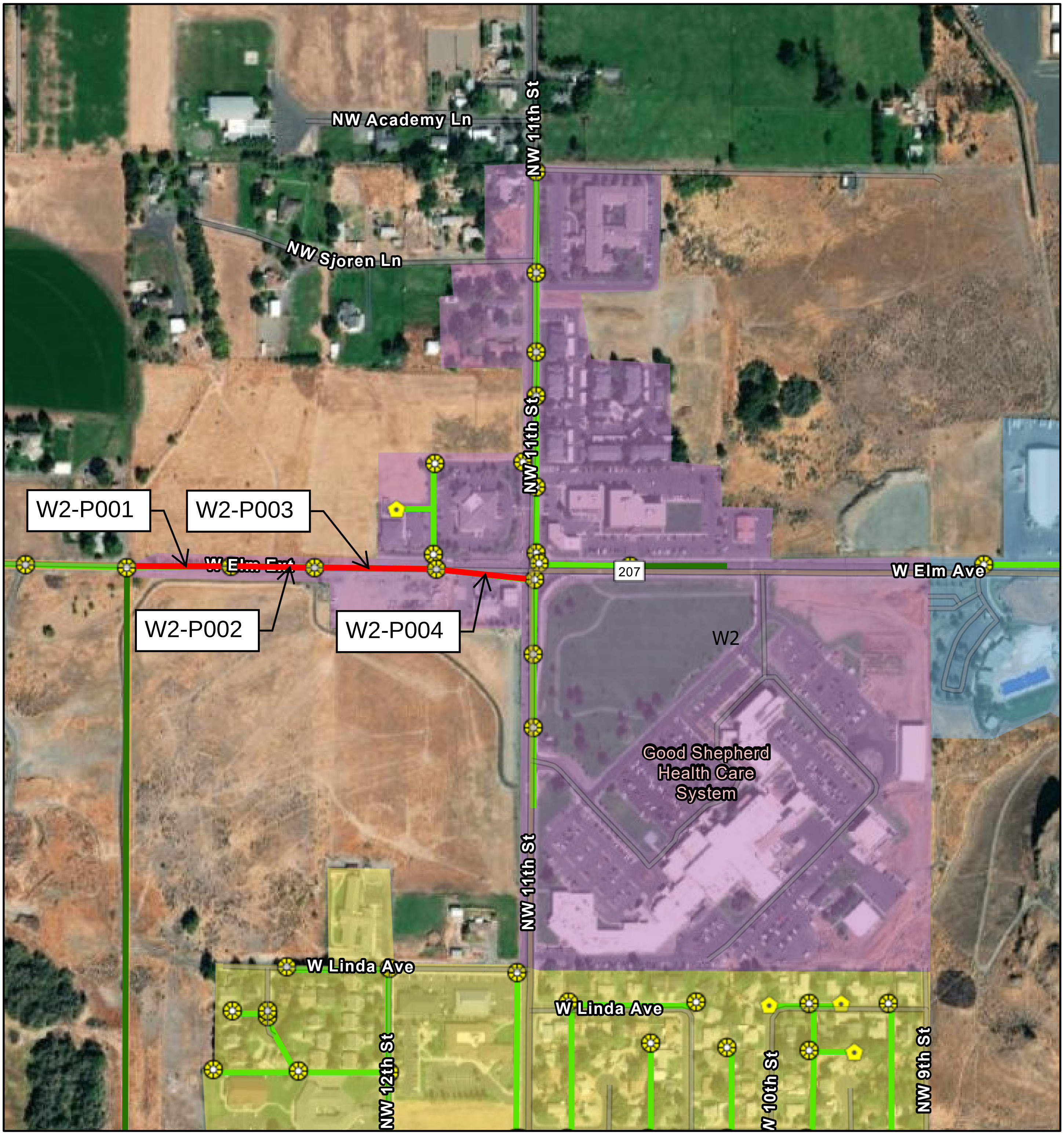
gpm = gallons per minute

in = inches

in^2 = square inch

= assumed pipe material or diameter

Basin W2



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ssCleanOut

ssManhole

ssGravityMain

ssPressurizedMain

ssBasin

W1

W10

W18

W2

1:8,000

0 255 510 1,020 ft

0 75 150 300 m

Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community, Sources: Esri, HERE, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community

City of Hermiston

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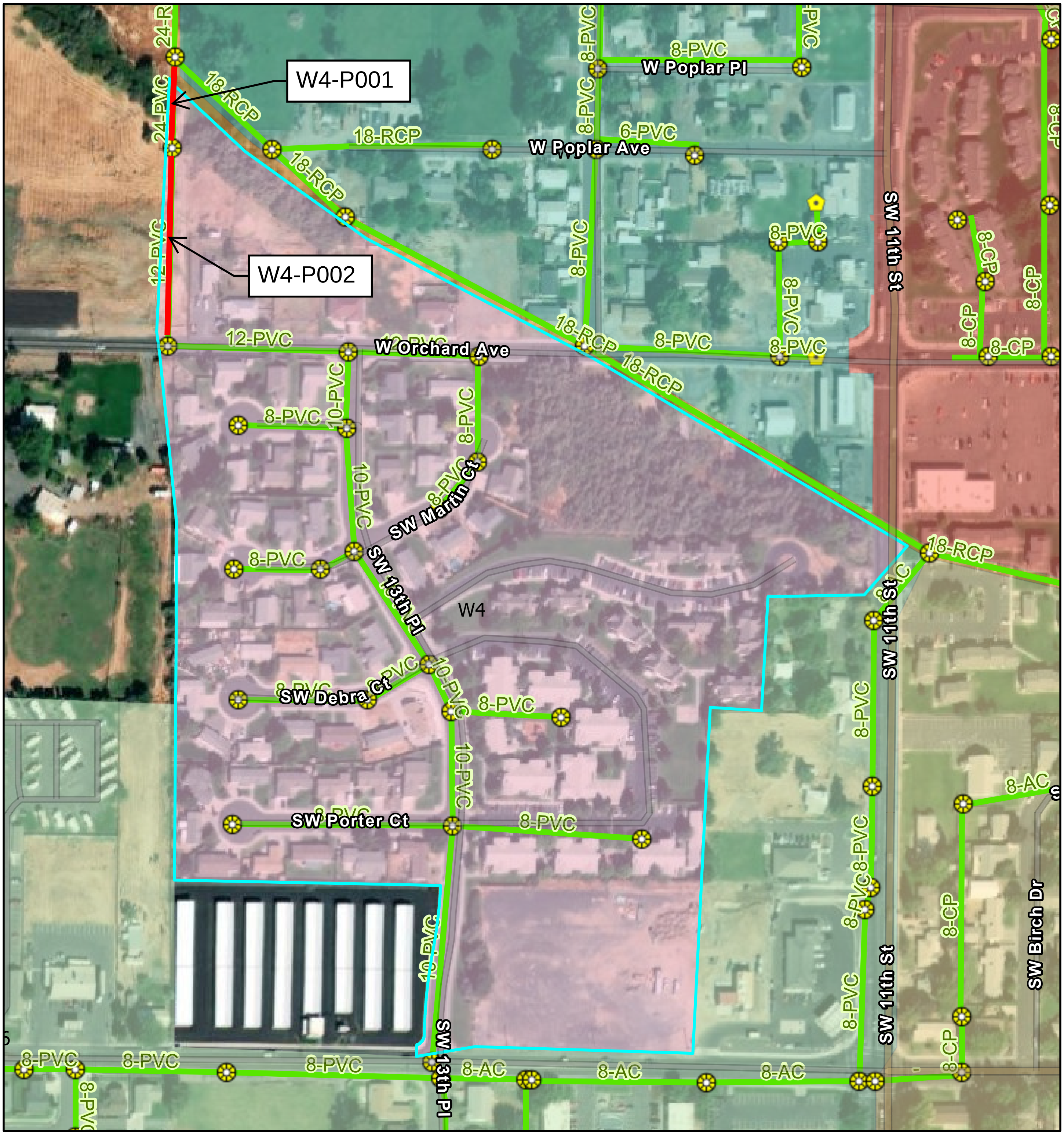
Basin W4

Pipe Capacity											Existing Conditions			Future Conditions		
Facility ID	Material	Diameter, D	Slope	Min Slope, S_{min}	Manning's n	Depth, d	Area, A	Hyd. Radius, Rh	Flow Capacity, Q_{cap}		Flow, Q_{EX}	Peak Hourly Flow, $Q_{EX.P}$	Capacity Utilization	Flow, Q_{FT}	Peak Hourly Flow, $Q_{EX.P}$	Capacity Utilization
-	-	(in)	(ft/ft)	(ft/ft)	-	(in)	(in^2)	[in]	(gpm)	(gpd)	(gpd)	(gpm)	-	(gpd)	(gpm)	-
W4-P002	Polyvinyl Chloride	12"		0.0022	0.013	9.6	97.0	3.7	733	1,055,725	14,264	26.7	0.04 - OK	119,636	216.0	0.3 - OK
W4-P001	Polyvinyl Chloride	24"		0.0008	0.013	19.2	388.0	7.3	2,807	4,042,325	14,264	26.7	0.01 - OK	119,636	216.0	0.08 - OK

ft/ft = feet per foot
gpd = gallons per day
gpm = gallons per minute
in = inches
in^2 = square inch

Basin W4



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ssCleanOut

ssManhole

ssGravityMain

ssBasin

W1

W4

W5

W6

W7

W9

1:4,500

0 145 290 580 ft

0 40 80 160 m

Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community, Sources: Esri, HERE, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community

City of Hermiston

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Basin W6

Pipe Capacity											Existing Conditions			Future Conditions		
Facility ID	Material	Diameter, D	Slope	Min Slope, S_{min}	Manning's n	Depth, d	Area, A	Hyd. Radius, Rh	Flow Capacity, Q_{cap}		Flow, Q_{EX}	Peak Hourly Flow, $Q_{EX.P}$	Capacity Utilization	Flow, Q_{FT}	Peak Hourly Flow, $Q_{EX.P}$	Capacity Utilization
-	-	(in)	(ft/ft)	(ft/ft)	-	(in)	(in^2)	(in)	(gpm)	(gpd)	(gpd)	(gpm)	-	(gpd)	(gpm)	-
W6-P015	Asbestos Cement	8"		0.0040	0.012	6.4	43.1	2.4	363	523,064	80,765	151.4	0.42 - OK	196,467	354.7	0.98 - OK
W6-P014	Asbestos Cement	8"		0.0040	0.012	6.4	43.1	2.4	363	523,064	80,765	151.4	0.42 - OK	196,467	354.7	0.98 - OK
W6-P013	Asbestos Cement	8"		0.0040	0.012	6.4	43.1	2.4	363	523,064	80,765	151.4	0.42 - OK	196,467	354.7	0.98 - OK
W6-P012	Asbestos Cement	8"		0.0040	0.012	6.4	43.1	2.4	363	523,064	80,765	151.4	0.42 - OK	196,467	354.7	0.98 - OK
W6-P011	Asbestos Cement	8"		0.0040	0.012	6.4	43.1	2.4	363	523,064	80,765	151.4	0.42 - OK	196,467	354.7	0.98 - OK
W6-P010	Asbestos Cement	8"		0.0040	0.012	6.4	43.1	2.4	363	523,064	80,765	151.4	0.42 - OK	196,467	354.7	0.98 - OK
W6-P009	Asbestos Cement	8"		0.0040	0.012	6.4	43.1	2.4	363	523,064	80,765	151.4	0.42 - OK	196,467	354.7	0.98 - OK
W6-P007	Asbestos Cement	8"		0.0040	0.012	6.4	43.1	2.4	363	523,064	80,765	151.4	0.42 - OK	196,467	354.7	0.98 - OK
W6-P006	Asbestos Cement	8"		0.0040	0.012	6.4	43.1	2.4	363	523,064	80,765	151.4	0.42 - OK	196,467	354.7	0.98 - OK
W6-P005	Polyvinyl Chloride	8"	0.0136	0.0040	0.013	6.4	43.1	2.4	618	890,078	80,765	151.4	0.25 - OK	196,467	354.7	0.58 - OK
W6-P004	Polyvinyl Chloride	8"	0.0529	0.0040	0.013	6.4	43.1	2.4	1,220	1,756,318	80,765	151.4	0.13 - OK	196,467	354.7	0.3 - OK
W6-P003	Polyvinyl Chloride	8"	0.0150	0.0040	0.013	6.4	43.1	2.4	649	934,827	80,765	151.4	0.24 - OK	196,467	354.7	0.55 - OK
W6-P002	Polyvinyl Chloride	8"	0.0281	0.0040	0.013	6.4	43.1	2.4	889	1,280,732	80,765	151.4	0.18 - OK	196,467	354.7	0.4 - OK
W6-P001	Asbestos Cement	8"		0.0040	0.012	6.4	43.1	2.4	363	523,064	80,765	151.4	0.42 - OK	196,467	354.7	0.98 - OK

ft/ft = feet per foot
gpd = gallons per day
gpm = gallons per minute
in = inches
in^2 = square inch

Basin W6

7/17/2020, 3:12:21 PM

ssCleanOut
ssManhole
ssGravityMain

ssBasin
W1
W4
W5
W6
W7
W8
W9

1:10,000

0 320 640 1,280 ft

0 95 190 380 m

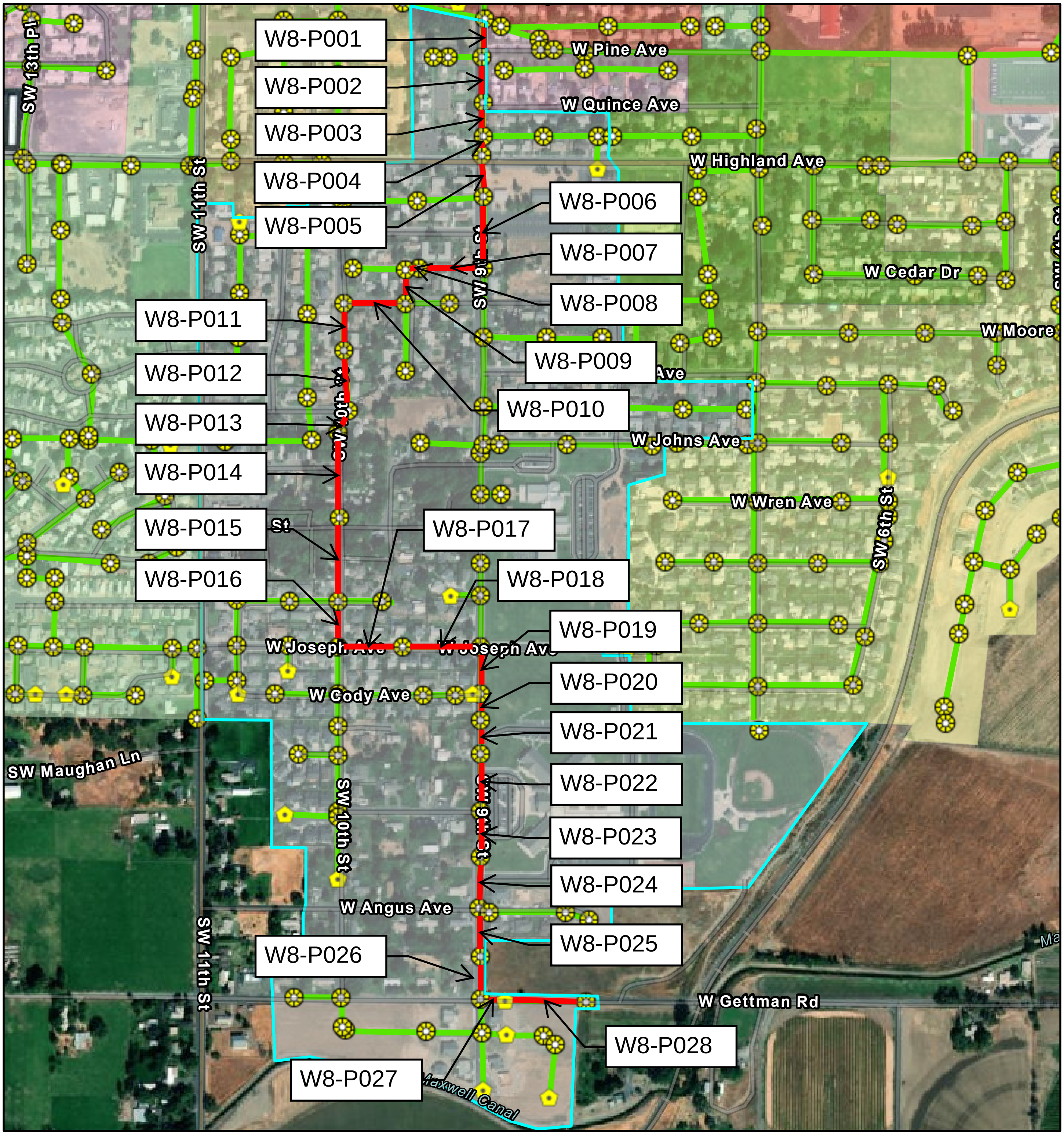
Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community, Sources: Esri, HERE, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community

Basin W8

Pipe Capacity											Existing Conditions			Future Conditions		
Facility ID	Material	Diameter, D	Slope	Min Slope, S_{min}	Manning's n	Depth, d	Area, A	Hyd. Radius, Rh	Flow Capacity, Q_{cap}		Flow, Q_{EX}	Peak Hourly Flow, $Q_{EX.P}$	Capacity Utilization	Flow, Q_{FT}	Peak Hourly Flow, $Q_{EX.P}$	Capacity Utilization
-	-	(in)	(ft/ft)	(ft/ft)	-	(in)	(in^2)	(in)	(gpm)	(gpd)	(gpd)	(gpm)	-	(gpd)	(gpm)	-
W8-P028	Polyvinyl Chloride	8"		0.0040	0.013	6.4	43.1	2.4	335	482,829	92,968	174.3	0.52 - OK	116,211	209.8	0.63 - OK
W8-P027	Polyvinyl Chloride	8"		0.0040	0.013	6.4	43.1	2.4	335	482,829	92,968	174.3	0.52 - OK	116,211	209.8	0.63 - OK
W8-P026	Polyvinyl Chloride	8"		0.0040	0.013	6.4	43.1	2.4	335	482,829	92,968	174.3	0.52 - OK	285,633	515.7	1.54 - NG
W8-P025	Polyvinyl Chloride	8"		0.0040	0.013	6.4	43.1	2.4	335	482,829	92,968	174.3	0.52 - OK	285,633	515.7	1.54 - NG
W8-P024	Polyvinyl Chloride	8"		0.0040	0.013	6.4	43.1	2.4	335	482,829	92,968	174.3	0.52 - OK	285,633	515.7	1.54 - NG
W8-P023	Polyvinyl Chloride	8"		0.0040	0.013	6.4	43.1	2.4	335	482,829	92,968	174.3	0.52 - OK	285,633	515.7	1.54 - NG
W8-P022	Polyvinyl Chloride	8"		0.0040	0.013	6.4	43.1	2.4	335	482,829	92,968	174.3	0.52 - OK	285,633	515.7	1.54 - NG
W8-P021	Polyvinyl Chloride	8"		0.0040	0.013	6.4	43.1	2.4	335	482,829	92,968	174.3	0.52 - OK	285,633	515.7	1.54 - NG
W8-P020	Polyvinyl Chloride	8"		0.0040	0.013	6.4	43.1	2.4	335	482,829	92,968	174.3	0.52 - OK	285,633	515.7	1.54 - NG
W8-P019	Polyvinyl Chloride	8"		0.0040	0.013	6.4	43.1	2.4	335	482,829	92,968	174.3	0.52 - OK	285,633	515.7	1.54 - NG
W8-P018	Polyvinyl Chloride	8"		0.0040	0.013	6.4	43.1	2.4	335	482,829	92,968	174.3	0.52 - OK	285,633	515.7	1.54 - NG
W8-P017	Polyvinyl Chloride	8"		0.0040	0.013	6.4	43.1	2.4	335	482,829	92,968	174.3	0.52 - OK	285,633	515.7	1.54 - NG
W8-P016	Polyvinyl Chloride	8"		0.0040	0.013	6.4	43.1	2.4	335	482,829	92,968	174.3	0.52 - OK	285,633	515.7	1.54 - NG
W8-P015	Polyvinyl Chloride	8"		0.0040	0.013	6.4	43.1	2.4	335	482,829	92,968	174.3	0.52 - OK	285,633	515.7	1.54 - NG
W8-P014	Polyvinyl Chloride	8"		0.0040	0.013	6.4	43.1	2.4	335	482,829	92,968	174.3	0.52 - OK	285,633	515.7	1.54 - NG
W8-P013	Polyvinyl Chloride	8"		0.0040	0.013	6.4	43.1	2.4	335	482,829	92,968	174.3	0.52 - OK	285,633	515.7	1.54 - NG
W8-P012	Asbestos Cement	8"		0.0040	0.012	6.4	43.1	2.4	363	523,064	92,968	174.3	0.48 - OK	285,633	515.7	1.42 - NG
W8-P011	Asbestos Cement	8"		0.0040	0.012	6.4	43.1	2.4	363	523,064	92,968	174.3	0.48 - OK	285,633	515.7	1.42 - NG
W8-P010	Asbestos Cement	8"		0.0040	0.012	6.4	43.1	2.4	363	523,064	92,968	174.3	0.48 - OK	285,633	515.7	1.42 - NG
W8-P009	Asbestos Cement	8"		0.0040	0.012	6.4	43.1	2.4	363	523,064	92,968	174.3	0.48 - OK	285,633	515.7	1.42 - NG
W8-P007	Concrete Pipe	8"		0.0040	0.015	6.4	43.1	2.4	291	418,451	92,968	174.3	0.6 - OK	285,633	515.7	1.78 - NG
W8-P006	Concrete Pipe	8"		0.0040	0.015	6.4	43.1	2.4	291	418,451	92,968	174.3	0.6 - OK	285,633	515.7	1.78 - NG
W8-P005	Concrete Pipe	10"		0.0028	0.015	8.0	67.4	3.0	441	634,776	92,968	174.3	0.4 - OK	285,633	515.7	1.17 - NG
W8-P004	Concrete Pipe	12"		0.0022	0.015	9.6	97.0	3.7	635	914,962	92,968	174.3	0.28 - OK	285,633	515.7	0.82 - OK
W8-P003	Concrete Pipe	12"		0.0022	0.015	9.6	97.0	3.7	635	914,962	92,968	174.3	0.28 - OK	285,633	515.7	0.82 - OK
W8-P002	Concrete Pipe	12"		0.0022	0.015	9.6	97.0	3.7	635	914,962	92,968	174.3	0.28 - OK	285,633	515.7	0.82 - OK
W8-P001	Concrete Pipe	12"		0.0022	0.015	9.6	97.0	3.7	635	914,962	92,968	174.3	0.28 - OK	285,633	515.7	0.82 - OK

ft/ft = feet per foot
gpd = gallons per day
gpm = gallons per minute
in = inches
in^2 = square inch
NG = Not Good
= assumed pipe material or diameter

Basin W8



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ssCleanOut

ssManhole

ssGravityMain

ssBasin

W1

W12

W13

W14

W15

W16

W17

W4

W6

W7

W8

W9

1:11,500

0 370 740 1,480 ft

0 112.5 225 450 m

Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community, Sources: Esri, HERE, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community

City of Hermiston

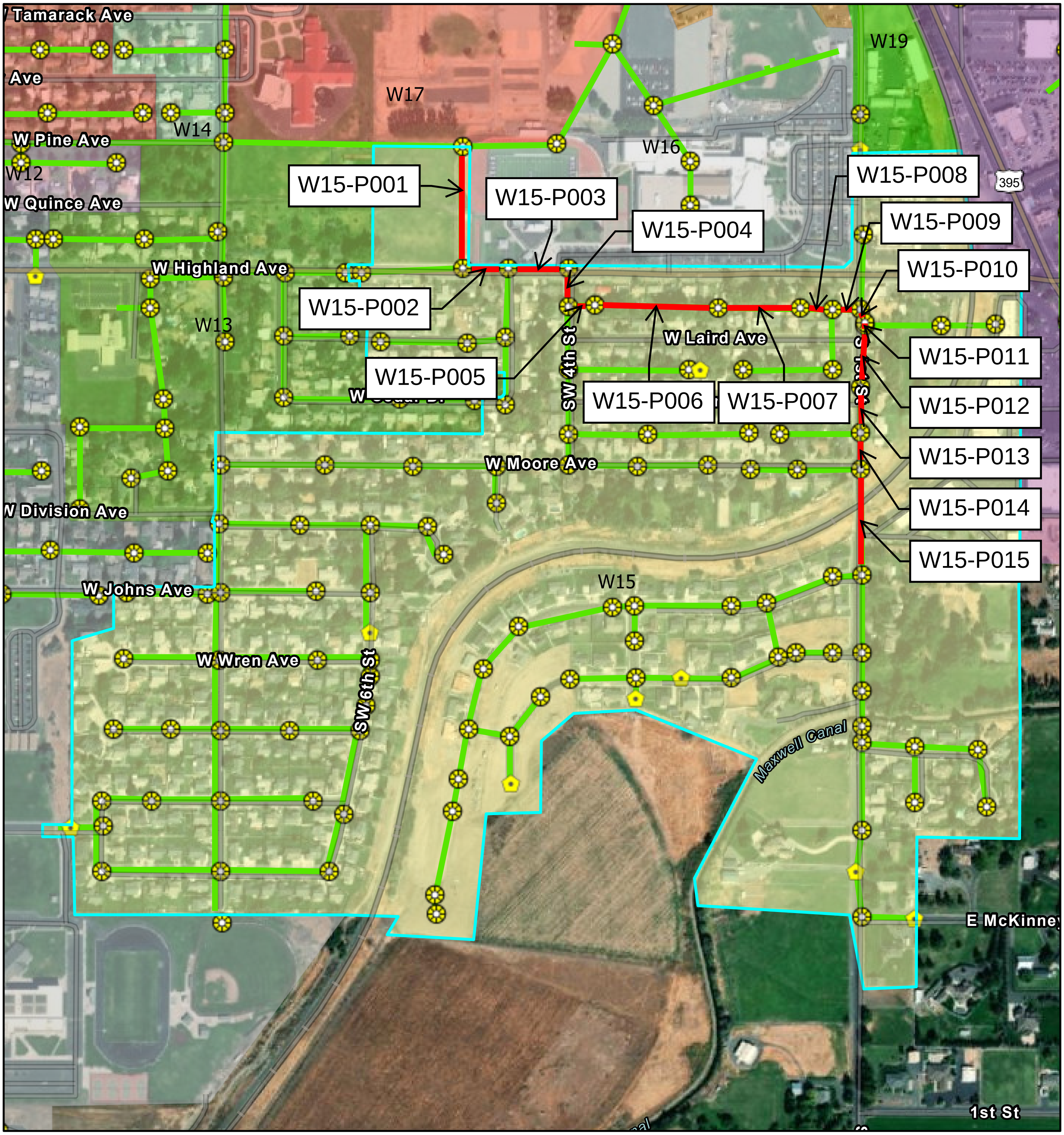
USDA FSA, GeoEye, Maxar, CNES/Airbus DS | Oregon Statewide Imagery Program (OSIP) - Oregon Imagery Framework Implementation Team | Esri Community Maps Contributors, State of Oregon

Basin W15

Pipe Capacity											Existing Conditions			Future Conditions		
Facility ID	Material	Diameter, D	Slope	Min Slope, S_{min}	Manning's n	Depth, d	Area, A	Hyd. Radius, Rh	Flow Capacity, Q_{cap}		Flow, Q_{EX}	Peak Hourly Flow, $Q_{EX.P}$	Capacity Utilization	Flow, Q_{FT}	Peak Hourly Flow, $Q_{EX.P}$	Capacity Utilization
-	-	(in)	(ft/ft)	(ft/ft)	-	(in)	(in^2)	(in)	(gpm)	(gpd)	(gpd)	(gpm)	-	(gpd)	(gpm)	-
W15-P015	Asbestos Cement	8"		0.0040	0.012	6.4	43.1	2.4	363	523,064	32,541	61.0	0.17 - OK	113,636	205.2	0.57 - OK
W15-P014	Concrete Pipe	8"		0.0040	0.015	6.4	43.1	2.4	291	418,451	34,607	64.9	0.23 - OK	115,702	208.9	0.72 - OK
W15-P013	Concrete Pipe	8"		0.0040	0.015	6.4	43.1	2.4	291	418,451	36,519	68.5	0.24 - OK	117,614	212.4	0.74 - OK
W15-P012	Concrete Pipe	8"		0.0040	0.015	6.4	43.1	2.4	291	418,451	36,519	68.5	0.24 - OK	117,614	212.4	0.74 - OK
W15-P011	Concrete Pipe	8"		0.0040	0.015	6.4	43.1	2.4	291	418,451	41,064	77.0	0.27 - OK	122,159	220.6	0.76 - OK
W15-P010	Concrete Pipe	8"		0.0040	0.015	6.4	43.1	2.4	291	418,451	41,064	77.0	0.27 - OK	122,159	220.6	0.76 - OK
W15-P009	Concrete Pipe	8"		0.0040	0.015	6.4	43.1	2.4	291	418,451	44,060	82.6	0.29 - OK	125,155	226.0	0.78 - OK
W15-P008	Concrete Pipe	8"		0.0040	0.015	6.4	43.1	2.4	291	418,451	46,229	86.7	0.3 - OK	127,324	229.9	0.8 - OK
W15-P007	Concrete Pipe	8"		0.0040	0.015	6.4	43.1	2.4	291	418,451	47,262	88.6	0.31 - OK	128,357	231.8	0.8 - OK
W15-P006	Concrete Pipe	8"		0.0040	0.015	6.4	43.1	2.4	291	418,451	49,122	92.1	0.32 - OK	130,217	235.1	0.81 - OK
W15-P005	Concrete Pipe	8"		0.0040	0.015	6.4	43.1	2.4	291	418,451	49,122	92.1	0.32 - OK	130,217	235.1	0.81 - OK
W15-P004	Concrete Pipe	8"		0.0040	0.015	6.4	43.1	2.4	291	418,451	85,176	159.7	0.55 - OK	166,271	300.2	1.04 - NG
W15-P003	Concrete Pipe	10"		0.0028	0.015	8.0	67.4	3.0	441	634,776	85,176	159.7	0.37 - OK	166,271	300.2	0.69 - OK
W15-P002	Concrete Pipe	10"		0.0028	0.015	8.0	67.4	3.0	441	634,776	88,171	165.3	0.38 - OK	169,267	305.6	0.7 - OK
W15-P001	Concrete Pipe	12"		0.0022	0.015	9.6	97.0	3.7	635	914,962	91,064	170.7	0.27 - OK	172,159	310.8	0.49 - OK

ft/ft = feet per foot
gpd = gallons per day
gpm = gallons per minute
in = inches
in^2 = square inch
NG = Not Good

Basin W15



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ssCleanOut	W1	W16
ssManhole	W12	W17
ssGravityMain	W13	W19
	W14	W8
ssBasin	W15	W9
E12		

1:10,000

0 320 640 1,280 ft

0 95 190 380 m

Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community, Sources: Esri, HERE, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community

City of Hermiston

USDA FSA, GeoEye, Maxar, CNES/Airbus DS | Oregon Statewide Imagery Program (OSIP) - Oregon Imagery Framework Implementation Team | Esri Community Maps Contributors, State of Oregon

APPENDIX H
Lift Station Data Summary

Lift Station No. 1 Summary																										
Month	Pump 1 (1,200 gpm)								Pump 2 (250 gpm)								Pump 3 (1,200 gpm)								Total of Average	
	Hours Operated	Hours Per Day			Gallons Pumped	Gallons Per Day			Hours Operated	Hours Per Day			Gallons Pumped	Gallons Per Day			Hours Operated	Hours Per Day			Gallons Pumped	Gallons Per Day			Hours per Day	Gallons per Day
		Avg	Max	Min		Avg	Max	Min		Avg	Max	Min		Avg	Max	Min		Avg	Max	Min		Avg	Max	Min		
Jan-17	68.9	2.2	3.1	1.6	4,960,800	160,026	223,200	115,200	545.2	17.6	21.5	15.8	8,178,000	263,806	322,500	237,000	53.4	1.7	2.6	1.4	3,844,800	124,026	187,200	100,800	21.5	547,858
Feb-17	61.2	2.2	2.6	1.6	4,406,400	157,371	187,200	115,200	523.5	18.7	23.4	15.9	7,852,500	280,446	351,000	238,500	48.0	1.7	2.2	1.1	3,456,000	123,429	158,400	79,200	22.6	561,246
Mar-17	63.0	2.0	2.5	1.6	4,536,000	146,323	180,000	115,200	584.2	18.8	21.2	15.9	8,763,000	282,677	318,000	238,500	47.6	1.5	2.4	1.0	3,427,200	110,555	172,800	72,000	22.4	539,555
Apr-17	71.3	2.4	3.1	1.6	5,133,600	171,120	223,200	115,200	540.2	18.0	20.9	15.7	8,103,000	270,100	313,500	235,500	52.4	1.7	2.6	1.3	3,772,800	125,760	187,200	93,600	22.1	566,980
May-17	72.5	2.3	4.0	1.4	5,220,000	168,387	288,000	100,800	532.9	17.2	21.1	0.0	7,993,500	257,855	316,500	0	48.4	1.6	2.5	1.0	3,484,800	112,413	180,000	72,000	21.1	538,655
Jun-17	67.9	2.3	3.0	1.6	4,888,800	162,960	216,000	115,200	541.6	18.1	20.4	16.9	8,124,000	270,800	306,000	253,500	48.4	1.6	1.9	1.3	3,484,800	116,160	136,800	93,600	21.9	549,920
Jul-17	40.5	1.3	3.6	0.0	2,916,000	94,065	259,200	0	595.0	19.2	23.3	14.7	8,925,000	287,903	349,500	220,500	31.0	1.0	2.1	0.0	2,232,000	72,000	151,200	0	21.5	453,968
Aug-17	65.2	2.1	3.0	1.4	4,694,400	151,432	216,000	100,800	583.8	18.8	21.3	15.4	8,757,000	282,484	319,500	231,000	47.2	1.5	2.2	1.2	3,398,400	109,626	158,400	86,400	22.5	543,542
Sep-17	52.0	1.7	2.4	0.3	3,744,000	124,800	172,800	21,600	576.9	19.2	21.9	17.4	8,653,500	288,450	328,500	261,000	39.5	1.3	2.0	0.2	2,844,000	94,800	144,000	14,400	22.3	508,050
Oct-17	60.7	2.0	2.5	1.6	4,370,400	140,981	180,000	115,200	594.6	19.2	22.3	17.1	8,919,000	287,710	334,500	256,500	47.2	1.5	1.7	1.1	3,398,400	109,626	122,400	79,200	22.7	538,316
Nov-17	72.4	2.4	3.2	1.6	5,212,800	173,760	230,400	115,200	547.4	18.2	19.9	16.2	8,211,000	273,700	298,500	243,000	52.3	1.7	2.1	1.1	3,765,600	125,520	151,200	79,200	22.4	572,980
Dec-17	93.6	3.0	7.3	0.0	6,739,200	217,394	525,600	0	232.2	7.5	19.1	0.0	3,483,000	112,355	286,500	0	67.3	2.2	5.2	0.0	4,845,600	156,310	374,400	0	12.7	486,058
Jan-18	114.1	3.7	4.9	3.0	8,215,200	265,006	352,800	216,000	0.0	0.0	0.0	0.0	0	0	0	0	77.2	2.5	3.1	2.1	5,558,400	179,303	223,200	151,200	6.2	444,310
Feb-18	85.7	3.1	4.1	2.4	6,170,400	220,371	295,200	172,800	368.3	13.2	20.4	0.0	5,524,500	197,304	306,000	0	60.7	2.2	2.8	1.4	4,370,400	156,086	201,600	100,800	18.4	573,761
Mar-18	90.3	2.9	3.8	1.9	6,502,800	209,768	273,600	136,800	484.2	15.6	18.3	12.2	7,263,000	234,290	274,500	183,000	72.7	2.3	3.0	1.8	5,234,400	168,852	216,000	129,600	20.9	612,910
Apr-18	34.0	1.1	3.3	0.0	2,448,000	81,600	237,600	0	484.5	16.2	18.5	14.5	7,267,500	242,250	277,500	217,500	120.1	4.0	5.6	2.0	8,647,200	288,240	403,200	144,000	21.3	612,090
May-18	0.0	0.0	0.0	0.0	0	0	0	0	507.7	16.4	18.8	14.3	7,615,500	245,661	282,000	214,500	158.7	5.1	8.2	2.5	11,426,400	368,594	590,400	180,000	21.5	614,255
Jun-18	13.8	0.5	5.8	0.0	993,600	33,120	417,600	0	467.0	15.6	18.6	12.5	7,005,000	233,500	279,000	187,500	139.2	4.6	6.1	0.0	10,022,400	334,080	439,200	0	20.7	600,700
Jul-18	99.1	3.2	5.2	0.9	7,135,200	230,168	374,400	64,800	453.1	14.6	15.9	11.6	6,796,500	219,242	238,500	174,000	78.1	2.5	4.1	1.7	5,623,200	181,394	295,200	122,400	20.3	630,803
Aug-18	0.4	0.0	0.4	0.0	28,800	929	28,800	0	431.7	13.9	15.4	12.0	6,475,500	208,887	231,000	180,000	216.9	7.0	9.1	5.0	15,616,800	503,768	655,200	360,000	20.9	713,584
Sep-18	34.4	1.1	2.9	0.0	2,476,800	82,560	208,800	0	415.9	13.9	16.6	11.1	6,238,500	207,950	249,000	166,500	174.5	5.8	9.0	3.1	12,564,000	418,800	648,000	223,200	20.8	709,310
Oct-18	61.5	2.0	3.8	0.0	4,428,000	142,839	273,600	0	383.3	12.4	14.6	3.4	5,749,500	185,468	219,000	51,000	186.3	6.0	12.1	3.7	13,413,600	432,697	871,200	266,400	20.4	761,003
Nov-18	71.3	2.4	4.1	0.0	5,133,600	171,120	295,200	0	359.2	12.0	16.0	4.2	5,388,000	179,600	240,000	63,000	207.3	6.9	15.4	2.0	14,925,600	497,520	1,108,800	144,000	21.3	848,240
Dec-18	108.3	3.5	6.2	1.6	7,797,600	251,535	446,400	115,200	377.5	12.2	14.4	7.4	5,662,500	182,661	216,000	111,000	170.4	5.5	7.9	2.1	12,270,600	395,826	568,800	151,200	21.2	830,023
Jan-19	81.8	2.6	4.4	0.0	5,889,600	189,987	316,800	0	376.7	12.2	14.2	8.3	5,650,500	182,274	213,000	124,500	192.3	6.2	11.0	0.0	13,842,000	446,516	792,000	0	21.0	818,777
Feb-19	44.4	1.6	3.2	0.0	3,196,800	114,171	230,400	0	349.4	12.5	14.3	9.2	5,241,000	187,179	214,500	138,000	197.2	7.0	12.4	3.8	14,198,400	507,086	892,800	273,600	21.1	808,436
Mar-19	211.2	6.8	19.1	0.0	15,206,400	490,529	1,375,200	0	358.0	11.5	15.7	4.7	5,370,000	173,226	235,500	70,500	91.4	2.9	6.6	0.0	6,580,800	212,284	475,200	0	21.3	876,039
Apr-19	36.4	1.2	4.6	0.0	2,620,800	87,360	331,200	0	455.5	15.2	17.4	13.4	6,832,500	227,750	261,000	201,000	127.3	4.2	5.9	2.0	9,165,600	305,520	424,800	144,000	20.6	620,630
May-19	62.8	2.0	3.7	0.0	4,521,570	145,857	266,400	0	461.6	14.9	16.8	11.6	6,924,000	223,355	252,000	174,000	83.4	2.7	5.2	0.9	6,004,800	193,703	374,400	64,800	19.6	562,915
Jun-19	68.7	2.3	2.6	1.8	4,946,400	164,880	187,200	129,600	471.2	15.7	17.7	14.0	7,068,000	235,600	265,500	210,000	76.7	2.6	4.7	0.0	5,522,400	184,080	338,400	0	20.6	584,560
Jul-19	71.0	2.3	3.1	1.8	5,112,000	164,903	223,200	129,600	489.1	15.8	17.4	13.5	7,336,500	236,661	261,000	202,500	76.2	2.5	3.3	1.9	5,486,400	176,981	237,600	136,800	20.5	578,545
Aug-19	72.1	2.3	2.8	1.9	5,191,200	167,458	201,600	136,800	473.1	15.3	17.6	3.2	7,096,500	228,919	264,000	48,000	78.3	2.5	2.9	2.1	5,637,600	181,858	208,800	151,200	20.1	578,235
Sep-19	74.2	2.5	2.9	0.9	5,342,400	178,080	208,800	64,800	122.8	4.1	16.7	0.0	1,842,000	61,400	250,500	0	80.2	2.7	3.5	0.9	5,774,400	192,480	252,000	64,800	9.2	431,960
Oct-19	78.6	2.5	3.1	1.8	5,659,200	182,555	226,800	129,600	472.3	15.2	16.4	13.7	7,084,500	228,532	246,000	205,500	87.5	2.8	3.6	2.3	6,300,000	203,226	259,200	165,600	20.6	614,313
Nov-19	74.3	2.5	3.2	1.8	5,349,600	178,320	230,400	129,600	449.4	15.0	16.7	12.7	6,741,000	224,700	250,500	190,500	90.2	3.0	3.9	2.6	6,494,400	216,480	280,800	187,200	20.5	619,500
Dec-19	82.0	2.6	3.7	2.1	5,904,000	190,452	266,400	151,200	416.6	13.4	16.4	9.4	6,249,000	201,581	246,000	141,000	148.9	4.8	10.1	2.2	10,720,800	345,832	727,200	158,400	20.9	737,865
Avg	68.3	2.2	3.9	1.0	4,919,233	161,450	282,500	72,400	445.2	14.6	17.8	10.5	6,677,333	219,619	267,125	157,458	99.3	3.3	5.3	1.6	7,148,750	235,317	378,000	113,600	20.2	616,386
Max	211.2	6.8	19.1	3.0	15,206,400	490,529	1,375,200	216,000	595.0	19.2	23.4	17.4	8,925,000	288,450	351,000	261,000	216.9	7.0	15.4	5.0	15,616,800	507,086	1,108,800	360,000	22.7	876,039
Min	0.0	0.0	0.0	0.0	0	0	0	0	0.0	0.0	0.0	0.0	0	0	0	0	31.0	1.0	1.7	0.0	2,232,000	72,000	122,400	0	6.2	431,960
Std Dev	35.2	1.1	2.9	0.9	2,532,453	81,610	208,311	64,688	124.5	4.1	4.0	5.7	1,867,167	61,048	59,618	84,869	54.8	1.8	3.5	1.1	3,943,895	130,631	252,334	82,497	3.5	113,781

Average without outliers:	21.4	553,479
Maximum without outliers:	22.7	619,500

Avg = average
gpm = gallons per minute
Min = minimum
Max = maximum
Std. Dev = standard deviation

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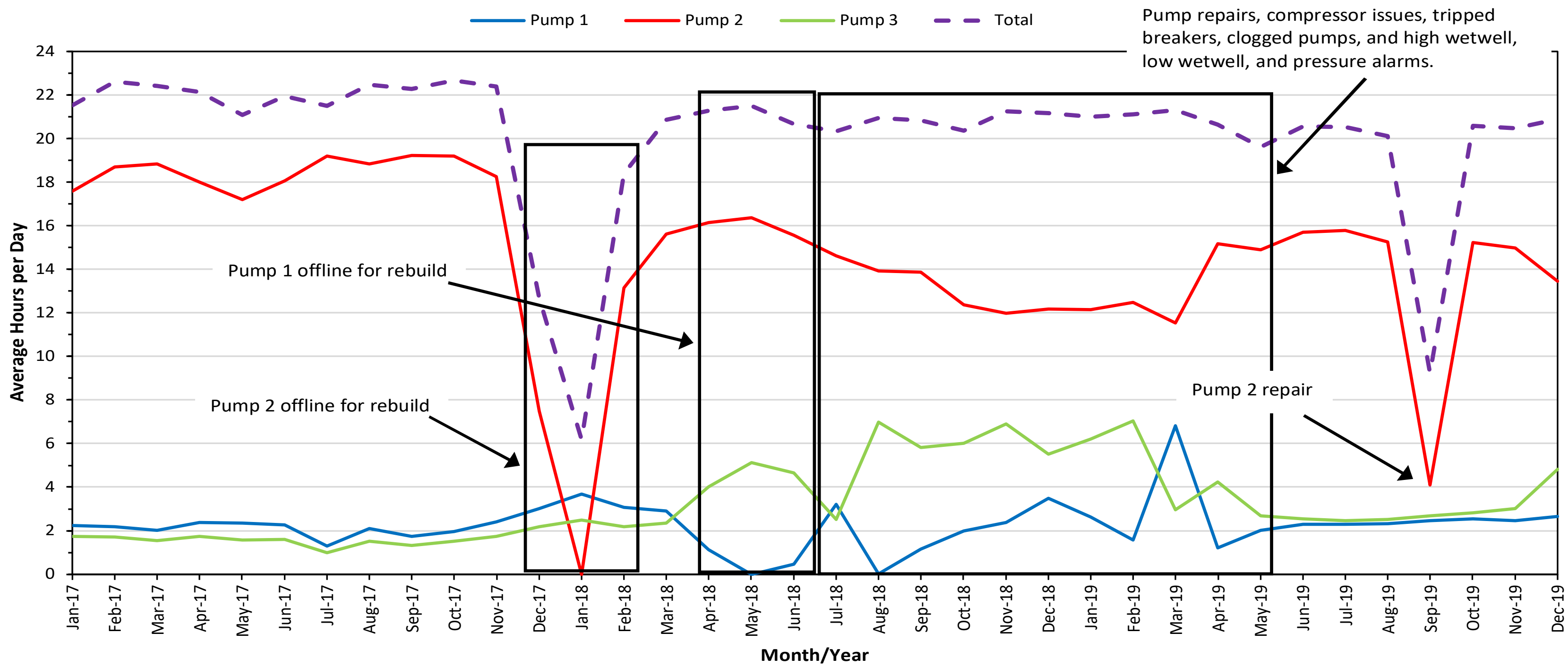
HERMISTON, OREGON
SANITARY SEWER COLLECTION SYSTEM STUDY

LIFT STATION 1 SUMMARY

APPENDIX H



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CITY OF
HERMISTON, OREGON
SANITARY SEWER COLLECTION SYSTEM STUDY
LIFT STATION 1
AVERAGE DAILY PUMP HOURS

APPENDIX H

Lift Station No. 4 Summary																		
	Pump 1 (170 gpm)								Pump 2 (170 gpm)								Total of Average	
Month	Hours	Hours Per Day			Gallons	Gallons Per Day			Hours	Hours Per Day			Gallons	Gallons Per Day			Hours	Gallons
	Operated	Avg	Max	Min	Pumped	Avg	Max	Min	Operated	Avg	Max	Min	Pumped	Avg	Max	Min	per Day	per Day
Jan-17	38.6	1.2	3.9	0.0	393,720	12,701	39,780	0	36.7	1.2	3.8	1.0	374,340	12,075	38,760	10,200	2.4	24,776
Feb-17	32.5	1.2	4.0	0.0	331,500	11,839	40,800	0	38.6	1.4	4.2	0.4	393,720	14,061	42,840	4,080	2.5	25,901
Mar-17	38.3	1.2	3.7	0.9	390,660	12,602	37,740	9,180	39.2	1.3	3.7	0.9	399,840	12,898	37,740	9,180	2.5	25,500
Apr-17	35.3	1.2	4.2	1.0	360,060	12,002	42,840	10,200	35.3	1.2	4.4	0.9	360,060	12,002	44,880	9,180	2.4	24,004
May-17	43.2	1.4	4.0	1.0	440,640	14,214	40,800	10,200	46.8	1.5	4.1	0.9	477,360	15,399	41,820	9,180	2.9	29,613
Jun-17	37.6	1.3	3.8	1.0	383,520	12,784	38,760	10,200	39.0	1.3	4.0	1.0	397,800	13,260	40,800	10,200	2.6	26,044
Jul-17	38.6	1.2	3.9	1.0	393,720	12,701	39,780	10,200	40.5	1.3	4.5	1.0	413,100	13,326	45,900	10,200	2.6	26,026
Aug-17	38.0	1.2	3.9	1.0	387,600	12,503	39,780	10,200	39.6	1.3	3.9	1.0	403,920	13,030	39,780	10,200	2.5	25,533
Sep-17	38.2	1.3	4.1	1.0	389,640	12,988	41,820	10,200	41.5	1.4	4.3	1.3	423,300	14,110	43,860	13,260	2.7	27,098
Oct-17	41.7	1.3	4.0	1.0	425,340	13,721	40,800	10,200	45.3	1.5	4.5	1.2	462,060	14,905	45,900	12,240	2.8	28,626
Nov-17	39.8	1.3	4.4	1.1	405,960	13,532	44,880	11,220	43.2	1.4	4.7	1.0	440,640	14,688	47,940	10,200	2.8	28,220
Dec-17	37.2	1.2	4.2	1.1	379,100	12,229	42,840	11,220	39.5	1.3	4.3	0.8	402,900	12,997	43,860	8,160	2.5	25,226
Jan-18	40.6	1.3	3.9	0.9	414,120	13,359	39,780	9,180	53.3	1.7	4.4	1.1	543,660	17,537	44,880	11,220	3.0	30,896
Feb-18	36.9	1.3	4.6	0.8	376,380	13,442	46,920	8,160	40.5	1.4	4.7	0.7	413,100	14,754	47,940	7,140	2.8	28,196
Mar-18	38.0	1.2	3.8	0.0	387,260	12,492	38,760	0	52.8	1.7	5.4	0.7	538,390	17,367	55,080	7,140	2.9	29,860
Apr-18	39.4	1.3	4.0	0.9	401,880	13,396	40,800	9,180	46.2	1.5	4.7	1.1	471,240	15,708	47,940	11,220	2.9	29,104
May-18	36.1	1.2	3.4	0.1	368,220	11,878	34,680	1,020	40.5	1.3	3.5	1.1	413,372	13,335	36,040	11,220	2.5	25,213
Jun-18	35.3	1.2	3.6	0.9	360,060	12,002	36,720	9,180	36.7	1.2	3.6	1.1	374,340	12,478	36,720	11,220	2.4	24,480
Jul-18	39.9	1.3	3.9	0.9	406,980	13,128	39,780	9,180	41.3	1.3	4.5	0.8	421,114	13,584	45,900	8,160	2.6	26,713
Aug-18	41.2	1.3	4.4	1.1	420,240	13,556	44,880	11,220	42.7	1.4	5.4	1.2	435,540	14,050	55,080	12,240	2.7	27,606
Sep-18	43.6	1.5	5.3	0.5	444,720	14,824	54,060	5,100	54.6	1.8	7.9	1.3	556,993	18,566	80,580	13,260	3.3	33,390
Oct-18	47.7	1.5	4.6	0.4	486,030	15,678	46,920	4,080	50.3	1.6	4.3	1.0	512,769	16,541	43,860	10,200	3.2	32,219
Nov-18	42.0	1.4	4.3	1.2	428,400	14,280	43,860	12,240	41.9	1.4	4.5	0.6	427,380	14,246	45,900	6,120	2.8	28,526
Dec-18	42.4	1.4	4.4	0.9	432,480	13,951	44,880	9,180	43.1	1.4	4.3	1.0	439,620	14,181	43,860	10,200	2.8	28,132
Jan-19	40.0	1.3	4.0	1.1	408,000	13,161	40,800	11,220	42.3	1.4	4.0	1.2	431,460	13,918	40,800	12,240	2.7	27,079
Feb-19	37.0	1.3	4.0	1.1	377,400	13,479	40,800	11,220	38.3	1.4	4.2	1.2	390,660	13,952	42,840	12,240	2.7	27,431
Mar-19	34.4	1.1	3.7	0.9	351,390	11,335	37,740	9,180	36.9	1.2	3.7	0.9	376,890	12,158	37,740	9,180	2.3	23,493
Apr-19	39.1	1.3	3.7	1.1	398,820	13,294	37,740	11,220	40.0	1.3	3.9	0.3	408,000	13,600	39,780	3,060	2.6	26,894
May-19	39.0	1.3	4.0	1.1	397,800	12,832	40,800	11,220	38.3	1.2	3.7	1.1	390,660	12,602	37,740	11,220	2.5	25,434
Jun-19	35.6	1.2	4.0	1.1	363,120	12,104	40,800	11,220	35.2	1.2	4.1	0.6	359,040	11,968	41,820	6,120	2.4	24,072
Jul-19	42.3	1.4	4.0	1.1	431,460	13,918	40,800	11,220	41.3	1.3	3.9	0.5	421,260	13,589	39,780	5,100	2.7	27,507
Aug-19	38.2	1.2	4.8	1.1	389,640	12,569	48,960	11,220	39.1	1.3	5.1	1.1	398,820	12,865	52,020	11,220	2.5	25,434
Sep-19	40.8	1.4	4.5	1.0	416,160	13,872	45,900	10,200	45.1	1.5	6.4	1.1	460,020	15,334	65,280	11,220	2.9	29,206
Oct-19	115.0	3.7	15.7	1.2	1,173,000	37,839	160,140	12,240	41.0	1.3	4.5	0.9	417,945	13,482	45,900	9,180	5.0	51,321
Nov-19	70.0	2.3	12.0	1.2	713,773	23,792	122,740	12,240	41.9	1.4	4.5	0.9	427,380	14,246	45,900	9,180	3.7	38,038
Dec-19	43.0	1.4	4.6	0.9	438,600	14,148	46,920	9,180	44.7	1.4	4.8	1.1	455,940	14,708	48,960	11,220	2.8	28,856
Avg	42.1	1.4	4.6	0.9	429,650	14,115	47,411	8,953	42.0	1.4	4.5	0.9	428,740	14,098	45,456	9,633	2.8	28,213
Max	115.0	3.7	15.7	1.2	1,173,000	37,839	160,140	12,240	54.6	1.8	7.9	1.3	556,993	18,566	80,580	13,260	5.0	51,321
Min	32.5	1.1	3.4	0.0	331,500	11,335	34,680	0	35.2	1.2	3.5	0.3	359,040	11,968	36,040	3,060	2.3	23,493
Std Dev	13.6	0.4	2.3	0.3	139,093	4,466	23,528	3,493	4.7	0.2	0.8	0.2	48,233	1,547	8,277	2,433	0.5	4,834
																Average without outliers:	2.7	27,244
																Maximum without outliers:	3.3	33,390

Avg = average
gpm = gallons per minute
Min = minimum
Max = maximum
Std. Dev = standard deviation

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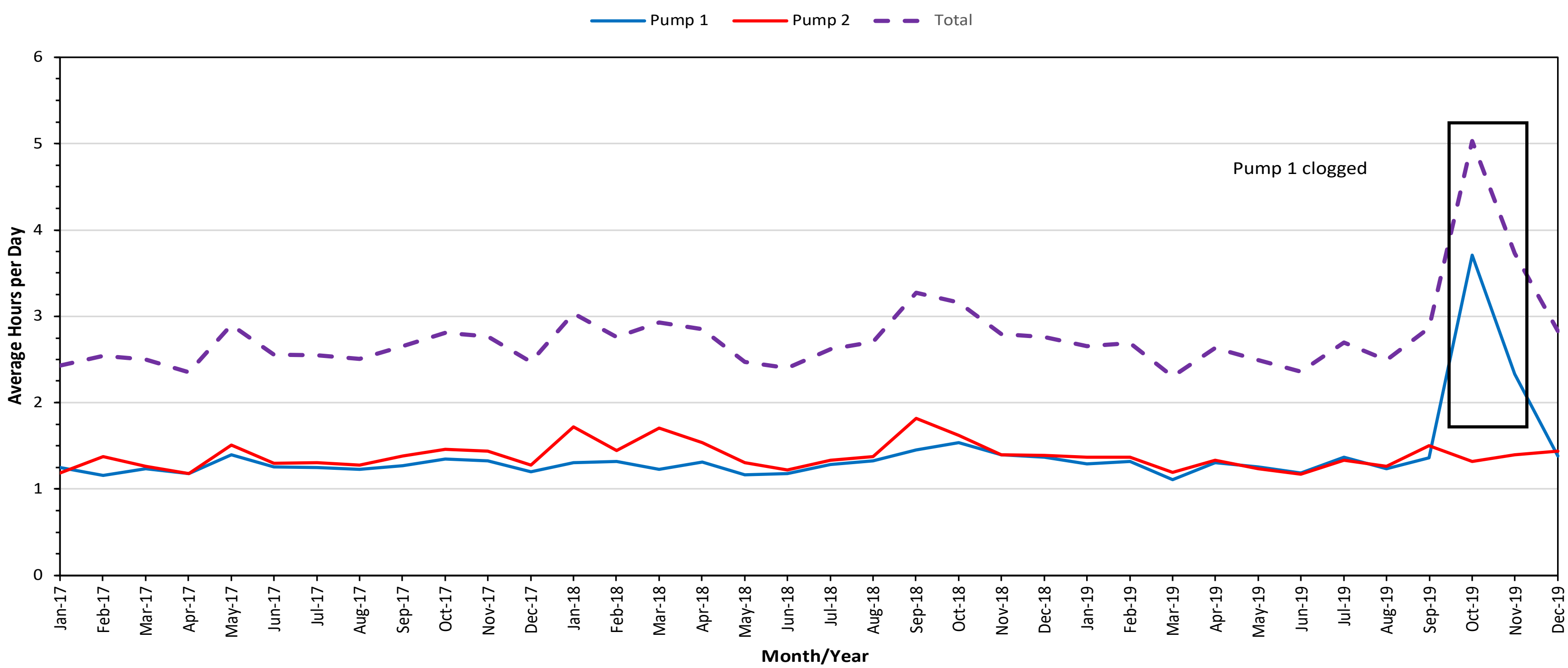
SANITARY SEWER COLLECTION SYSTEM STUDY

LIFT STATION 4 SUMMARY

APPENDIX
H



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CITY OF
HERMISTON, OREGON
SANITARY SEWER COLLECTION SYSTEM STUDY
LIFT STATION 4
AVERAGE DAILY PUMP HOURS

APPENDIX H

Lift Station No. 5 Summary

Month	Pump 1 (350 gpm)								Pump 2 (350 gpm)								Total of Average	
	Hours	Hours Per Day			Gallons	Gallons Per Day			Hours	Hours Per Day			Gallons	Gallons Per Day			Hours	Gallons
	Operated	Avg	Max	Min	Pumped	Avg	Max	Min	Operated	Avg	Max	Min	Pumped	Avg	Max	Min	per Day	per Day
Jan-17	33.4	1.1	3.4	1.0	701,190	22,619	71,400	21,000	32.4	1.0	3.4	0.9	680,190	21,942	71,190	19,950	2.1	44,561
Feb-17	29.6	1.1	4.3	0.8	620,760	22,170	90,930	16,800	29.1	1.0	4.3	0.8	611,100	21,825	89,460	16,590	2.1	43,995
Mar-17	30.7	1.0	3.7	0.8	644,490	20,790	76,860	15,750	30.2	1.0	3.6	0.5	634,410	20,465	75,600	9,660	2.0	41,255
Apr-17	28.5	1.0	3.2	0.8	598,920	19,964	66,360	17,220	27.9	0.9	3.1	0.8	585,270	19,509	64,890	16,380	1.9	39,473
May-17	33.2	1.1	3.1	0.8	698,040	22,517	64,260	17,850	32.6	1.1	3.0	0.8	685,020	22,097	63,630	16,800	2.1	44,615
Jun-17	28.8	1.0	3.1	0.8	605,640	20,188	64,680	15,960	28.4	0.9	3.0	0.7	596,820	19,894	62,790	14,910	1.9	40,082
Jul-17	27.7	0.9	2.9	0.6	581,070	18,744	60,270	13,440	27.3	0.9	2.8	0.6	572,460	18,466	59,220	12,810	1.8	37,211
Aug-17	29.0	0.9	2.9	0.6	609,420	19,659	61,740	13,230	28.2	0.9	2.9	0.7	592,830	19,124	61,740	14,070	1.8	38,782
Sep-17	29.0	1.0	3.1	0.9	608,580	20,286	66,150	19,530	28.3	0.9	3.1	0.9	594,720	19,824	65,100	18,900	1.9	40,110
Oct-17	32.4	1.0	3.1	0.8	679,350	21,915	65,940	17,640	31.7	1.0	3.1	0.6	666,540	21,501	65,520	11,970	2.1	43,416
Nov-17	33.0	1.1	3.6	0.8	694,050	23,135	76,230	17,220	32.0	1.1	3.5	0.8	672,630	22,421	74,340	17,430	2.2	45,556
Dec-17	30.7	1.0	3.4	0.5	644,070	20,776	71,400	9,450	30.7	1.0	3.3	0.9	645,120	20,810	69,090	19,530	2.0	41,587
Jan-18	34.4	1.1	3.3	0.9	722,610	23,310	69,930	18,900	34.9	1.1	3.3	0.9	732,060	23,615	68,880	19,110	2.2	46,925
Feb-18	30.3	1.1	3.3	0.8	635,880	22,710	69,720	15,960	30.1	1.1	3.3	0.8	633,150	22,612	69,930	16,590	2.2	45,322
Mar-18	30.3	1.0	3.2	0.7	636,300	20,526	68,040	15,540	30.1	1.0	3.2	0.7	631,260	20,363	66,990	15,120	1.9	40,889
Apr-18	33.0	1.1	3.4	0.9	693,000	23,100	71,400	19,110	32.5	1.1	3.3	0.9	682,080	22,736	70,140	18,900	2.2	45,836
May-18	32.2	1.0	3.3	0.9	675,570	21,793	68,670	18,270	31.7	1.0	3.1	0.9	665,910	21,481	66,150	18,690	2.1	43,274
Jun-18	29.9	1.0	3.2	0.7	627,480	20,916	66,150	14,700	29.4	1.0	3.1	0.5	616,350	20,545	64,680	10,710	2.0	41,461
Jul-18	31.7	1.0	3.2	0.8	664,650	21,440	66,150	15,750	31.3	1.0	3.2	0.7	657,930	21,224	66,570	15,540	2.0	42,664
Aug-18	31.2	1.0	3.1	0.9	654,780	21,122	65,100	18,480	30.7	1.0	3.0	0.9	644,700	20,797	63,840	18,690	2.0	41,919
Sep-18	58.6	2.0	7.6	1.8	1,229,760	40,992	159,390	37,590	66.3	2.2	8.5	2.0	1,392,930	46,431	178,920	42,630	4.2	87,423
Oct-18	76.2	2.5	7.1	2.0	1,601,040	51,646	149,310	40,950	18.3	0.6	7.7	0.0	383,460	12,370	161,070	0	3.0	64,016
Nov-18	52.4	1.7	7.1	0.8	1,099,560	36,652	149,520	16,800	16.7	0.6	3.5	0.0	350,070	11,669	73,290	0	2.3	48,321
Dec-18	36.6	1.2	3.8	0.6	769,020	24,807	78,750	11,550	36.2	1.2	3.7	0.8	760,830	24,543	77,280	17,220	2.4	49,350
Jan-19	35.9	1.2	3.7	1.0	754,110	24,326	76,860	20,580	35.6	1.1	3.6	1.0	748,440	24,143	76,230	20,580	2.3	48,469
Feb-19	33.2	1.2	3.8	1.1	697,830	24,922	80,640	22,680	32.8	1.2	3.8	1.0	687,960	24,570	80,346	21,630	2.4	49,492
Mar-19	35.1	1.1	3.9	0.9	736,260	23,750	81,480	17,850	34.7	1.1	4.1	0.4	728,070	23,486	85,050	8,190	2.2	47,236
Apr-19	33.1	1.1	3.3	0.9	695,940	23,198	68,250	19,110	32.9	1.1	3.2	0.9	690,270	23,009	67,620	18,480	2.2	46,207
May-19	33.2	1.1	3.4	1.0	697,410	22,497	72,240	20,160	32.8	1.1	3.4	1.0	687,750	22,185	70,770	20,370	2.1	44,683
Jun-19	28.5	0.9	3.3	0.9	598,080	19,936	69,300	17,850	28.3	0.9	3.3	0.9	593,460	19,782	69,720	18,060	1.9	39,718
Jul-19	30.6	1.0	3.1	0.7	643,650	20,763	65,100	14,910	30.7	1.0	3.0	0.7	644,910	20,804	62,160	15,330	2.0	41,566
Aug-19	28.7	0.9	3.1	0.8	602,700	19,442	66,150	16,380	28.4	0.9	3.1	0.8	596,610	19,245	65,520	17,640	1.8	38,687
Sep-19	31.5	1.0	3.2	0.8	660,660	22,022	67,830	16,800	30.9	1.0	3.1	0.8	649,740	21,658	65,310	17,430	2.1	43,680
Oct-19	32.4	1.0	3.3	0.8	681,030	21,969	69,090	17,220	32.0	1.0	3.3	0.8	671,370	21,657	68,460	17,220	2.1	43,626
Nov-19	29.5	1.0	3.2	0.8	619,920	20,664	67,200	17,640	28.9	1.0	3.1	0.9	607,950	20,265	65,520	17,850	1.9	40,929
Dec-19	31.9	1.0	3.3	0.9	670,740	21,637	69,930	18,480	31.6	1.0	3.3	0.8	664,440	21,434	68,880	17,430	2.1	43,070
Avg	34.1	1.1	3.7	0.9	715,377	23,525	77,012	18,288	31.3	1.0	3.6	0.8	657,189	21,625	74,886	16,456	2.2	45,150
Max	76.2	2.5	7.6	2.0	1,601,040	51,646	159,390	40,950	66.3	2.2	8.5	2.0	1,392,930	46,431	178,920	42,630	4.2	87,423
Min	27.7	0.9	2.9	0.5	581,070	18,744	60,270	9,450	16.7	0.6	2.8	0.0	350,070	11,669	59,220	0	1.8	37,211
Std Dev	9.3	0.3	1.1	0.3	194,762	6,348	23,642	5,696	7.0	0.2	1.1	0.3	147,769	4,946	24,008	6,548	0.4	8,486
																Average without outliers:	2.1	43,352
																Maximum without outliers:	2.4	49,492

Avg = average
gpm = gallons per minute
Min = minimum
Max = maximum
Std. Dev = standard deviation

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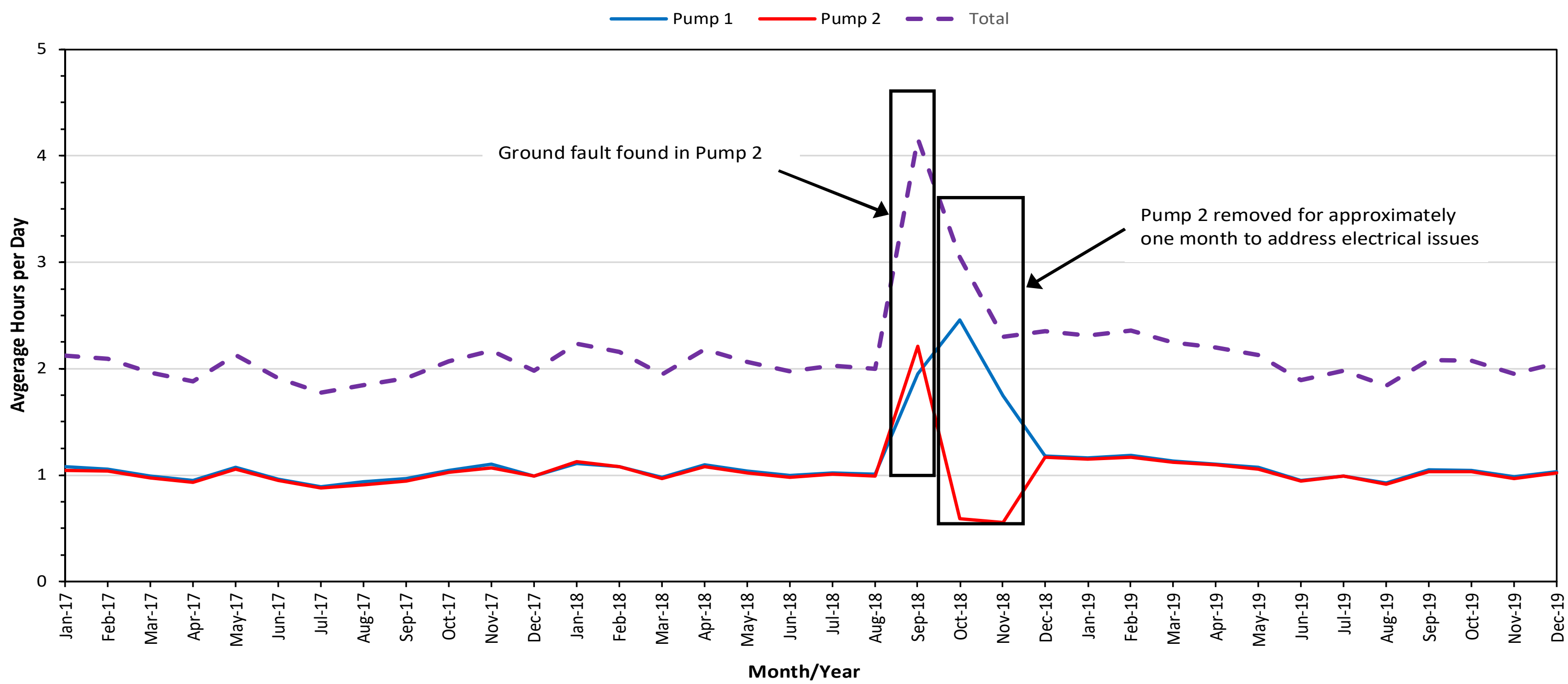
CITY OF
HERMISTON, OREGON
SANITARY SEWER COLLECTION SYSTEM STUDY

LIFT STATION 5 SUMMARY

APPENDIX H



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CITY OF
HERMISTON, OREGON
SANITARY SEWER COLLECTION SYSTEM STUDY
LIFT STATION 5
AVERAGE DAILY PUMP HOURS

APPENDIX H

Lift Station No. 6 Summary																		
Month	Pump 1 (75 gpm)								Pump 2 (75 gpm)								Total of Average	
	Hours	Hours Per Day			Gallons	Gallons Per Day			Hours	Hours Per Day			Gallons	Gallons Per Day			Hours	Gallons
	Operated	Avg	Max	Min	Pumped	Avg	Max	Min	Operated	Avg	Max	Min	Pumped	Avg	Max	Min	per Day	per Day
Jan-17	85.8	2.8	10.2	0.1	385,950	12,450	45,900	450	67.7	2.2	7.3	1.9	304,866	9,834	32,850	8,550	5.0	22,284
Feb-17	68.7	2.5	8.0	1.7	309,150	11,041	36,000	7,650	58.0	2.1	6.7	1.5	261,000	9,321	30,150	6,750	4.5	20,363
Mar-17	67.7	2.2	6.7	1.8	304,650	9,827	30,150	8,100	58.9	1.9	5.9	1.2	265,050	8,550	26,550	5,400	4.1	18,377
Apr-17	63.8	2.1	7.9	1.6	287,100	9,570	35,550	7,200	54.6	1.8	6.7	1.3	245,700	8,190	30,150	5,850	3.9	17,760
May-17	72.4	2.3	7.1	1.5	325,650	10,505	31,950	6,750	58.0	1.9	6.0	1.3	261,150	8,424	27,000	5,850	4.2	18,929
Jun-17	87.5	2.9	9.5	2.2	393,750	13,125	42,750	9,900	74.6	2.5	8.1	1.6	335,700	11,190	36,450	7,200	5.4	24,315
Jul-17	97.3	3.1	10.6	2.7	437,850	14,124	47,700	12,150	83.4	2.7	9.4	2.1	375,300	12,106	42,300	9,450	5.8	26,231
Aug-17	98.3	3.2	12.9	0.7	442,350	14,269	58,050	3,150	86.3	2.8	9.9	2.2	388,350	12,527	44,550	9,900	6.0	26,797
Sep-17	64.7	2.2	6.7	1.9	291,150	9,705	30,150	8,550	55.9	1.9	5.7	1.7	251,550	8,385	25,650	7,650	4.0	18,090
Oct-17	69.7	2.2	6.7	1.7	313,650	10,118	30,150	7,650	62.9	2.0	6.0	1.6	283,050	9,131	27,000	7,200	4.3	19,248
Nov-17	67.2	2.2	7.8	1.8	302,400	10,080	35,100	8,100	66.1	2.2	7.6	1.7	297,450	9,915	34,200	7,650	4.4	19,995
Dec-17	79.0	2.5	8.8	2.0	355,500	11,468	39,600	9,000	65.0	2.1	7.3	1.9	292,500	9,435	32,850	8,550	4.6	20,903
Jan-18	79.4	2.6	8.2	1.8	357,300	11,526	36,900	8,100	75.2	2.4	8.0	1.7	338,400	10,916	36,000	7,650	5.0	22,442
Feb-18	65.6	2.3	7.9	2.0	295,405	10,550	35,550	9,000	56.8	2.0	6.3	0.2	255,600	9,129	28,350	900	4.4	19,679
Mar-18	67.2	2.2	7.4	1.7	302,400	9,755	33,300	7,650	57.6	1.9	6.2	1.4	259,200	8,361	27,900	6,300	4.0	18,116
Apr-18	82.1	2.7	9.7	2.0	369,450	12,315	43,650	9,000	69.5	2.3	8.2	1.6	312,750	10,425	36,900	7,200	5.1	22,740
May-18	75.3	2.4	7.1	1.5	338,850	10,931	31,950	6,750	64.9	2.1	6.4	1.4	292,050	9,421	28,800	6,300	4.5	20,352
Jun-18	82.5	2.8	8.5	1.9	371,250	12,375	38,250	8,550	76.6	2.6	8.0	1.8	344,700	11,490	36,000	8,100	5.3	23,865
Jul-18	99.7	3.2	10.4	1.9	448,650	14,473	46,800	8,595	95.7	3.1	10.3	1.8	430,650	13,892	46,350	8,100	6.3	28,365
Aug-18	96.5	3.1	9.4	2.7	434,250	14,008	42,300	12,150	93.4	3.0	9.7	2.6	420,300	13,558	43,650	11,700	6.1	27,566
Sep-18	91.6	3.1	12.5	2.2	412,200	13,740	56,250	9,900	91.2	3.0	12.7	2.2	410,400	13,680	57,150	9,900	6.1	27,420
Oct-18	113.2	3.7	11.2	2.2	509,400	16,432	50,400	9,900	93.8	3.0	8.7	1.8	422,100	13,616	39,150	8,100	6.7	30,048
Nov-18	165.2	5.5	27.4	2.0	743,400	24,780	123,300	9,000	105.3	3.5	15.3	0.5	473,850	15,795	68,850	2,250	9.0	40,575
Dec-18	85.7	2.8	9.9	2.0	385,650	12,440	44,550	9,000	71.6	2.3	8.1	1.7	322,200	10,394	36,450	7,650	5.1	22,834
Jan-19	108.5	3.5	17.4	2.2	488,250	15,750	78,300	9,900	69.7	2.2	8.4	0.6	313,650	10,118	37,800	2,700	5.7	25,868
Feb-19	114.0	4.1	15.8	2.2	513,195	18,328	71,100	9,900	51.8	1.9	6.1	1.0	233,100	8,325	27,450	4,500	5.9	26,653
Mar-19	198.1	6.4	35.5	1.5	891,450	28,756	159,750	6,750	46.3	1.5	6.0	0.2	208,350	6,721	27,000	900	7.9	35,477
Apr-19	68.4	2.3	8.1	0.0	307,800	10,260	36,450	0	72.1	2.4	11.2	1.6	324,450	10,815	50,400	7,200	4.7	21,075
May-19	114.1	3.7	12.9	2.3	513,450	16,563	58,050	10,350	62.2	2.0	6.3	0.0	279,900	9,029	28,350	0	5.7	25,592
Jun-19	84.1	2.8	8.6	2.2	378,450	12,615	38,700	9,900	62.2	2.1	8.5	0.3	279,900	9,330	38,250	1,350	4.9	21,945
Jul-19	130.0	4.2	14.6	0.1	585,000	18,871	65,700	450	87.6	2.8	9.6	1.7	394,200	12,716	43,200	7,650	7.0	31,587
Aug-19	167.2	5.4	24.4	2.4	752,400	24,271	109,800	10,800	123.1	4.0	21.7	0.5	553,950	17,869	97,650	2,250	9.4	42,140
Sep-19	139.2	4.6	28.4	1.8	626,400	20,880	127,800	8,100	116.7	3.9	19.1	0.9	525,150	17,505	85,950	4,050	8.5	38,385
Oct-19	84.0	2.7	9.2	2.2	378,000	12,194	41,400	9,900	63.7	2.1	6.8	1.7	286,650	9,247	30,600	7,650	4.8	21,440
Nov-19	148.9	5.0	17.5	2.4	670,050	22,335	78,750	10,800	56.8	1.9	6.2	1.2	255,600	8,520	27,900	5,400	6.9	30,855
Dec-19	70.3	2.3	7.9	0.1	316,463	10,208	35,663	450	70.3	2.3	6.7	1.8	316,350	10,205	30,150	8,100	4.5	20,413
Avg	95.9	3.2	12.0	1.8	431,618	14,184	54,103	7,876	72.9	2.4	8.6	1.4	328,198	10,780	38,888	6,275	5.5	24,965
Max	198.1	6.4	35.5	2.7	891,450	28,756	159,750	12,150	123.1	4.0	21.7	2.6	553,950	17,869	97,650	11,700	9.4	42,140
Min	63.8	2.1	6.7	0.0	287,100	9,570	30,150	0	46.3	1.5	5.7	0.0	208,350	6,721	25,650	0	3.9	17,760
Std Dev	32.5	1.1	6.7	0.7	146,201	4,763	30,322	3,121	17.9	0.6	3.5	0.6	80,567	2,591	15,852	2,794	1.4	6,279

Average without outliers:	4.9	21,982
Maximum without outliers:	6.3	28,365

Avg = average
gpm - gallons per minute
Min = minimum
Max = maximum
Std. Dev = standard deviation

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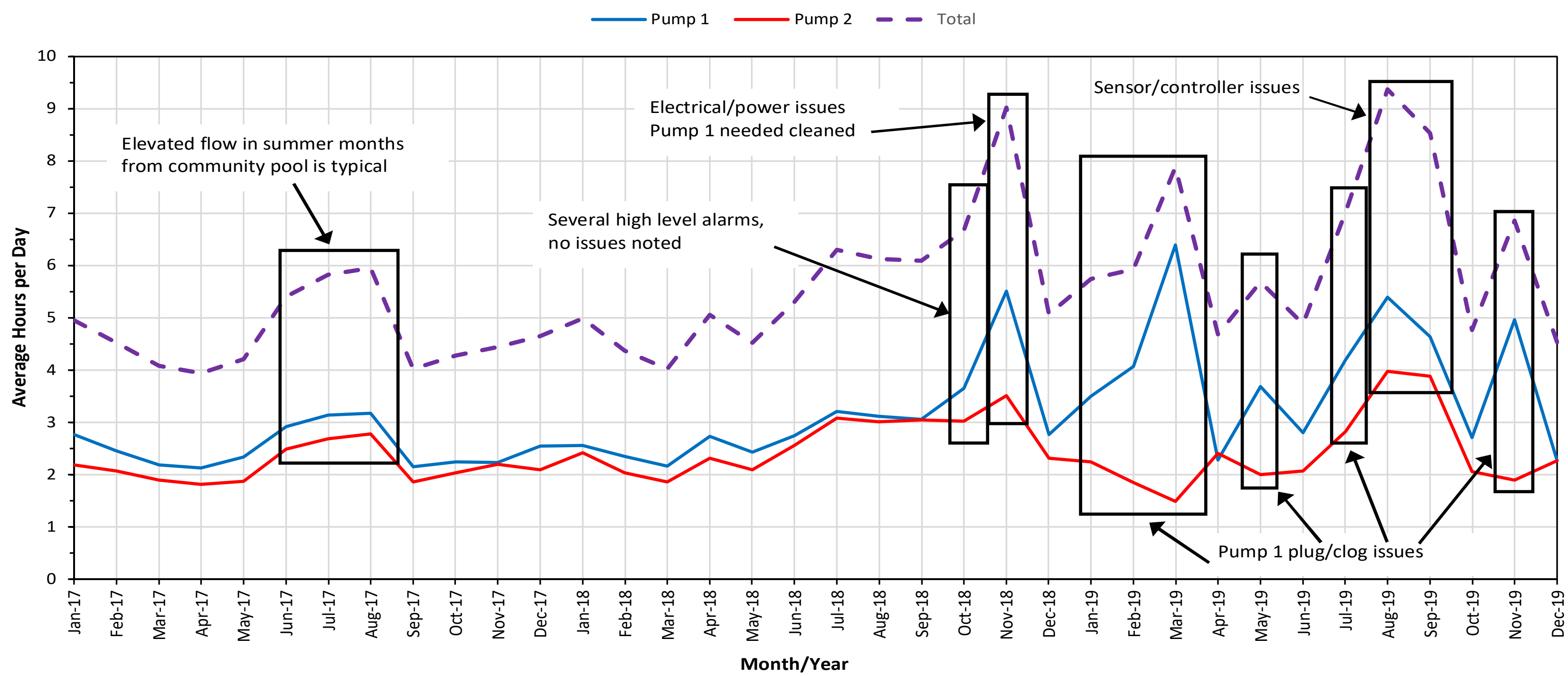
CITY OF
HERMISTON, OREGON
SANITARY SEWER COLLECTION SYSTEM STUDY

LIFT STATION 6 SUMMARY

APPENDIX H



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CITY OF
HERMISTON, OREGON
SANITARY SEWER COLLECTION SYSTEM STUDY
LIFT STATION 6
AVERAGE DAILY PUMP HOURS

APPENDIX H

Lift Station No. 7 Summary

Month	Pump 1 (60 gpm)								Pump 2 (60 gpm)								Total of Average	
	Hours	Hours Per Day			Gallons	Gallons Per Day			Hours	Hours Per Day			Gallons	Gallons Per Day			Hours	Gallons
	Operated	Avg	Max	Min	Pumped	Avg	Max	Min	Operated	Avg	Max	Min	Pumped	Avg	Max	Min	per Day	per Day
Mar-18	84.4	2.7	9.5	2.3	303,840	9,801	34,200	8,280	57.6	1.9	6.5	1.5	207,360	6,689	23,400	5,400	4.6	16,490
Apr-18	90.3	3.0	9.1	2.3	325,080	10,836	32,760	8,280	60.4	2.0	6.0	1.5	217,440	7,248	21,600	5,400	5.0	18,084
May-18	120.4	3.9	11.5	2.4	433,440	13,982	41,400	8,640	71.4	2.3	6.2	1.7	257,130	8,295	22,320	6,120	6.2	22,276
Jun-18	104.3	3.5	12.3	2.5	375,480	12,516	44,280	9,000	62.4	2.1	7.1	1.6	224,640	7,488	25,560	5,760	5.6	20,004
Jul-18	116.7	3.8	11.1	2.8	420,120	13,552	39,960	10,080	70.1	2.3	6.7	1.7	252,360	8,141	24,120	6,120	6.0	21,693
Aug-18	111.4	3.6	11.2	3.2	401,040	12,937	40,320	11,520	67.9	2.2	6.9	1.4	244,440	7,885	24,840	5,040	5.8	20,822
Sep-18	108.5	3.6	12.1	3.2	390,600	13,020	43,560	11,520	65.2	2.2	7.3	1.9	234,720	7,824	26,280	6,840	5.8	20,844
Oct-18	122.6	4.0	12.3	2.9	441,360	14,237	44,280	10,440	73.3	2.4	7.0	1.8	263,880	8,512	25,200	6,480	6.3	22,750
Nov-18	111.8	3.7	11.3	3.0	402,480	13,416	40,680	10,800	65.3	2.2	6.5	1.8	235,080	7,836	23,400	6,480	5.9	21,252
Dec-18	125.9	4.1	13.0	3.0	453,240	14,621	46,800	10,800	70.5	2.3	7.3	1.6	253,800	8,187	26,280	5,760	6.3	22,808
Jan-19	104.0	3.4	10.6	2.8	374,400	12,077	38,160	10,080	63.6	2.1	6.2	1.1	229,050	7,389	22,320	3,960	5.4	19,466
Feb-19	95.0	3.4	10.3	2.9	342,000	12,214	37,080	10,440	48.4	1.7	6.7	0.0	174,240	6,223	24,120	0	5.1	18,437
Mar-19	93.6	3.0	13.7	2.4	336,960	10,870	49,320	8,640	61.2	2.0	8.6	1.7	220,320	7,107	30,960	6,120	5.0	17,977
Apr-19	105.0	3.5	11.1	2.6	378,000	12,600	39,960	9,360	64.4	2.1	6.4	1.7	231,840	7,728	23,040	6,120	5.6	20,328
May-19	95.9	3.1	12.3	2.6	345,240	11,137	44,280	9,360	63.2	2.0	8.2	1.7	227,520	7,339	29,520	6,120	5.1	18,476
Jun-19	92.5	3.1	10.2	2.5	333,000	11,100	36,720	9,000	61.2	2.0	6.8	1.8	220,320	7,344	24,480	6,480	5.1	18,444
Jul-19	115.3	3.7	10.3	2.8	414,960	13,386	37,080	10,080	75.5	2.4	7.2	1.7	271,680	8,764	25,920	6,120	6.2	22,150
Aug-19	100.5	3.2	11.5	0.4	361,800	11,671	41,400	1,440	77.0	2.5	8.6	2.2	277,200	8,942	30,960	7,920	5.7	20,613
Sep-19	97.0	3.2	10.2	0.6	349,200	11,640	36,720	2,160	73.2	2.4	7.2	1.0	263,520	8,784	25,920	3,600	5.7	20,424
Oct-19	90.7	2.9	8.8	2.5	326,520	10,533	31,680	9,000	70.6	2.3	7.1	2.0	254,160	8,199	25,560	7,200	5.2	18,732
Nov-19	90.4	3.0	9.7	2.5	325,440	10,848	34,920	9,000	70.9	2.4	7.9	1.8	255,240	8,508	28,440	6,480	5.4	19,356
Dec-19	98.2	3.2	10.4	2.2	353,520	11,404	37,440	7,920	81.2	2.6	8.2	2.0	292,320	9,430	29,520	7,200	5.8	20,834
Avg	103.4	3.4	11.0	2.5	372,169	12,200	39,682	8,902	67.0	2.2	7.1	1.6	241,285	7,903	25,625	5,760	5.6	20,103
Max	125.9	4.1	13.7	3.2	453,240	14,621	49,320	11,520	81.2	2.6	8.6	2.2	292,320	9,430	30,960	7,920	6.3	22,808
Min	84.4	2.7	8.8	0.4	303,840	9,801	31,680	1,440	48.4	1.7	6.0	0.0	174,240	6,223	21,600	0	4.6	16,490
Std Dev	11.5	0.4	1.2	0.7	41,523	1,296	4,434	2,461	7.2	0.2	0.7	0.4	25,765	754	2,676	1,577	0.5	1,676

Average without outliers:	5.6	20,103
Maximum without outliers:	6.3	22,808

Avg = average
gpm - gallons per minute
Min = minimum
Max = maximum
Std. Dev = standard deviation

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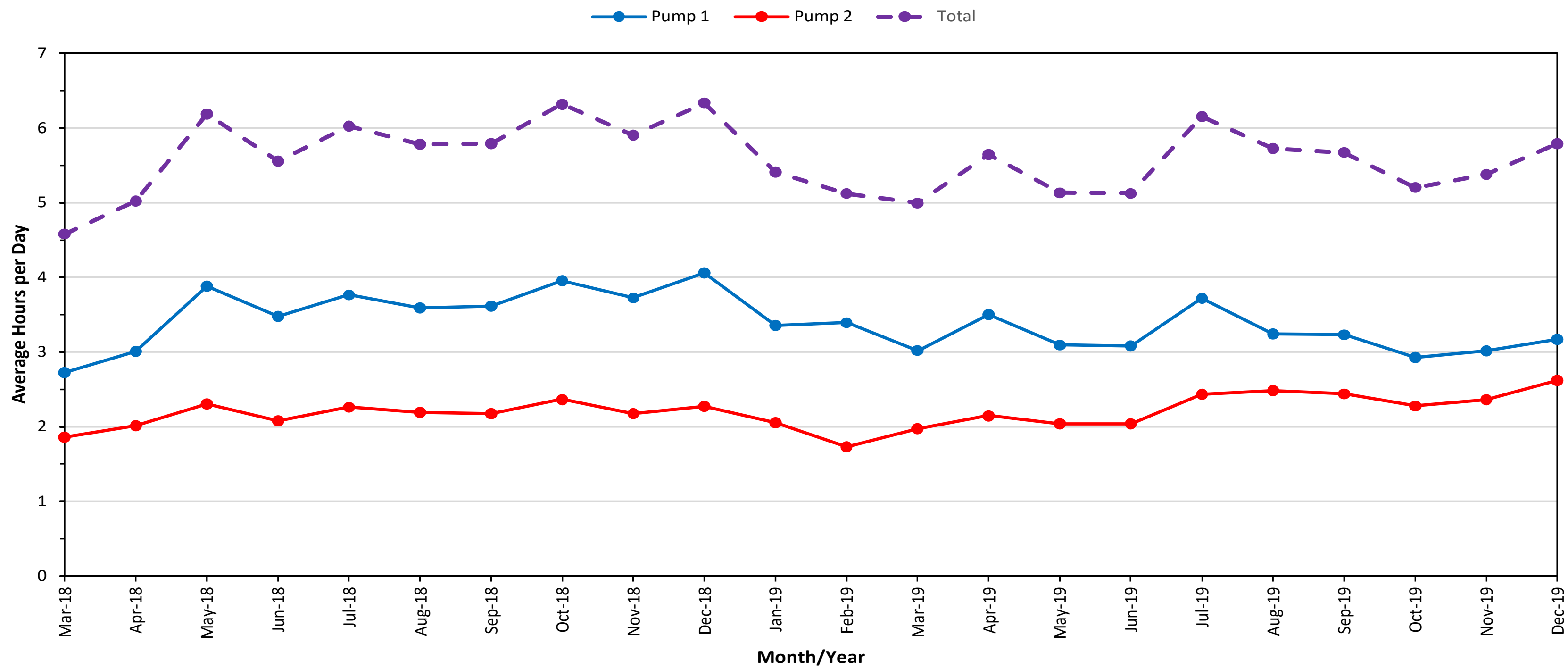
CITY OF
HERMISTON, OREGON
SANITARY SEWER COLLECTION SYSTEM STUDY

LIFT STATION 7 SUMMARY

APPENDIX H



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CITY OF
HERMISTON, OREGON
SANITARY SEWER COLLECTION SYSTEM STUDY
LIFT STATION 7
AVERAGE DAILY PUMP HOURS

APPENDIX
H

Lift Station No. 8 Summary																										
Month	Pump 1 (900 gpm)								Pump 2 (900 gpm)								Pump 3 (900 gpm)								Total of Average	
	Hours	Hours Per Day			Gallons	Gallons Per Day			Hours	Hours Per Day			Gallons	Gallons Per Day			Hours	Hours Per Day			Gallons	Gallons Per Day			Hours	Gallons
	Operated	Avg	Max	Min	Pumped	Avg	Max	Min	Operated	Avg	Max	Min	Pumped	Avg	Max	Min	Operated	Avg	Max	Min	Pumped	Avg	Max	Min	per Day	per Day
Jan-17	130.6	4.2	13.0	0.0	7,052,400	227,497	702,000	0	107.1	3.5	11.8	0.0	5,783,400	186,561	637,200	0	107.8	3.5	10.8	0.0	5,821,200	187,781	583,200	0	11.1	601,839
Feb-17	136.1	4.9	13.9	0.0	7,349,400	262,479	750,600	0	110.1	3.9	11.1	0.0	5,945,400	212,336	599,400	0	94.8	3.4	23.0	0.0	5,119,200	182,829	1,242,000	0	12.2	657,643
Mar-17	130.7	4.2	12.4	0.0	7,057,800	227,671	669,600	0	100.4	3.2	10.7	0.0	5,421,600	174,890	577,800	0	110.0	3.5	10.3	0.0	5,940,000	191,613	556,200	0	11.0	594,174
Apr-17	114.9	3.8	12.0	0.0	6,204,600	206,820	648,000	0	111.9	3.7	10.3	0.0	6,042,600	201,420	556,200	0	96.0	3.2	9.6	0.0	5,184,000	172,800	518,400	0	10.8	581,040
May-17	145.5	4.7	13.9	0.0	7,857,000	253,452	750,600	0	109.4	3.5	10.6	0.0	5,907,600	190,568	572,400	0	97.8	3.2	11.1	0.0	5,281,200	170,361	599,400	0	11.4	614,381
Jun-17	111.5	3.7	11.3	0.0	6,021,000	200,700	610,200	0	105.1	3.5	11.0	0.0	5,675,400	189,180	594,000	0	96.2	3.2	9.6	0.0	5,194,800	173,160	518,400	0	10.4	563,040
Jul-17	114.7	3.7	10.7	0.0	6,193,800	199,800	577,800	0	153.0	4.9	14.0	0.0	8,262,000	266,516	756,000	0	98.3	3.2	9.0	0.0	5,308,200	171,232	486,000	0	11.8	637,548
Aug-17	168.3	5.4	18.2	0.0	9,088,200	293,168	982,800	0	125.0	4.0	20.1	0.0	6,750,000	217,742	1,085,400	0	112.3	3.6	9.3	0.0	6,064,200	195,619	502,200	0	13.1	706,529
Sep-17	191.0	6.4	14.9	0.0	10,314,000	343,800	804,600	0	55.9	1.9	9.9	0.0	3,018,600	100,620	534,600	0	111.7	3.7	10.1	0.0	6,031,800	201,060	545,400	0	12.0	645,480
Oct-17	134.3	4.3	12.3	0.0	7,252,200	233,942	664,200	0	104.3	3.4	20.2	0.0	5,632,200	181,684	1,090,800	0	112.1	3.6	9.7	0.0	6,053,400	195,271	523,800	0	11.3	610,897
Nov-17	119.9	4.0	11.1	0.0	6,474,600	215,820	599,400	0	115.8	3.9	10.5	0.0	6,253,200	208,440	567,000	0	102.4	3.4	10.1	0.0	5,529,600	184,320	545,400	0	11.3	608,580
Dec-17	103.7	3.3	11.3	0.0	5,599,800	180,639	610,200	0	99.4	3.2	9.9	0.0	5,367,600	173,148	534,600	0	116.9	3.8	8.9	0.0	6,312,600	203,632	480,600	0	10.3	557,419
Jan-18	127.0	4.1	12.3	0.0	6,858,000	221,226	664,200	0	101.8	3.3	10.3	0.0	5,497,200	177,329	556,200	0	96.6	3.1	9.8	0.0	5,216,400	168,271	529,200	0	10.5	566,826
Feb-18	99.7	3.6	11.3	0.0	5,383,800	192,279	610,200	0	85.1	3.0	9.2	0.0	4,595,400	164,121	496,800	0	94.5	3.4	9.6	0.0	5,103,000	182,250	518,400	0	10.0	538,650
Mar-18	111.5	3.6	10.2	0.0	6,021,000	194,226	550,800	0	98.0	3.2	9.7	0.0	5,292,000	170,710	523,800	0	99.4	3.2	9.7	0.0	5,367,600	173,148	523,800	0	10.0	538,084
Apr-18	117.0	3.9	11.4	0.0	6,318,000	210,600	615,600	0	105.0	3.5	10.1	0.0	5,670,000	189,000	545,400	0	93.9	3.1	9.6	0.0	5,070,600	169,020	518,400	0	10.5	568,620
May-18	55.2	1.8	9.7	0.0	2,980,800	96,155	523,800	0	137.8	4.4	11.1	0.0	7,441,200	240,039	599,400	0	143.5	4.6	18.0	0.0	7,749,000	249,968	972,000	0	10.9	586,161
Jun-18	87.0	2.9	10.5	0.0	4,698,000	156,600	567,000	0	121.8	4.1	9.8	0.0	6,577,200	219,240	529,200	0	109.5	3.7	21.9	0.0	5,913,000	197,100	1,182,600	0	10.6	572,940
Jul-18	108.2	3.5	10.3	0.0	5,842,800	188,477	556,200	0	104.3	3.4	9.8	0.0	5,632,200	181,684	529,200	0	103.0	3.3	8.8	0.0	5,562,000	179,419	475,200	0	10.2	549,581
Aug-18	116.9	3.8	10.9	0.0	6,312,600	203,632	588,600	0	98.6	3.2	8.8	0.0	5,324,400	171,755	475,200	0	117.8	3.8	20.8	0.0	6,361,200	205,200	1,123,200	0	10.8	580,587
Sep-18	58.8	2.0	10.4	0.0	3,175,200	105,840	561,600	0	148.7	5.0	14.0	0.0	8,029,800	267,660	756,000	0	104.6	3.5	10.6	0.0	5,648,400	188,280	572,400	0	10.4	561,780
Oct-18	82.2	2.7	10.5	0.0	4,438,800	143,187	567,000	0	180.7	5.8	14.7	0.0	9,757,800	314,768	793,800	0	101.0	3.3	9.7	0.0	5,454,000	175,935	523,800	0	11.7	633,890
Nov-18	1.5	0.1	1.5	0.0	81,000	2,700	81,000	0	212.1	7.1	13.8	0.1	11,453,400	381,780	745,200	5,400	112.3	3.7	10.3	0.0	6,064,200	202,140	556,200	0	10.9	586,620
Dec-18	0.1	0.0	0.1	0.0	5,400	174	5,400	0	209.5	6.8	17.9	0.0	11,313,000	364,935	966,600	0	95.1	3.1	9.7	0.0	5,135,400	165,658	523,800	0	9.8	530,768
Jan-19	120.3	3.9	11.4	0.0	6,496,200	209,555	615,600	0	89.6	2.9	10.3	0.0	4,838,400	156,077	556,200	0	59.8	1.9	10.6	0.0	3,229,200	104,168	572,400	0	8.7	469,800
Feb-19	108.3	3.9	18.1	0.0	5,848,200	208,864	977,400	0	142.4	5.1	21.1	0.0	7,689,600	274,629	1,139,400	0	91.7	3.3	10.0	0.0	4,951,800	176,850	540,000	0	12.2	660,343
Mar-19	103.4	3.3	12.6	0.0	5,583,600	180,116	680,400	0	137.4	4.4	20.3	0.0	7,419,600	239,342	1,096,200	0	133.5	4.3	10.1	0.0	7,209,000	232,548	545,400	0	12.1	652,006
Apr-19	33.8	1.1	13.8	0.0	1,825,200	60,840	745,200	0	168.9	5.6	18.1	0.0	9,120,600	304,020	977,400	0	153.5	5.1	10.7	0.0	8,289,000	276,300	577,800	0	11.9	641,160
May-19	48.3	1.6	9.2	0.0	2,608,200	84,135	496,800	0	204.0	6.6	16.5	0.0	11,016,000	355,355	891,000	0	115.1	3.7	10.1	0.0	6,215,400	200,497	545,400	0	11.9	639,987
Jun-19	94.4	3.1	9.1	0.0	5,097,600	169,920	491,400	0	127.1	4.2	11.9	0.0	6,863,400	228,780	642,600	0	110.9	3.7	11.3	0.0	5,988,600	199,620	610,200	0	11.1	598,320
Jul-19	99.1	3.2	8.6	0.0	5,351,400	172,626	464,400	0	124.7	4.0	14.1	0.0	6,733,800	217,219	761,400	0	104.7	3.4	9.4	0.0	5,653,800	182,381	507,600	0	10.6	572,226
Aug-19	102.0	3.3	9.2	0.0	5,508,000	177,677	496,800	0	127.2	4.1	12.3	0.0	6,868,800	221,574	664,200	0	108.1	3.5	9.6	0.0	5,837,400	188,303	518,400	0	10.9	587,555
Sep-19	93.5	3.1	8.8	0.0	5,049,000	168,300	475,200	0	117.7	3.9	11.7	0.0	6,355,800	211,860	631,800	0	106.0	3.5	10.2	0.0	5,724,000	190,800	550,800	0	10.6	570,960
Oct-19	92.6	3.0	8.8	0.0	5,000,400	161,303	475,200	0	116.1	3.7	10.4	0.0	6,269,400	202,239	561,600	0	105.3	3.4	9.5	0.0	5,686,200	183,426	513,000	0	10.1	546,968
Nov-19	94.3	3.1	8.3	0.0	5,092,200	169,740	448,200	0	116.7	3.9	10.7	0.0	6,301,800	210,060	577,800	0	89.9	3.0	9.3	0.0	4,854,600	161,820	502,200	0	10.0	541,620
Dec-19	94.8	3.1	9.0	0.0	5,119,200	165,135	486,000	0	140.3	4.5	19.5	0.0	7,576,200	244,394	1,053,000	0	102.7	3.3	9.2	0.0	5,545,800	178,897	496,800	0	10.9	588,426
Avg	101.4	3.3	10.9	0.0	5,476,650	180,253	586,500	0	125.4	4.1	12.9	0.0	6,769,350	222,547	699,300	150	105.8	3.5	11.1	0.0	5,713,050	187,824	600,000	0	10.9	590,624
Max	191.0	6.4	18.2	0.0	10,314,000	343,800	982,800	0	212.1	7.1	21.1	0.1	11,453,400	381,780	1,139,400	5,400	153.5	5.1	23.0	0.0	8,289,000	276,300	1,242,000	0	13.1	706,529
Min	0.1	0.0	0.1	0.0	5,400	174	5,400	0	55.9	1.9	8.8	0.0	3,018,600	100,620	475,200	0	59.8	1.9	8.8	0.0	3,229,200	104,168	475,200	0	8.7	469,800
Std Dev	38.5	1.3	3.4	0.0	2,079,731	68,716	181,029	0	34.1	1.1	3.7	0.0	1,843,431	60,164	199,360	887	15.5	0.5	3.6	0.0	834,851	26,779	192,797	0	0.8	45,578

	Hours per Day	Gallons per Day
Average without outliers:	10.9	590,624
Maximum without outliers:	13.1	706,529

Avg = average
gpm = gallons per minute
Min = minimum
Max = maximum
Std. Dev = standard deviation

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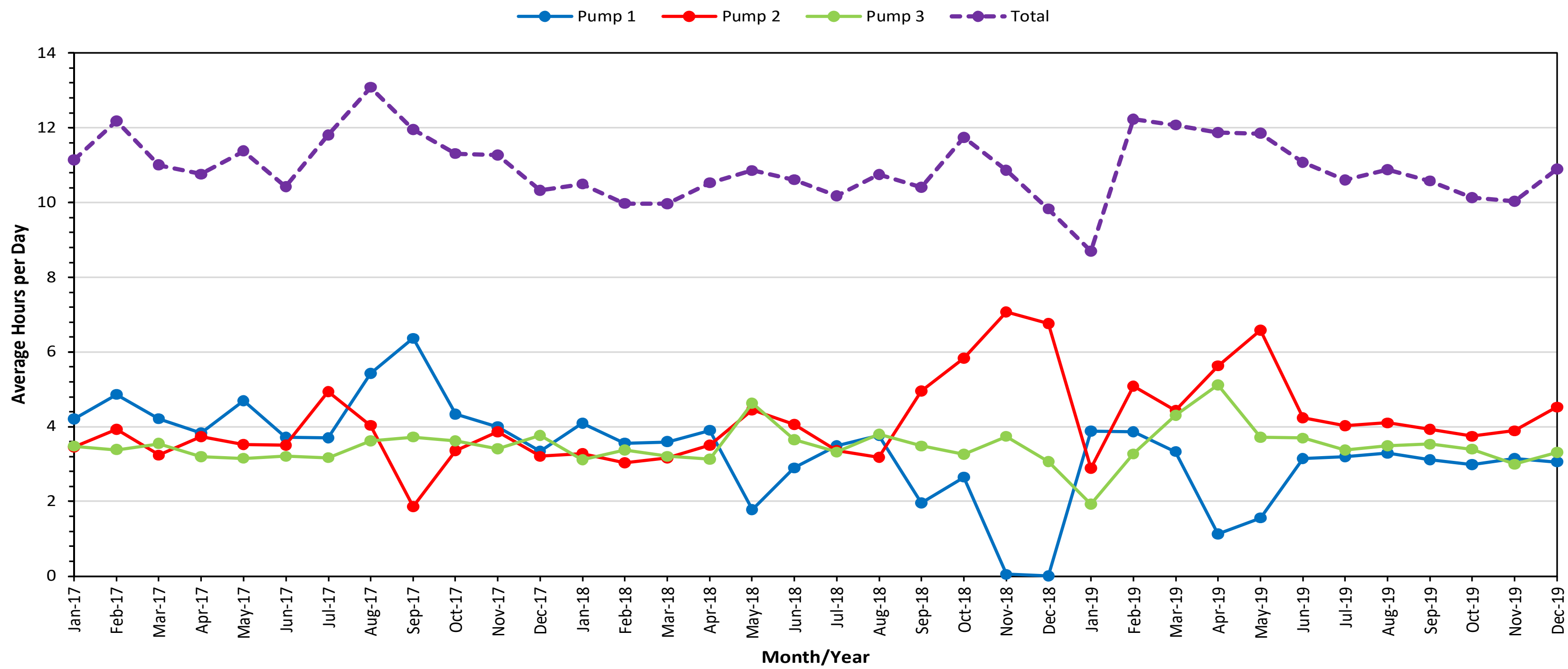
CITY OF
HERMISTON, OREGON
SANITARY SEWER COLLECTION SYSTEM STUDY

LIFT STATION 8 SUMMARY

APPENDIX H



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CITY OF
HERMISTON, OREGON
SANITARY SEWER COLLECTION SYSTEM STUDY
LIFT STATION 8
AVERAGE DAILY PUMP HOURS

APPENDIX H

Lift Station No. 10 Summary																		
Month	Pump 1 (240 gpm)								Pump 2 (240 gpm)								Total of Average	
	Hours	Hours Per Day			Gallons	Gallons Per Day			Hours	Hours Per Day			Gallons	Gallons Per Day			Hours	Gallons
	Operated	Avg	Max	Min	Pumped	Avg	Max	Min	Operated	Avg	Max	Min	Pumped	Avg	Max	Min	per Day	per Day
Jan-17	17.8	0.6	1.9	0.5	255,888	8,254	27,216	7,056	18.1	0.6	1.8	0.5	260,496	8,403	26,640	7,632	1.2	16,658
Feb-17	16.8	0.6	2.5	0.5	241,632	8,630	35,856	6,480	17.1	0.6	2.5	0.5	245,808	8,779	36,576	6,768	1.2	17,409
Mar-17	17.9	0.6	1.9	0.4	258,480	8,338	27,504	6,480	18.2	0.6	1.9	0.5	261,648	8,440	27,936	6,480	1.2	16,778
Apr-17	16.3	0.5	1.8	0.5	234,288	7,810	26,208	6,768	16.4	0.5	1.9	0.5	236,448	7,882	26,784	6,768	1.1	15,691
May-17	19.0	0.6	1.8	0.5	273,888	8,835	26,496	7,056	19.3	0.6	1.8	0.5	278,352	8,979	26,496	7,056	1.2	17,814
Jun-17	17.4	0.6	1.7	0.5	250,128	8,338	25,056	6,624	17.6	0.6	1.8	0.4	253,728	8,458	25,920	6,336	1.2	16,795
Jul-17	17.8	0.6	1.8	0.4	256,320	8,268	25,776	5,760	17.9	0.6	1.8	0.4	257,328	8,301	26,064	5,904	1.2	16,569
Aug-17	19.1	0.6	1.9	0.4	275,328	8,882	27,216	5,760	19.7	0.6	2.1	0.4	283,536	9,146	30,096	5,616	1.3	18,028
Sep-17	17.6	0.6	2.0	0.6	253,008	8,434	28,512	7,920	17.9	0.6	2.0	0.6	257,328	8,578	28,800	8,064	1.2	17,011
Oct-17	19.6	0.6	1.9	0.5	282,528	9,114	27,504	7,344	19.8	0.6	1.9	0.5	285,120	9,197	27,792	6,912	1.3	18,311
Nov-17	19.0	0.6	2.1	0.0	273,312	9,110	29,808	0	19.2	0.6	2.1	0.5	276,192	9,206	30,672	7,056	1.3	18,317
Dec-17	17.9	0.6	1.9	0.5	257,760	8,315	27,648	7,632	18.0	0.6	1.9	0.5	259,200	8,361	27,936	7,632	1.2	16,676
Jan-18	20.6	0.7	1.9	0.5	296,640	9,569	27,648	7,632	20.8	0.7	2.0	0.5	298,800	9,639	28,224	7,344	1.3	19,208
Feb-18	17.0	0.6	1.9	0.5	244,800	8,743	27,504	7,200	17.2	0.6	1.9	0.5	247,104	8,825	27,504	6,912	1.2	17,568
Mar-18	18.1	0.6	2.0	0.5	260,208	8,394	28,368	6,624	18.4	0.6	2.0	0.5	264,528	8,533	28,800	7,056	1.2	16,927
Apr-18	19.1	0.6	2.0	0.5	274,608	9,154	28,800	7,344	19.3	0.6	2.0	0.5	277,632	9,254	29,088	7,776	1.3	18,408
May-18	17.9	0.6	1.9	0.2	257,904	8,319	26,640	3,312	18.3	0.6	1.9	0.5	263,808	8,510	26,928	7,056	1.2	16,829
Jun-18	18.8	0.6	2.1	0.5	271,152	9,038	30,384	7,056	19.1	0.6	2.2	0.5	275,040	9,168	31,104	6,912	1.3	18,206
Jul-18	18.4	0.6	1.8	0.4	264,960	8,547	26,064	6,048	18.6	0.6	1.8	0.4	267,552	8,631	26,208	6,480	1.2	17,178
Aug-18	18.1	0.6	1.9	0.5	260,496	8,403	26,640	7,632	18.3	0.6	1.9	0.5	262,944	8,482	26,784	7,488	1.2	16,885
Sep-18	17.9	0.6	2.2	0.5	257,184	8,573	31,536	7,632	18.0	0.6	2.2	0.5	258,624	8,621	31,392	7,488	1.2	17,194
Oct-18	21.3	0.7	2.0	0.1	307,152	9,908	29,088	1,440	21.4	0.7	2.2	0.3	307,584	9,922	31,968	4,320	1.4	19,830
Nov-18	19.1	0.6	2.0	0.3	274,896	9,163	29,088	3,888	18.8	0.6	2.0	0.1	271,440	9,048	28,512	1,440	1.3	18,211
Dec-18	19.2	0.6	1.9	0.5	276,336	8,914	27,936	6,768	19.2	0.6	1.9	0.4	276,624	8,923	27,648	6,336	1.2	17,837
Jan-19	19.0	0.6	2.0	0.5	273,168	8,812	28,368	7,632	19.3	0.6	2.1	0.5	278,352	8,979	29,808	7,776	1.2	17,791
Feb-19	17.5	0.6	2.0	0.5	252,576	9,021	29,232	7,776	17.8	0.6	2.1	0.5	255,888	9,139	29,520	7,488	1.3	18,159
Mar-19	17.0	0.5	2.0	0.5	244,512	7,887	28,368	6,768	17.4	0.6	1.9	0.5	250,416	8,078	27,936	6,912	1.1	15,965
Apr-19	19.0	0.6	2.0	0.5	273,168	9,106	28,512	7,056	20.7	0.7	3.2	0.5	298,368	9,946	46,080	7,488	1.3	19,051
May-19	18.7	0.6	1.9	0.5	268,560	8,663	27,504	7,776	18.9	0.6	1.9	0.5	272,592	8,793	27,504	7,776	1.2	17,457
Jun-19	17.3	0.6	2.0	0.5	249,408	8,314	28,080	7,488	17.8	0.6	2.0	0.5	256,464	8,549	29,232	7,488	1.2	16,862
Jul-19	19.0	0.6	2.0	0.4	273,744	8,830	28,512	6,048	19.3	0.6	2.0	0.5	277,920	8,965	28,224	6,624	1.2	17,796
Aug-19	18.0	0.6	2.0	0.5	259,056	8,357	28,080	7,632	18.3	0.6	2.0	0.5	262,800	8,477	28,368	7,632	1.2	16,834
Sep-19	18.8	0.6	2.0	0.5	271,296	9,043	28,800	7,056	19.1	0.6	2.0	0.0	274,752	9,158	28,512	576	1.3	18,202
Oct-19	18.6	0.6	2.0	0.4	268,272	8,654	28,512	6,336	19.1	0.6	2.0	0.5	274,752	8,863	29,376	6,624	1.2	17,517
Nov-19	17.1	0.6	1.9	0.5	246,384	8,213	27,792	7,344	17.5	0.6	2.2	0.4	252,000	8,400	31,536	5,328	1.2	16,613
Dec-19	19.3	0.6	2.1	0.5	278,208	8,974	30,528	7,632	19.8	0.6	2.2	0.5	284,544	9,179	30,960	7,632	1.3	18,153
Avg	18.4	0.6	2.0	0.5	264,368	8,692	28,244	6,500	18.6	0.6	2.0	0.5	268,492	8,828	29,248	6,616	1.2	17,521
Max	21.3	0.7	2.5	0.6	307,152	9,908	35,856	7,920	21.4	0.7	3.2	0.6	307,584	9,946	46,080	8,064	1.4	19,830
Min	16.3	0.5	1.7	0.0	234,288	7,810	25,056	0	16.4	0.5	1.8	0.0	236,448	7,882	25,920	576	1.1	15,691
Std Dev	1.0	0.0	0.1	0.1	14,906	437	1,849	1,716	1.1	0.0	0.2	0.1	15,369	456	3,522	1,561	0.1	883

Avg = average
gpm = gallons per minute
Min = minimum
Max = maximum
Std. Dev = standard deviation

Average without outliers:	1.2	17,521
Maximum without outliers:	1.4	19,830

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CITY OF
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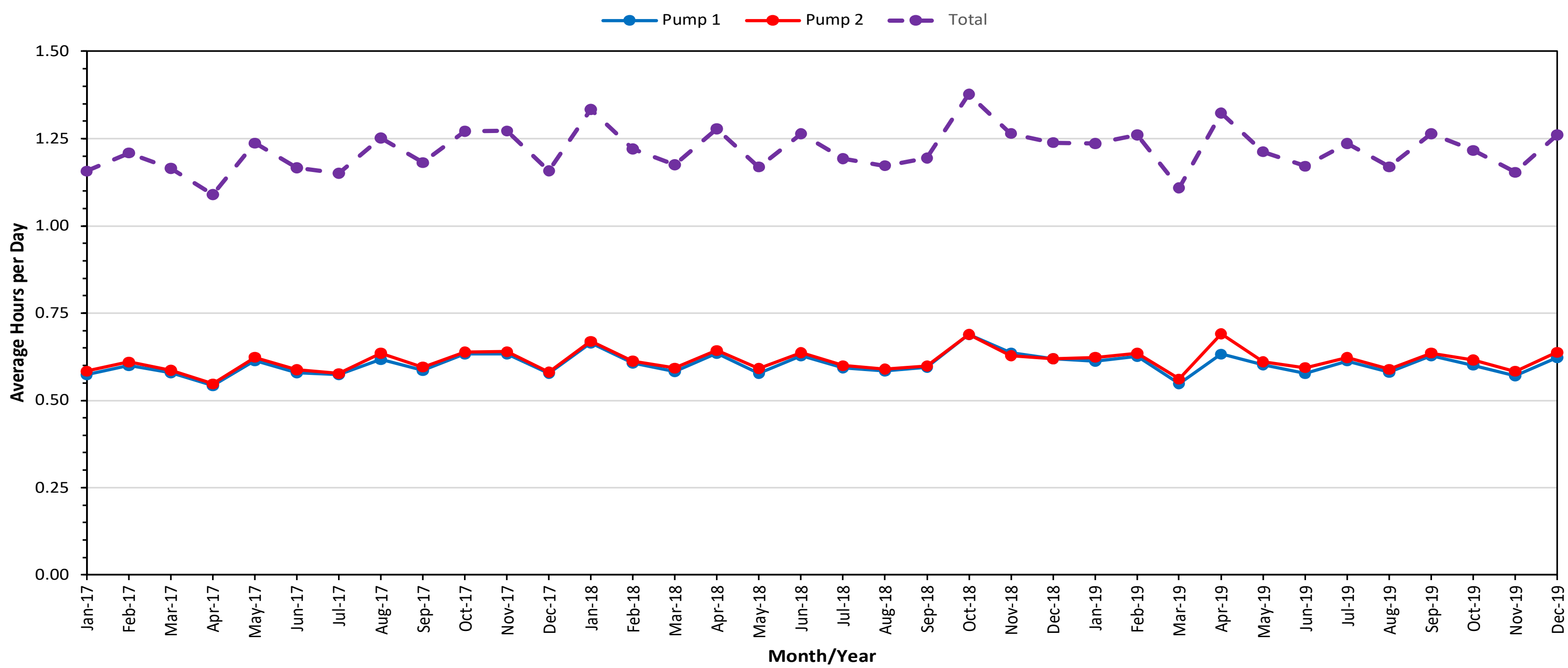
SANITARY SEWER COLLECTION SYSTEM STUDY

LIFT STATION 10 SUMMARY

APPENDIX H



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CITY OF
HERMISTON, OREGON
SANITARY SEWER COLLECTION SYSTEM STUDY
LIFT STATION 10
AVERAGE DAILY PUMP HOURS

APPENDIX H

Lift Station No. 10 Summary																		
Month	Pump 1 (230 gpm)								Pump 2 (230 gpm)								Total of Average	
	Hours	Hours Per Day			Gallons	Gallons Per Day			Hours	Hours Per Day			Gallons	Gallons Per Day			Hours	Gallons
	Operated	Avg	Max	Min	Pumped	Avg	Max	Min	Operated	Avg	Max	Min	Pumped	Avg	Max	Min	per Day	per Day
Jan-17	0.3	0.0	0.1	0.0	4,416	142	1,242	0	0.4	0.0	0.1	0.0	5,106	165	1,104	0	0.0	307
Feb-17	0.5	0.0	0.1	0.0	6,210	222	1,242	0	0.4	0.0	0.1	0.0	5,244	187	1,242	0	0.0	409
Mar-17	0.5	0.0	0.1	0.0	7,314	236	1,242	0	1.0	0.0	0.4	0.0	14,076	454	4,968	0	0.1	690
Apr-17	0.3	0.0	0.1	0.0	4,278	143	1,794	0	0.4	0.0	0.1	0.0	4,830	161	1,932	0	0.0	304
May-17	0.5	0.0	0.1	0.0	7,452	240	1,932	0	0.5	0.0	0.1	0.0	7,038	227	1,380	0	0.0	467
Jun-17	0.4	0.0	0.1	0.0	5,106	170	1,242	0	0.4	0.0	0.1	0.0	4,968	166	1,242	0	0.0	336
Jul-17	1.0	0.0	0.4	0.0	13,248	427	5,244	0	1.0	0.0	0.4	0.0	13,386	432	5,382	0	0.1	859
Aug-17	6.0	0.2	1.3	0.0	82,524	2,662	17,802	0	2.5	0.1	0.8	0.0	34,086	1,100	10,902	0	0.3	3,762
Sep-17	0.4	0.0	0.1	0.0	4,968	166	1,242	0	0.4	0.0	0.1	0.0	5,796	193	1,242	0	0.0	359
Oct-17	0.7	0.0	0.2	0.0	9,522	307	2,484	0	0.7	0.0	0.2	0.0	8,970	289	2,622	0	0.0	597
Nov-17	0.3	0.0	0.1	0.0	4,278	143	690	0	0.3	0.0	0.1	0.0	4,278	143	690	0	0.0	285
Dec-17	0.3	0.0	0.0	0.0	4,140	134	690	0	0.4	0.0	0.1	0.0	5,106	165	1,242	0	0.0	298
Jan-18	0.5	0.0	0.1	0.0	6,900	223	1,242	0	0.5	0.0	0.1	0.0	7,176	231	1,104	0	0.0	454
Feb-18	0.4	0.0	0.1	0.0	6,210	222	1,794	0	0.4	0.0	0.1	0.0	6,210	222	1,380	0	0.0	444
Mar-18	0.4	0.0	0.1	0.0	4,830	156	1,242	0	0.3	0.0	0.1	0.0	4,278	138	1,242	0	0.0	294
Apr-18	1.5	0.1	0.5	0.0	20,976	699	7,038	0	1.5	0.1	0.5	0.0	20,976	699	7,176	0	0.1	1,398
May-18	4.4	0.1	0.6	0.1	60,582	1,954	8,970	1,242	4.2	0.1	0.7	0.0	58,236	1,879	8,970	0	0.3	3,833
Jun-18	3.2	0.1	0.4	0.0	44,436	1,481	5,658	0	3.2	0.1	0.4	0.0	43,746	1,458	5,658	0	0.2	2,939
Jul-18	2.6	0.1	0.5	0.0	35,880	1,157	7,038	0	2.6	0.1	0.5	0.0	36,294	1,171	6,900	0	0.2	2,328
Aug-18	6.9	0.2	1.4	0.0	95,496	3,081	19,734	0	6.8	0.2	1.4	0.0	86,112	2,778	19,734	0	0.4	5,858
Sep-18	0.5	0.0	0.2	0.0	7,038	235	2,622	0	0.5	0.0	0.2	0.0	6,486	216	2,760	0	0.0	451
Oct-18	0.8	0.0	0.2	0.0	11,592	374	3,312	0	0.9	0.0	0.2	0.0	12,144	392	3,312	0	0.1	766
Nov-18	0.4	0.0	0.1	0.0	4,830	161	690	0	0.4	0.0	0.1	0.0	4,968	166	1,242	0	0.0	327
Dec-18	0.3	0.0	0.1	0.0	4,278	138	1,104	0	0.3	0.0	0.1	0.0	3,588	116	690	0	0.0	254
Jan-19	0.5	0.0	0.1	0.0	7,314	236	1,932	0	0.5	0.0	0.1	0.0	7,452	240	1,932	0	0.0	476
Feb-19	0.3	0.0	0.1	0.0	4,416	158	1,242	0	0.3	0.0	0.1	0.0	4,554	163	690	0	0.0	320
Mar-19	0.5	0.0	0.1	0.0	6,486	209	1,932	0	0.5	0.0	0.1	0.0	6,348	205	1,380	0	0.0	414
Apr-19	0.7	0.0	0.3	0.0	9,108	304	4,002	0	0.6	0.0	0.3	0.0	8,418	281	3,450	0	0.0	584
May-19	0.9	0.0	0.3	0.0	12,420	401	4,002	0	0.9	0.0	0.2	0.0	12,696	410	3,312	0	0.1	810
Jun-19	0.7	0.0	0.2	0.0	9,108	304	2,760	0	0.7	0.0	0.2	0.0	9,108	304	2,760	0	0.0	607
Jul-19	0.7	0.0	0.2	0.0	9,384	303	2,622	0	0.6	0.0	0.2	0.0	8,280	267	2,622	0	0.0	570
Aug-19	5.4	0.2	2.5	0.0	74,106	2,391	34,362	0	2.3	0.1	0.6	0.0	31,464	1,015	8,004	0	0.2	3,405
Sep-19	0.8	0.0	0.3	0.0	11,178	373	4,002	0	0.7	0.0	0.3	0.0	9,108	304	4,002	0	0.0	676
Oct-19	1.5	0.0	0.6	0.0	21,114	681	7,866	0	1.5	0.0	0.6	0.0	20,838	672	8,004	0	0.1	1,353
Nov-19	0.4	0.0	0.1	0.0	5,520	184	1,794	0	0.4	0.0	0.1	0.0	5,382	179	1,794	0	0.0	363
Dec-19	0.3	0.0	0.1	0.0	3,726	120	690	0	0.3	0.0	0.1	0.0	3,726	120	690	0	0.0	240
Avg	1.3	0.0	0.3	0.0	17,511	570	4,569	34	1.1	0.0	0.3	0.0	14,735	481	3,688	0	0.1	1,051
Max	6.9	0.2	2.5	0.1	95,496	3,081	34,362	1,242	6.8	0.2	1.4	0.0	86,112	2,778	19,734	0	0.4	5,858
Min	0.3	0.0	0.0	0.0	3,726	120	690	0	0.3	0.0	0.1	0.0	3,588	116	690	0	0.0	240
Std Dev	1.7	0.1	0.5	0.0	23,432	756	6,581	204	1.3	0.0	0.3	0.0	17,397	562	3,804	0	0.1	1,288

Average without outliers: 0.1 1,051
Maximum without outliers: 0.4 5,858

Avg = average
gpm = gallons per minute
Min = minimum
Max = maximum
Std. Dev = standard deviation

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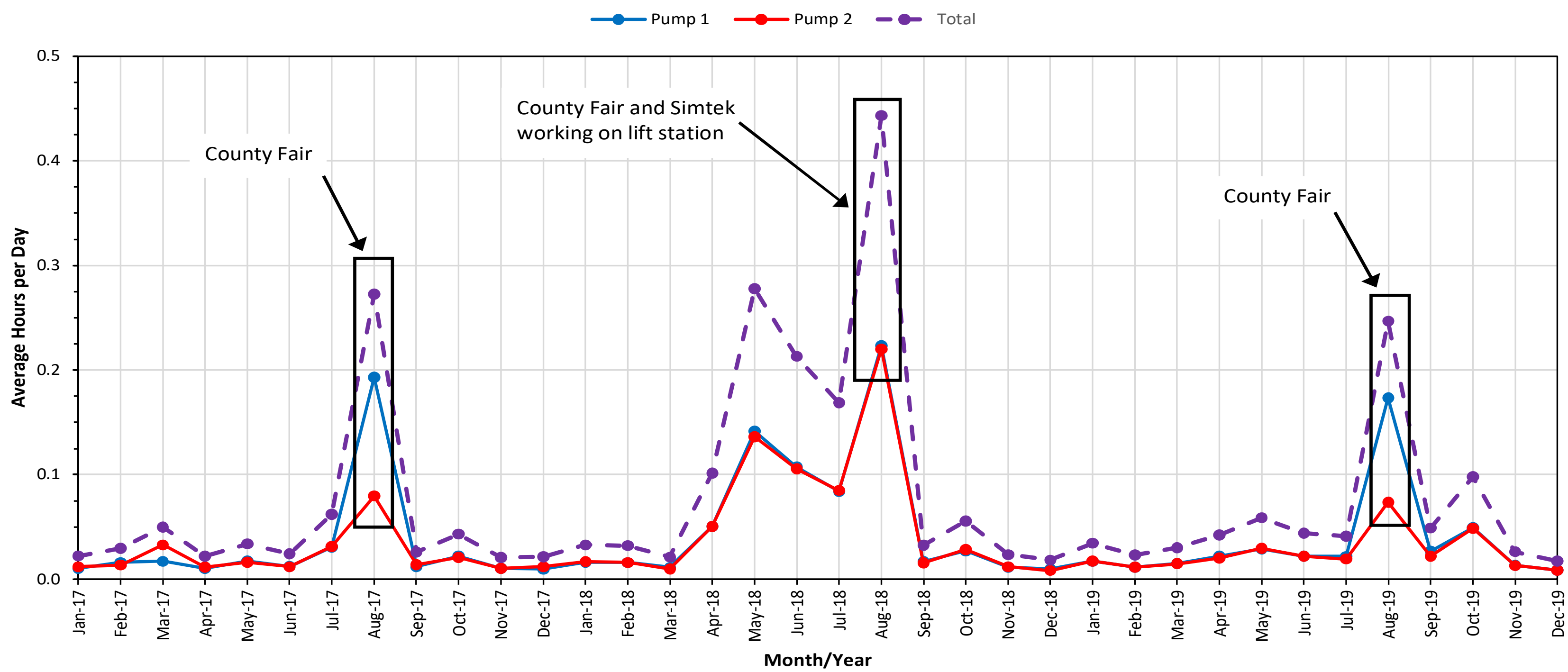
CITY OF
HERMISTON, OREGON
SANITARY SEWER COLLECTION SYSTEM STUDY

LIFT STATION 12 SUMMARY

APPENDIX
H



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CITY OF
HERMISTON, OREGON
SANITARY SEWER COLLECTION SYSTEM STUDY
LIFT STATION 12
AVERAGE DAILY PUMP HOURS

APPENDIX
H

APPENDIX I
Oregon Department of Environmental Quality Guidelines

APPENDIX A

SEWER PIPELINES

(1) MINIMUM REQUIREMENTS FOR SEWER - PIPELINES

(a) Capacity:

Sewers shall be of such diameter as to pass without overflow, bypass, or back flow onto damageable property of a user the design peak flow including sewage and infiltration. All unavoidable inflow from roof, surface, footing, foundation, or other groundwater or surface water sources shall be excluded from capacity allowance.

(b) Velocity:

Sewers shall be designed to have a velocity to "self clean" or transport constituent solids to the treatment facility or the owner shall periodically service sewers to flush, transport, or remove solids from sewers with minimal velocity.

(2) GUIDELINES FOR SEWER PIPELINES

(a) Capacity:

(A) Collection sewers should be designed for the ultimate development of the tributary areas as determined by master sewerage and land use plans of the owner.

(B) The design of sewers should be based upon initial and ultimate flows. Flows should be broken down into domestic, industrial, and infiltration/inflow fractions. A peaking factor should be applied to domestic and industrial fractions.

(C) Domestic flows should be between 50 and 100 gallons per capita per day (gpcd). Peaking factors should be between 1.8 and 4.0. Infiltration allowance should be normally less than 2,000 gallons per acre per day; any greater allowance should be justified. Any significant inflow allowance should be justified.

(D) The minimum diameter of sewers should be 8 inches for maintenance purposes. Short nonextendable 6 inch sections of up to 250 feet are permissible.

(E) Replacement sewers should be designed commensurate with flow conditions.

(b) Velocity:

(A) Sewers should be laid on a gradient which will produce a mean velocity, when flowing full or half full, of at least (2) two feet per second, based upon the Manning formula with "n", the coefficient of roughness, valued at 0.013.

(b) Sewers with minimal flow such as upper reaches of laterals or those sewers serving few dwellings should be steepened and/or reduced in diameter to approach a (2) two feet per second selfcleaning velocity. Actual flows during initial years of use should be carefully evaluated in this regard.

(C) Force mains and inverted siphons should be designed for (3) three feet per second at average flows.

(D) The minimum gradient for 8 inch sewers should be no less than 0.4 percent regardless of pipe material.

(E) The minimum gradient for 6 inch sewers should be no less than 0.6 percent, preferably 0.75 percent.

(F) The flow channel(s) through manhole bases should be smooth and conform to the shape and slope of the inlet sewer(s).

(G) Intersecting sewers, sewer connections, etc., should be made without causing backup into the smaller sewer. For intersecting unequal sized sewers in manholes, the elevation at 0.8 of full depth of flow in each sewer should match.

(c) <u>Watertightness:</u>

Completed sewer construction shall result in limited infiltration/exfiltration through pipe walls, joints, fittings, and connection fittings, etc., and no inflow. The limit shall be consistent with the pipe and manhole materials and with what is obtainable at the time by the construction industry on representative jobs for the same type of construction using high quality materials and state-of-the-art methods of workmanship. All completed sewer lines in new work shall be tested for watertightness using either recognized air or water testing requirements and procedures.

(c) <u>Watertightness:</u>

(A) Watertightness begins with good material and finally depends upon sound field practices. Good inspection and tests should be supplemented with an initial television inspection after trench backfilling is complete. Since many defects do not appear initially, an eleventh month final inspection should be performed where that capability is available and determined necessary to obtain acceptable in-place work. If only one television inspection is considered, the eleventh month inspection is recommended.

(B) Exfiltration testing or the low pressure air test for sanitary sewers should be a pressure at least 6 feet greater than the groundwater conditions which the sewer is subject to at test time.

(C) Pipe materials, joints, fittings, and appurtenances should be selected for their watertight capabilities.

(D) Acceptance or performance standards should not necessarily be uniform for all pipe materials since average testing results with good workmanship for work will vary depending upon pipe materials. The range of allowable exfiltration/infiltration for work acceptance should be between 50 and 200 gallons per day per inch-of-diameter per mile (gpdidm). Nonporous (non-airpermeable) pipe should sustain pressure for twice the computed time for the same one pound per square inch (psi) air pressure drop required by the air test. Test sections should be from manhole-to-manhole or about 700 feet maximum.

(E) The watertightness of all building sewers should conform to the State Plumbing Code and be tested without exception.

(F) Manholes should be water tested for exfiltration during construction and/or visually inspected during first wet weather season after construction for infiltration. Leaks should be promptly repaired.

(G) Curved sewers should be as watertight as other sewers and be tested. While not recommended, horizontal/vertical curves at times may be allowed but should be limited in use. When used, the minimum radius of curvature should be not less than 200 feet and the maximum computed joint opening no more than 3/8 inch. Complete and accurate records should be kept of the exact location of such curved sewers for future reference. Reasonable field control should be exercised to not compound joint deflections and compromise watertightness.

(d) Structural Strength:

The completed installation including the excavated trench, the pipe, the bedding, and the pipe zone materials shall resist imposed loads from backfill, impact, and live loads (construction and design) without pipe failure through crushing, loss of watertightness, settlement, or significant capacity loss.

(d) Structural Strength:

(A) Bedding material should be placed full trench width from at least 4 inches under to spring line of all pipe for a leveling course and proper pipe support. Hand shaping of the native trench bottom for rigid pipe is not recommended but may be allowed, if appropriate, and uniform pipe support can be obtained and grade/ alignment can be maintained.

(B) Cantilevering of nonreinforced rigid pipe at manholes should be limited to the least distance practicable to make a flexible connection. A flexible joint should be within 12 inches of manhole for smaller pipe sizes. A second flexible joint should be provided within 4 feet of the manhole.

(C) Where cover from top of pipe to finished grade is less than 36 inches, special design and/or construction requirements should be considered including, but not limited to, raising finish grade, increasing class of pipe and/or pipe bedding, use of ductile iron, concrete encasement and restriction of construction equipment from travel over partially backfilled trench.

(e) Ability to Pass Solids:

Sewer systems shall be free of depressions, sharp edges, roughness, side sewer projections, obstructions, restrictions, displaced "0" rings, etc., which can cause solids to accumulate or deposit.

(e) Ability to Pass Solids:

(A) New sewers should be thoroughly flushed and visually inspected for accumulated debris prior to use.

(B) Building sewer connections should be made with fittings which prevent any projection into the main sewer. The main sewer should not be cracked, crushed, or otherwise damaged in making taps. All taps should be watertight.

(C) A tolerance for vertical deviation from true grade line should be plus or minus 0.02 feet. Depressions for solids deposition should be avoided. Similarly, the horizontal tolerance for deviation from line should be plus or minus 3/8 inch.

(f) Durability:

(A) The materials and details of construction shall provide an inplace sewerage system which will resist corrosion of the pipe and manhole materials caused by any source or condition. Any corrosive effect shall be consistent with the design life of the sewer.

(B) Resistance to erosion of surfaces by grit, high velocity flow, etc., shall be addressed if appropriate.

(C) Temperature effect upon thermoplastic materials shall be appropriate.

(g) Stability:

(A) Line and Grade: Horizontal alignment and vertical grade of inplace sewers upon construction completion and construction acceptance shall be relatively stable.

Design considerations, construction specifications, inspections, etc., shall preclude pipe settlement, shifting, or flotation such that capacity, watertightness structural integrity, ability to pass solids, maintainability, etc., are not compromised either at construction or any later time.

(B) Diameter: Rigid, flexible and

(D) Drop manhole piping should be easily maintained, self cleaning or able to "overflow" into the manhole. Pressure sewer piping connections, flow measuring devices, etc., in manholes should be designed to not obstruct flow.

(E) Flow channels in manholes should slope at least 0.1 feet from inlet to outlet.

(f) Durability:

(A) Sewers should be constructed of materials resistant to or protected from biological degradation, acid and alkaline solutions, normal sewer temperature variations, abrasion and industrial wastes (where applicable), or other harmful service conditions which may exist in the sewerage system.

The owner should have a user ordinance which restricts discharge of harmful substances into the sewerage system.

(B) Velocities over 15 feet per second in sewers should have special consideration for erosion control.

(g) Stability:

(A) Appropriate foundation stabilization or soils should be employed in unstable soils. Back fill should be in small lifts and compacted uniformly to specified density along and around the pipe.

(B) The Soil Class and density for bedding and pipe zone materials should be carefully selected and then compacted in the field to the required in-place density.

PVC and ABS composite sewer pipe should be deflection tested upon construction completion prior to acceptance with an approved nine blade go-no-go gauge. Initial deflection at construction completion should be no more than the following:

semiflexible pipes tend to lose minimum inside diameter if not designed and/or installed properly. Design considerations, construction specifications, field inspections, etc., shall preclude diameter loss such that capacity, watertightness, structural integrity, ability to pass solids, maintainability, etc., are not compromised either at construction or any later time.

(i) PVC (ASTM D-3034) sewer pipe should deflect no more than 4 to 5 percent based upon inside base diameters of 7.76, 9.71, 11.56 and 14.14 inches for 8, 10, 12, and 15 inch nominal pipe respectively.

(ii) ABS (ASTM D-2680) composite sewer pipe should deflect no more than 2 to 3 percent based upon inside average diameters of 7.75, 9.75, 11.75 and 14.75 inches for 8, 10, 12, and 15 inch nominal pipe respectively.

(C) Sewers on slopes over 25 percent should be evaluated for slippage or pipe bedding depending upon soil type, groundwater presence, construction conditions, etc. Appropriate anchors should be provided if necessary.

(h) Operation, Maintenance, and Safety:

Sewer systems require periodic and unscheduled maintenance for sustained operation. Designs shall conform to requirements of the sewage works owner for manhole construction, spacing, size, details and easements. All parts of the sewerage system shall be readily accessible. The minimum inside bottom diameter of manholes shall be 42 inches.

(h) Operation, Maintenance. and Safety:

(A) Access to the sewer by the sewer owner is essential to perform maintenance tasks. Easements should be granted along the sewer line to the system owner for any sewer for emergency repairs. Manholes and cleanouts are necessary for routine access. Structures should not be located over sewers.

(B) Owners should review own procedures, equipment, construction standards, etc., for sewer maintenance. Requirements of the owner should be obtained by designers upon start of sewer design since the owner must assume all future maintenance. Stricter standards of the owner should prevail if in conflict with these guidelines.

(C) General Manhole/Cleanout Standards for Sewers:

(i) The minimum inside bottom diameter should be no less than 48 inches. The least inside dimension may be reduced 38 inches where an integral inside drop is acceptable to the owner. No more than one inside drop should be installed in a manhole.

(ii) Minimum cover opening diameter should be 22 inches.

(iii) Manholes should be located at:

(I) Every change in grade or alignment of sewer.

(II) Every point of change in size or elevation of sewer.

(III) Each intersection or junction of sewers.

(IV) Upper end of a lateral sewer.

(V) At intervals of 500 feet or less except for 24 inch and larger sewers.

(iv) Cleanouts should not be substituted for manholes except at the upper end of lateral sewers 250 feet or less in length.

(v) Channel width and depth should be equal pipe diameter. Manhole base ledges should be sloped to drain at least I in 12.

(vi) Access to manholes may be by portable ladder. Manhole rungs and in-place ladders which are subject to considerable corrosion and sliming are not recommended.

(vii) Where free fall of sewage into a manhole exceeds 24 inches from inlet pipe invert to manhole invert, an approved drop manhole should be used.

(D) Inverted Siphons:

Inverted siphons should include at least two pipe lines of such size and hydraulic gradient as to maintain a velocity of at least 3 feet per second in one pipe under conditions of average dry weather flow. Control manholes must be provided at both ends of the inverted siphon line. The inlet and outlet details shall be so arranged that the normal flow is diverted to either barrel so that the other barrel may be removed from service for maintenance.

(i) Separation of Water and Sewer Lines:

Protection of the water supply, be it distribution system, production facilities or source is not only prudent but mandatory and absolutely necessary.

Sanitary sewers and appurtenances thereto shall not physically connect to a public or private potable water supply system so as to permit the passage of any sewage or polluted water into the potable supply.

Sewer construction shall not disturb, degrade, or decrease the watertightness of any existing water supply line.

(i) Separation of Water and Sewer Lines:

(A) Parallel Water and Sewer Lines:

(i) Sewer lines should conform to Figure A-1.

(ii) Common trench construction for water and sewer should be avoided where practical. Where used, the minimum pipe separations of Figure A-1 should be maintained.

(B) Vertical Separation at Crossings of Water and Sewer Lines:

No special precautions should be necessary where top of sewer line is at least 1.5 feet below bottom of waterline and adequate structural protection for each line is provided.

(C) Exceptions: Use of Pressure Pipe Material for Sewer Line:

(i) Where the above horizontal or vertical separations cannot be maintained, the following pressure pipe materials should be used in addition to whatever waterline improvements or reconstruction that may be advisable or required for protection of water. The use of these pressure pipe materials from manhole-to-manhole is encouraged to avoid discontinuity of materials.

(I) Ductile iron pipe, class 50, ANSI Standard A21.51 (AWWA C- 15 1) with either Push-on or mechanical rubber gasket joints in accordance with ANSI Standard A21. 11 (AWWA-C I 11).

(II) PVC pressure pipe, ASTM D-2241, SDR 32.5, (125 psi) with rubber-gasket joint in accordance with UNI-Bell Plastic Pipe Association recommended Standard Specification UNI-B-1 for a pressure-joint assembly.

(III) Asbestos-Cement pressure pipe, class 100, ASTMC-296 (AWWA C-400) with rubberring gaskets in accordance with ASTM D-1869

(IV) High density polyethylene pipe (Driscopipe 1000) PE 3406, minimum SDR 32.5, with butt fused joints.

(V) Other materials approved by the State Health Division.

(ii) At crossings requiring pressure pipe materials, the following should apply with one standard length of special pressure pipe centered over the waterline in all cases:

Pipe Material	Standard Pipe Length	Minimum Laying Length Each Side of Waterline Crossing
Ductile Iron	18 Feet	18 Feet
PVC	20 Feet	20 Feet
Asbestos-Cement	13 Feet	19 Feet
High-Density Polyethylene	38 Feet	19 Feet

(D) Soil Restoration at Crossings:

Soil removed in sewer line trench construction at waterline crossings where sewer crosses over water should be replaced in all areas to as near natural densities as possible through mechanical compaction to restore any natural resistance to groundwater movement which did exist prior to construction. Soil should include no rock fragments over 1-1/2 inch in the pipe zone.

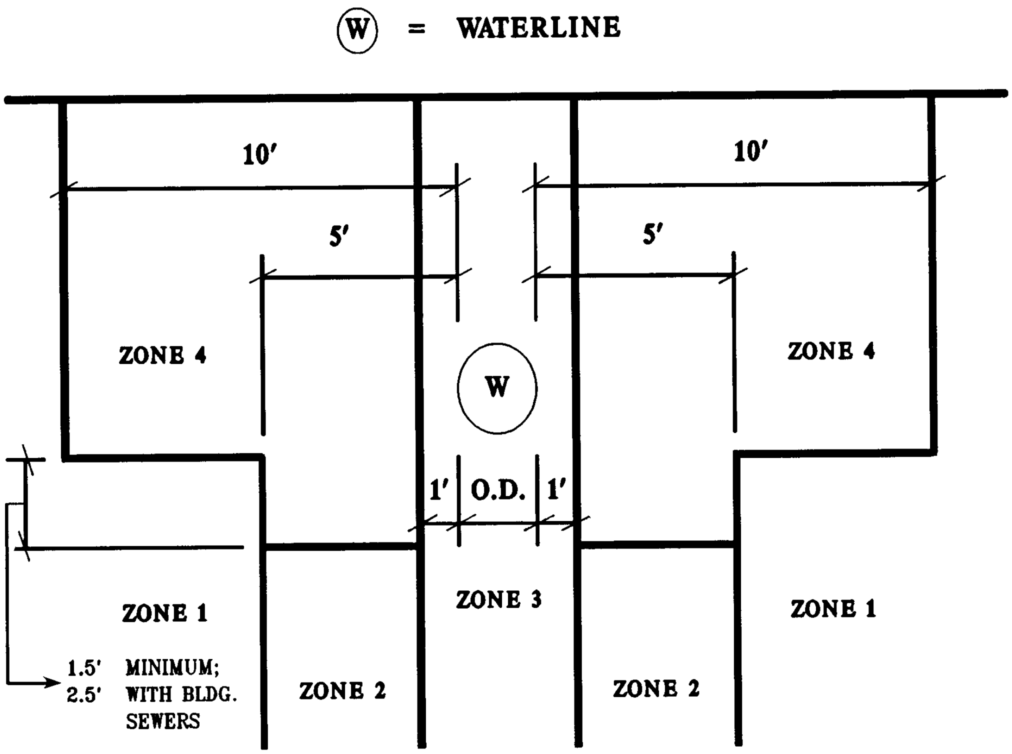
(E) Well Protection:

No sewer pipe should be laid less than 50 feet from any well without specific Health Division approval. Pressure pipe materials should be used to protect wells where minimum setbacks are not obtainable or where additional protection is required as determined by the State Health Division.

(F) Pipe Testing:

Whenever a pressure pipe material is used for any of the above purposes of separation, an appropriate pressure test should be conducted on the pressure pipe to confirm watertightness. Test pressures should be no less than 15 psig where use will be for a gravity sewer and higher where use will be for a pressure sewer (force main).

(G) Other Exceptions should be resolved jointly with the water purveyor and the State Health Division.



SEWER LINE ZONES

ZONE 1 SEWER LINE CAN BE LAID IN THIS AREA WITH NO SPECIAL REQUIREMENTS OF EITHER CONSTRUCTION OR MATERIALS.

ZONE 2 INSTALLING A SEWER LINE IN THIS ZONE IS NOT ADVISABLE AND MUST BE JUSTIFIED IN EACH CASE. WATER LINE SHOULD BE LOCATED ON A BENCH OF UNDISTURBED EARTH WHEN CONSTRUCTED CONCURRENTLY IN A COMMON TRENCH WITH SEWER LINE.

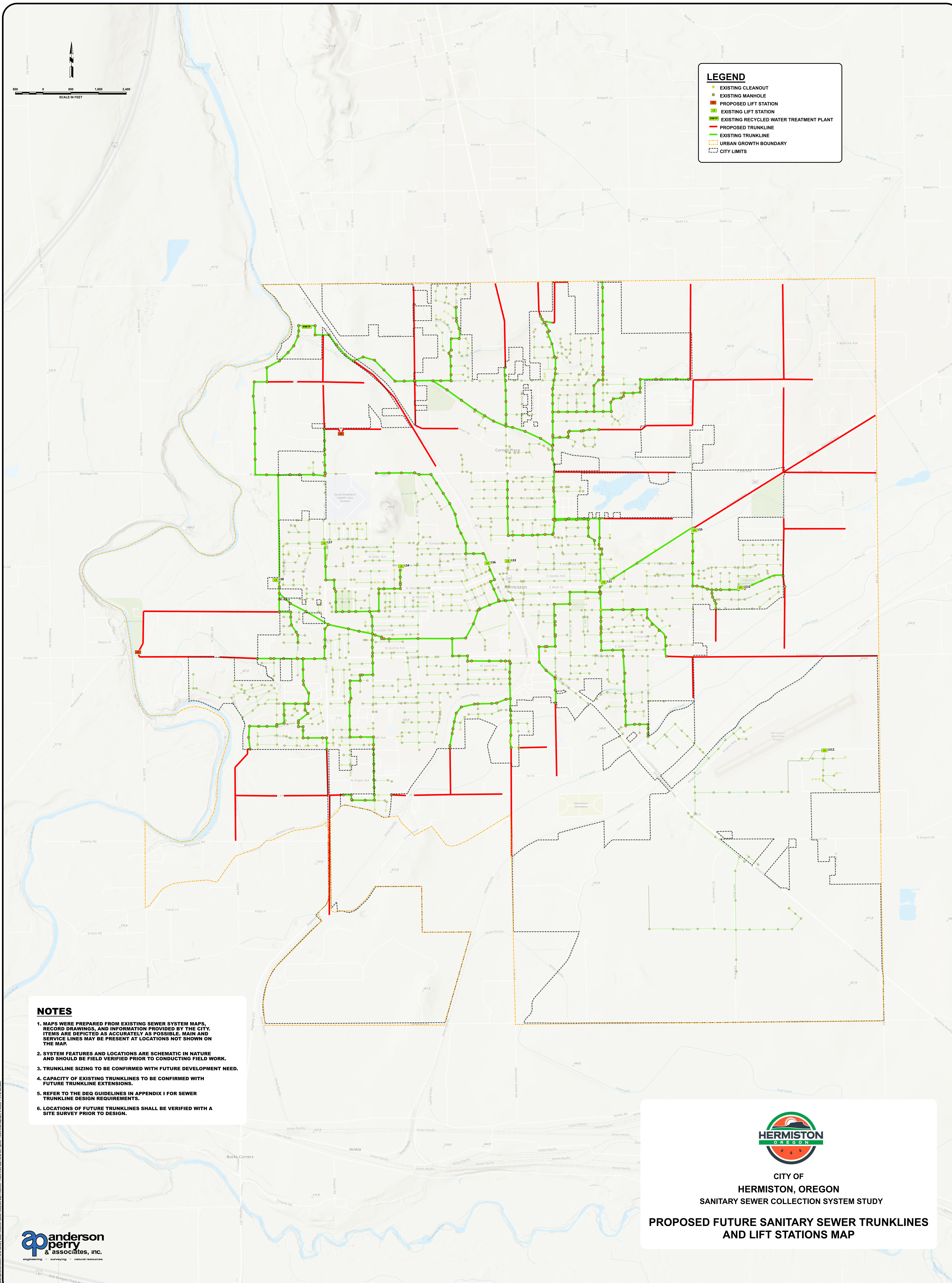
ZONE 3 INSTALLING A SEWER MAIN DIRECTLY OVER A WATER MAIN OR DIRECTLY UNDER A WATER MAIN IN THIS ZONE IS PROHIBITED SINCE TAPPING AND O. & M. OF EACH LINE WOULD BE IMPAIRED.

ZONE 4 SEWER LINE CONSTRUCTION IN THIS ZONE WOULD GENERALLY NOT BE PERMITTED. EACH INSTALLATION MUST BE JUSTIFIED. IF CONSTRUCTION WAS PERMITTED, PRESSURE PIPE MATERIALS FOR THIS SEWER LINE WOULD BE REQUIRED.

Effective 9/1/81

FIGURE A-1
SEPARATION OF PARALLEL WATER-SEWER LINES

APPENDIX J
Proposed Future Sanitary Sewer Trunklines and Lift Stations Map



NOTES

1. MAPS WERE PREPARED FROM EXISTING SEWER SYSTEM MAPS, RECORD DRAWINGS, AND INFORMATION PROVIDED BY THE CITY. ITEMS ARE DEPICTED AS ACCURATELY AS POSSIBLE. MAIN AND SERVICE LINES MAY BE PRESENT AT LOCATIONS NOT SHOWN ON THE MAP.
2. SYSTEM FEATURES AND LOCATIONS ARE SCHEMATIC IN NATURE AND SHOULD BE FIELD VERIFIED PRIOR TO CONDUCTING FIELD WORK.
3. TRUNKLINE SIZING TO BE CONFIRMED WITH FUTURE DEVELOPMENT NEED.
4. CAPACITY OF EXISTING TRUNKLINES TO BE CONFIRMED WITH FUTURE TRUNKLINE EXTENSIONS.
5. REFER TO THE DEQ GUIDELINES IN APPENDIX I FOR SEWER TRUNKLINE DESIGN REQUIREMENTS.
6. LOCATIONS OF FUTURE TRUNKLINES SHALL BE VERIFIED WITH A SITE SURVEY PRIOR TO DESIGN.

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HERMISTON OREGON

CITY OF
HERMISTON, OREGON
SANITARY SEWER COLLECTION SYSTEM STUDY

PROPOSED FUTURE SANITARY SEWER TRUNKLINES AND LIFT STATIONS MAP

APPENDIX K
Existing Loan Information

CLEAN WATER STATE REVOLVING FUND
LOAN AGREEMENT
NO. R43770

BETWEEN

THE STATE OF OREGON
ACTING BY AND THROUGH ITS
DEPARTMENT OF ENVIRONMENTAL QUALITY

AND

CITY OF HERMISTON

THIS LOAN AGREEMENT is made and entered into as of the date it is fully executed by both parties (and in the case of the State, approved by the Attorney General's Office, if required) and is by and between the **State of Oregon, acting by and through its Department of Environmental Quality ("DEQ")**, and the **Borrower** (as defined below). Unless the context requires otherwise, capitalized terms not defined below shall have the meanings assigned to them by ARTICLE 9 of this Loan Agreement. The reference number for the Loan made pursuant to this Loan Agreement is Loan No. R43770. Each of DEQ and the Borrower is sometimes referred to individually without distinction as a "Party" and collectively as the "Parties".

DEQ agrees to make, and Borrower agrees to accept, the Loan on the terms and subject to the conditions set forth below.

ARTICLE 1: THE LOAN - SPECIFIC TERMS

DEQ agrees to make the Loan on the following terms and conditions:

(A) **BORROWER:** City of Hermiston.

(B) **BORROWER'S ADDRESS:** City of Hermiston
180 NE 2nd Avenue
Hermiston, Oregon 97838
Fax 541-567-5530

The loan amount shown is split half and half between the Water and Recycled Water Departments.

(C) **LOAN AMOUNT:** $4,047,328.

(D) **TYPE AND PURPOSE OF LOAN.** The Loan is a "Revenue Secured Loan" made by DEQ pursuant to OAR Section 340-054-0065(2) for the purpose of financing the Project.

(E) **PROJECT TITLE:** Wastewater Treatment Improvements

(F) **DESCRIPTION OF THE PROJECT:** Improvements to the wastewater treatment system, as described in the Borrower's application dated December 31, 2008.

(G) **INTEREST RATE:** Two and 83/100 percent (2.83%) per annum. Calculation of interest is also discussed in ARTICLE 2(E) and in ARTICLE 2(F)(4) of this Agreement.

(H) **REPAYMENT PERIOD:** Twenty (20) years after the Completion Date.

(I) **TERMS OF REPAYMENT:** An interest-only payment within six months after the Project Completion Date and thereafter semi-annual payments of principal and interest in accordance with Appendix A and ARTICLE 2(F) of this Agreement.

(J) **PLEDGE:** The Borrower hereby pledges its full faith and credit and taxing power (collectively "Revenues") within the limitations of Article XI, Sections 11 and 11b, of the Oregon Constitution to pay the amounts due under the Loan Agreement. The Loan Agreement shall be payable from all legally available funds of the Borrower.

APPENDIX A: REPAYMENT SCHEDULE

Due Date	Pmt#	PAYMENT Principal	Interest	Fees	Total	Principal Balance
						4,047,328
11/1/2012	1	0	213,400	0	213,400	4,047,328
5/1/2013	2	78,477	57,270	20,237	155,984	3,968,851
11/1/2013	3	79,588	56,159	0	135,747	3,889,263
5/1/2014	4	80,714	55,033	19,446	155,193	3,808,549
11/1/2014	5	81,856	53,891	0	135,747	3,726,693
5/1/2015	6	83,014	52,733	18,633	154,380	3,643,679
11/1/2015	7	84,189	51,558	0	135,747	3,559,490
5/1/2016	8	85,380	50,367	17,797	153,544	3,474,110
11/1/2016	9	86,588	49,159	0	135,747	3,387,522
5/1/2017	10	87,814	47,933	16,938	152,685	3,299,708
11/1/2017	11	89,056	46,691	0	135,747	3,210,652
5/1/2018	12	90,316	45,431	16,053	151,800	3,120,336
11/1/2018	13	91,594	44,153	0	135,747	3,028,742
5/1/2019	14	92,890	42,857	15,144	150,891	2,935,852
11/1/2019	15	94,205	41,542	0	135,747	2,841,647
5/1/2020	16	95,538	40,209	14,208	149,955	2,746,109
11/1/2020	17	96,890	38,857	0	135,747	2,649,219
5/1/2021	18	98,261	37,486	13,246	148,993	2,550,958
11/1/2021	19	99,651	36,096	0	135,747	2,451,307
5/1/2022	20	101,061	34,686	12,257	148,004	2,350,246
11/1/2022	21	102,491	33,256	0	135,747	2,247,755
5/1/2023	22	103,941	31,806	11,239	146,986	2,143,814
11/1/2023	23	105,412	30,335	0	135,747	2,038,402
5/1/2024	24	106,904	28,843	10,192	145,939	1,931,498
11/1/2024	25	108,416	27,331	0	135,747	1,823,082
5/1/2025	26	109,950	25,797	9,115	144,862	1,713,132
11/1/2025	27	111,506	24,241	0	135,747	1,601,626
5/1/2026	28	113,084	22,663	8,008	143,755	1,488,542
11/1/2026	29	114,684	21,063	0	135,747	1,373,858
5/1/2027	30	116,307	19,440	6,869	142,616	1,257,551
11/1/2027	31	117,953	17,794	0	135,747	1,139,598
5/1/2028	32	119,622	16,125	5,698	141,445	1,019,976
11/1/2028	33	121,314	14,433	0	135,747	898,662
5/1/2029	34	123,031	12,716	4,493	140,240	775,631
11/1/2029	35	124,772	10,975	0	135,747	650,859
5/1/2030	36	126,537	9,210	3,254	139,001	524,322
11/1/2030	37	128,328	7,419	0	135,747	395,994
5/1/2031	38	130,144	5,603	1,980	137,727	265,850
11/1/2031	39	131,985	3,762	0	135,747	133,865
5/1/2032	40	133,865	1,894	669	136,428	0
TOTALS		4,047,328	1,460,217	225,476	5,733,021	

REQUIRED LOAN RESERVE: $ 137,689

CLEAN WATER STATE REVOLVING FUND
LOAN AGREEMENT
NO. R43771

BETWEEN

THE STATE OF OREGON
ACTING BY AND THROUGH ITS
DEPARTMENT OF ENVIRONMENTAL QUALITY

AND

CITY OF HERMISTON

THIS LOAN AGREEMENT is made and entered into as of the date it is fully executed by both parties (and in the case of the State, approved by the Attorney General's Office, if required) and is by and between the **State of Oregon, acting by and through its Department of Environmental Quality** ("**DEQ**"), and the **Borrower** (as defined below). Unless the context requires otherwise, capitalized terms not defined below shall have the meanings assigned to them by ARTICLE 9 of this Loan Agreement. The reference number for the Loan made pursuant to this Loan Agreement is Loan No. R43771. Each of DEQ and the Borrower is sometimes referred to individually without distinction as a "Party" and collectively as the "Parties".

DEQ agrees to make, and Borrower agrees to accept, the Loan on the terms and subject to the conditions set forth below.

ARTICLE 1: THE LOAN - SPECIFIC TERMS

DEQ agrees to make the Loan on the following terms and conditions:

(A) **BORROWER:** City of Hermiston.

(B) **BORROWER'S ADDRESS:** City of Hermiston
180 NE 2nd Avenue
Hermiston, Oregon 97838
Fax 541-567-5530

The loan amount shown is split half and half between the Water and Recycled Water Departments.

(C) **LOAN AMOUNT:** $11,409,645.

(D) **TYPE AND PURPOSE OF LOAN.** The Loan is a "Revenue Secured Loan" made by DEQ pursuant to OAR Section 340-054-0065(2) for the purpose of financing the Project. The Loan is an increase to the Borrower's existing CWSRF loan #R43770 and is made in the form of a new loan pursuant to this Agreement under authority of OAR 340-054-0025(6)(c)(F).

(E) **PROJECT TITLE:** Wastewater Treatment Improvements

(F) **DESCRIPTION OF THE PROJECT:** Improvements to the wastewater treatment system, as described in the Borrower's application dated December 31, 2008.

(G) **INTEREST RATE:** Two and 65/100 percent (2.65%) per annum. Calculation of interest is also discussed in ARTICLE 2(E) and in ARTICLE 2(F)(4) of this Agreement.

(H) **REPAYMENT PERIOD:** Subject to ARTICLE 1(I), twenty (20) years commencing the Completion Date.

(I) **TERMS OF REPAYMENT:** An interest-only payment within six months after the estimated Project Completion Date set forth in ARTICLE 3(A)(10) and thereafter semi-annual payments of principal and interest in accordance with Appendix A and ARTICLE 2(F) of this Agreement.

(J) **PLEDGE:** The Borrower hereby pledges its full faith and credit and taxing power (collectively "Revenues") within the limitations of Article XI, Sections 11 and 11b, of the

APPENDIX A: REPAYMENT SCHEDULE

Due Date	Pmt#	PAYMENT Principal	Interest	Fees	Total	Principal Balance
						11,409,645
11/1/2012	1	0	186,000	0	186,000	11,409,645
5/1/2013	2	225,339	151,178	57,048	433,565	11,184,306
11/1/2013	3	228,325	148,192	0	376,517	10,955,981
5/1/2014	4	231,350	145,167	54,780	431,297	10,724,631
11/1/2014	5	234,416	142,101	0	376,517	10,490,215
5/1/2015	6	237,522	138,995	52,451	428,968	10,252,693
11/1/2015	7	240,669	135,848	0	376,517	10,012,024
5/1/2016	8	243,858	132,659	50,060	426,577	9,768,166
11/1/2016	9	247,089	129,428	0	376,517	9,521,077
5/1/2017	10	250,363	126,154	47,605	424,122	9,270,714
11/1/2017	11	253,680	122,837	0	376,517	9,017,034
5/1/2018	12	257,041	119,476	45,085	421,602	8,759,993
11/1/2018	13	260,447	116,070	0	376,517	8,499,546
5/1/2019	14	263,898	112,619	42,498	419,015	8,235,648
11/1/2019	15	267,395	109,122	0	376,517	7,968,253
5/1/2020	16	270,938	105,579	39,841	416,358	7,697,315
11/1/2020	17	274,528	101,989	0	376,517	7,422,787
5/1/2021	18	278,165	98,352	37,114	413,631	7,144,622
11/1/2021	19	281,851	94,666	0	376,517	6,862,771
5/1/2022	20	285,585	90,932	34,314	410,831	6,577,186
11/1/2022	21	289,369	87,148	0	376,517	6,287,817
5/1/2023	22	293,203	83,314	31,439	407,956	5,994,614
11/1/2023	23	297,088	79,429	0	376,517	5,697,526
5/1/2024	24	301,025	75,492	28,488	405,005	5,396,501
11/1/2024	25	305,013	71,504	0	376,517	5,091,488
5/1/2025	26	309,055	67,462	25,457	401,974	4,782,433
11/1/2025	27	313,150	63,367	0	376,517	4,469,283
5/1/2026	28	317,299	59,218	22,346	398,863	4,151,984
11/1/2026	29	321,503	55,014	0	376,517	3,830,481
5/1/2027	30	325,763	50,754	19,152	395,669	3,504,718
11/1/2027	31	330,079	46,438	0	376,517	3,174,639
5/1/2028	32	334,453	42,064	15,873	392,390	2,840,186
11/1/2028	33	338,885	37,632	0	376,517	2,501,301
5/1/2029	34	343,375	33,142	12,507	389,024	2,157,926
11/1/2029	35	347,924	28,593	0	376,517	1,810,002
5/1/2030	36	352,534	23,983	9,050	385,567	1,457,468
11/1/2030	37	357,206	19,311	0	376,517	1,100,262
5/1/2031	38	361,939	14,578	5,501	382,018	738,323
11/1/2031	39	366,734	9,783	0	376,517	371,589
5/1/2032	40	371,589	4,924	1,858	378,371	0
TOTALS		11,409,645	3,460,514	632,467	15,502,626	

REQUIRED LOAN RESERVE: $ 371,754

MERSEREAU SHANNON LLP

LAWYERS

FOUNDED IN 1885

SMITH & TEAL

PETER R. MERSEREAU
KAREN M. VICKERS
BARRETT C. MERSEREAU
BLAKE H. FRY

JAMES P. SHANNON, LLM
THOMAS W. MCPHERSON
COURTNEY L. DAUSZ

TELEPHONE: 503-226-6400

ONE S.W. COLUMBIA STREET, SUITE 1600
PORTLAND, OREGON 97258
MERSHANLAW.COM

FACSIMILE: 503-226-0383

CITY OF HERMISTON
UMATILLA COUNTY, OREGON

WATER AND SEWER SYSTEM REVENUE BONDS
SERIES 2014

$4,175,000

The loan amount shown is split half and half between the Water and Recycled Water Departments.

$4,715,000

City of Hermiston, Oregon
Water & Sewer System Revenue Bonds, Series 2014
Assured Guaranty Insurance

Pricing Summary

Maturity	Type of Bond	Coupon	Yield	Maturity Value	Price		YTM	Call Date	Call Price	Dollar Price
11/01/2019	Term 1 Coupon	4.000%	1.500%	390,000.00	113.073%		-	-	-	440,984.70
11/01/2020	Serial Coupon	4.000%	2.120%	140,000.00	111.304%		-	-	-	155,825.60
11/01/2021	Serial Coupon	4.000%	2.430%	145,000.00	110.660%		-	-	-	160,457.00
11/01/2022	Serial Coupon	4.000%	2.660%	155,000.00	110.097%		-	-	-	170,650.35
11/01/2023	Serial Coupon	4.000%	2.820%	160,000.00	109.743%		-	-	-	175,588.80
11/01/2024	Serial Coupon	4.000%	2.940%	165,000.00	109.489%		-	-	-	180,656.85
11/01/2029	Term 2 Coupon	4.000%	3.440%	930,000.00	104.886%	c	3.586%	11/01/2024	100.000%	975,439.80
11/01/2034	Term 3 Coupon	5.000%	3.800%	1,170,000.00	110.282%	c	4.243%	11/01/2024	100.000%	1,290,299.40
11/01/2039	Term 4 Coupon	4.000%	4.090%	1,460,000.00	98.582%		-	-	-	1,439,297.20
Total	-	-	-	**$4,715,000.00**	-	-	-	-	-	**$4,989,199.70**

Bid Information

Par Amount of Bonds	$4,715,000.00
Reoffering Premium or (Discount)	274,199.70
Gross Production	$4,989,199.70
Total Underwriter's Discount (0.600%)	$(28,290.00)
Bid (105.215%)	4,960,909.70
Total Purchase Price	$4,960,909.70
Bond Year Dollars	$77,000.33
Average Life	16.331 Years
Average Coupon	4.2822196%
Net Interest Cost (NIC)	3.9620577%
True Interest Cost (TIC)	3.8326706%

$4,715,000

City of Hermiston, Oregon
Water & Sewer System Revenue Bonds, Series 2014
Assured Guaranty Insurance

Debt Service Schedule

Part 1 of 2

Date	Principal	Coupon	Interest	Total P+I	Fiscal Total
05/13/2014	-	-	-	-	-
11/01/2014	-	-	93,473.33	93,473.33	-
05/01/2015	-	-	100,150.00	100,150.00	-
06/30/2015	-	-	-	-	193,623.33
11/01/2015	-	-	100,150.00	100,150.00	-
05/01/2016	-	-	100,150.00	100,150.00	-
06/30/2016	-	-	-	-	200,300.00
11/01/2016	-	-	100,150.00	100,150.00	-
05/01/2017	-	-	100,150.00	100,150.00	-
06/30/2017	-	-	-	-	200,300.00
11/01/2017	125,000.00	4.000%	100,150.00	225,150.00	-
05/01/2018	-	-	97,650.00	97,650.00	-
06/30/2018	-	-	-	-	322,800.00
11/01/2018	130,000.00	4.000%	97,650.00	227,650.00	-
05/01/2019	-	-	95,050.00	95,050.00	-
06/30/2019	-	-	-	-	322,700.00
11/01/2019	135,000.00	4.000%	95,050.00	230,050.00	-
05/01/2020	-	-	92,350.00	92,350.00	-
06/30/2020	-	-	-	-	322,400.00
11/01/2020	140,000.00	4.000%	92,350.00	232,350.00	-
05/01/2021	-	-	89,550.00	89,550.00	-
06/30/2021	-	-	-	-	321,900.00
11/01/2021	145,000.00	4.000%	89,550.00	234,550.00	-
05/01/2022	-	-	86,650.00	86,650.00	-
06/30/2022	-	-	-	-	321,200.00
11/01/2022	155,000.00	4.000%	86,650.00	241,650.00	-
05/01/2023	-	-	83,550.00	83,550.00	-
06/30/2023	-	-	-	-	325,200.00
11/01/2023	160,000.00	4.000%	83,550.00	243,550.00	-
05/01/2024	-	-	80,350.00	80,350.00	-
06/30/2024	-	-	-	-	323,900.00
11/01/2024	165,000.00	4.000%	80,350.00	245,350.00	-
05/01/2025	-	-	77,050.00	77,050.00	-
06/30/2025	-	-	-	-	322,400.00
11/01/2025	170,000.00	4.000%	77,050.00	247,050.00	-
05/01/2026	-	-	73,650.00	73,650.00	-
06/30/2026	-	-	-	-	320,700.00
11/01/2026	180,000.00	4.000%	73,650.00	253,650.00	-

Debt Service Schedule

Date	Principal	Coupon	Interest	Total P+I	Fiscal Total
05/01/2027	-	-	70,050.00	70,050.00	-
06/30/2027	-	-	-	-	323,700.00
11/01/2027	185,000.00	4.000%	70,050.00	255,050.00	-
05/01/2028	-	-	66,350.00	66,350.00	-
06/30/2028	-	-	-	-	321,400.00
11/01/2028	195,000.00	4.000%	66,350.00	261,350.00	-
05/01/2029	-	-	62,450.00	62,450.00	-
06/30/2029	-	-	-	-	323,800.00
11/01/2029	200,000.00	4.000%	62,450.00	262,450.00	-
05/01/2030	-	-	58,450.00	58,450.00	-
06/30/2030	-	-	-	-	320,900.00
11/01/2030	210,000.00	5.000%	58,450.00	268,450.00	-
05/01/2031	-	-	53,200.00	53,200.00	-
06/30/2031	-	-	-	-	321,650.00
11/01/2031	220,000.00	5.000%	53,200.00	273,200.00	-
05/01/2032	-	-	47,700.00	47,700.00	-
06/30/2032	-	-	-	-	320,900.00
11/01/2032	235,000.00	5.000%	47,700.00	282,700.00	-
05/01/2033	-	-	41,825.00	41,825.00	-
06/30/2033	-	-	-	-	324,525.00
11/01/2033	245,000.00	5.000%	41,825.00	286,825.00	-
05/01/2034	-	-	35,700.00	35,700.00	-
06/30/2034	-	-	-	-	322,525.00
11/01/2034	260,000.00	5.000%	35,700.00	295,700.00	-
05/01/2035	-	-	29,200.00	29,200.00	-
06/30/2035	-	-	-	-	324,900.00
11/01/2035	270,000.00	4.000%	29,200.00	299,200.00	-
05/01/2036	-	-	23,800.00	23,800.00	-
06/30/2036	-	-	-	-	323,000.00
11/01/2036	280,000.00	4.000%	23,800.00	303,800.00	-
05/01/2037	-	-	18,200.00	18,200.00	-
06/30/2037	-	-	-	-	322,000.00
11/01/2037	290,000.00	4.000%	18,200.00	308,200.00	-
05/01/2038	-	-	12,400.00	12,400.00	-
06/30/2038	-	-	-	-	320,600.00
11/01/2038	305,000.00	4.000%	12,400.00	317,400.00	-
05/01/2039	-	-	6,300.00	6,300.00	-
06/30/2039	-	-	-	-	323,700.00
11/01/2039	315,000.00	4.000%	6,300.00	321,300.00	-
06/30/2040	-	-	-	-	321,300.00
Total	**$4,715,000.00**	-	**$3,297,323.33**	**$8,012,323.33**	-

Yield Statistics

Net Interest Cost (NIC)	3.9628577%
True Interest Cost (TIC)	3.8326706%
Bond Yield for Arbitrage Purposes	3.7025607%
All Inclusive Cost (AIC)	4.0272150%

IRS Form 8038

Net Interest Cost	3.7669637%
Weighted Average Maturity	16.085 Years

Transcript of Proceedings

$6,755,000
City of Hermiston
Umatilla County, Oregon
Full Faith and Credit Obligations, Series 2017

Date of Closing: March 30, 2017

BOND SUMMARY STATISTICS

City of Hermiston
Full Faith and Credit Obligations, Series 2017
Final Numbers (3-16-17)

Dated Date	03/30/2017
Delivery Date	03/30/2017
Last Maturity	03/01/2037
Arbitrage Yield	2.805954%
True Interest Cost (TIC)	2.916052%
Net Interest Cost (NIC)	2.977817%
All-In TIC	3.037428%
Average Coupon	3.201149%
Average Life (years)	11.446
Weighted Average Maturity (years)	11.386
Duration of Issue (years)	9.432
Par Amount	6,755,000.00
Bond Proceeds	6,980,553.25
Total Interest	2,475,155.20
Net Interest	2,302,473.00
Total Debt Service	9,230,155.20
Maximum Annual Debt Service	467,875.00
Average Annual Debt Service	463,374.13

Bond Component	Par Value	Price	Average Coupon	Average Life	PV of 1 bp change
2018-2037 Serial Bonds	6,755,000.00	103.339	3.201%	11.446	4,927.20
	6,755,000.00			11.446	4,927.20

	TIC	All-In TIC	Arbitrage Yield
Par Value	6,755,000.00	6,755,000.00	6,755,000.00
+ Accrued Interest	-	-	-
+ Premium (Discount)	225,553.25	225,553.25	225,553.25
- Underwriter's Discount	-52,871.05	-52,871.05	
- Cost of Issuance Expense		-77,550.00	
- Other Amounts	-	-	-
Target Value	6,927,682.20	6,850,132.20	6,980,553.25
Target Date	03/30/2017	03/30/2017	03/30/2017
Yield	2.916052%	3.037428%	2.805954%

BOND DEBT SERVICE

TOTAL

City of Hermiston
Full Faith and Credit Obligations, Series 2017
Final Numbers (3-16-17)

Dated Date 03/30/2017
Delivery Date 03/30/2017

Period Ending	Principal	Coupon	Interest	Debt Service	Annual Debt Service
09/01/2017	-	-	88,555.20	88,555.20	-
03/01/2018	235,000	3.000%	105,562.50	340,562.50	429,117.70
09/01/2018	-	-	102,037.50	102,037.50	-
03/01/2019	255,000	3.000%	102,037.50	357,037.50	459,075.00
09/01/2019	-	-	98,212.50	98,212.50	-
03/01/2020	270,000	3.000%	98,212.50	368,212.50	466,425.00
09/01/2020	-	-	94,162.50	94,162.50	-
03/01/2021	275,000	3.000%	94,162.50	369,162.50	463,325.00
09/01/2021	-	-	90,037.50	90,037.50	-
03/01/2022	280,000	3.000%	90,037.50	370,037.50	460,075.00
09/01/2022	-	-	85,837.50	85,837.50	-
03/01/2023	290,000	3.000%	85,837.50	375,837.50	461,675.00
09/01/2023	-	-	81,487.50	81,487.50	-
03/01/2024	300,000	3.000%	81,487.50	381,487.50	462,975.00
09/01/2024	-	-	76,987.50	76,987.50	-
03/01/2025	305,000	3.000%	76,987.50	381,987.50	458,975.00
09/01/2025	-	-	72,412.50	72,412.50	-
03/01/2026	320,000	3.000%	72,412.50	392,412.50	464,825.00
09/01/2026	-	-	67,612.50	67,612.50	-
03/01/2027	330,000	3.000%	67,612.50	397,612.50	465,225.00
09/01/2027	-	-	62,662.50	62,662.50	-
03/01/2028	340,000	3.000%	62,662.50	402,662.50	465,325.00
09/01/2028	-	-	57,562.50	57,562.50	-
03/01/2029	350,000	3.000%	57,562.50	407,562.50	465,125.00
09/01/2029	-	-	52,312.50	52,312.50	-
03/01/2030	360,000	3.000%	52,312.50	412,312.50	464,625.00
09/01/2030	-	-	46,912.50	46,912.50	-
03/01/2031	365,000	3.000%	46,912.50	411,912.50	458,825.00
09/01/2031	-	-	41,437.50	41,437.50	-
03/01/2032	385,000	3.000%	41,437.50	426,437.50	467,875.00
09/01/2032	-	-	35,662.50	35,662.50	-
03/01/2033	395,000	3.250%	35,662.50	430,662.50	466,325.00
09/01/2033	-	-	29,243.75	29,243.75	-
03/01/2034	405,000	3.250%	29,243.75	434,243.75	463,487.50
09/01/2034	-	-	22,662.50	22,662.50	-
03/01/2035	415,000	3.500%	22,662.50	437,662.50	460,325.00
09/01/2035	-	-	15,400.00	15,400.00	-
03/01/2036	430,000	3.500%	15,400.00	445,400.00	460,800.00
09/01/2036	-	-	7,875.00	7,875.00	-
03/01/2037	450,000	3.500%	7,875.00	457,875.00	465,750.00
	6,755,000		2,475,155.20	9,230,155.20	9,230,155.20

BOND DEBT SERVICE

City of Hermiston
Full Faith and Credit Obligations, Series 2017 (Water)
Final Numbers (3-16-17)

SPLIT 50/50 WATER/SEWER

Dated Date 03/30/2017
Delivery Date 03/30/2017

Period Ending	Principal	Coupon	Interest	Debt Service	Annual Debt Service
09/01/2017	-	-	41,425.38	41,425.38	-
03/01/2018	110,000	3.000%	49,381.25	159,381.25	200,806.63
09/01/2018	-	-	47,731.25	47,731.25	-
03/01/2019	120,000	3.000%	47,731.25	167,731.25	215,462.50
09/01/2019	-	-	45,931.25	45,931.25	-
03/01/2020	125,000	3.000%	45,931.25	170,931.25	216,862.50
09/01/2020	-	-	44,056.25	44,056.25	-
03/01/2021	130,000	3.000%	44,056.25	174,056.25	218,112.50
09/01/2021	-	-	42,106.25	42,106.25	-
03/01/2022	130,000	3.000%	42,106.25	172,106.25	214,212.50
09/01/2022	-	-	40,156.25	40,156.25	-
03/01/2023	135,000	3.000%	40,156.25	175,156.25	215,312.50
09/01/2023	-	-	38,131.25	38,131.25	-
03/01/2024	140,000	3.000%	38,131.25	178,131.25	216,262.50
09/01/2024	-	-	36,031.25	36,031.25	-
03/01/2025	145,000	3.000%	36,031.25	181,031.25	217,062.50
09/01/2025	-	-	33,856.25	33,856.25	-
03/01/2026	150,000	3.000%	33,856.25	183,856.25	217,712.50
09/01/2026	-	-	31,606.25	31,606.25	-
03/01/2027	155,000	3.000%	31,606.25	186,606.25	218,212.50
09/01/2027	-	-	29,281.25	29,281.25	-
03/01/2028	160,000	3.000%	29,281.25	189,281.25	218,562.50
09/01/2028	-	-	26,881.25	26,881.25	-
03/01/2029	165,000	3.000%	26,881.25	191,881.25	218,762.50
09/01/2029	-	-	24,406.25	24,406.25	-
03/01/2030	165,000	3.000%	24,406.25	189,406.25	213,812.50
09/01/2030	-	-	21,931.25	21,931.25	-
03/01/2031	170,000	3.000%	21,931.25	191,931.25	213,862.50
09/01/2031	-	-	19,381.25	19,381.25	-
03/01/2032	180,000	3.000%	19,381.25	199,381.25	218,762.50
09/01/2032	-	-	16,681.25	16,681.25	-
03/01/2033	185,000	3.250%	16,681.25	201,681.25	218,362.50
09/01/2033	-	-	13,675.00	13,675.00	-
03/01/2034	190,000	3.250%	13,675.00	203,675.00	217,350.00
09/01/2034	-	-	10,587.50	10,587.50	-
03/01/2035	195,000	3.500%	10,587.50	205,587.50	216,175.00
09/01/2035	-	-	7,175.00	7,175.00	-
03/01/2036	200,000	3.500%	7,175.00	207,175.00	214,350.00
09/01/2036	-	-	3,675.00	3,675.00	-
03/01/2037	210,000	3.500%	3,675.00	213,675.00	217,350.00
	$\boxed{3,160,000}$		1,157,369.13	4,317,369.13	4,317,369.13

The loan amount shown is split half and half between the Water and Recycled Water Departments.

BOND DEBT SERVICE

City of Hermiston
Full Faith and Credit Obligations, Series 2017 (TPA)
Final Numbers (3-16-17)

Dated Date	03/30/2017
Delivery Date	03/30/2017

Period Ending	Principal	Coupon	Interest	Debt Service	Annual Debt Service
09/01/2017	-	-	27,788.19	27,788.19	-
03/01/2018	75,000	3.000%	33,125.00	108,125.00	135,913.19
09/01/2018	-	-	32,000.00	32,000.00	-
03/01/2019	80,000	3.000%	32,000.00	112,000.00	144,000.00
09/01/2019	-	-	30,800.00	30,800.00	-
03/01/2020	85,000	3.000%	30,800.00	115,800.00	146,600.00
09/01/2020	-	-	29,525.00	29,525.00	-
03/01/2021	85,000	3.000%	29,525.00	114,525.00	144,050.00
09/01/2021	-	-	28,250.00	28,250.00	-
03/01/2022	90,000	3.000%	28,250.00	118,250.00	146,500.00
09/01/2022	-	-	26,900.00	26,900.00	-
03/01/2023	90,000	3.000%	26,900.00	116,900.00	143,800.00
09/01/2023	-	-	25,550.00	25,550.00	-
03/01/2024	95,000	3.000%	25,550.00	120,550.00	146,100.00
09/01/2024	-	-	24,125.00	24,125.00	-
03/01/2025	95,000	3.000%	24,125.00	119,125.00	143,250.00
09/01/2025	-	-	22,700.00	22,700.00	-
03/01/2026	100,000	3.000%	22,700.00	122,700.00	145,400.00
09/01/2026	-	-	21,200.00	21,200.00	-
03/01/2027	105,000	3.000%	21,200.00	126,200.00	147,400.00
09/01/2027	-	-	19,625.00	19,625.00	-
03/01/2028	105,000	3.000%	19,625.00	124,625.00	144,250.00
09/01/2028	-	-	18,050.00	18,050.00	-
03/01/2029	110,000	3.000%	18,050.00	128,050.00	146,100.00
09/01/2029	-	-	16,400.00	16,400.00	-
03/01/2030	115,000	3.000%	16,400.00	131,400.00	147,800.00
09/01/2030	-	-	14,675.00	14,675.00	-
03/01/2031	115,000	3.000%	14,675.00	129,675.00	144,350.00
09/01/2031	-	-	12,950.00	12,950.00	-
03/01/2032	120,000	3.000%	12,950.00	132,950.00	145,900.00
09/01/2032	-	-	11,150.00	11,150.00	-
03/01/2033	125,000	3.250%	11,150.00	136,150.00	147,300.00
09/01/2033	-	-	9,118.75	9,118.75	-
03/01/2034	125,000	3.250%	9,118.75	134,118.75	143,237.50
09/01/2034	-	-	7,087.50	7,087.50	-
03/01/2035	130,000	3.500%	7,087.50	137,087.50	144,175.00
09/01/2035	-	-	4,812.50	4,812.50	-
03/01/2036	135,000	3.500%	4,812.50	139,812.50	144,625.00
09/01/2036	-	-	2,450.00	2,450.00	-
03/01/2037	140,000	3.500%	2,450.00	142,450.00	144,900.00
	2,120,000		775,650.69	2,895,650.69	2,895,650.69

BOND DEBT SERVICE

City of Hermiston
Full Faith and Credit Obligations, Series 2017 (HURA)
Final Numbers (3-16-17)

Dated Date	03/30/2017
Delivery Date	03/30/2017

Period Ending	Principal	Coupon	Interest	Debt Service	Annual Debt Service
09/01/2017	-	-	19,341.63	19,341.63	-
03/01/2018	50,000	3.000%	23,056.25	73,056.25	92,397.88
09/01/2018	-	-	22,306.25	22,306.25	-
03/01/2019	55,000	3.000%	22,306.25	77,306.25	99,612.50
09/01/2019	-	-	21,481.25	21,481.25	-
03/01/2020	60,000	3.000%	21,481.25	81,481.25	102,962.50
09/01/2020	-	-	20,581.25	20,581.25	-
03/01/2021	60,000	3.000%	20,581.25	80,581.25	101,162.50
09/01/2021	-	-	19,681.25	19,681.25	-
03/01/2022	60,000	3.000%	19,681.25	79,681.25	99,362.50
09/01/2022	-	-	18,781.25	18,781.25	-
03/01/2023	65,000	3.000%	18,781.25	83,781.25	102,562.50
09/01/2023	-	-	17,806.25	17,806.25	-
03/01/2024	65,000	3.000%	17,806.25	82,806.25	100,612.50
09/01/2024	-	-	16,831.25	16,831.25	-
03/01/2025	65,000	3.000%	16,831.25	81,831.25	98,662.50
09/01/2025	-	-	15,856.25	15,856.25	-
03/01/2026	70,000	3.000%	15,856.25	85,856.25	101,712.50
09/01/2026	-	-	14,806.25	14,806.25	-
03/01/2027	70,000	3.000%	14,806.25	84,806.25	99,612.50
09/01/2027	-	-	13,756.25	13,756.25	-
03/01/2028	75,000	3.000%	13,756.25	88,756.25	102,512.50
09/01/2028	-	-	12,631.25	12,631.25	-
03/01/2029	75,000	3.000%	12,631.25	87,631.25	100,262.50
09/01/2029	-	-	11,506.25	11,506.25	-
03/01/2030	80,000	3.000%	11,506.25	91,506.25	103,012.50
09/01/2030	-	-	10,306.25	10,306.25	-
03/01/2031	80,000	3.000%	10,306.25	90,306.25	100,612.50
09/01/2031	-	-	9,106.25	9,106.25	-
03/01/2032	85,000	3.000%	9,106.25	94,106.25	103,212.50
09/01/2032	-	-	7,831.25	7,831.25	-
03/01/2033	85,000	3.250%	7,831.25	92,831.25	100,662.50
09/01/2033	-	-	6,450.00	6,450.00	-
03/01/2034	90,000	3.250%	6,450.00	96,450.00	102,900.00
09/01/2034	-	-	4,987.50	4,987.50	-
03/01/2035	90,000	3.500%	4,987.50	94,987.50	99,975.00
09/01/2035	-	-	3,412.50	3,412.50	-
03/01/2036	95,000	3.500%	3,412.50	98,412.50	101,825.00
09/01/2036	-	-	1,750.00	1,750.00	-
03/01/2037	100,000	3.500%	1,750.00	101,750.00	103,500.00
	1,475,000		542,135.38	2,017,135.38	2,017,135.38