FINAL

Sanitary Sewer Master Plan

Prepared for

City of Newport, Oregon

February 9, 2018

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List of Abbreviations

AC	asbestos cement
BC	Brown and Caldwell
BLI	buildable lands inventory
BOD	biochemical oxygen demand
CCTV	closed-circuit television
CIP	Capital Improvement Plan
CIPP	cured-in-place pipe
City	City of Newport
CMOM	Capacity, Management, Operation, and Maintenance
Comp Plan	Comprehensive Plan
CSP	concrete sewer pipe
d/D	ratio of depth to pipe diameter
DEQ	Department of Environmental Quality
DI	ductile iron
DLCD	Oregon Department of Land Conservation and Development
EPA	Environmental Protection Agency
°F	degree(s) Fahrenheit
FM	force main
fps	feet per second
GIS	geographic information system
gpad	gallon(s) per acre per day
gpcd	gallon(s) per capita per day
gpm	gallon(s) per minute
HDPE	high-density polyethylene
HDR	high-density residential
HGL	hydraulic grade line
HMSC	Hatfield Marine Science Center
I/I	infiltration/inflow
ID	identifier
LDR	low-density residential
LF	linear foot/feet
LID	Local Improvement District
MDR	medium-density residential
mgd	million gallons per day
NASSCO	National Association of Sewer Service Companies
NAVD88	North American Vertical Datum of 1988
NMC	Newport Municipal Code
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
OAR	Oregon Administrative Rules
OSU	Oregon State University
PACP	Pipeline Assessment and Certification Program
PRI	Pipe Rating Index
PS	pump station
PVC	polyvinyl chloride
Q	maximum predicted flow
Q_m	pipe capacity
R&R	rehabilitation and replacement
RDII	rainfall-derived infiltration/inflow
RG-1	Rain Gauge 1
RTK	a unit hydrograph method
SCADA	Supervisory Control and Data Acquisition
SDC	system development charge
SFE	SFE Global, Incorporated
SSMP	Sanitary Sewer Master Plan
SSO	sanitary sewer overflow
STEP	Septic Tank Effluent Pump
SWMM	Storm Water Management Model
UGB	urban growth boundary
Utility	Sanitary Sewer Utility
WU	Weather Underground
WWTP	wastewater treatment plant

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Executive Summary

This Executive Summary provides a brief description of each section of the Sanitary Sewer Master Plan (SSMP). Recommendations and costs for a Capital Improvement Plan (CIP) are provided at the end of the section.

Introduction

The City of Newport (City) commissioned this SSMP and retained Brown and Caldwell (BC) to evaluate and make recommendations on capital improvement projects related to the City's sanitary sewer collection system. The plan was needed to help the City in continuing to provide reliable and effective sanitary services to the community. A number of key objectives have been identified in the report with the main objective for the City being to identify improvements in its system, as required to convey current and future flows. These improvements and their respective costs are presented herein.

Basis of Planning

The City provides sanitary sewer collection system services to approximately 10,000 people spread across an area of approximately 11.2 square miles. The City oversees over 62 miles of gravity pipelines ranging in size from approximately 3 to 36 inches in diameter, 1,400 manholes, 9 major pump stations, 16 minor pump stations, and 12 miles of sanitary force mains.

Pipe within the collection system is comprised of a variety of materials that range in age from almost 100 years to 10 years or less. The City provides wastewater collection services to residents, commercial establishments, institutional customers, and a number of industries in the service area. Sewer service is provided only to customers within the city limits.

Wastewater System Policies

Policies and standards have been created to guide the City and its users in the operation and development of the City's wastewater collection system. The policies and standards are derived from the City's Comprehensive Plan, City Resolutions, and Newport Municipal Code (NMC). Suggested modifications to the NMC have been provided to facilitate the continued protection of the City's valuable assets. They include the following:

- Vegetation requirements
- Root control
- Side sewer condition education requirement
- Fees for commercial/industrial wastewater groups
- Voluntary pretreatment program
- I/I reduction

Flow Projections and Modeling

In order to understand the current conditions and predict future deficiencies, a hydrologic/hydraulic (H/H) model was constructed. The model used base wastewater flows and rainfall-derived infiltration/inflow (RDII) data. The model was calibrated against measured field information collected using flow meters installed within the City sewer system over a 4-month period.

The information provided through the modeling activities helped to complete capacity analyses and identify issues for current, 20-year, and build-out development planning scenarios. The modeling results, when compared against design parameters established by the Oregon Department of Environmental Quality, BC, and the City, formed the basis for identifying deficient areas of the system.

The model includes all major trunk lines (greater than 10 inches in diameter), major pump stations, and sewers that could be impacted by future growth.

The primary modeling parameter for flow associated with selecting and sizing gravity sewers, pump stations, and force mains is the once-per-10-year, 24-hour duration recurrence flow interval. The flow condition was selected based on guidance provided by the Oregon Administrative Rules (OAR), specifically OAR 340-041-0009 (6) and (7), which prohibits discharge of raw sewage to waters of the state with some exceptions. The most notable of these are sanitary sewer overflows (SSOs) from a pump station or sanitary structure during a winter storm event greater than the 1-in-5-year, 24-hour duration storm, or a summer storm event greater than the 1-in-10-year, 24-hour duration storm. The more conservative condition was used herein. The U.S. EPA recommends that municipalities evaluate a range of storm events (typically 5- through 20-year storms) and to select an event that provides a level of protection against SSOs that is in accordance with community values.

Additional guidance parameters were established when reviewing the data and performing the hydraulic analysis.

Hydraulic Analysis

To determine the capacity limits of the system (gravity, force mains, and pump station), a hydraulic analysis was completed. Each category was evaluated to determine if an overflow was possible, given current and future flow conditions. For the gravity sewers the guidance parameter/criteria limit was that the available freeboard between the hydraulic grade line and the lowest sewered fixture be greater than 7 feet. The pump stations were evaluated on their ability to provide firm pumping capacity for future flows. The forcemains were evaluated and/or sized to maintain a velocity between 3.5 and 8 feet per second. A number of deficiencies were identified during the exercise and included in the plan recommendations.

In general, gravity sewer replacements include areas of Avery Street and NW Nye Street. The Bayfront PS and Nye Beach PS lack the firm capacity to convey existing, 20-year and buildout conditions peak flows; the Northside PS lacks firm capacity to convey the 20-year and buildout conditions peak flows; and the SE Running Springs Drive PS lacks firm capacity to convey the buildout conditions peak flow.

The Northwest 56th Street PS is located in a geologically unstable area. Though the pump station does not exceed parameters for flow or velocity, it is recommended that it be included on the pump station upgrade list. Initial efforts should be focused on completing an alternative analysis to determine the best solution (e.g., stabilize the current infrastructure, relocate)

The velocities in most force mains are within acceptable limits with the exception of Bayfront and HMSC for future peak flows and firm pumping capacity, respectively.

Capital Improvement Plan

The CIP is based on reviewing existing conditions and applying the results of the modeling effort. The plan is intended to help the City make decisions on existing and potential expected deficiencies given growth and flow increases in the system. It also provides guidance for expanding the system to meet the City's future growth needs.

Capital improvements have been developed based on the buildout condition planning scenario. These include sewer replacements that will be required to convey future flows and sewer extensions and pump stations that will be required to provide new sewer service to areas of the city without sewer service and to areas that may be annexed by the City in the foreseeable future.

The plan was established in a manner that is consistent with other communities, and is based on "existing conditions" planning. This type of planning focuses efforts on existing deficiencies first before preparing for future conditions. Also, the plan is structured to help allocate rates and system development charges based on improvements that are focused on existing and new users, respectively.

The average yearly cost of the plan has been separated into two categories: planned activities and rehabilitation/replacement (R&R). The planned activities address known deficiencies (i.e., capacity) based on the performed H/H analysis. The R&R activities assume a schedule that targets a discrete portion of the system.

It is recommended that the City allocate a yearly budget of approximately $1.17M for planned projects (e.g. pump station gravity sewer upgrades) and $1.53 for annual reoccurring activities (e.g. inspections and rehabilitation of known and assumed deficient sewers). A total annual budget of $2.70M is expected with this plan.

Because of the timing of some projects, year-to-year expenditures may fluctuate. Estimated project costs are presented in Table ES-1 below, with discrete projects and annual activities broken out by description, location, and type. A timeline for each project has been identified.

Table ES-1. Cost of Recommended CIP s and Implementation Schedule

Project no.	Project name	Project description	Year completed	Estimated cost of improvements, 2016 dollars[a]
Gravity Sewer Improvements				
1	NE Avery Street	Upsize gravity sewer from the Bayfront FM to the Northside PS	5-10	1,230,000
2	NW Nye Street	Upsize and rehabilitate gravity sewer from the Big Creek FM to the Northside PS	1-5	1,140,000
Total all gravity sewer improvements				**2,370,000**
Major Pump Station and FM Improvements				
3	Nye Beach PS	Upgrade pump station firm capacity to 2.74 mgd	1-5	2,828,000
4	Bayfront PS	Upgrade pump station firm capacity to 2.59 mgd	1-5	3,224,000
4	Bayfront FM	Upgrade force main to 14-inch diameter	1-5	490,000
5	Northside PS	Upgrade pump station firm capacity to 9.2 mgd	5-10	2,780,000
5	Northside FM	A conservative cost estimate was assumed from previously chosen alternatives.	5-10	1,500,000
6	SE Running Springs Drive PS	Upgrade pump station firm capacity to 0.27 mgd	5-10	1,178,000
6	SE Running Springs Drive FM	Upgrade force main to 14-inch diameter	5-10	330,000

Table ES-1. Cost of Recommended CIP s and Implementation Schedule				
Project no.	Project name	Project description	Year completed	Estimated cost of improvements, 2016 dollars[a]
7	SE 3rd St PS	Replace pump station with a gravity line extending to SE 4th St	10-15	310,000
7	NW 56th St PS	PS is located in a geologically unstable area; Conduct alternative analysis and implement project solution.	10-15	1,347,000
Total all pump station and FM improvements				**13,987,000**
Sewer Extension Improvements				
8	Surfland Septic Conversion	Construct new gravity system	15-20	4,620,000
8	Surfland Septic Conversion	Construct new pump station	15-20	1,000,000
8	Surfland Septic Conversion	Construct new force main	15-20	612,000
Total all sewer extension improvements				6,232,000
Other Improvements				
9	Maintenance Program	Conduct a study to establish a cleaning schedule for sewer mains. Currently the City has 19 sewer mains identified for regular cleaning	1-5	20,000
10	Re-route building crossings	Re-route sewer mains that cross under buildings including: • Gravity system just east of NW Nye St, north of NW 12th St. • Sewer main under Washington Federal Bank, 505 N Coast Hwy (SSMH 7003 to 7002 to 7061). • Sewer main under house at 1819 NW Crestview Place (SSMH 4774 to 4787). • Sewer main under house at 270 SE Penter Lane (SSMH 7531 to 7533). The sewer main under the Newport Fire Station, 245 NW 10th St (SSMH 5045 to 5518) will be addressed by the Nazarene Church Sewer Replacement project and is not included in this cost.	10-15	760,000
Total all other improvements				**780,000**
Annual Rehabilitation and Repair Costs				
11	Sewer R/R Program (excluding PSs)	Rehabilitate sewers and FMs based on R/R implementation plan. Target Grade 5 and 4 sewers.	Annual	1,011,750
12	Inspection Program	Inspect 47,000 LF of gravity pipe per year	Annual	117,500
12	Inspection Program	Inspect 9,300 LF of force mains per year	Annual	186,000
12	Inspection Program	PS inspection program	Annual	15,000
13	Minor PS R/R Program	A schedule should be established to conduct these improvements on an annual basis. Priority pump stations include, but are not limited to: • Embarcadero PS • SW Minnie St PS • San Bay-O PS • NE 10th St PS	Annual	200,000
Total all annual costs				**1,530,000**
Total of 20-yr CIP (without annual R&R costs, no inflation)				**23,369,000**
Total of 20-yr CIP (with annual R&R costs, no inflation)				**53,969,000**

a. *Estimated costs include a 30% allowance for construction contingencies and a 20% allowance for engineering design and administration. PS costs include a 25% allowance for contractor markups. See Appendix E for unit cost tables - assumes a depth of 10' per cost condition 2 for gravity and sewer extensions.*

As part of the R&R program, the City should assess goals for I/I reduction. Currently, some areas of the system contribute higher I/I flows than others, when normalized by pipe length. As an example, Basins 4B and 7 together contribute 19 percent of the peak wet weather I/I but comprise only 7 percent of the sewered area. Further analysis is warranted to determine if an I/I reduction program is cost-effective and could defer, or even eliminate, the need for some predicted future capacity increase projects.

Costs associated with project no. 11 (Sewer R/R) are based on existing inspection data which was used to generate an assumed percent of the total system that will require R/R in the future. This approach assumes that existing Grades 2-4 will become Grade 5 or that new Grade 5 will be identified in later inspections, thus needing repair within 5-years of identifying. This approach carries some risk for pipes yet to be inspected, where Grade 5 pipe may currently exist in areas that will not be targeted for inspection for many years; thus, failure could prematurely occur and require emergency repairs. An alternate approach for consideration would be to complete a comprehensive inspection of the entire system and establish a more accurate understanding of Grade 5 deficiencies so that the plan can be revised to reflect actual versus assumed conditions. This approach may require more upfront costs, but has the potential of reducing future expenditures as the planning period advances.

For long-term planning purposes, the City should consider conducting a rate study in order to prepare financially for implementing future CIP projects.

Benefits of implementing this CIP program include:

- Optimization of the life-cycle of the existing system by selecting and sizing the projects according to population projections.
- Prioritization of the projects will enable the City to plan and prepare financially for implementing improvements.
- Optimization of public support for potential future rate increases.

Because the CIP program has been developed according to the scope of the SSMP, only key portions of the system have been evaluated for capacity limitations. It is possible that smaller, upstream systems may also need to be increased for capacity in the future.

Figure ES-2 below shows the locations of the recommended improvements.

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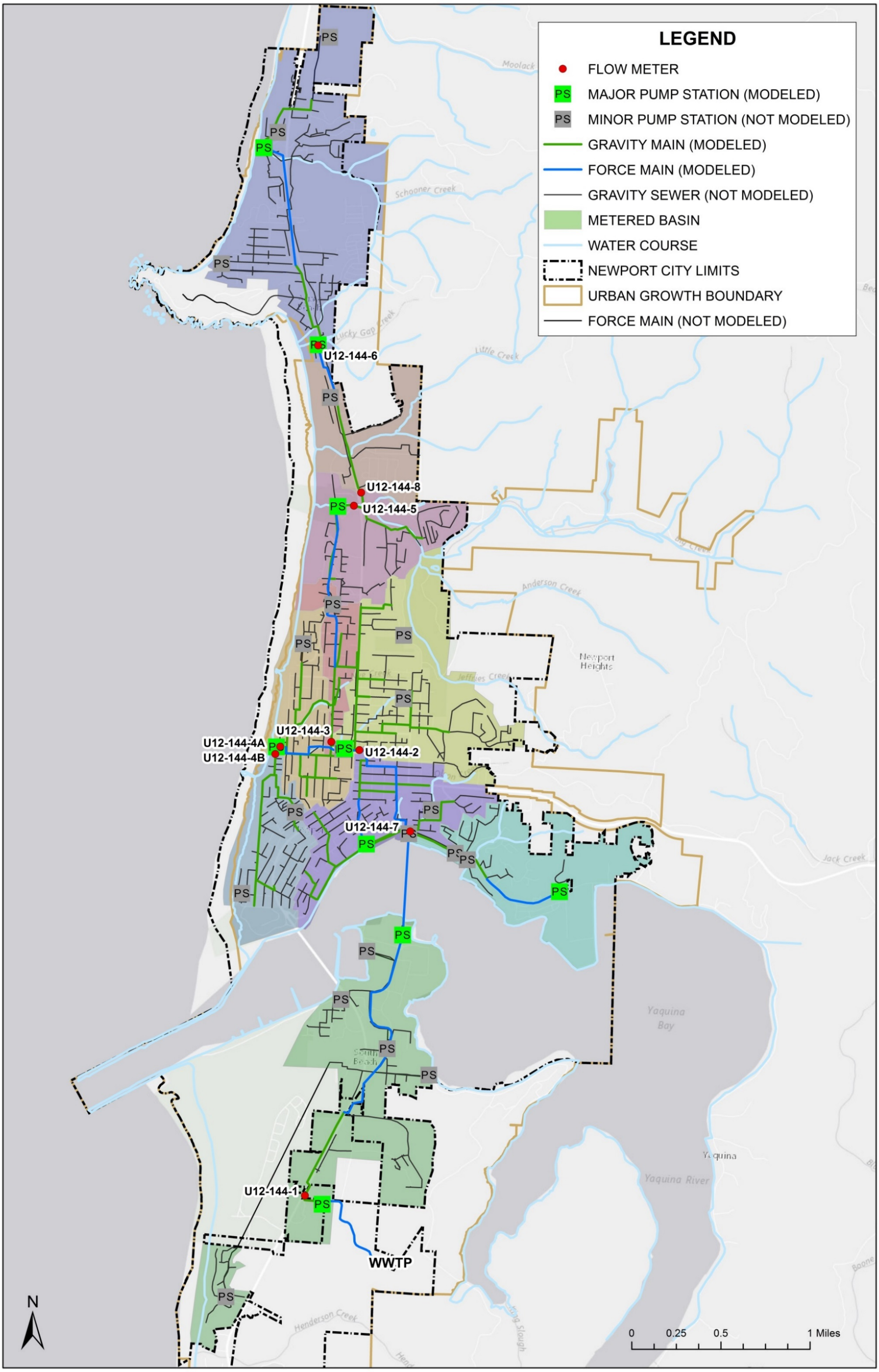

Figure ES-1. SSMP model extents and flow meter locations

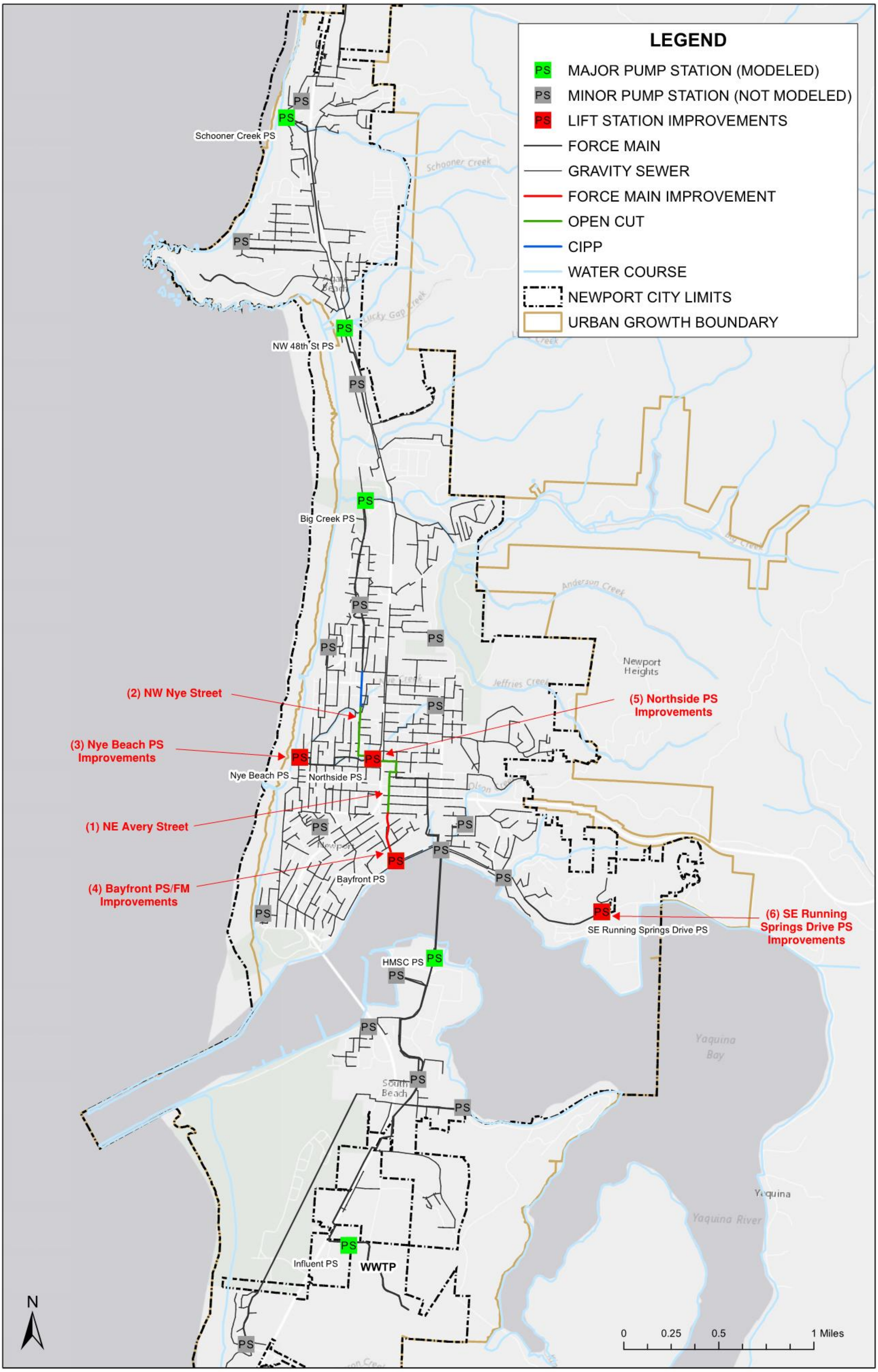

Figure ES-2. Recommended capacity-based future capital improvements

Section 1
Introduction

The City of Newport (City) provides sanitary sewer collection system services for approximately 10,000 people spread across an area of approximately 11.2 square miles. The City owns over 62.5 miles of gravity pipelines ranging in size from approximately 3 to 36 inches in diameter, 1,400 manholes, 9 major pump stations, 16 minor pump stations, and 12 miles of sanitary force mains. A majority of the sewer system was built after 1950 and is concrete, while much of the newer pipe is polyvinyl chloride (PVC).

The City commissioned this Sanitary Sewer Master Plan (SSMP) and retained Brown and Caldwell (BC) to evaluate and make recommendations on capital improvement projects related to the City's sanitary sewer collection system.

This section describes the purpose and scope of work for the master planning project.

1.1 Need for the Plan

The City recognizes that changes have occurred in the population, the area available for development, and land uses since the development of the last SSMP in 1988. A new hydrologic/hydraulic model and guidance on the capital improvement needs of the collection system are required as part of prudent planning for the future and for continued reliable and effective sanitary service to the community.

1.2 Plan Objectives

The objectives of the SSMP include the following:

- Evaluate the current and future flows and system conveyance capacity
- Identify capital improvements and their costs as required to convey current and future flows
- Identify potential additions or extensions of the collection system associated with future growth
- Identify probable future condition and serviceability of the system because of aging
- Evaluate the Newport Municipal Code (NMC) and provide recommended improvements
- Document the above activities in a new contemporary SSMP

1.3 Approach

In general, the following approach was used for the project:

- Acquisition and review of the geographic information system (GIS) data with respect to land use, zoning, and the layout of the sanitary sewer system
- Field survey or measure-downs of key manholes to determine manhole rim elevations and elevations of pipes
- Identification of data gaps and a request to the City to fill them
- Development of a hydrologic/hydraulic model
- Calibration of the model based on flow information from the previous year's wet weather flow monitoring task

- Additional calibration of the model based on the City's Supervisory Control and Data Acquisition (SCADA) information from pump stations
- Identification of existing (current) system hydraulic deficiencies and the improvements required
- Identification of future system hydraulic deficiencies and the improvements required
- Description of the major elements of a sewer rehabilitation program and why such a program is important for long-term collection system management success
- Development of the SSMP documenting all of the above

1.4 Plan Organization

The SSMP is organized as follows:

Section 1: Introduction. Defines why the SSMP was developed and its purpose.

Section 2: Basis of Planning. Documents the primary elements that formulate the basis of the planning effort.

Section 3: Wastewater System Policies. Documents the existing Comprehensive Plan (Comp Plan), Resolutions, and NMC and recommends improvements.

Section 4: Flow Projections and Modeling. Documents the flow projections used in the modeling and the modeling process.

Section 5: Hydraulic Analysis. Identifies hydraulic deficiencies for the existing and future planning scenarios.

Section 6: Capital Improvement Plan. Identifies capital improvements and costs associated with existing and future planning scenarios.

Appendices A through H provide supporting information for Sections 1 through 6.

Section 2

Basis of Planning

This section includes an overview of study area characteristics including location, topography, soils, land use, rainfall, and sanitary sewer collection system conditions.

2.1 Background and History

In 1856, Yaquina Bay was visited by the Calumet, a sailing vessel bound for a nearby military garrison. Six years later oyster beds were discovered in Yaquina Bay, turning Yaquina Bay into a profitable location. Newport was officially founded in 1866. Despite not being accessible by road until 1927, the city became a popular tourist destination. While Newport remains a popular tourist destination today, the city is also home to the National Oceanic and Atmospheric Administration (NOAA), Oregon State University's (OSU's) Hatfield Marine Science Center (HMSC), the Oregon Coast Aquarium, and Rogue Ales brewery.

In 1880, the city had a population of about 50. Newport continued to grow rapidly through 1910, reaching a population of 721 people. Growth continued but slowed during the Great Depression, with a population of 1,530 in 1930. The city saw substantial growth after World War II, reaching a population of 3,241 in 1950. Growth continued at a rapid pace, with a nearly 60 percent increase in population between 1970 and 1990. By 2000, the population was 9,532. According to the Population Research Center at Portland State University the 2015 population is estimated at 10,165.

The city's sewers convey the wastewater flows to the wastewater treatment plant (WWTP) southeast of the city where the water is treated, pumped north across Yaquina Bay, and then discharged into the Pacific Ocean.

2.2 City Location

Newport is located along the Oregon Coast in Lincoln County. Figure 2-1 below shows the city's location within the region.

2.3 Service Area Description

The City provides wastewater collection services to its residents, commercial establishments, institutional customers, and a number of industries. Sewer service is provided only to customers within the city limits. Figure 2-2 below is a general map of the collection system.

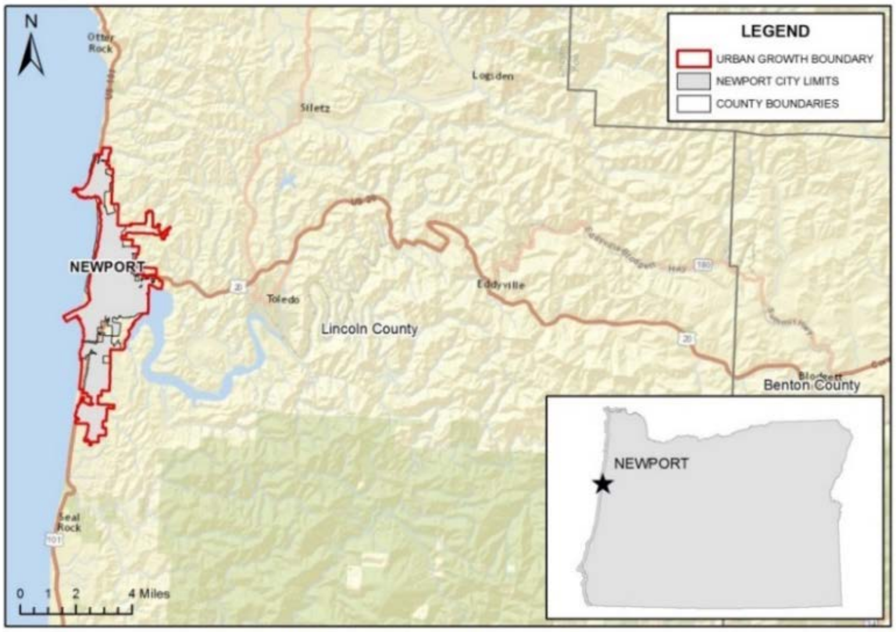

Figure 2-1. Vicinity map

2.4 Topography

The topography of Newport influenced how the sanitary sewer system was constructed. In general, the city is influenced by the Pacific Ocean and Yaquina Bay. Gravity sewers convey the flow down hills and toward the WWTP. Pump stations convey flows up hills and over divides, ultimately discharging into the gravity sewers.

2.5 Climate and Rainfall

Newport experiences relatively warm, dry summers and mild, wet winters. The majority of rainfall occurs during the months of October through April. The driest months are July and August, which typically average approximately 1 inch of monthly rainfall. The average annual precipitation for Newport is 68 inches.

Table 2-1 provides historical climate data averages for Newport.

Table 2-1. Historical Climate Data

Data	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Annual
Average maximum temperature, °F	50.4	52.5	53.7	55.9	59.3	62.4	64.4	65.3	65.1	61.1	55.1	51.0	58.0
Average minimum temperature, °F	38.4	39.1	39.5	41.2	44.9	48.7	50.4	50.7	49.0	45.6	42.1	39.4	44.1
Average total precipitation, "	10.2	8.0	7.9	4.8	3.2	2.5	0.8	1.1	2.4	5.6	9.7	11.5	67.7
Average total snowfall, "	0.6	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	1.0
Average snow depth, "	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Note: *°F = degree(s) Fahrenheit.*

a. *The historical climate data are provided by the Western Regional Climate Center. The historical climate data are based on a period of record from 1931–2005.*

2.6 Population

According to the Population Research Center at Portland State University the 2015 population is estimated at 10,165. A 2014 U.S. Census Bureau report shows the population of the city to be 10,116 (USCB 2014). The Comp Plan calculates the 2011 population to be 11,243 and predicts a population of 12,846 by 2031 (Multiple Authors, Latest Update 2012). It is expected that growth will be focused on expansion more than infill.

2.7 Land Use and Zoning

Land use and zoning provide the basis for developing future unit wastewater flows and overall wastewater flow projections for buildout conditions. Understanding the nature and distribution of the various land use classifications is important for accurate identification of future wastewater flow rates and the phasing of required improvements. This section describes both the existing and proposed future land uses for the study area.

Land use and zoning are largely governed by the local topography and by decisions made by the City, its citizens, and the Oregon Department of Land Conservation and Development (DLCD). Expansion of the urban growth boundary (UGB) must be approved by the DLCD before such actions can be adopted.

Information on current land use was obtained from GIS data provided by the City. The existing land use classifications are shown in Figure 2-3, below.

In addition, the City maintains a buildable lands inventory (BLI). The BLI was developed as part of the *Newport Economic Opportunities Analysis* to estimate land capacity in terms of dwelling units (ECONNorthwest 2012). These buildable parcels are identified as "infill development" in Figure 2-4, below.

The City's planning department provided 20-year and buildout development conditions. Table 2-2 provides the 20-year and buildout projections for identified development in the city. The development identifier (ID) corresponds to the development area on Figure 2-4. Detailed views of the development areas are provided in Appendix B.

Table 2-2. 20-year and Buildout Development Conditions

Development ID	20-year development conditions	Buildout development conditions [c]
1	• 30-acre light industrial development [a]	-
2	• 6-acre annexation for 48-unit assisted living facility	-
3	• 50 LDR units	50 LDR units
4	• 120-unit assisted living facility • 170 MDR units	-
5	• 50 LDR units	50 LDR units
6	• 236 apartment units	-
7	• 38.5-acre LDR development [a]	38.5-acre LDR development [a]
8	• 135-acre LDR development [b]	135-acre LDR development [b]

Table 2-2. 20-year and Buildout Development Conditions		
Development ID	20-year development conditions	Buildout development conditions [c]
9	• 9-acre log yard (light industrial) • 1.1-acre light industrial development • 1.2-acre waterfront commercial	12-acre waterfront heavy industrial
10	• 1.4-acre heavy industrial development • 3.4-acre classroom/research facility (light industrial) • 0.2-acre commercial development	-
11	• 2.3-acre commercial development • Oregon Museum of Science and Industry (OMSI) youth camp (assume 250 maximum occupancy) • 60 MDR units	-
12	• 0.2-acre commercial development • 0.2-acre light industrial development	-
13	• 4.1-acre commercial development	-
14	• 1.1-acre light industrial development • 1.1-acre commercial development	-
15	• 1.0-acre commercial development	-
16	• 7-acre commercial development • 2.3-acre commercial development • 350 LDR units • 500-unit OSU student housing	• 3-acre commercial development • 650 LDR units
17	• 1.1-acre light industrial development	2.2-acre light industrial development
18	• 0.5-acre commercial development • 3 LDR units	-
19	• 18 LDR units	-
20	• 0.5-acre light industrial development • Airport (assume 5-acre commercial development)	-
Infill development	• 215 residential parcels	501 residential parcels
Septic conversion	• 184 LDR units	-

Note: HDR = high-density residential, LDR = low-density residential, and MDR = medium-density residential.

Development densities specified in the NMC were used to determine the number of dwellings per acre. LDR = 5 dwellings per acre, MDR = 10 dwellings per acre, HDR = 10 dwellings per acre. An average of 2.19 people per household was assumed.

a. Assume 80% infill to account for roads and rights-of-way.

b. Assume 40% infill to account for steep-sloped terrain, roads, and rights-of-way.

c. 20-year development conditions are not included in buildout conditions.

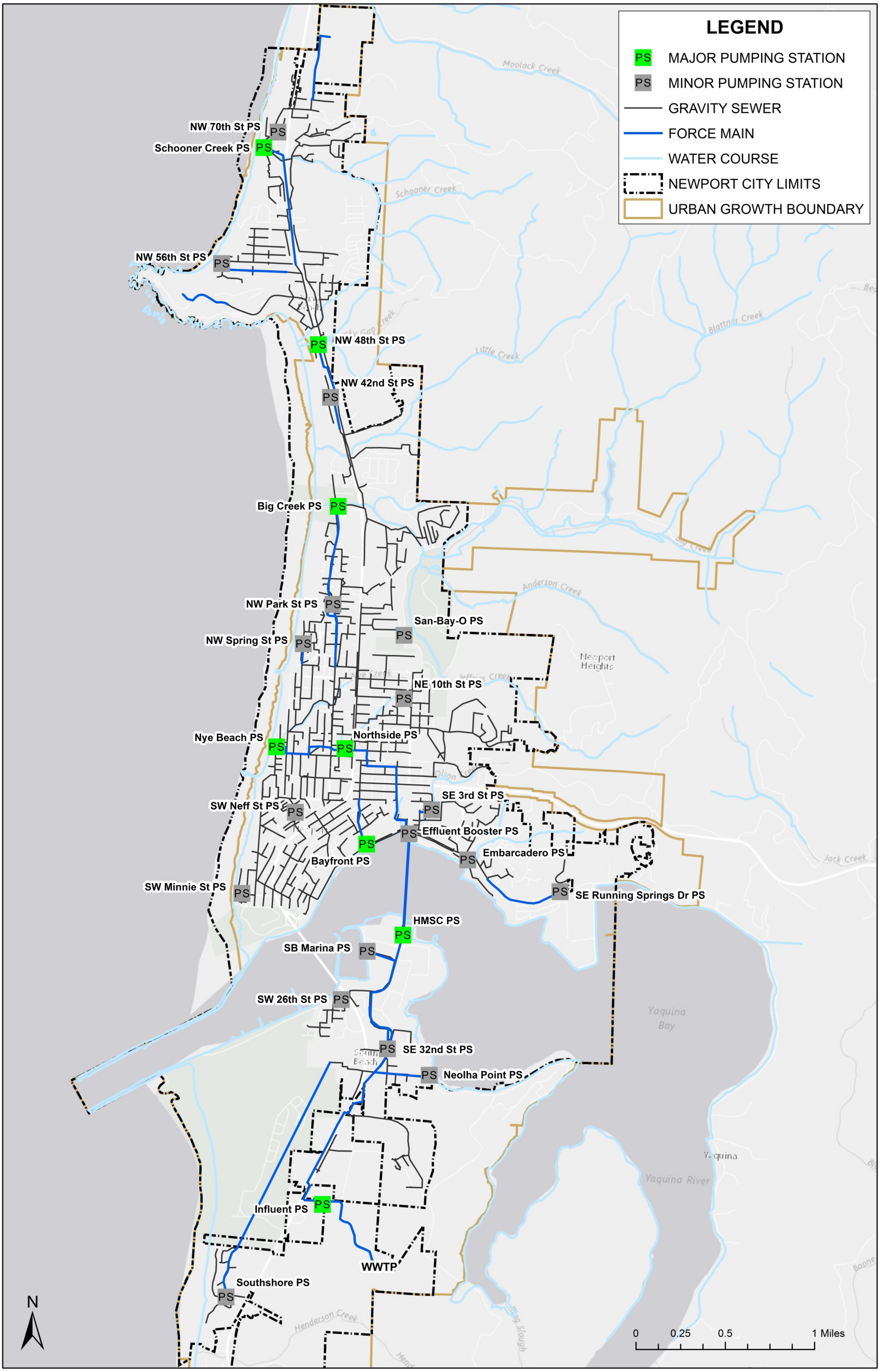

Figure 2-2. Collection system map

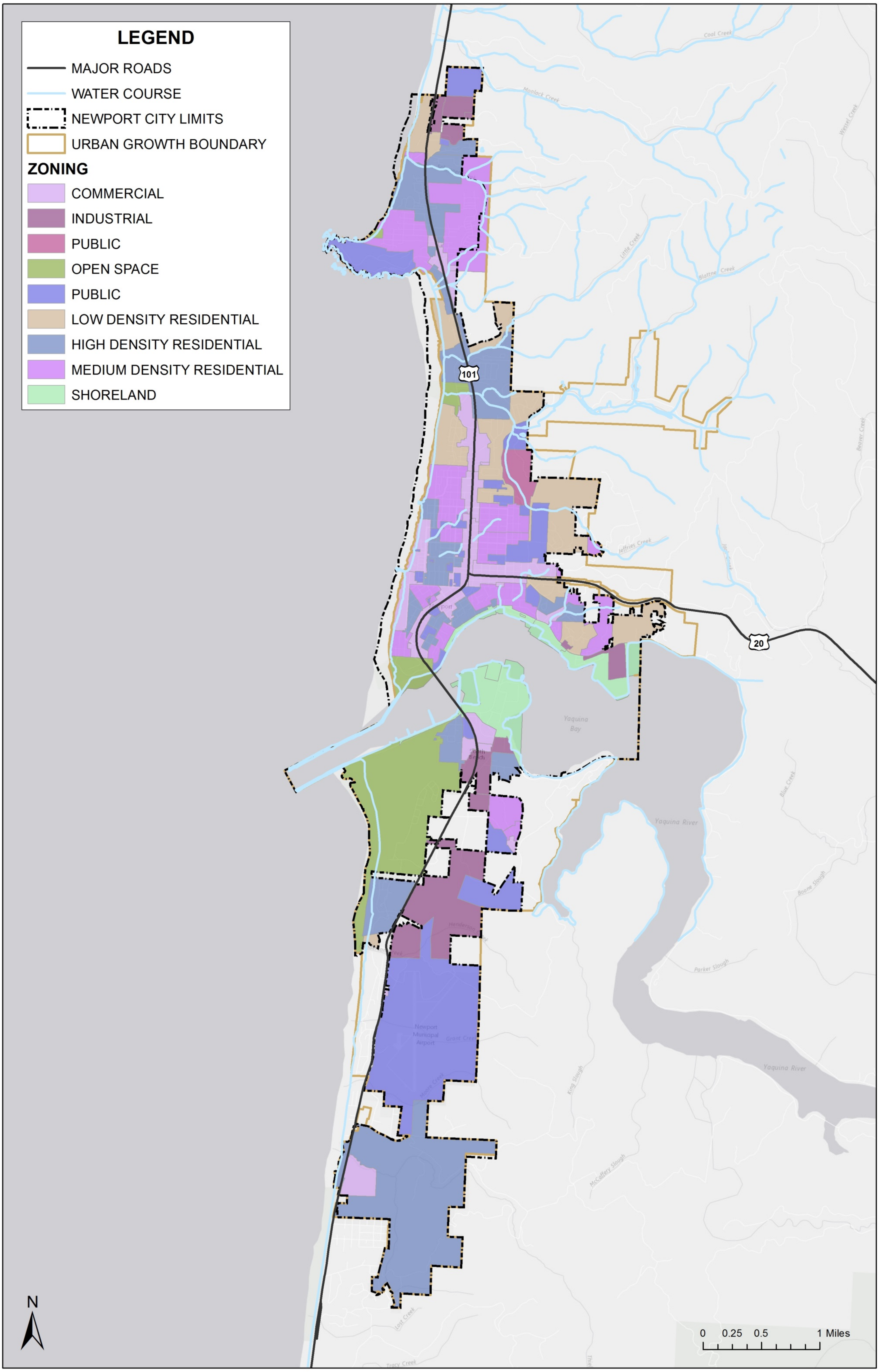

Figure 2-3. Existing zoning classifications

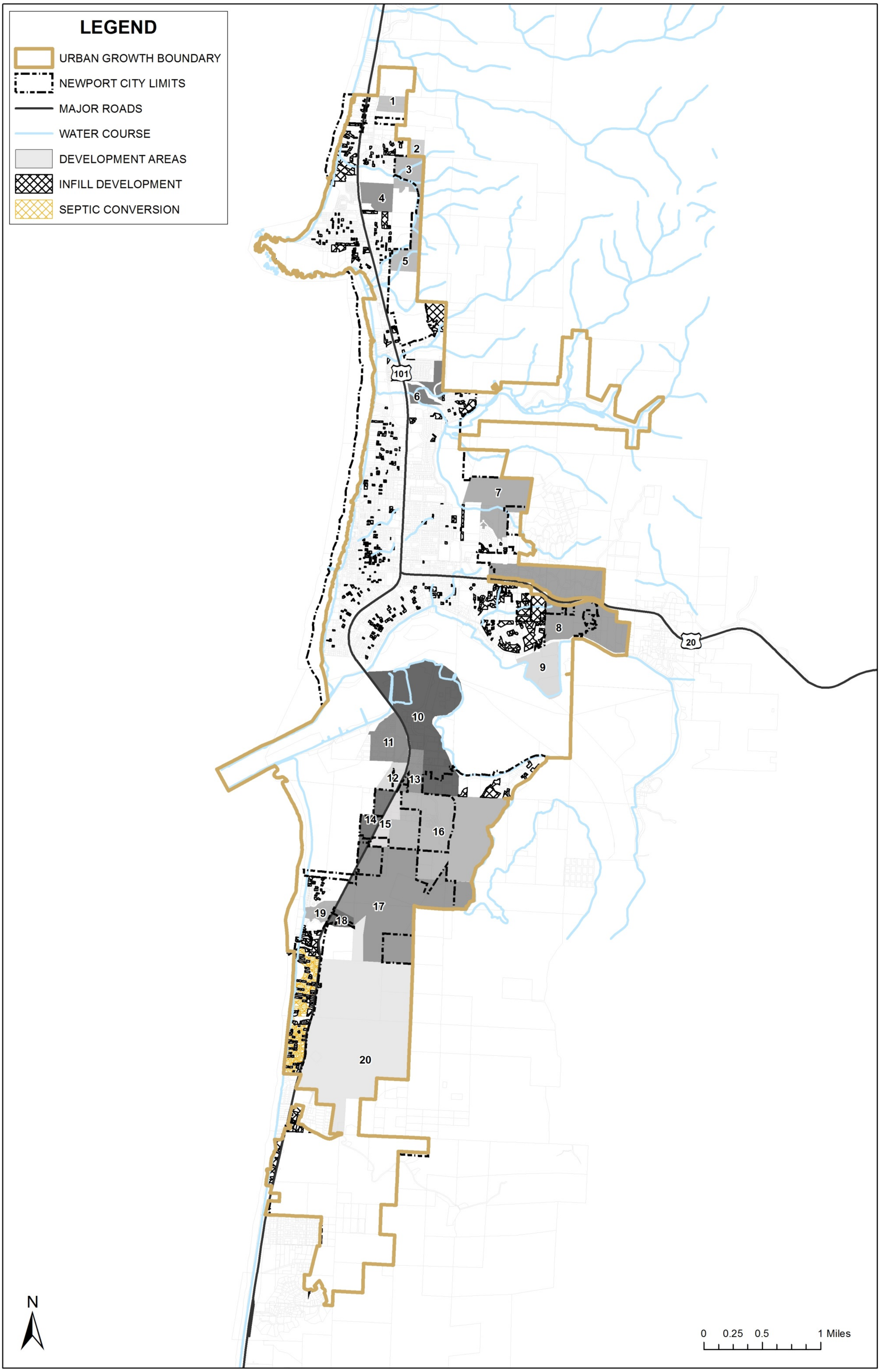

Figure 2-4. Future development for 20-year and buildout conditions

2.8 Description of Existing Collection System

According to the City's GIS, sanitary sewer collection system services to approximately 10,000 people spread across an area of approximately 11.2 square miles. The City owns over 62.5 miles of gravity pipelines ranging in size from approximately 3 to 36 inches in diameter, 1,4 manholes, 9 major pump stations, 16 minor pump stations, and 12 miles of sanitary force mains.

According to GIS data, approximately 59 percent of the City's sanitary sewer system was constructed since 1950, with 40 percent of the construction date unknown. As shown in Figure 2-5, growth was very strong in the 1970s through 2000s, but has slowed somewhat since 2010. Age data on the sewers constructed prior to the 1950s are not reliable. Figure 2-9 below shows the locations of sewers (gravity and forcemain) by age.

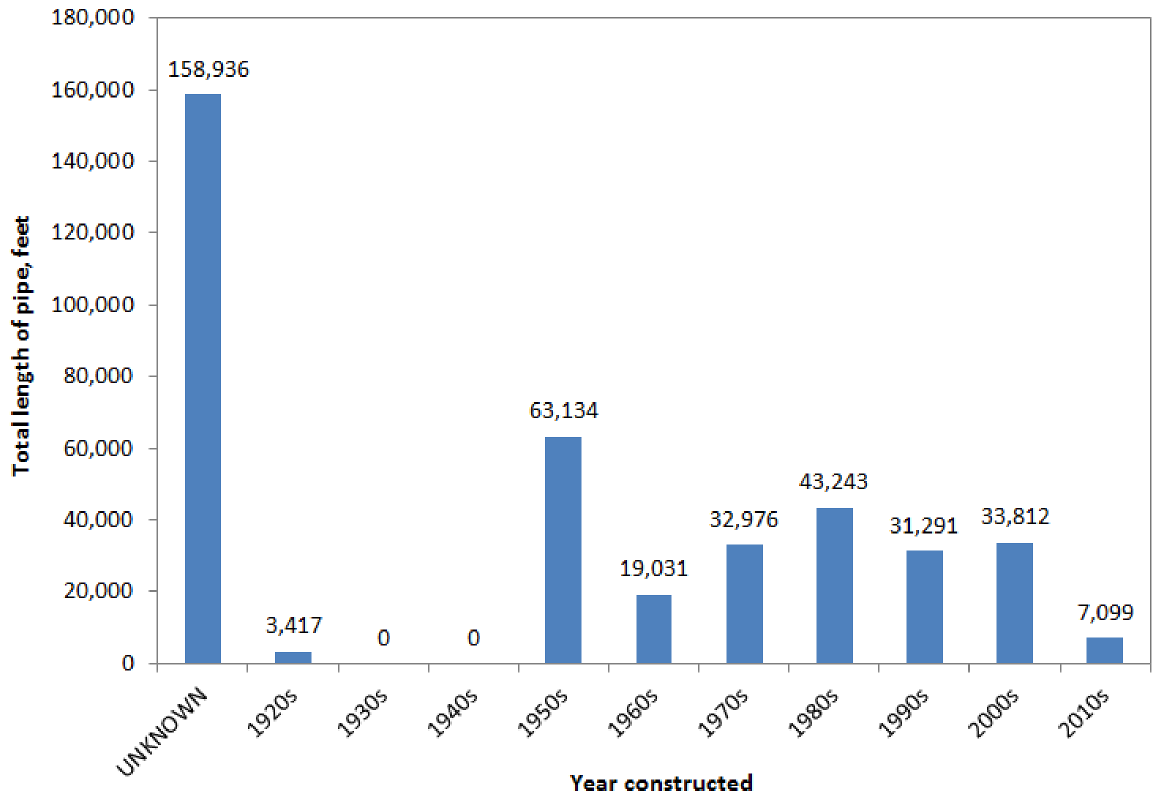

Figure 2-5. Pipe age distribution

The distribution of pipe size and material used throughout the city is based on data extracted from the City's GIS. Approximately 25 percent of the pipes did not have an identified diameter. The size distribution of pipes within the sanitary collection system is shown in Figure 2-6, below. Approximately 53 percent of the sanitary sewer collection system consists of pipes 8 to 10 inches in diameter.

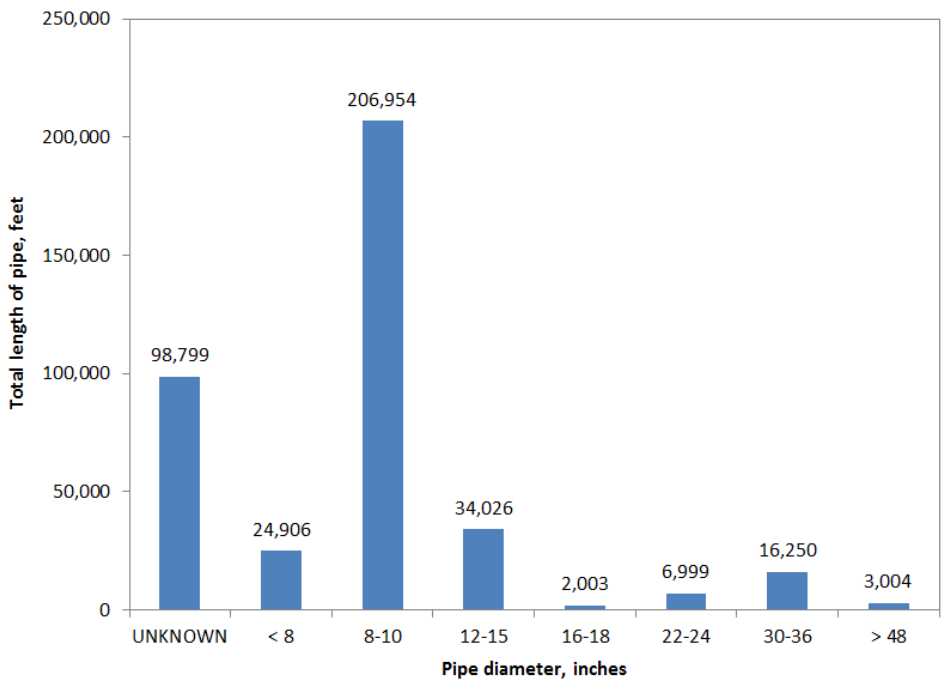

Figure 2-6. Pipe size distribution

The distribution of pipe materials used throughout the city is based on data extracted from the City's GIS. Approximately 63 percent of the pipes did not have a material identifier. The distribution of materials shown in Figure 2-7 is based on the pipes for which the pipe material was identified. This figure includes the linear feet (LF) of force mains and gravity sewers. Figure 2-8 below shows the location of pipe materials as used throughout the collection system.

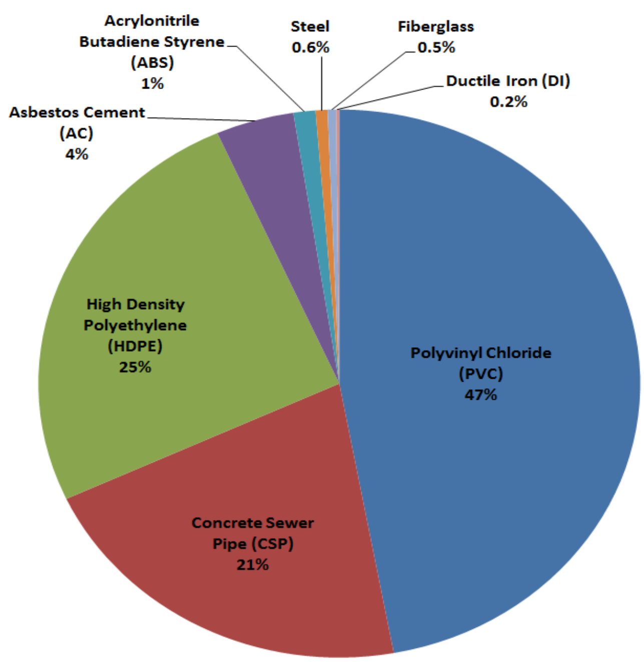

Figure 2-7. Pipe material distribution

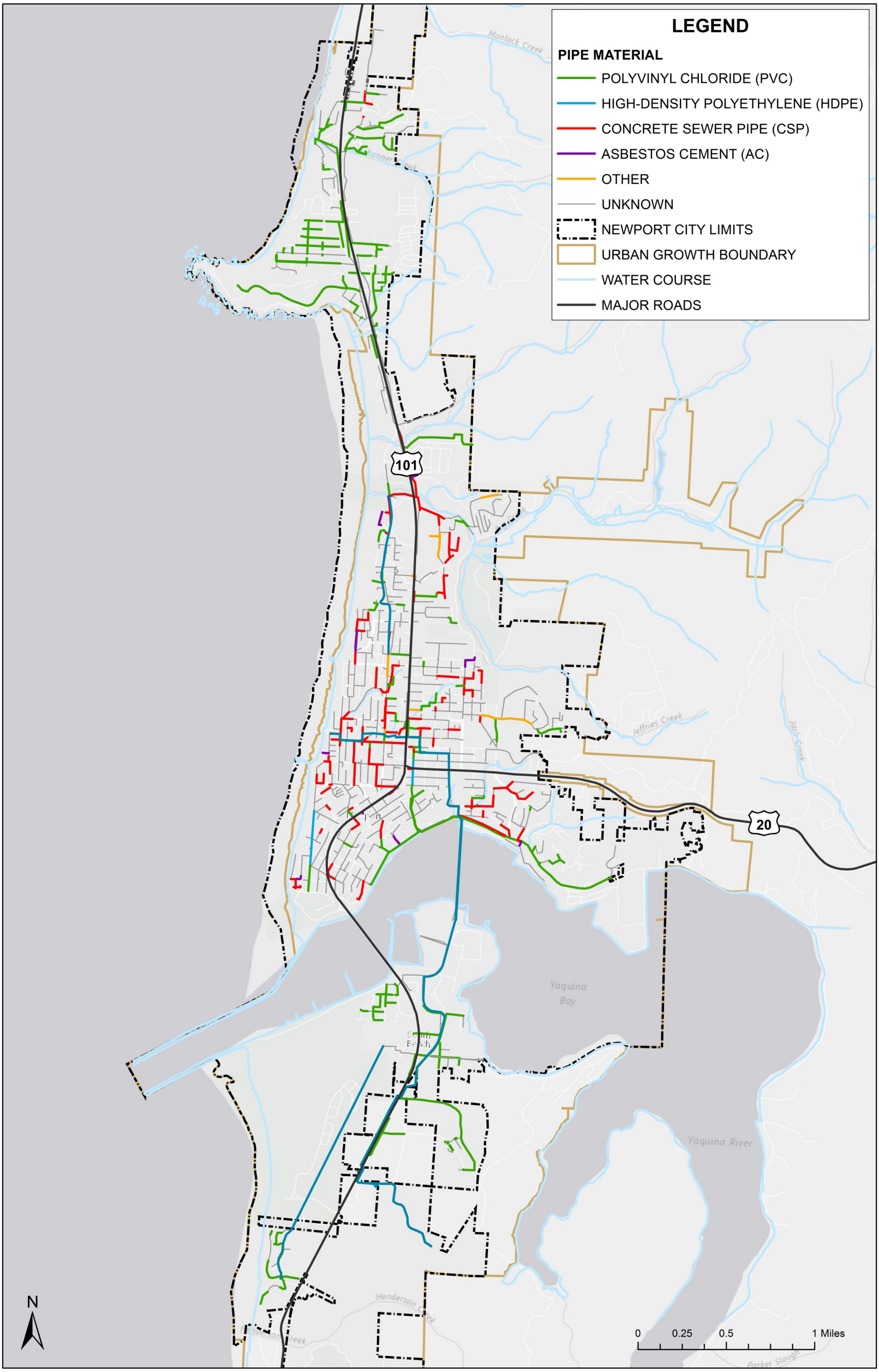

Figure 2-8. Pipe material location

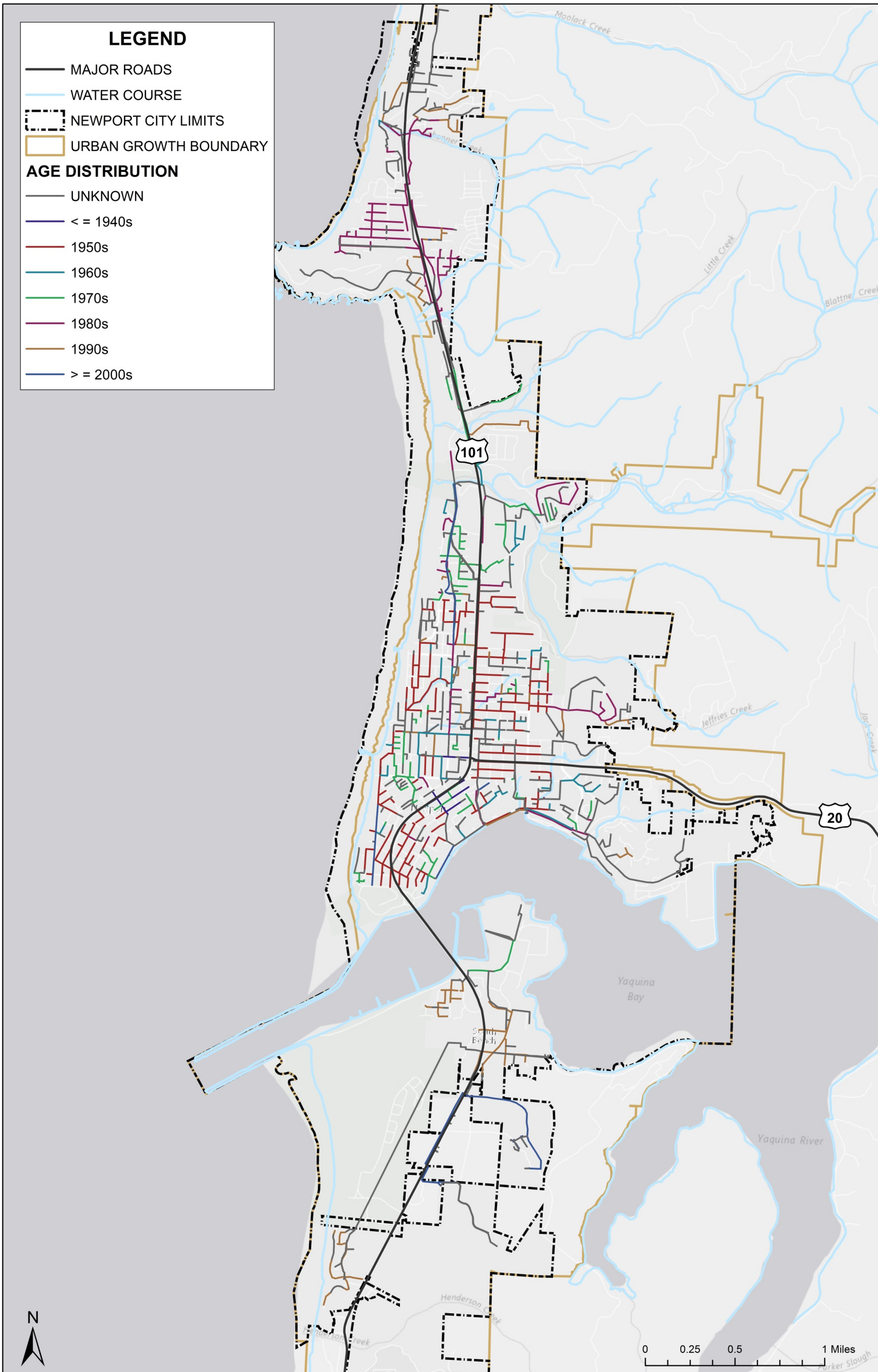

Figure 2-9. Pipe age location

The most widely represented pipe materials are PVC and concrete sewer pipe (CSP). Most new construction has used PVC pipe as the material of choice. Most of the high-density polyethylene (HDPE) pipes included in the inventory are used for force mains. Also, some of the City's force mains are constructed of PVC or ductile iron (DI), and three pump stations have force mains constructed in part, or in total, of asbestos cement (AC).

2.9 Description of Pump Stations

The topography of Newport has required that pump stations be used to serve a number of areas throughout the city. Currently, there are 9 major pump stations, 16 minor pump stations, and 12 miles of sanitary force mains within the service area owned and operated by the City.

The major pump stations are the primary focus of this SSMP because of their critical importance on the collection system. Minor pump station facilities and individual septic tank effluent pump (STEP) systems were not closely evaluated or modeled in this SSMP; however, an estimated allowance for inspection and maintenance of these pump stations is included in the sections below for planning purposes.

Table 2-3 summarizes the design data for the City's major pump stations.

Table 2-3. Pump Station Summary

PS	Current firm pumping capacity [a], gpm	Number of pumps	FM size, in.	FM material [f]	FM length, ft	Year constructed	Year upgraded [b]
Bay Front	1,200	2	8	PVC	1,370	unknown	2001
Big Creek	2,430	3	14	HDPE	5,040	unknown	2016
HMSC	1,390	2	8	DI	35	unknown	2001
Influent	850	2	24	HDPE	3,000	unknown	2001
	3,500	4					
Northside	3,000	3	20–24	Steel/DI/HDPE	142,000	unknown	2001
NW 48th Street [c]	1,215	2	10	PVC/HDPE	1,564	1980	1980/2018
Nye Beach	1,400	2	12	PVC/AC	2,200	unknown	-
Schooner Creek [c]	660	2	8	HDPE	3,779	unknown	2018
SE Running Springs Drive	153	2	4	PVC	2,505	unknown	-

Note: gpm = gallon(s) per minute.

a. *The firm pumping capacity is based on PS operation without the use of the redundant pump(s).*

b. *Year upgraded is based on record drawings, if available. Pump configuration and sizes and FM geometries are shown for current conditions.*

c. *The NW 48th Street PS, Schooner Creek PS, and Schooner Creek FM are currently being upgraded as part of the Agate Beach Improvement Project. These values represent their planned improvements.*

Of the pump stations shown in Table 2-3, Nye Beach is the only pump station with a force main constructed in part of AC. The U.S. Environmental Protection Agency (EPA) has identified asbestos as a hazardous material requiring special precautionary handling and disposal procedures. The Oregon Department of Environmental Quality (DEQ) has developed a Fact Sheet with information about AC pipe. This Fact Sheet is provided in Appendix F.

Projects and costs identified in sections below do not account for handling and/or replacing AC pipe. Costs for AC pipe removal should be evaluated on a case-by-case basis or considered part of the contingency estimate to each project.

Section 3

Wastewater System Policies

This chapter presents policies and standards that guide the operation and development of the City's wastewater collection and conveyance system. The policies and standards are derived from the City's Comp Plan, City resolutions, and NMC (City 2011, 2015a).

3.1 Comp Plan

The City revised its Comp Plan in 2015 and included excerpts from the environmental geology of Lincoln County, Oregon. The summarized planning concerns for the City are listed below. Table 3-1 presents the Comp Plan goals and policies:

- There are large landslides on both the north and south sides of Yaquina Head. The landslide on the south side has made several buildings unusable. In Agate Beach, subsurface drainage is restricted and a public sewerage system is necessary before additional developments are made.

- Just east of Newport, in the vicinity of McClean [sic] Point, much of the slope has been affected by landslides. Development in this area should proceed with caution. The making of steep cuts, removal of toe support, the additional weight of embankments on the upper slopes, and the addition of moisture from the developments, including subsurface sewage disposal, all add to the instability of the slope. Serious problems can arise, especially following periods of extremely heavy rainfall. Developments in this area could suffer serious slope problems unless the slopes and embankments are properly constructed and a public sewerage system is installed.

- The area south of Yaquina Bay from Highway 101 eastward as far south as Henderson Creek is subject to a seasonal high water table. Before development reaches a greater density, a public sewerage system should be installed. A high water table creates problems for foundations of structures, and in some areas the water will stand at the surface after a heavy rainfall (City 2015a).

Table 3-1. Comp Plan Goals and Policies

Item	Policy, standard, or guideline statement
General Goals and Policies	
Goal	To assure adequate planning for public facilities to meet the changing needs of the City of Newport urbanizable area.
Policy 1	The city shall develop and maintain public facilities master plans (by reference incorporated herein). These facility plans should include generalized descriptions of existing facilities operation and maintenance needs, future facilities needed to serve the urbanizable area, and rough estimates of projected costs, timing, and probable funding mechanisms. Public facilities should be designed and developed consistent with the various master plans.
Policy 2	In order to assure the orderly and cost efficient extension of public facilities, the city shall use the public facilities master plans in the capital improvement planning.
Policy 3	The city shall work with other providers of public facilities to facilitate coordinated development.
Policy 4	Essential public services should be available to a site or can be provided to a site with sufficient capacity to serve the property before it can receive development approval from the city. For purposes of this policy, essential services shall mean: • Sanitary Sewers • Water • Storm Drainage • Streets Development may be permitted for parcels without the essential services if: • The proposed development is consistent with the Comp Plan; and • The property owner enters into an agreement, that runs with the land and is therefore binding upon future owners, that the property will connect to the essential service when it is reasonably available; and • The property owner signs an irrevocable consent to annex if outside the city limits and/or agrees to participate in a local improvement district for the essential service.
Policy 5	Upon the annexation of territory to the City of Newport, the city will be the provider of water and sewer service except as specified to the contrary in an urban service agreement or other intergovernmental agreement.
Policy 6	Local Improvement Districts (LIDs) should be evaluated as a means of funding public facilities where the construction of such facilities is expected to enhance the value of properties that are adjacent or proximate to the planned improvements. For LIDs in developed residential areas, the aggregate assessment amount within a prospective LID should be no more than 10% of the assessed value of properties within the boundaries of the proposed district. The aggregate assessed value may be higher for other types of LIDs, such as developer initiated districts; however, in no case should it exceed 50% of the assessed value of the affected property. When considering a new LID, the City should proceed with preparing an engineer's report that sets out the likely cost of constructing the improvement. Consideration should be given to bundling LID projects with other capital projects that the City secures bond funds to construct. For an LID to proceed, it must have a reasonable chance of being self-financing, with adequate reserves to ensure that payments are made on bonds/loans regardless of the property-owners' repayment. If an LID project is considered by the City Engineer to be a partial improvement (less than ultimate planned design), the City should require that interim improvements conform to current City standards in a manner which will allow for completion of the total facility at such time that resources are available. New LIDs may be initiated by petition or resolution of the City Council. <u>Formation of an LID by Petition</u> The City Council shall evaluate new LIDs proposed by petition to determine if City resources should be expended to formulate an engineer's report. Only those projects with substantial public support should proceed. An LID petition that includes non-remonstrance agreements and/or petitions of support from property owners representing 75% of the benefited area shall be presumed to have substantial public support. If an LID petition seeks to leverage other funding to achieve 100% of the project costs then the City Council should consider the likelihood of whether or not those funds will be available within the timeframe that they would need to be committed for construction. When the City receives petitions for multiple LIDs, priority should be given to prospective LIDs with the highest level of documented support, as measured by recorded non-remonstrance agreements and/or petitions in the benefit area in question. The cost of completing the engineer's report should be included in the total LID assessment. The City should update its fee schedule to include a nonrefundable LID Application Fee to be paid by LID petitioner(s) for petition-initiated LIDs.

Table 3-1. Comp Plan Goals and Policies	
Item	Policy, standard, or guideline statement
	City Council Initiated LIDs The City Council on its own motion or upon recommendation by the City Manager may initiate an LID without a petition. In doing so the City Council shall consider the following factors: • Project purpose and need, including whether or not the improvement addresses an immediate health and safety risk or if it has been identified as a priority improvement in an adopted public facility plan. • Whether the improvement will address existing deficient infrastructure that is chronically failing. • Capital cost of the improvement. • Project cost contingencies and related construction risk factors, such as the need to acquire new public right-of-way, unique construction challenges, or environmental issues. • Nature of the area benefited, including its existing condition. • The amount of potential non-LID funding that is expected to be leveraged by the LID, if any. This may include, but is not limited to, federal or state grants, sewer or other types of service charges, urban renewal funds, revenue or general obligation bonds, and reimbursement districts. • Percentage of properties within the benefit area that have prerecorded non-remonstrance agreements or have owners that favor formation of an LID. When considering multiple City-initiated LIDs, priority should be given to the LID that addresses the greatest number of factors identified above.
Policy 7	The City may use various means to finance, in whole or in part, improvements to public services in order to maintain public facility service levels and to carryout improvements identified in public facility plans, and adopted city goals and policies. This includes but is not limited to consideration of federal or state grants; water, sewer, storm drainage and other types of service charges; urban renewal funds, revenue or general obligation bonds, local improvement districts, and reimbursement districts.
Wastewater Goals and Policies	
Goal	To provide a wastewater collection and treatment system with sufficient capacity to meet the present and future needs of the Newport urbanizable area in compliance with State and Federal regulations.
Policy 1	On-site sewer systems shall not be allowed unless the city's sanitary sewer system is greater than 250 feet away. In any case, a subsurface permit from the Lincoln County Sanitarian must be obtained prior to any development that will rely on an on-site sewer system.
Policy 2	City wastewater services may be extended to any property within the urban growth boundary. Except for the very limited circumstances allowed by state law and regulations, the city will not generally provide wastewater services outside the urban growth boundary. The city may require a consent to annexation as a condition of providing wastewater service outside the city limits. Nothing in this policy obligates the City to provide wastewater services outside of the city limits. For property outside the city limits but within the urban growth boundary, wastewater services may be provided at the City's discretion only for: a. residentially zoned lands as allowed by county zoning without full services, and b. commercial and industrial zoned lands to existing lawful uses as of the date (9/4/07) of this amendment.
Policy 3	The city will design and develop the wastewater collection and treatment system in a way that addresses the demands of the various users under normal and predictable daily and seasonal patterns of use.

3.2 City Resolutions

A resolution is a policy that has been adopted by the City Council. The following sections summarize resolutions that address wastewater policies. A copy of the City's resolutions, as noted below, are provided in Appendix G.

3.2.1 Wastewater Utility Rates: Resolution No. 3721

The City's *Resolution No. 3721: Setting the Rates for Sewer Utility Charges* was adopted on June 15, 2015 (City 2015b). The resolution went into effect July 1, 2015. This resolution establishes the rates for:

- Metered rates: Defines established sanitary sewer rates for properties within and outside of the city limits, establishes an "extra strength charge" for biochemical oxygen demand (BOD), and a monitoring sewage discharge rate
- Individually determined rate: Commercial customers shall have a sewer use charge established based on the impact of the property on the sewer system, as determined by the City Manager
- Septage: Defines a disposal rate for septage at the City's WWTP
- Class A sludge sales: Establishes the price per cubic yard of Class A sludge

The City's sewer rates should be evaluated according to the financial obligation required to complete the CIP projects established in this SSMP.

3.2.2 Infrastructure Improvement Fees: Resolution No. 3722

The City's *Resolution No. 3722* sets the utility infrastructure improvement fees for the water, wastewater, and stormwater utilities as authorized in the NMC (City 2015c). This resolution was adopted on June 15, 2015, and went into effect on July 1, 2015. This resolution establishes the rates for utility infrastructure improvement fees; customers pay a monthly utility infrastructure improvement fee based on the water meter size.

The City's utility infrastructure improvement fees should be evaluated according to the financial obligation required to complete the CIP projects established in this SSMP.

3.3 Newport Municipal Code

The NMC is a collection of the regulatory and penal ordinances and certain administrative ordinances of the City. Chapter 5.15 of the NMC, "Sewer System and Charges," contains the ordinances most relevant to how the utility operates. The NMC in its entirety is a 700-page document that was too large to include as an appendix to this document; however, it can be accessed on the City's website or by requesting an electronic copy from the Department of Public Works.

3.3.1 Existing Municipal Code

Table 3-2 below summarizes the information pertaining to the sewer system in the NMC. The information is organized by the following categories:

- Service area
- Planning considerations
- Design standards
- Protection and improvement of the environment and public health
- Utility financing
- Wastewater quality
- Pretreatment
- Operations and maintenance

Table 3-2. Municipal Code Policies

NMC	Policy, standard, or guideline statement
Service Area	
5.15.020	Connection Required A. All structures containing sanitary facilities that are located within 250 feet of a collection sewer or intercepting sewer other than a force main must be connected to the sewer system. Connection to the public sewer system for new buildings or structures is required prior to the issuance of a certificate of occupancy. Any building served by a private sewage disposal system shall be connected to the city sewer system within 60 days of the date that a city sewer line is extended to within 250 feet of the property and is available for connection. At the request of the property owner of an existing structure, the City Council may allow deferral of the connection if connection would impose an undue hardship on the property owner. In determining what constitutes an undue hardship, the Council may consider the following factors: 1. Whether the property owner is contributing to the cost of extending the main. 2. The cost of connection. 3. The condition and capacity of the private sewage disposal system. Deferral shall be allowed only if the existing structure is served by a private sewage disposal system in good condition and adequate to serve the sanitary facilities on the property. Council may require proof that the disposal system is properly and regularly maintained and pumped, and routinely inspected by the county. The Council's decision shall be by written order with findings. Any deferral allowed by the Council may be revoked by the Council at any time. If sewer connection is deferred, the deferral is automatically revoked and sewer connection must occur within 30 days of: 1. Failure of the private sewage disposal system; 2. Failure of the private sewage disposal system to comply with all applicable state and county standards and requirements; 3. Sale of the property; or 4. Any determination by the state or county that the private sewage disposal system presents a health or environmental risk. B. All private sewage disposal systems allowed by subsection A shall comply with all applicable state and county standards and requirements.
14.06.050	Recreational Vehicles: General Provisions C. It shall be unlawful for any person occupying or using any recreational vehicle within the City of Newport to discharge wastewater unless connected to a public sewer or an approved septic tank in accordance with the ordinances of the City of Newport relating thereof. All recreational vehicle parks within the City of Newport shall comply with the sanitary requirements of the City of Newport and the State of Oregon.
14.09.030	Temporary Living Quarters. Notwithstanding any other restrictions and prohibitions in this code, a recreational vehicle may be used as a temporary living quarters subject to the following conditions: C. The recreational vehicle used as the temporary living quarters must be self-contained for sanitary sewer.
Planning Considerations	
5.15.030	Permit and Construction Requirements A. No person, firm, or corporation shall construct or reconstruct any sanitary or storm drains within the city on private property or in public ways without a city permit. B. Applications for permits to construct or reconstruct sanitary sewers or storm drains shall be made in writing on a city form and include the location of the property, the name of the owner, the name of the person or firm engaged to construct or reconstruct the proposed sanitary sewer or storm drain and such other information and plans as may be required by the city. C. The applicant upon approval of permit shall pay all applicable fees established by Council resolution. If excavation work in the public right-of-way is required, the applicant shall deposit a cash bond in the amount determined by the city. D. All costs and expenses incidental to the installation of the building sewer connection shall be borne by the applicant. E. A separate building sewer connection shall be provided for every building, unless otherwise authorized in writing by the city. F. Existing building sewers may be used in connection with new buildings only when they are found, on examination and tests, to meet all requirements. G. All design, construction and materials and repairs shall conform to the city's design and construction standards. H. Emergency repairs may be made without first obtaining a permit providing that the owner or his representative shall obtain a permit at the earliest possible time, by the end of the next normal business day. I. Sewer system users are responsible for all costs of service laterals and building sewers.

Table 3-2. Municipal Code Policies

NMC	Policy, standard, or guideline statement
5.15.030	Permit and Construction Requirements D. No person, firm, or corporation shall construct or reconstruct any sanitary or storm drains within the city on private property or in public ways without a city permit. E. Applications for permits to construct or reconstruct sanitary sewers or storm drains shall be made in writing on a city form and include the location of the property, the name of the owner, the name of the person or firm engaged to construct or reconstruct the proposed sanitary sewer or storm drain and such other information and plans as may be required by the city. F. The applicant upon approval of permit shall pay all applicable fees established by Council resolution. If excavation work in the public right-of-way is required, the applicant shall deposit a cash bond in the amount determined by the city. G. All costs and expenses incidental to the installation of the building sewer connection shall be borne by the applicant. H. A separate building sewer connection shall be provided for every building, unless otherwise authorized in writing by the city. I. Existing building sewers may be used in connection with new buildings only when they are found, on examination and tests, to meet all requirements. J. All design, construction and materials and repairs shall conform to the city's design and construction standards. K. Emergency repairs may be made without first obtaining a permit providing that the owner or his representative shall obtain a permit at the earliest possible time, by the end of the next normal business day. L. Sewer system users are responsible for all costs of service laterals and building sewers.
9.15.050	Standards and Conditions The city manager may approve the issuance of a permit for encroachment within the unimproved public right of way, easement, or public property where compliance with the following standards can be demonstrated or specific findings are made that the standard is not applicable. The city manager or designee may attach any conditions to the issuance of the permit that are reasonably related to ensuring compliance with this section, other applicable city codes and ordinances, and to protect the public interest. A. The following standards must be met for a permit to be granted 3. Clearances from manholes and underground pipelines such as city sewer lines, water lines, and storm drain lines shall be a minimum of 7 feet.
12.15.090	Prohibited Connection No person may connect to the water or sewer system of the city or obtain a building permit unless the appropriate SDCs have been paid, or the installment payment method has been applied for and approved.
13.05.035	Public Improvement Procedures. In addition to other requirements, public improvements installed by a developer that is dividing land, whether required or voluntarily provided, shall comply with this chapter, and with any public improvement standards or specifications adopted by the city. The following procedure shall be followed: D. Underground utilities, sanitary sewers, and storm drains installed in streets shall be constructed prior to the surfacing of the streets. Stubs for service connection for underground utilities and sanitary sewers shall be placed to allow future connections without disturbing the street improvements.
13.05.045	Adequacy of Public Facilities and Utilities (Electric and Phone) Tentative plans for land divisions shall be approved only if public facilities and utilities (electric and phone) can be provided to adequately service the land division as demonstrated by a written letter from the public facility provider or utility provider stating the requirements for the provision of public facilities or utilities (electric and phone) to the proposed land division: A. For public facilities of sewer, water, storm water, and streets, the letter must identify the: 2. Sewer mains sizes and locations, and pumping facilities needed, if any, to serve the land division.
13.05.095	Minor Replats and Partitions A. Procedure for Review. After an application for minor replat or partition is deemed complete, the community development director shall send notice to persons within 100 feet of the subject property and, if there are existing public easements, affected utilities, that the tentative plan has been filed. Notified parties shall be given 14 days to provide written comments. After the 14-day period, the community development director shall decide whether the application complies with the criteria and provide a written decision. The criteria for approval are: 4. The applicant has agreed to sign a consent to participate in sewer, water, or street local improvement districts that the subject lots or parcels would be part of once those districts are formed. The consent shall be a separate document recorded upon the lots or parcels subject to the partition. The document shall be recorded prior to final plat approval.

Table 3-2. Municipal Code Policies	
NMC	Policy, standard, or guideline statement
13.05.070	<u>Land Division Application</u> A. A person seeking approval of a land division shall submit the following to the Community Development Department: 11. Written letters from public facilities (water, sewer, storm water, and streets) and utilities (electric and phone) identifying requirements for providing service to the land division. C. The following general information shall be shown on the tentative plan of the land division: A. The following existing conditions shall be shown on the tentative plan: f. The location within the land division and in the adjoining streets and property of existing sewers, water mains, culverts, drain pipes, and utility lines.
13.05.025	<u>Easements</u> A. Utility Lines. Easements for sewers and water mains shall be dedicated to the city wherever a utility is proposed outside of a public right-of-way. Such easements must be in a form acceptable to the city. Easements for electrical lines, or other public utilities outside of the public right-of-way shall be dedicated when requested by the utility provider. The easements shall be at least 12 feet wide and centered on lot or parcel lines, except for utility pole tieback easements, which may be reduced to six (6) feet in width. B. Utility Infrastructure. Utilities may not be placed within one foot of a survey monument location noted on a subdivision or partition plat.
14.04.150	<u>Aquaculture</u>. By definition, "aquaculture" is the raising, feeding, planting, and harvesting of fish, shellfish, or marine plants, including facilities necessary to engage in the use. D. Aquaculture facilities shall be located far enough from any sanitary sewer outfalls to prevent any potential health hazard.
14.16.050	<u>Development Standards – Accessory Dwelling Unit Standards</u>. Accessory Dwelling Units shall conform to the following standards: H. An Accessory Dwelling Unit shall share water, sewer, electric, and gas connections with the primary dwelling.
14.20.050	<u>Provisions for Flood Hazard Reduction</u>. A. General Standards. In areas of special flood hazard as adopted by this ordinance (which may be illustrated on a zoning map as a Flood Hazard Overlay Zone (FH Zone)) the following provisions are required: 8. Subdivision Proposals. b. All subdivision proposals shall have public utilities and facilities such as sewer, gas, electrical, and water systems located and constructed to minimize flood damage.
14.33.050	<u>Criteria for Approval of an Adjustment.</u> The approval authority may grant an Adjustment using a Type I or Type III decision-making process when it finds that the application complies with the following criteria: C. The Adjustment will not interfere with the provision of or access to appropriate utilities, including sewer, water, storm drainage, streets, electricity, natural gas, telephone, or cable services, nor will it hinder fire access;
14.33.060	<u>Criteria for Approval of a Variance.</u> The approval authority may grant a Variance using a Type III decision-making process when it finds that the application complies with the following criteria: E. The Variance will not interfere with the provision of or access to appropriate utilities, including sewer, water, storm drainage, streets, electricity, natural gas, telephone, or cable services, nor will it hinder fire access.
14.40.100	<u>Procedure for Preliminary Development Plan (PDP) Application.</u> A PDP shall be provided for each development phase of the destination resort. Completion of construction of a phase shall not be a prerequisite to approval of subsequent PDP's. A. The PDP application shall include: d. Preliminary location of all sewer, water, storm drainage, and other utility facilities, and the materials, specifications and construction methods for the water and waste water systems;

Table 3-2. Municipal Code Policies	
NMC	Policy, standard, or guideline statement
Design Standards	
11.05.130	<u>Demolition</u> A. The demolition of any building that contains asbestos or other hazardous materials shall be conducted in accordance with all applicable state laws and regulations, including regulations relating to removal, transportation and disposal of asbestos or other hazardous materials B. The Building Official may require any or all of the following as conditions of issuing demolition permits: 4. Compliance with all applicable local, state and federal laws and regulations, including regulations relating to asbestos and hazardous materials and regulations relating to the protection of water and sewer systems.
13.05.040	<u>Public Improvement Requirements</u> A. The following public improvements are required for all land divisions, except where a subdivision plat is reconfiguring or establishing rights-of-way for future public streets: 3. <u>Sanitary Sewers</u>. Sanitary sewers shall be installed to serve each lot or parcel in accordance with standards adopted by the city, and sewer mains shall be installed in streets as necessary to connect each lot or parcel to the city's sewer system.
14.04.180	<u>Outfalls.</u> By definition, an "outfall" is an outlet through which materials are discharged into the estuary. Outfalls include sanitary (sewer) discharges, storm drainage facilities, waste seawater discharges, and industrial waste discharges. A. As applicable, the standards for dredging, shoreline stabilization, and placement of structures as set forth in this ordinance must be complied within the installation of outfalls. B. Sanitary outfalls shall not be allowed in poorly flushed areas of the estuary.
14.04.190	<u>Submerged Crossings</u>. By definition, "submerged crossings" are power, telephone, water, sewer, gas, or other transmission lines that are constructed across the estuary, usually by embedding into the bottom of the estuary. A. Trenching or other bottom disturbance undertaken in conjunction with installation of a submerged crossing shall conform to the standards for dredging as set forth in this ordinance. B. Submerged crossings shall be designed and located so as to eliminate interference with present or future navigational activities. C. Submerged crossings shall be designed and located so as to ensure sufficient burial or water depth to avoid damage to the crossing.
14.32.070	<u>Alteration, Expansion, or Replacement of Nonconforming Uses or Structures.</u> A. After verification of the status of a nonconforming use pursuant to subsection 14.32.030, the approval authority may authorize alteration, expansion, or replacement of any nonconforming use or structure when it is found that such alteration, expansion, or replacement will not result in a greater adverse impact on the neighborhood. In making this finding, the approval authority shall consider the factors listed below. Adverse impacts to one of the factors may, but shall not automatically, constitute greater adverse impact on the neighborhood. 3. Adequacy of infrastructure to accommodate the use. For the purpose of this subsection, infrastructure includes sewer, water, and streets;
Protection and Improvement of the Environment and Public Health	
5.15.020	<u>Connection Required</u> C. No person shall discharge any sewage into any storm drain or natural drainage outlet.
5.15.060	<u>Discharge Regulations</u> E. No unauthorized person shall maliciously, willfully or negligently break, damage, destroy, uncover, deface or tamper with any part of the sewer system. F. The public works director may adopt specifications and additional regulations consistent with city ordinances to carry out the purpose of this chapter. A copy of such additional material shall be maintained in the public works department.
5.15.080	<u>Violation — Penalty</u> A. A violation of any provision of this chapter is a civil infraction subject to a civil penalty of up to five hundred dollars. Each day a violation continues shall be considered a separate violation. B. Violations that constitute a health hazard are nuisances and may be abated as nuisance or by any other legal means of

Table 3-2. Municipal Code Policies

NMC	Policy, standard, or guideline statement
	eliminating the hazard.
Utility Financing	
5.15.070	Sewer Service Charges A. Users of sanitary sewer service shall be charged fees established by resolution of the City Council. The amounts may be based in whole or in part on the amount of water consumed at the property. The Council may establish fees for any service or impact on the system, including, but not limited to: 1. Application fees. 2. Connection fees. 3. Usage fees. 4. Inspection fees. 5. Fees for improper connection. 6. Fees for misuse of the system. 7. Disconnection fees. C. Sewer users are responsible for payment for sewer services as follows: 1. The city shall prepare and mail billings for sanitary sewer services monthly. Billing shall be in the same manner as billings for water services, and shall be combined with water bills, if applicable. Deadlines for payment shall be the same as for water bills. 2. A delinquent fee in an amount established by Council resolution shall be added to all delinquent accounts. 3. The city shall charge a fee of 10% per year on all accounts that remain delinquent for more than three months to cover interest and collection costs. 4. The finance director is authorized to determine what constitutes a de minimis account balance and to waive the penalties in paragraphs two and three of this subsection in de minimis or extenuating circumstances. 5. The city may require deposits prior to providing sanitary sewer service or in lieu of a deposit, obtain a signed agreement from the property owner, whether the user of the system or not, that the owner will be ultimately liable for the user charges. 6. In addition to other lawful remedies, the city may enforce the collection of charges authorized by this chapter by withholding delivery of water to any premises where the sanitary sewer service fees are delinquent or unpaid, following the procedures and standards for shutting off water service for nonpayment of water bills. However, the city shall not deny or shut off water service to any subsequent tenant based upon an unpaid claim for services furnished to a previous tenant who has vacated the premises.
12.05.005	Initiation of Local Improvement Districts The Council by motion or on petition of the owners of half the property benefited by the proposed public improvement may direct that a preliminary engineering report be prepared to assist the Council in determining whether a local improvement district should be formed to pay all or part of proposed street, sewer, sidewalk, drain, and/or other public improvements.
12.10.020	Application for a Reimbursement District A. Any person who is required to or chooses to pay for some or all of the cost of a street, water, sewer or other improvement in excess of what is needed to provide services to the person's property may, by written application filed with the city engineer, request that the city establish a reimbursement district. The street, water and sewer improvements must include improvements in addition to those that are required in connection with an application for permit approval and must be available to provide service to property other than property owned by the applicant. Examples include but are not limited to full street improvements instead of half street improvements, off-site sidewalks, connection of street sections for continuity, and extension or over-sizing of water or sewer lines. The city may be an applicant. The application shall be accompanied by a fee or deposit in an amount set by Council resolution sufficient to cover the city's administrative costs. If the Council establishes a deposit system, the applicant shall be responsible for supplementing the deposit on demand by the city in an amount sufficient to cover all anticipated costs by the city, including the costs of engineer's reports.
12.10.070	City Council Action D. The City Council resolution and reimbursement agreement shall determine the boundaries of the reimbursement district and shall determine the methodology for imposing a fee which considers the cost of reimbursing the applicant for financing the construction of a street, water or sewer improvement within the reimbursement district.

Table 3-2. Municipal Code Policies	
NMC	Policy, standard, or guideline statement
12.10.110	Obligation to Pay Reimbursement Fee A. The applicant for a permit related to property within any reimbursement district shall pay the, in addition to any other applicable fees and charges, the reimbursement fee established by the Council, if within the time specified in the resolution establishing the district, the person applies for and receives approval from the city for any of the following activities: 5. Connection to or new use of a sewer improvement, if the reimbursement district is based on the sewer improvement;
12.15.020	System Development Charged Imposed; Method for Establishment B. Unless otherwise exempted, SDCs for water, wastewater, storm water, transportation and parks are imposed on all development within the city, on all development outside the city that connects to the water and/or sewer facilities of the city, and on all other development which increases the usage of the water and/or sewer system or that contributes to the need for additional or enlarged capital improvements. This shall include new construction and the alteration, expansion or replacement of a building or development if such alteration, expansion or replacement results in a change in any of the components of the formula for determining the amount of SDCs to be paid. For redevelopment, the amount of the SDC to be paid shall be the difference between the rate for the proposed redevelopment and the rate that would be applicable to the existing development.
12.15.050	Collection of Charge A. The SDC is payable on: 2. Issuance of a development permit or approval for development not requiring the issuance of a building permit. A permit or approval to connect to the water and/or sewer system; 4. Issuance of a permit to connect to the sewer system or actual connection to the sewer system if a permit is not obtained. B. SDCs are payable only for those types of improvements affected by the development, permit or connection. For example, a permit to connect an existing structure to the sewer system does not necessarily trigger an obligation to pay Parks, Transportation, Water or Stormwater SDCs. C. The amount of SDC payable shall be established by resolution relying on an approved methodology and SDC project plan. The SDC project plan, methodology and amount of charge may be adopted in a single resolution, and more than one type of SDC (water, sewer, storm, transportation and park) can be included in a single resolution.
12.15.065	Credits B. On termination of a use for which SDCs have been paid, a credit certificate shall be issued on written request of the property owner. 1. The credit shall be for water, sewer and transportation SDC improvement fees only.
Wastewater Quality	
5.15.060	Discharge Regulations A. No person shall discharge or cause to be discharged any stormwater, surface water, groundwater, roof runoff, cooling water or unpolluted industrial process waters to any sanitary sewer. In the event the sewer system user fails to comply with any order requiring disconnection or it is impractical to require the disconnection of any storm drain from the sewer system, the sewer system user shall be required to pay a surcharge for the use of the system as established by Council resolution. B. Stormwater and all other unpolluted drainage shall be discharged to storm drains, ditches, or natural storm drainage facilities or into drywells as approved by the city. C. Except as provided in this section, no person shall discharge or cause to be discharged any of the following waters or wastes to any public sewer: 1. Any liquid or vapor having a temperature higher than one hundred fifty degrees Fahrenheit; 2. Any water or waste which may contain more than one hundred parts per million, by weight of fat, oil, or grease; 3. Any gasoline, benzene, naphtha, fuel oil, or other flammable or explosive liquid, solid or gas; 4. Any garbage except organic wastes from a commercial source that have been shredded by a disposal system with a maximum 1.5 horsepower; 5. Any ashes, cinders, sand, mud, straw, shavings, metal, glass, rags, feathers, tar, plastics, wood, paunch manure, or any other solid or viscous substance capable of causing obstruction to the flow in sewers or other interference with the proper operation of the sewer system; 6. Any waters or wastes having pH lower than 5.5 or higher than 9.0 or having any other corrosive property capable of causing damage or hazard to structures, equipment and personnel of the sewage works; 7. Any waters or wastes containing a toxic or poisonous substance in sufficient quantity to injure or interfere with any sewage treatment process or constitute a hazard in the receiving waters of the sewage treatment plant;

Table 3-2. Municipal Code Policies	
NMC	Policy, standard, or guideline statement
	8. Any waters or wastes containing suspended solids of such character and quantity that unusual attention or expense is required to handle such materials at the sewage treatment plant; 9. Any noxious or malodorous gas or substance capable of creating a public nuisance; 10. Any material from septic tanks or recreational vehicle holding tanks except at dump stations for that purpose operated or authorized by the city. D. Grease, oil, and sand interceptors shall be provided when necessary for the handling of those wastes; except that interceptors shall not be required for private living quarters. All interceptors shall be of a type and capacity approved by the city and shall be located so as to be easily cleaned and inspected. Where installed, all grease, oil and sand interceptors shall be maintained by the sewer system users, at their expense, in continuously efficient operation. The city may inspect facilities at any time for proper operation and maintenance.
Pretreatment	
5.15.070	Sewer Service Charges B. When an industrial or commercial sewer system user will discharge sewage of unusual strength or character, the city reserves the right to reject the application for service, to require pretreatment of such waste, and/or require the sewer system user to pay additional charges as provided in this chapter.
5.15.060	Discharge Regulations E. The admission into the sewer system of waters or wastes having: 1. A five-day Biochemical Oxygen Demand greater than 300 parts per million by weight, or 2. Containing more than 350 parts per million by weight of suspended solids, or 3. Containing any quantity of the substances described in Subsection C., or 4. Having an average daily flow greater than 2% of the average daily sewer flow of the city shall be subject to the review and approval of the city manager. The city may require pretreatment at the owner's expense and may establish a fee for acceptance of the wastes.
5.15.065	Industrial Pretreatment All non-domestic users of the city sewer system shall comply with industrial pretreatment standards of 40 CFR Chapter 1 Part 403.
Operations and Maintenance	
5.15.040	Power and Authority of Inspectors A. Duly authorized city employees shall be permitted to enter upon all properties for the purposes of inspection, observation, measurement, samplings and testing. B. It shall be the permittee or permittee's representative responsibility to request inspection of the work and to allow reasonable time for the city to schedule the inspection. Inspections shall be requested for and made during the normal business hours of the city. Should inspections be required during non-business hours, the permittee shall reimburse the city for all overtime costs incurred.

3.3.2 Proposed Municipal Code Updates

BC has identified items that could be added or amended into the NMC that could provide additional protection for the City. Some of these items the City may choose to implement while others may be too politically sensitive to adopt. It is recommended that all NMC updates presented below be reviewed by the City Attorney.

Vegetation Requirements. The City may consider implementing new municipal code that grants the City the right to fall any trees necessary to install or maintain improvements, including sewer infrastructure, within the public right-of-way, or utility easements (temporary or permanent).

Root Control. The City may consider to include language in its municipal code that reserves the right to address vegetation on public or private property whose roots have entered the sewer and are restricting flow.

Side Sewer Condition Education Requirement. The City may consider implementing a side sewer condition education requirement to help educate homeowners on the condition of their private sanitary sewer system. This program would require educational flyers to be distributed to the homeowners at the time of sale or major remodel. The intention of this program is to raise awareness and encourage owners to maintain their private system, with the goal of reducing infiltration/inflow (I/I) in the City's system. In addition, the City may choose to provide financial assistance for side sewer rehabilitation to qualified customers to incentivize the program.

Charge for Commercial/Industrial Wastewater User Groups. The City may consider implementing new requirements or modifying its current "unusual strength or character" charges (5.15.070, 060) specific to commercial and industrial users based on their constituent strength, flow quantity, and/or duration and timing of discharge. The latter component not being covered in 5.15.060. Because of the sensitive nature of a secondary treatment plant's biological mass (i.e., biomass), large slug loads of high-strength material on an intermittent basis could result in reduced performance or efficiency of the treatment plant. Also, restaurants may be added to a specific billing category, with their rate table adjusted based on the implementation of a grease-retention service.

Voluntary Pretreatment Program. The City may consider amending the NMC to include the implementation of a voluntary pretreatment program. The implementation of a program in advance of a new National Pollutant Discharge Elimination System (NPDES) permit may provide the City with the most flexibility to manage pretreatment issues. Currently, the City has an expired permit that has been administratively extended. A new permit is needed; however, timing is unknown. The DEQ and EPA have specific requirements for implementing a pretreatment program, which can be explored at a later date if warranted.

I/I Reduction. The City may consider developing new municipal code to support the implementation of I/I-reduction activities. Code may be developed to require the disconnection of sump pumps, roof leaders, and footing drains where alternatives to the sanitary sewer are available. New code is required to support the rehabilitation of service laterals. Because the most effective I/I abatement programs include rehabilitation of the service laterals, the City needs the authority to have this work performed. Factors to be considered in developing new code language for service lateral rehabilitation include the following:

- Will the homeowner or the City perform the required upgrades?
- Who will pay for the upgrades, or what will be the cost-sharing mechanism?
- At what point will the improvements be required?
- How long will the homeowner have to perform the improvements if they are required to perform them?

Section 4

Flow Projections and Modeling

Hydraulic modeling of the City's trunk sewer system was performed to identify hydraulic capacity deficiencies in the existing wastewater sewer collection system for existing, 20-year, and buildout planning scenarios. This section documents the modeling process that was performed.

As part of the modeling effort, a hydrologic/hydraulic model was constructed. Base wastewater flows and rainfall-derived infiltration/inflow (RDII) were loaded into the model and calibrated. A capacity analysis was performed to determine hydraulic capacity issues during a design flow recurrence for current, 20-year, and buildout development planning scenarios.

4.1 Flow Monitoring Activities

Nine flow meters were installed from mid-December 2012 through March 2013 to collect information about wastewater flows in the conveyance system. Flow meters were distributed throughout the wastewater conveyance system to capture flow data for each of the major branches of the piped system.

SFE Global, Incorporated (SFE), under contract with BC, installed and maintained the flow monitors. SFE used an ISCO Model 2150 area-velocity flow monitor at each site. The flow monitoring information was used to develop dry weather flow diurnal patterns and calibrate wet weather response to rainfall. The flow data included 5-minute averages for a range of conditions including between a 2-year and 5-year storm event (i.e., 3.6 inches in 24 hours) in December and periods of both wet and dry weather. Rainfall for the overall flow monitoring period was approximately 40 percent below average, with rainfall in March being 65 percent below average.

The pump run time information was recorded by the City's SCADA system located at the major pump stations. Pump run time and nameplate pump capacity were used to estimate the flows pumped from the pump stations. Actual pump capacity could be less than the nameplate value dependent on force main and impeller conditions. A more accurate representation of these flows would require calibrated flow monitors installed in the force main, or extensive pump draw down testing. This additional effort was not deemed appropriate for this planning document. The flow monitoring sites and associated tributary areas, along with pump station observation locations, are shown in Table 4-1.

Table 4-1. Flow Monitors

Flow meter ID	Location	Manhole ID	Date range
U12-144-1	SE 50th Street PS	8115	12/15/2012–4/1/2013
U12-144-2	134 NE 4th Street	7010	12/20/2012–4/1/2013
U12-144-3	NE Nye Street at 5th Street	6256	12/21/2012–4/1/2013
U12-144-4A	NW 3rd Street at Cliff Street	6014	12/15/2012–4/1/2013
U12-144-4B	729 NW Beach Drive	6084	12/21/2012–4/1/2013
U12-144-5	NW Ocean View at Big Creek Park	4031	12/21/2012–4/1/2013
U12-144-6	130 NW 48th Street	3501	12/14/2012–4/1/2013
U12-166-7	506 SE Bay Boulevard	7572	12/13/2012–4/1/2013
U12-166-8	On trail south of 134 Nye Street	4022	1/5/2013–4/1/2013

The boundaries shown in Figure 4-1 below define the extent of each calibration. The extent of each monitoring basin also defines the extent to which portions of the model were calibrated. The model's hydrologic parameter sets are defined by monitoring basin.

4.2 Model Development

The Storm Water Management Model (SWMM) urban hydrology and conveyance system hydraulics software was used for this effort. The following were completed as part of the model development:

- The model network was created using the City's pipe and manhole GIS data. Elevation data contained in the GIS were supplemented with a survey of select structures, record drawings, and surface elevation contours. The vertical datum used to report elevations in this plan is the North American Vertical Datum of 1988 (NAVD88).
- The major pump stations were included in the model with a simulated peak flow equivalent to their published firm capacity.
- Pipe elevation profiles of the trunk sewers were reviewed for continuity error and adverse pipe slope.

Note: Although SWMM is named as a storm water model, its hydrologic and hydraulic modeling components make it a model of choice for many engineers who model wastewater collection systems.

4.3 Model Extents and Design Parameters

The model includes all major trunk lines (i.e., greater than 10 inches diameter), major pump stations, and sewers that could be impacted by future growth. Figure 4-2 below shows the model extents.

The main modeling parameter selected for sizing gravity sewers, pump stations, and force mains is the once-per-10-year, 24-hour duration recurrence flow interval. The flow condition was selected based on guidance provided by the Oregon Administrative Rules (OAR), specifically OAR 340-041-0009 (6) and (7) which prohibits discharge of raw sewage to waters of the state with some exceptions. The most notable exceptions are that overflows from a pump station or sanitary structure are acceptable during a winter storm event greater than the 1-in-5-year, 24-hour duration storm or a summer storm event greater than the 1-in-10-year, 24-hour duration storm. The more conservative condition was used herein. The U.S. EPA recommends that municipalities evaluate a range of storm events (i.e., 5- through 20-year events is typical) and to select a storm event that provides a level of protection against sanitary sewer overflows (SSOs) that is in accordance with community values.

An additional design parameter for the conveyance system was set where the hydraulic grade maintains at least 7 feet of freeboard from the lowest sewered fixture during surcharged situations in the sewer (i.e., below-grade structures or the invert at below-grade spaces like a basement). This freeboard height was selected by BC based on past experience in other communities and confirmed acceptable by the City for use on the project.

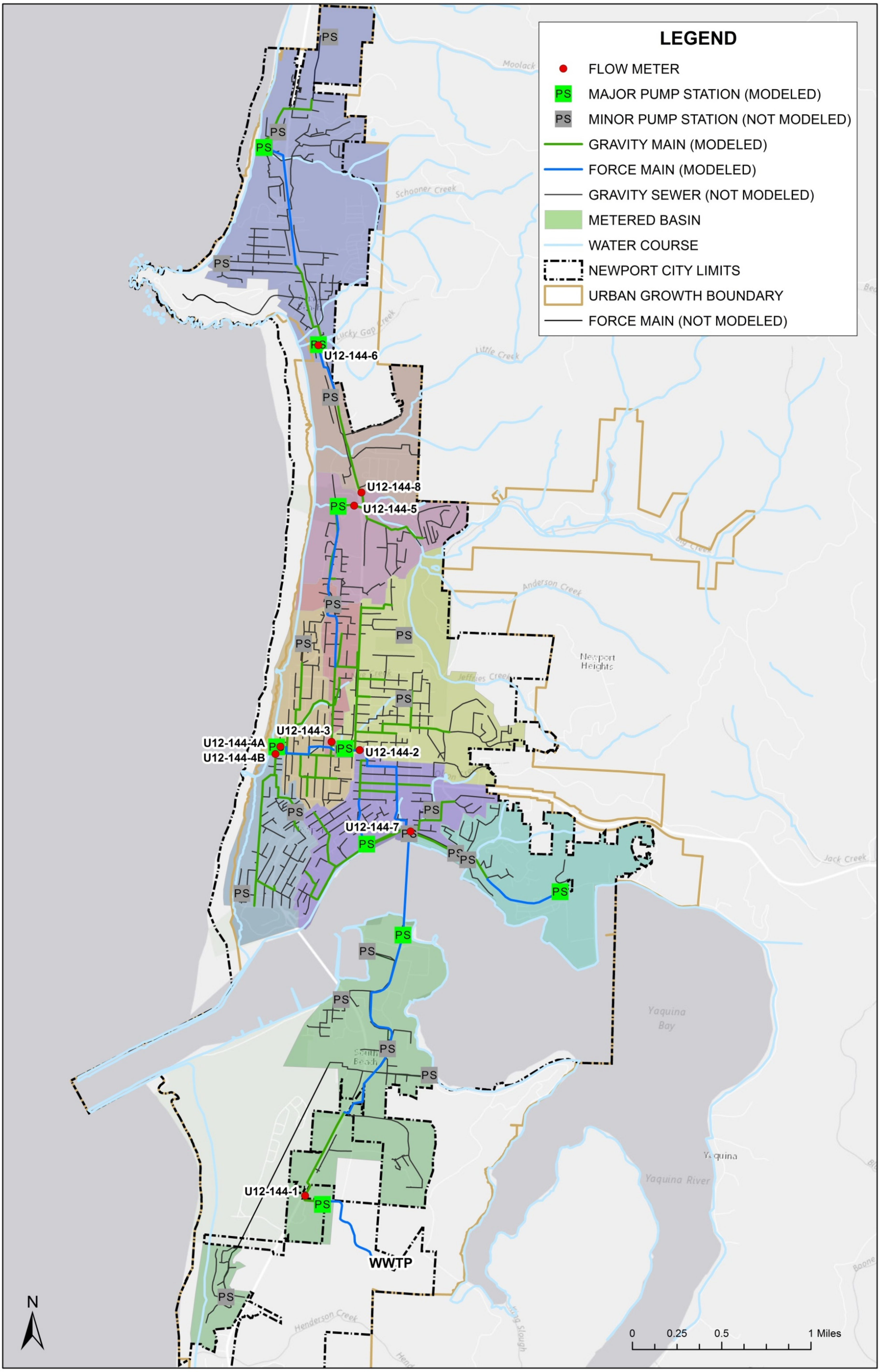

Figure 4-1. Flow monitoring sites

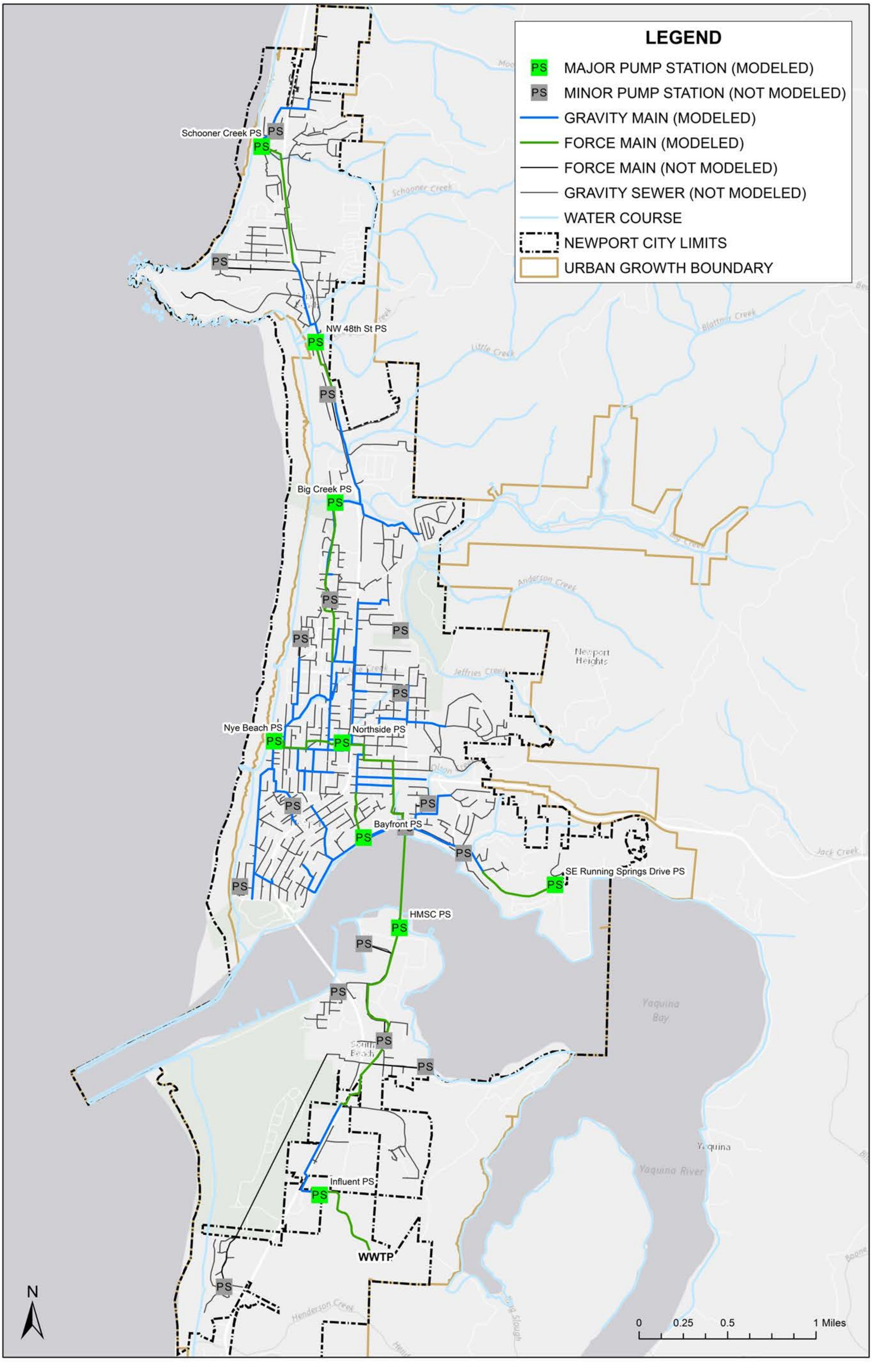

Figure 4-2. Model extents

4.4 Base Flows

Base sanitary sewer flows in the existing sanitary sewer collection system were developed from March 2013 recorded flows. The base flow includes wastewater contributions from residential, commercial, and industrial sources and continual groundwater infiltration that finds its way into sewers and manholes through cracks, joint separations, and other defects. RDII is not included in the base flow whereas groundwater infiltration is included. The flow monitoring record includes the groundwater sources so that with the addition of the wet weather I/I, the modeling portrays the entire wet weather flow regime.

4.5 Wet Weather Flows

RDII sewer flow was developed through the RTK method. The flow meter data were used to calibrate the RTK parameters and compare modeled flows to observed flows. Once calibrated, the model was used to simulate the design storm and determine capacity deficiencies in the system for both current and future development planning scenarios.

4.5.1 RTK Method

The RTK method uses a set of triangular unit hydrographs to generate flows. The hydrograph shapes are described by three parameters, R, T, and K, described as follows:

- R is the fraction of total precipitation that enters the sewer system as RDII
- T is the time to peak of the hydrograph
- K is the ratio of the recession time to time to peak

A typical hydrograph is shown in Figure 4-3.

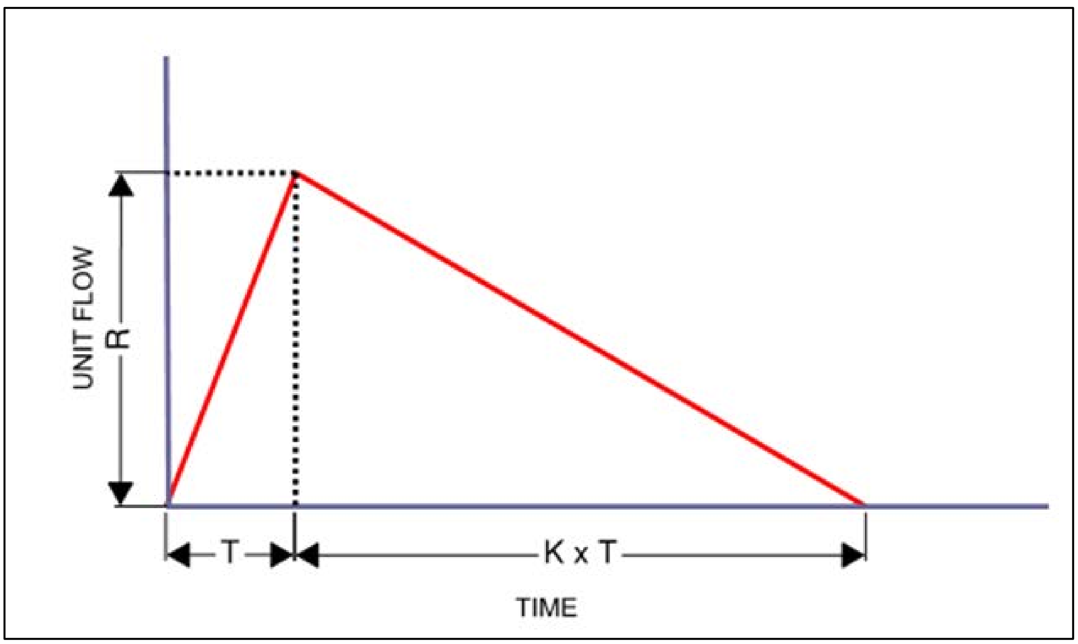

Figure 4-3. RTK unit hydrograph

Actual RDII hydrographs do not look like the simple triangular plot shown in Figure 4-3 because they are influenced by several different phenomena including inflow from rainfall sources, RDII, and direct infiltration from groundwater sources. To model this varied phenomenon, the RTK analysis is represented by three unit hydrographs corresponding to rapid inflow, moderate groundwater infiltration, and slow groundwater infiltration. Figure 4-4 depicts all three unit hydrographs combined into one that can be used to approximate RDII flows in a sewer system.

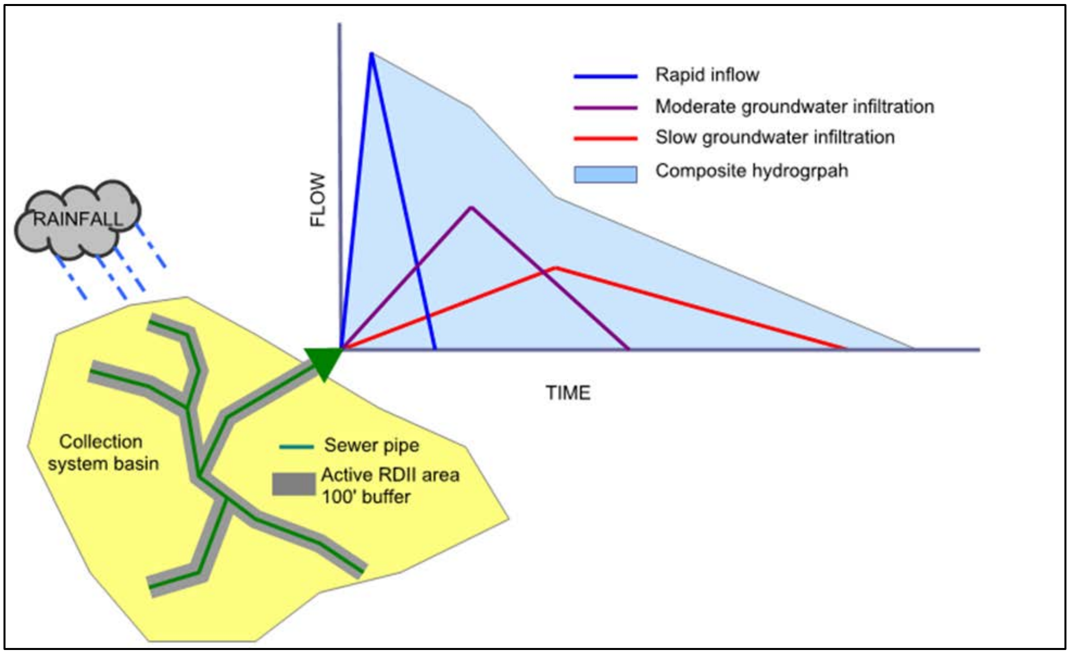

Figure 4-4. RTK method schematic

4.5.2 Precipitation Data

To calculate the R parameter for the RTK analysis, precipitation data representative of the sewer system are required. Rainfall data sets were obtained from the following sources and compared. Figure 4-5 below includes rain gauge locations:

- Rain Gauge 1 (RG-1): This rain gauge was installed in Newport during the flow metering period, mid-December 2012 through March 2013. The data provided for this gauge are in 5-minute increments.
- HMSC rain gauge: HMSC has a rain gauge with data from September 1996 through the present. The data provided for this gauge are in hourly increments. Uncorrected hourly data from August 2009 to present can be obtained at OSU's weather website (OSU 2016).

  Additional data for September 1996 through July 2009 were obtained electronically from HMSC. These data are provided as an electronic deliverable in Appendix A.
- Newport Municipal Airport rain gauge: The Newport Municipal Airport rain gauge was used to provide antecedent precipitation conditions for the flow monitoring period. Uncorrected provisional 20-minute data from January 2002 to present can be obtained online (WU 2016).

The RG-1 data, with Newport Municipal Airport rain gauge data added to the beginning of the time series (from October 1 to December 31, 2012), were used for model calibration.

The HMSC rain gauge data were used in the long-term model simulation described in Section 4.5.5.

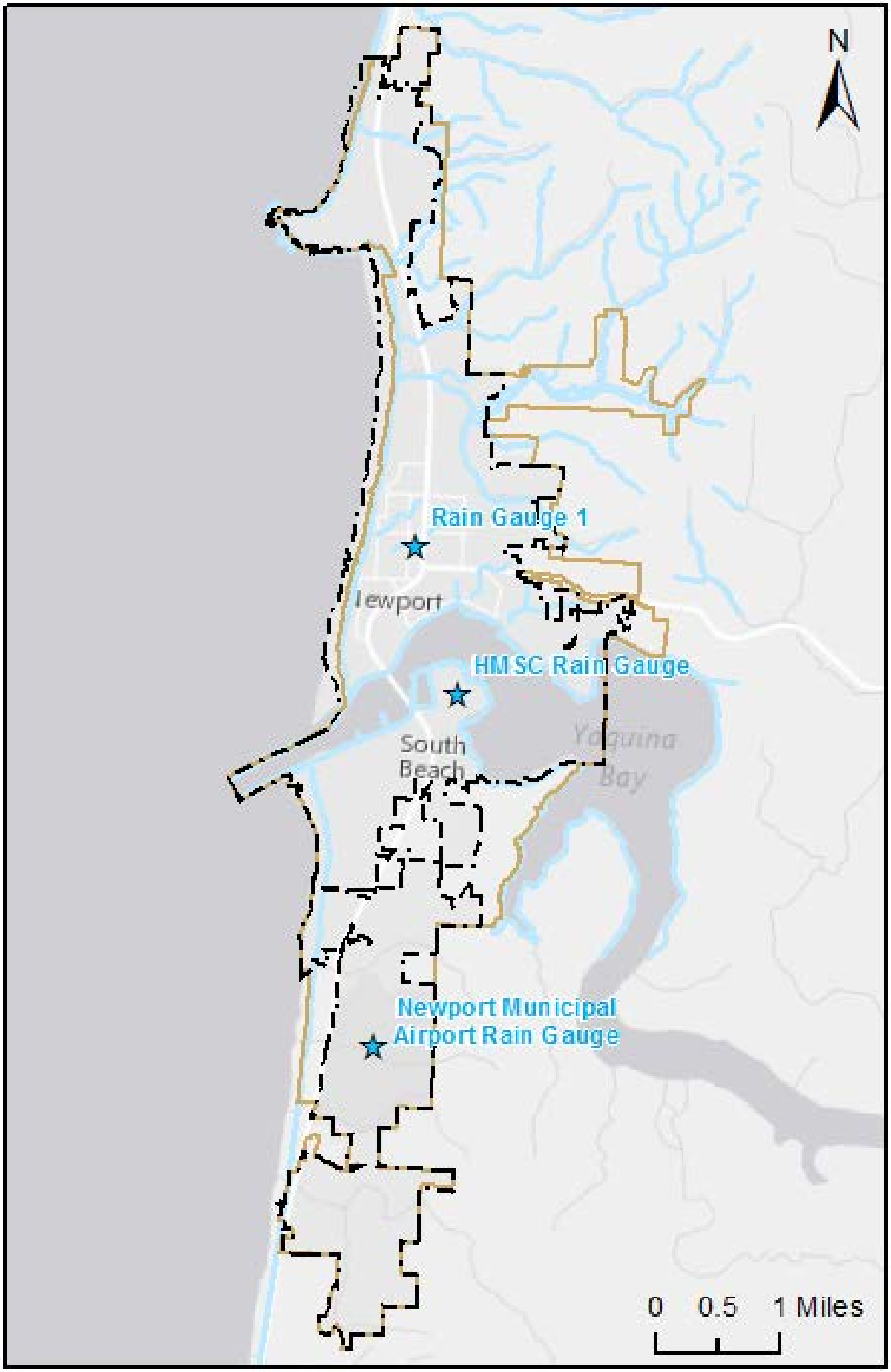

Figure 4-5. Rain gauge locations

4.5.3 Area Contributing to Rainfall-Derived Infiltration and Inflow

As shown in Figure 4-4 above, only a portion of a sewer basin was assumed to contribute to RDII in the sewer system. This portion of the overall area was estimated by applying a 100-foot buffer to all active sanitary mainline sewers in the system. This buffer area was distributed among all of the active model manholes based on upstream pipe length using GIS.

4.5.4 Wet Weather Model Calibration

The wet weather flow prediction capabilities of the model were verified against actual recorded flows to calibrate the model for wet weather conditions. Calibration of a model involves applying base flows and selecting RTK parameters that match RDII occurring during an observed storm event. Confidence in the prediction capabilities of the model are then increased by applying the parameters to other storm events in the flow record.

Calibration of the model was completed for each flow meter location and each pump station with recorded data from the field monitors. The results for the available flow meters are shown in Figures 4-6 through Figure 4-13, below.

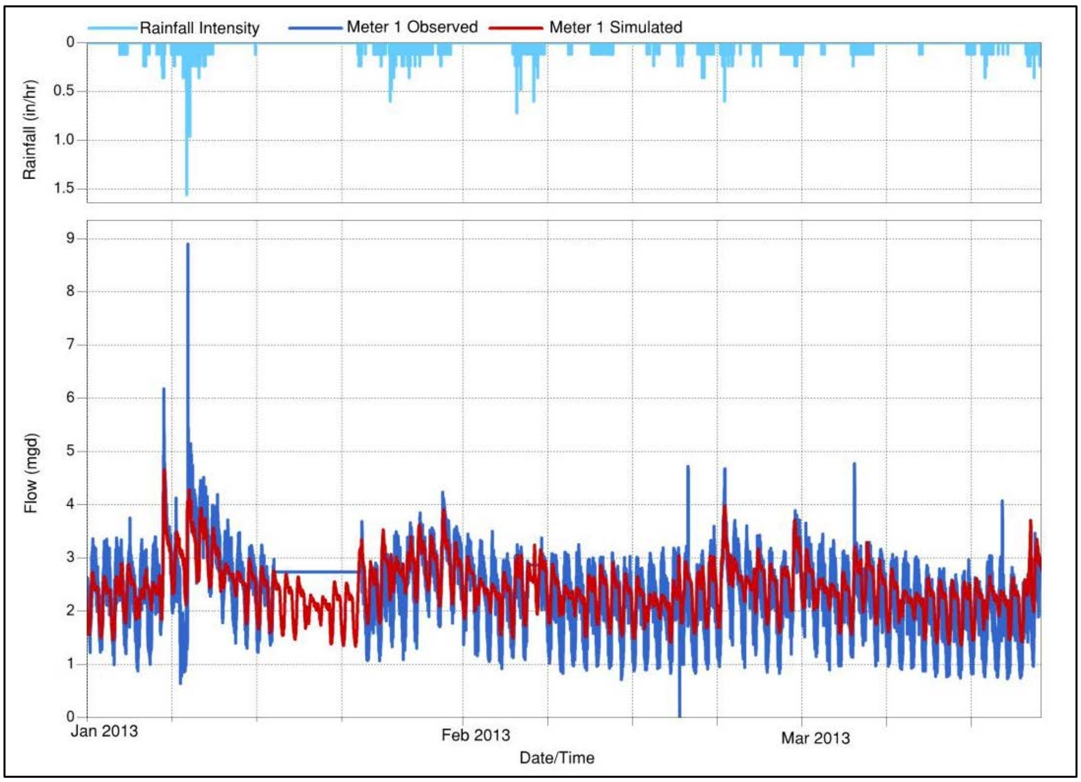

Figure 4-6. Meter 1 calibration

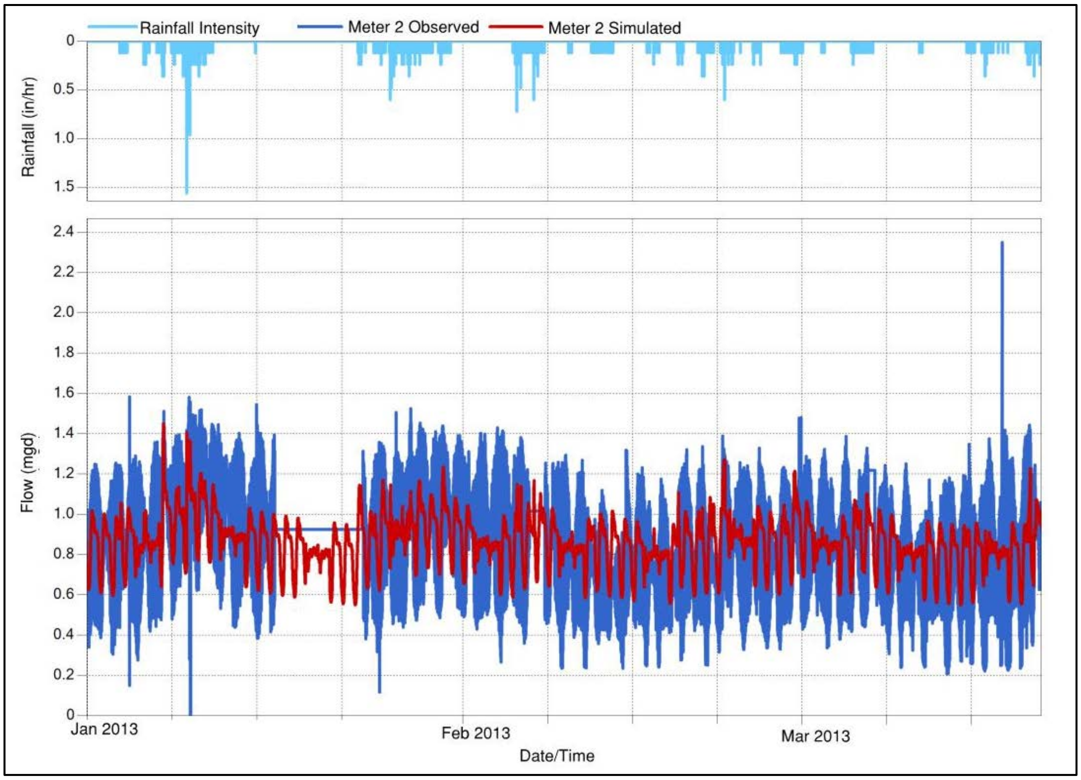

Figure 4-7. Meter 2 calibration

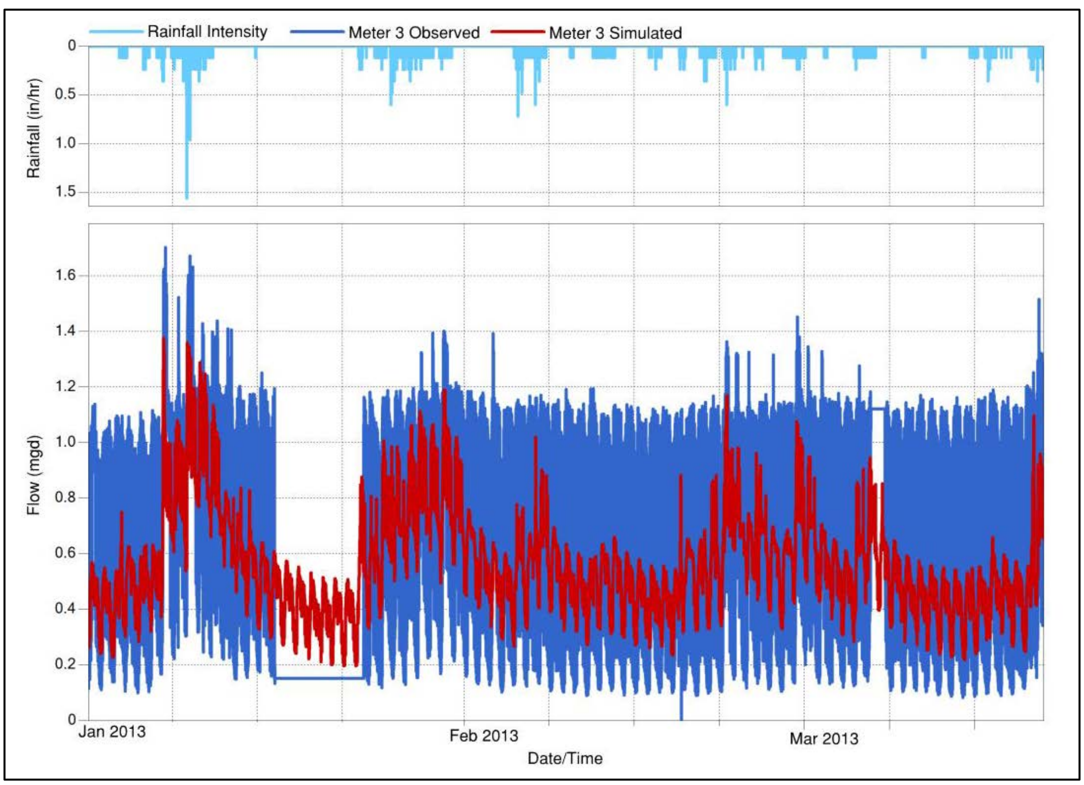

Figure 4-8. Meter 3 calibration

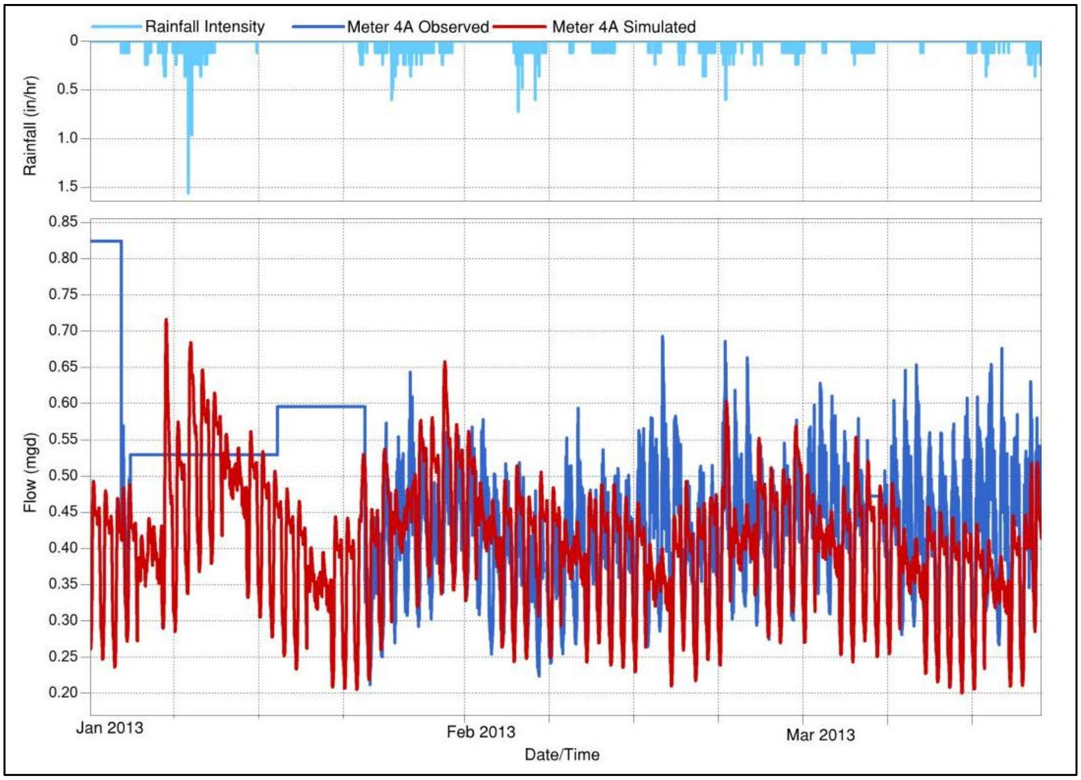

Figure 4-9. Meter 4A calibration

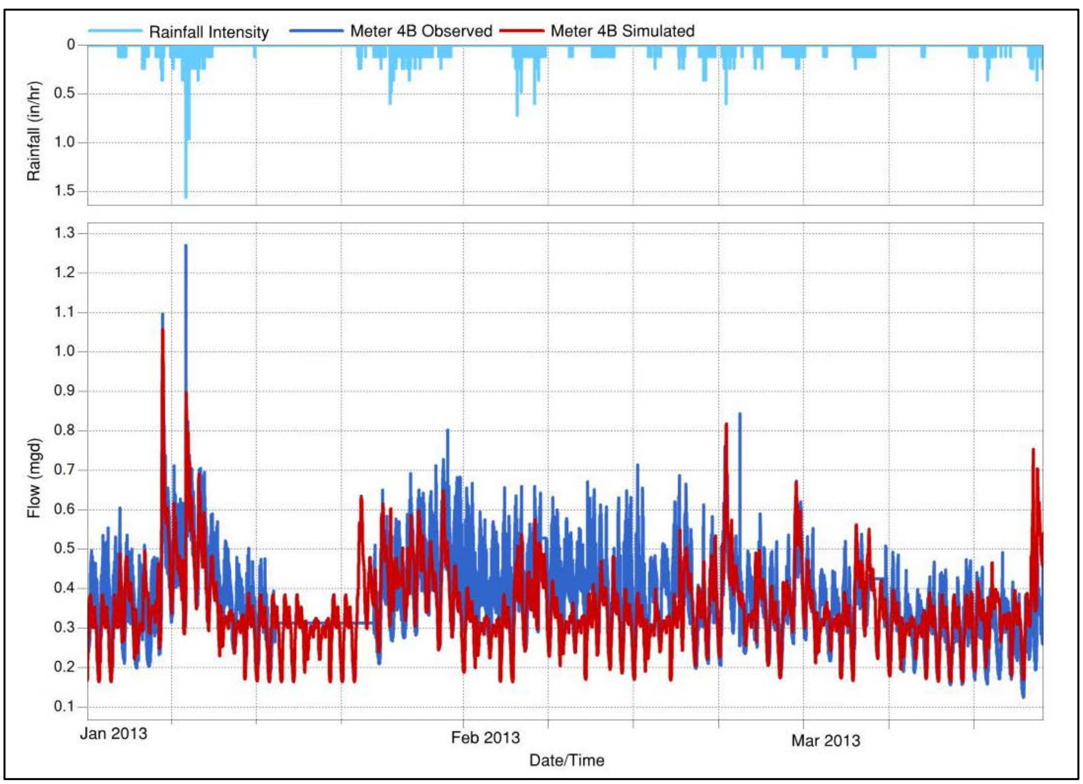

Figure 4-10. Meter 4B calibration

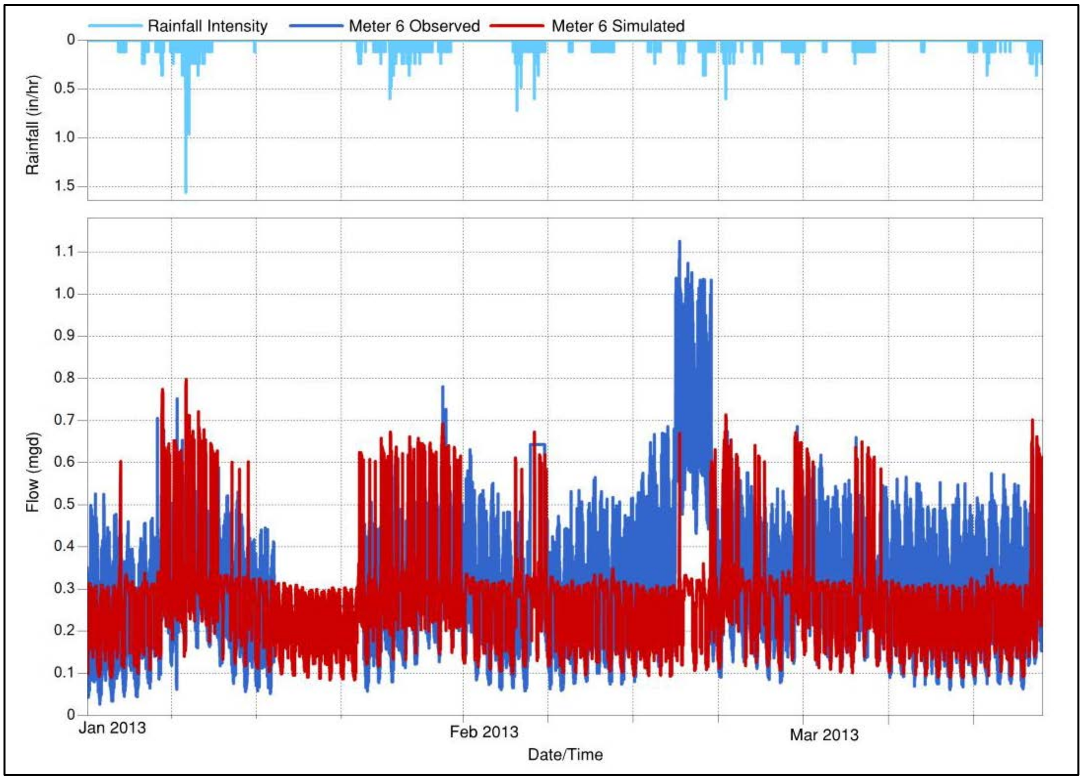

Figure 4-11. Meter 6 calibration

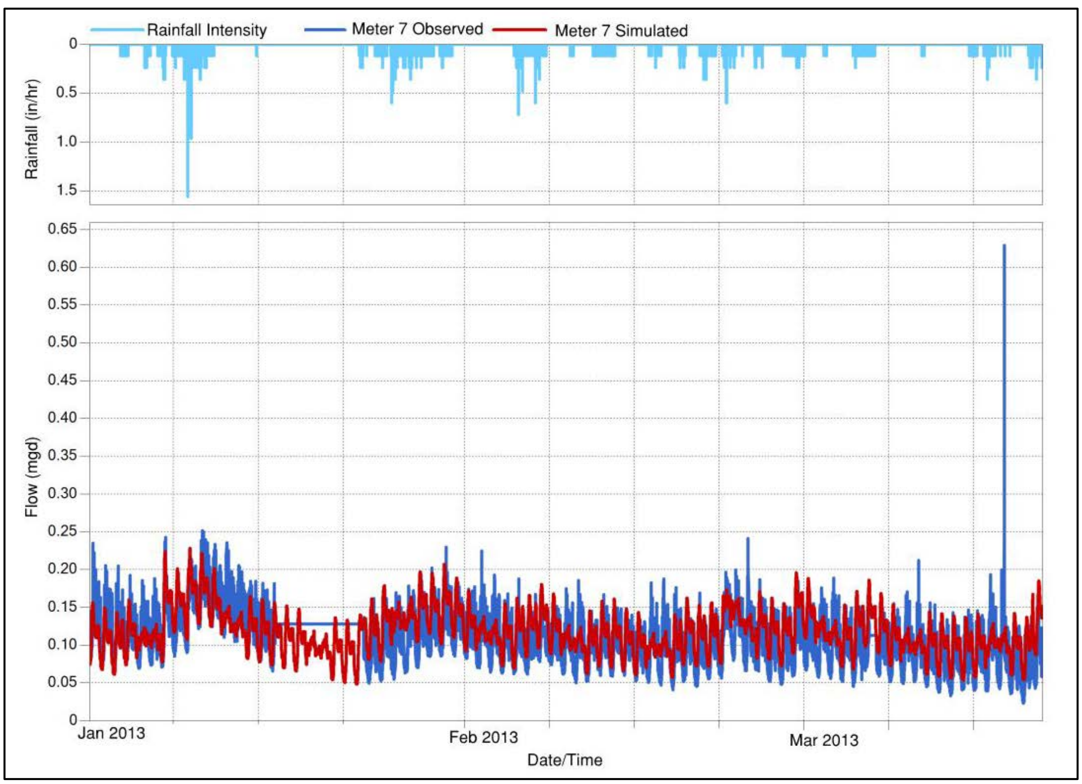

Figure 4-12. Meter 7 calibration

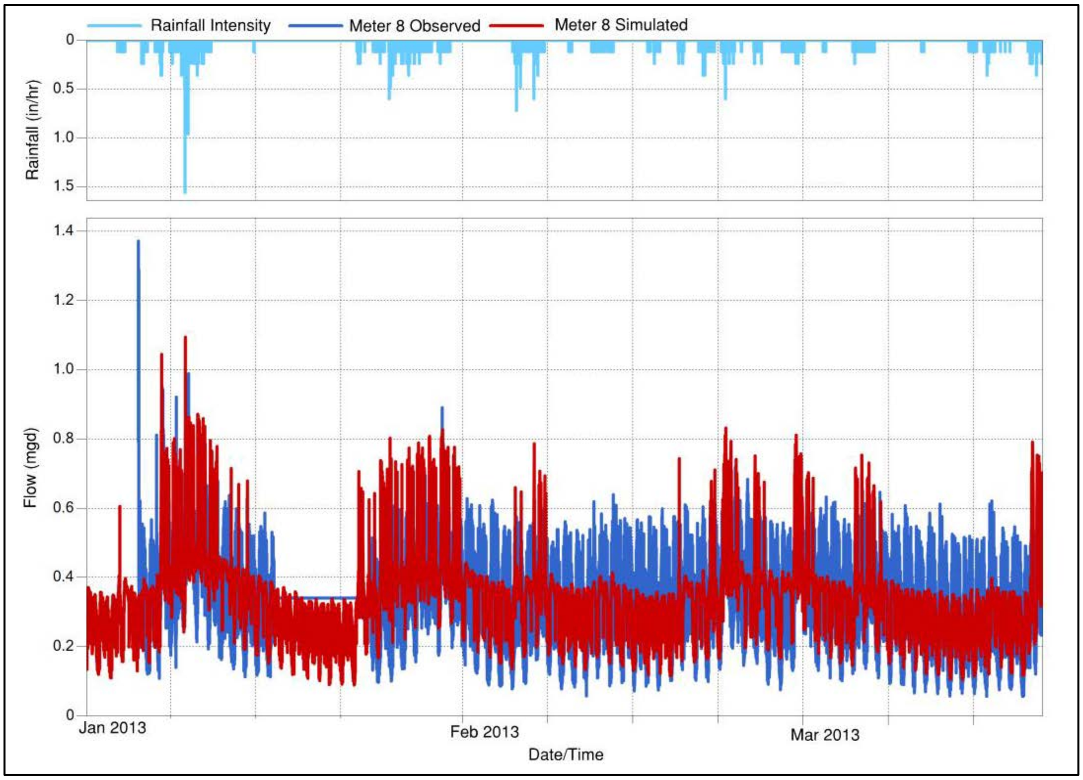

Figure 4-13. Meter 8 calibration

4.5.5 Long-Term Simulation

BC ran hydrologic model simulations to calculate long-term flow hydrographs that can be used to analyze the magnitude and frequency of historical wet weather events. The long-term rainfall record (described in Section 4.5.2) provides enough data for the model to be run from September 1, 1996, through December 31, 2015 (19 years). Identification of the 10-year flow recurrence event is necessary, based on previously stated goals. Running the model through a 10-year flow recurrence interval storm will indicate areas of the system that back up or flood, which can help to identify areas that do not meet the stated level of service.

Each of the hydrologic/hydraulic models was run using the 19-year rainfall record. The flooded and surcharged portions of the system were then evaluated using an 8-hour inter-event duration to isolate periods when the RDII peaked above a threshold minimum flow value. This means that only the events that produced a peak RDII were included, and smaller events were removed from the analysis.

The selected events were ordered from largest to smallest and assigned a rank. A rank of 1 was assigned to the largest storm, 2 to the second-largest, and so on. Cunnane plotting parameters were used to estimate the recurrence interval for each event in years, as follows (Maidment 1992):

$$TR = \frac{i + 0.2}{Rank - 0.4}$$

$Where$:

$i = number\ of\ simulation\ years$

$Rank = rank\ of\ storm\ where\ 1\ is\ the\ largest\ storm$

The above equation will not identify a historical storm event that has exactly a 10-year peak flow recurrence. For a 19-year record, the second-largest event is estimated to have about a 12-year recurrence and the third-largest event is estimated to have about an 8-year recurrence using Cunnane parameters.

Figure 4-14 and Table 4-2 below provide an example of the peak inflow frequency for specific recurrence intervals based on log-interpolation between plotted events. Therefore, the 10-year recurrence event is determined using a log-interpolation between the 8-year and 12-year events.

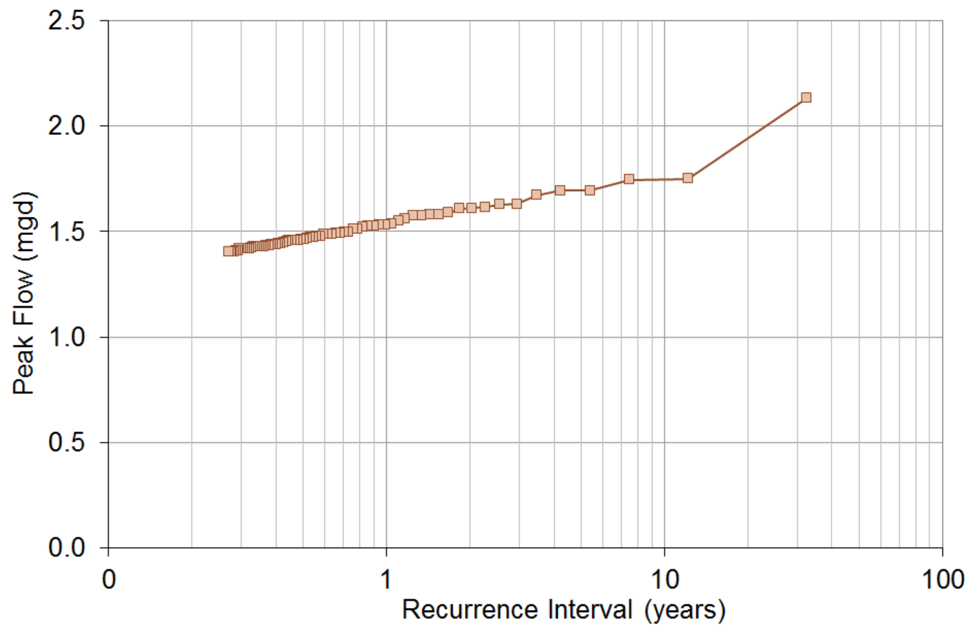

Figure 4-14. Example peak flow Cunnane plot

Table 4-2. Example peak Cunnane Estimated Flow Frequency	
Flow threshold	**Flow, mgd**
Q_{25}	2.03
Q_{10}	1.75
Q_{5}	1.69
Q_{2}	1.61
$Q_{1.5}$	1.58
Q_{1}	1.53

10-year peak RDII frequency values were calculated for each capacity-limited area to examine the relative contributions from each basin. The unit RDII values are calculated by dividing the peak RDII by the total length of the upstream collection system. This value provides insight into how leaky the pipes are for each monitoring basin.

Table 4-3 provides the peak current conditions RDII statistics for each monitoring basin. The peak RDII for downstream monitoring basins does not account for the inflows from the upstream basins. In other words, the RDII values are specific to the RDII created solely within the monitoring basin regardless of the influence of upstream basins.

Monitoring basins U12-144-1 and U12-144-4A illustrate the importance of calculating unit RDII values. Although U12-144-1 has a higher 10-year peak RDII than U12-144-4A, the unit RDII per mile of pipe for each basin is the same. This indicates that the pipes within the U12-144-4A monitoring basin may be in worse physical condition than those in the U12-144-1 basin, as U12-144-4A pipes create more RDII per length of pipe.

Table 4-3. Peak RDII per Monitoring Basin

Monitoring basin	Current conditions RDII, mgd	RDII/mile [a], mgd/mile
U12-144-1	2.7	0.1
U12-144-2	1.3	0.1
U12-144-3	2.0	0.1
U12-144-4A	0.4	0.1
U12-144-4B	1.5	0.2
U12-144-5	-	-
U12-144-6	1.5	0.1
U12-166-7	0.4	0.2
U12-166-8	0.1	0.0

a. RDII per mile is a calculation of the peak RDII divided by the total length of upstream pipe in miles without regard for the size of those upstream pipes.

4.6 Future Flows

Base flows and RDII from future developments were estimated and routed through the model to estimate future capacity deficiencies in the trunk sewer system. Three types of future development areas were included in the analysis:

- Large future development areas at the boundaries of the City's urban growth area
- Undeveloped land parcels within the city limits with future development potential
- Parcels currently serviced by onsite septic systems that are anticipated by the City to connect to the sanitary sewer system

4.6.1 Future Base Flows

Future average daily base flows were estimated from industry standard rates for each land use designation. For some large development areas, the proposed unit development was provided by the City. For other areas, the developed acreage was calculated assuming that 20 percent of the gross acreage would be used for local roads, easements, and other utilities. Table 4-4 below lists the rates used to develop future base flows.

Table 4-4. Future Sewer Base Flow Unit Rates

Land use	Unit type	Unit flow
Residential [a,b]	gpcd	100
Commercial [c]	gpad	1,000
Light industrial [c]	gpad	2,000
Heavy industrial [c]	gpad	5,000

Note: gpcd = gallon(s) per capita per day.

a. *An average of 2.19 people per household was assumed.*

b. *Development densities specified in the NMC were used to determine the number of dwellings per acre. LDR = 5 dwellings per acre, MDR = 10 dwellings per acre, HDR = 10 dwellings per acre.*

c. *Unit flow rates for commercial, light industrial, and heavy industrial areas were based on industry standard.*

4.6.2 Future Wet Weather Flows

RDII from future areas was calculated by estimating the amount of future sewered areas and applying an I/I rate of 1,000 gallons per acre per day (gpad). I/I were not applied to parcels within the city limits that are already developed, because it was assumed the I/I contribution from these parcels already would be accounted for in the existing conditions model.

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Section 5

Hydraulic Analysis

This section documents the results of the hydraulic analysis used to evaluate the collection system under existing and future planning scenarios.

5.1 Assessment Criteria

This section discusses the criteria used to determine the adequacy of existing and future collection system infrastructure.

5.1.1 Gravity Sewer Pipelines

Two criteria are used to evaluate whether pipes are too small to convey the design flow. The first criterion is percent capacity, which is a ratio of maximum predicted flow (Q) to pipe capacity (Q_m) expressed as a percentage. The maximum predicted flow, Q, is the calculated peak flow in each pipe from the model. The pipe capacity, Q_m, is the theoretical pipe capacity according to Manning's equation, which assumes unpressurized flow (no surcharging). A percentage greater than 100 indicates the pipe is carrying more flow than is theoretically possible for unpressurized flow given a certain pipe slope, diameter, and internal roughness. A percent capacity greater than 100 is an indication of a surcharged pipe.

The percent capacity cannot be the only parameter used for determining pipe capacity. This is due to the way that SWMM-based models report data. In some situations, peak flows reported by the model exist for extremely short periods of time, sometimes only for seconds. Consequently, some of these peak flow values should not be used as the basis for pipe replacement. The second criterion, the ratio of depth of water to pipe diameter (d/D) is often more reliable. Use of the d/D ratio is described in more detail below.

In an unpressurized pipe, or a pipe with open-channel flow characteristics, the hydraulic grade line (HGL) is the elevation of the water surface within the pipe, or the d value. In a pipe that is surcharged (pressurized flow), the HGL is defined by the elevation to which water would rise in an open pipe, or manhole, as shown in Figure 5-1. In hydraulic terms, the HGL is equal to the pressure head measured above the invert of the pipe.

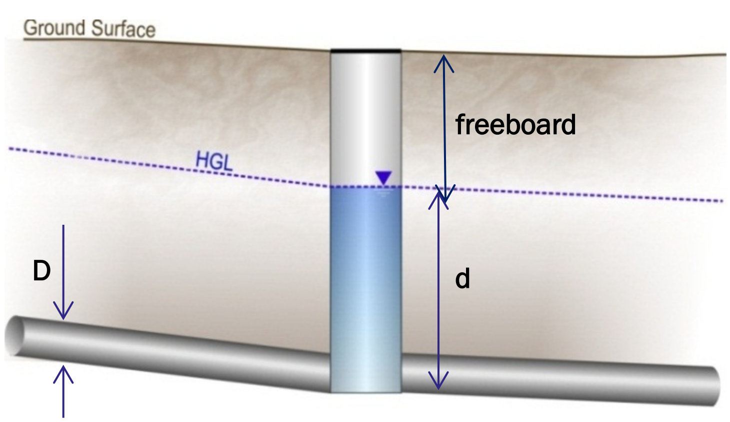

Figure 5-1. HGL for surcharged condition

The distance from the HGL to the top of a structure or to the invert of a pipe in a below-grade building (i.e., basement) is called "freeboard."

The recommended approach for determining which pipes need to be upsized is to consider the amount and frequency of surcharging. For example, if minor surcharging (i.e., maintaining more than 7 feet freeboard) were to occur only during large storm events (i.e., the 1-in 10-year storm) and the surcharging did not impact property or create an SSO, City staff should not consider upsizing this pipe. However, if the frequency or amount of surcharging were to increase and endanger property or overflow, then the pipe should be upsized or capacity reclaimed through reduction of I/I.

Pipes that surcharge frequently should be upsized (or tributary I/I reduced) because frequent surcharging has the potential to reduce structural stability because of loss of pipe support from fine-grain soils washing into the sewer. Similarly, City staff should consider the amount of remaining freeboard with regard to the risk of SSOs or basement backups. As flows increase in the future, City staff will need to monitor water surface elevations throughout the system to determine when pipes should be upsized. This approach will help to ensure that the City has adequate capacity for conveying the design flows without spending more capital dollars than necessary.

In general, sewers with more than 7 feet of freeboard are not identified for replacement. City staff should monitor these sewers during large storm events to quantify the amount of surcharging that actually occurs. If the observed surcharging increases to the point of risking property or becoming an SSO, then the pipe or pipes creating the capacity limitation should be upsized (or I/I reduction sought). Some pipes with minor surcharging are identified for replacement even though they have more than 7 feet of freeboard. Upsizing of these pipes will help to reduce more significant surcharging in the upstream system.

5.1.2 Pump Stations and Force Mains

The existing capacities of the pump stations are based on the available wetwell and pump operational data. Recommendations to upsize capacity are made when influent flows to the wetwell exceed existing stated capacities of the pumps. As part of the modeling, influent flows were generated for existing, peak, and buildout conditions.

Capacity of a force mains is largely based on the age of the pipe and the velocity that is maintained during operating conditions. If the velocity increases beyond recommended values, negative impacts can be seen with energy consumption, abrasiveness on the pipe material, and unfavorable discharge conditions. DEQ's *Oregon Standards for Design and Construction of Wastewater Pump Stations*, recommends force main velocities be between 3.5 and 8.0 feet per second (fps) for pump discharge lines and force mains (DEQ 2001).

5.2 Existing Conditions Planning Scenario: Modeling Results

The existing conditions modeling scenario represents the existing collection system, including the current Agate Beach Improvement Project, under current flow conditions. This modeling scenario identifies the hydraulic deficiencies that are currently within the system. Based on discussions with City staff, the model predictions generally support its observations.

In general, the existing conditions modeling scenario provides an initial priority ranking of required sewer improvements because sewers that are currently undersized should be upsized prior to addressing problems associated with future flows.

Highlights of the modeling results are discussed below.

5.2.1 Gravity Sewers

The modeling of the existing conditions planning scenario revealed surcharging throughout the collection system with 12 sewers showing minor to severe surcharging during a 10-year, 24-hour duration event. Surcharged sewers include all sewers with a modeled d/D ratio of greater than 1.0 and with less than 7 feet of available freeboard. The locations of the surcharged sewers are shown in Figure 5-2 and listed in Appendix C. City staff should note the remaining freeboard predicted by the model. Sewers with limited freeboard should be monitored to determine if, and when, improvements may be required to prevent basement backups or SSOs.

Not all of the identified sewers would need to be replaced to eliminate or reduce the surcharging. The upsizing of a number of strategically located downstream sewers will significantly reduce the number of sewers that need to be replaced because many sewers are surcharged because of downstream restrictions in the collection system. In addition, the implementation of an I/I-reduction program may reduce the number of pipes that must be replaced.

The existing conditions planning scenario provides information on which sewers should be upsized first, but the flows shown for this scenario should not be used as the basis of upsizing the pipes. Rather, the future conditions planning scenario should be used for pipe sizing information (or for I/I-reduction targets). Refer to Chapter 6 for capital improvement recommendations.

5.2.2 Pump Stations and Force Mains

The pump run time information was recorded by the City's SCADA system located at the major pump stations. Pump run time and nameplate pump capacity were used to estimate the flows pumped from the pump stations. Actual pump capacity could be less than the nameplate value dependent on force main and impeller conditions. A more accurate representation of these flows would require calibrated flow monitors installed in the force main, or extensive pump draw down testing. This additional effort was not deemed appropriate for this planning document.

Two of the modeled pump stations were found to lack firm capacity for conveying the existing peak 10-year, 24-hour recurrence interval flows. The Bayfront PS has an estimated peak flow of 2.2 million gallons per day (mgd) and a current firm capacity of 1.7 mgd. The Nye Beach Pump Station has a projected project peak flow of 2.67 mgd and a current firm pumping capacity of 2.0 mgd. These values are indicated in bold red text below as part of the pump station and force main flow statistics listed in Table 5-1. Additional values presented in bold are forcemain velocities that exceed the recommended range. The locations of the pump stations are shown in Figure 5-2, below.

Table 5-1. Flows to Pump Stations, Existing Conditions Planning Scenario					
PS	Current firm pumping capacity [a], mgd	Number of pumps	Existing 10-year peak flow, mgd	FM size, in.	Maximum FM velocity [b], fps
Bayfront	1.70	2	2.20	8	7.5/9.8
Big Creek	3.50	3	2.60	14	5.1/3.8
HMSC	2.00	2	0.40	8	8.9/1.8
Influent	15.00	6	8.10	24	7.4/4.0
Northside	8.50	3	8.00	20–24	6.0/5.7
NW 48th Street [c]	1.75	2	1.70	10	5.0/4.8
Nye Beach	2.00	2	2.67	12	3.9/5.3
Schooner Creek [c]	0.92	2	0.70	8	4.2/3.1
SE Running Springs Drive	0.22	2	0.05	4	3.9/0.9

a. The firm pumping capacity is based on PS operation without the use of the redundant pump(s).

b. The first number is the maximum velocity based on firm pumping capacity, the second number is the velocity based on the existing 10-year peak flow from the model.

c. The NW 48th Street PS, Schooner Creek PS, and Schooner Creek FM are currently being upgraded as part of the Agate Beach Improvement Project. These values represent their planned improvements.

5.3 Future Conditions Planning Scenario: Modeling Results

The results of the future conditions planning scenario modeling are described in this section. Refer to Chapter 6 for capital improvement recommendations.

5.3.1 Gravity Sewers

Surcharged gravity sewers for the 20-year and buildout planning scenarios are shown in Figure 5-3 and Figure 5-4, respectively. Capacity-limited sections of gravity mains with less than 7 feet of freeboard must be upsized to prevent excessive surcharging that could lead to basement backups and/or flooding (i.e., SSOs). Flooding is predicted in one location in the City's system: downstream of the Bayfront FM, along NE Avery Street. Surcharging occurs at miscellaneous areas throughout the City as shown in Figure 5-3 and Figure 5-4.

The flooding and surcharging predicted by the model will increase in frequency and volume as growth increases unless pipes are upsized and/or I/I reduction is achieved.

Buildout planning scenario results should be consulted for Capital Improvement Plan (CIP) sizing rather than the results of the existing conditions or 20-year planning scenario modeling. It is recommended that a detailed analysis is completed during the design phase of each project to confirm facility sizing.

Some of the identified sewers shown in Figure 5-3 and Figure 5-4 are not identified for replacement, but are locations where the surcharging conditions should be monitored by City staff. In general, these are sewers with less than 7 feet of freeboard. The surcharging of these sewers could present a risk of flooding for homes and businesses with basements. City staff should monitor flow levels in these sewers for frequent surcharging and/or surcharging that is too high in elevation.

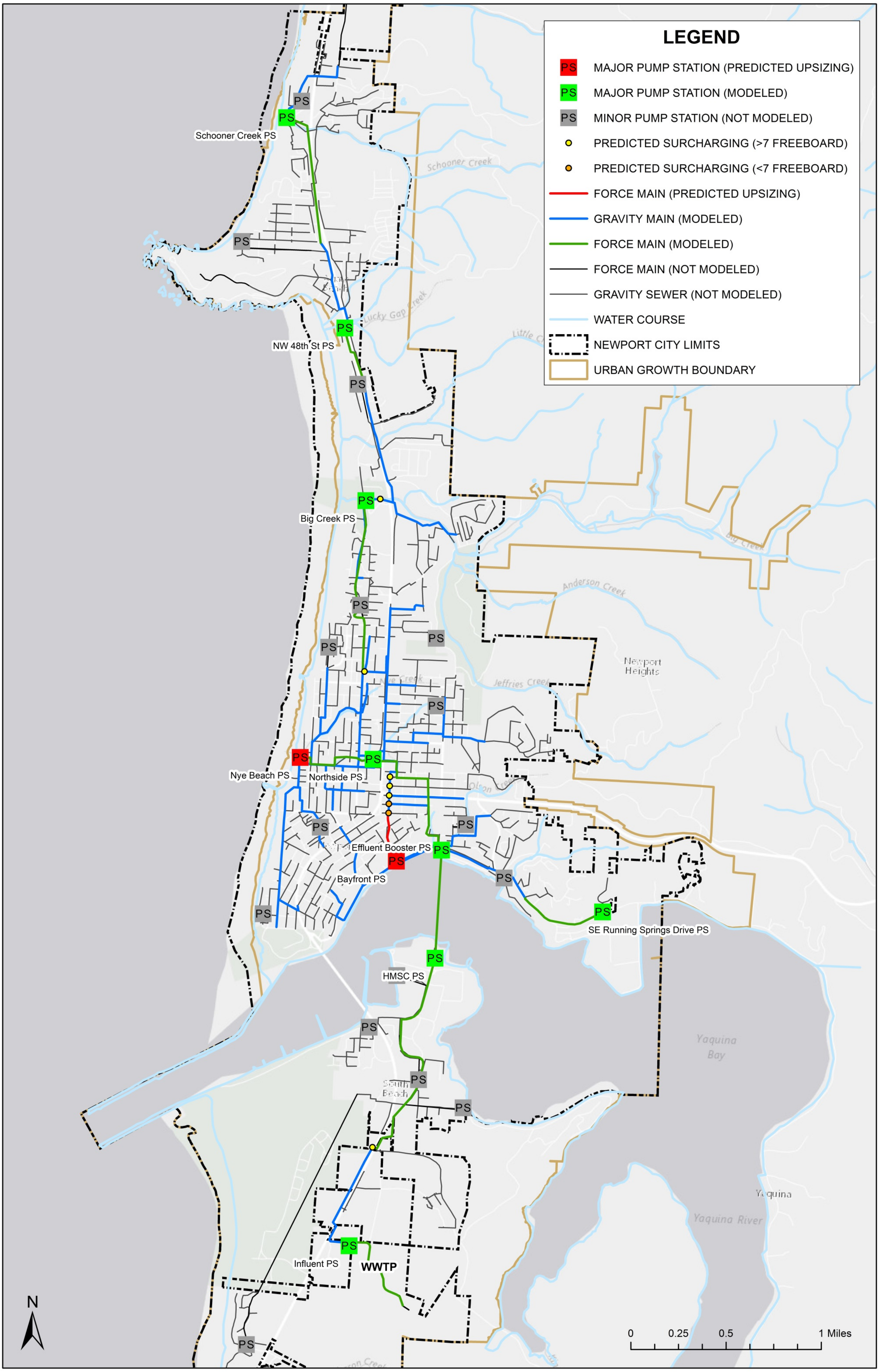

Figure 5-2. Model simulation results (existing conditions)

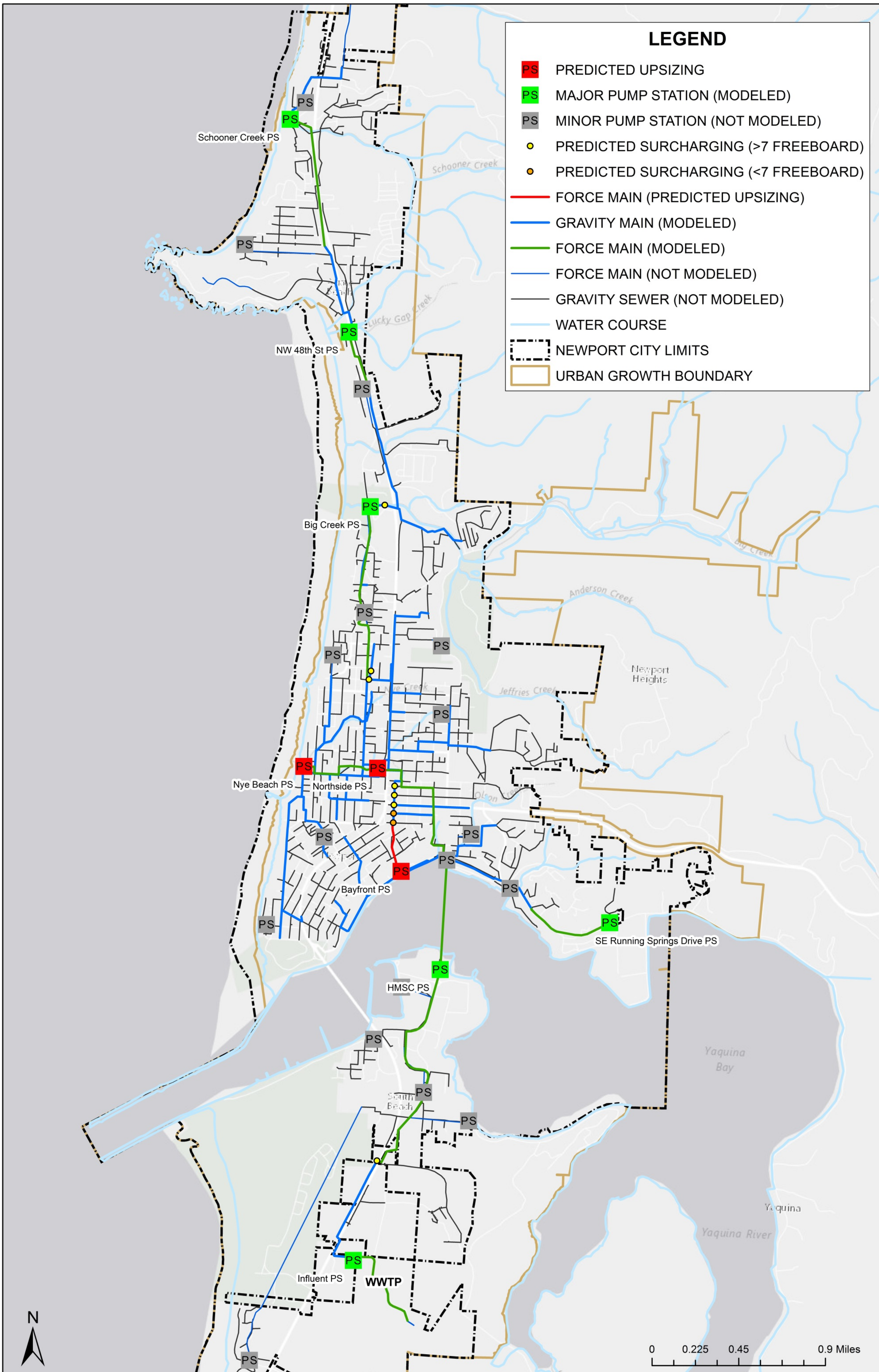

Figure 5-3. Model simulation results (20-year conditions)

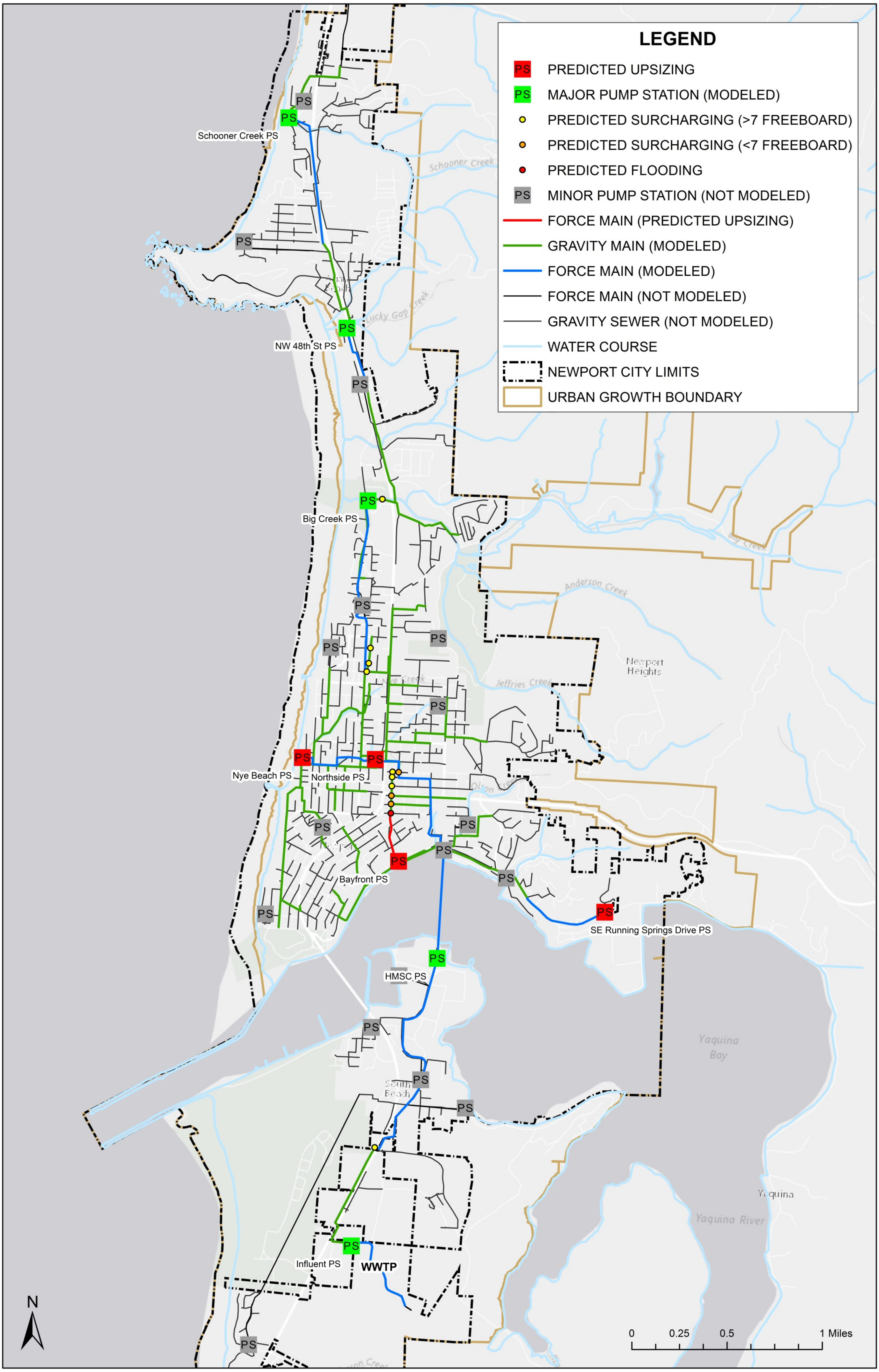

Figure 5-4. Model simulation results (buildout conditions)

5.3.2 Pump Stations and Force Mains

Three of the nine modeled pump stations were found to lack firm capacity for conveying the future 20-year conditions peak flows. The Bayfront PS has a projected peak flow of 2.3 mgd and a current firm capacity of 1.7 mgd. The Nye Beach PS has a projected peak flow of 2.69 mgd and a current firm pumping capacity of 2.00 mgd. The Northside PS has a projected peak flow of 9.0 mgd and a current firm capacity of 8.5 mgd. These values are indicated in bold red text below as part of the pump station and force main flow statistics listed in Table 5-2. Additional values presented in bold are forcemain velocities that exceed the recommended range.

Table 5-2. Flows to Pump Stations, 20-Year Conditions Planning Scenario

PS	Current firm pumping capacity [a], mgd	Number of pumps	Future 20-year peak flow, mgd	FM size, in.	Maximum FM velocity [b], fps
Bayfront	1.70	2	**2.30**	8	7.5/**10.2**
Big Creek	3.50	3	3.00	14	5.1/4.3
HMSC	2.00	2	0.70	8	**8.9**/3.1
Influent	15.00	6	8.90	24	7.4/4.4
Northside	8.50	3	**9.00**	20–24	6.0/6.0
NW 48th Street [c]	1.76	2	1.76	10	5.0/5.1
Nye Beach	2.00	2	**2.69**	12	3.9/5.3
Schooner Creek [c]	0.92	2	0.90	8	4.2/4.0
SE Running Springs Drive	0.22	2	0.12	4	3.9/**2.1**

a. *The firm pumping capacity is based on PS operation without the use of the redundant pump(s).*

b. *The first number is the maximum velocity based on firm pumping capacity, the second number is the velocity based on the existing 10-year peak flow from the model.*

c. *The NW 48th Street PS, Schooner Creek PS, and Schooner Creek FM are currently being retrofitted as part of the Agate Beach Improvement Project. These values represent their planned improvements.*

Four of the nine modeled pump stations were found to lack firm capacity for conveying the future buildout conditions peak flows. The Bayfront PS has a projected peak flow of 2.3 mgd and a current firm capacity of 1.7 mgd. The Nye Beach PS has a projected peak flow of 2.74 mgd and a current firm pumping capacity of 2.00 mgd. The Northside PS has a projected peak flow of 9.2 mgd and a current firm capacity of 8.5 mgd. The SE Running Springs Drive PS has a projected peak flow of 0.27 mgd and a current firm capacity of 0.22 mgd. These values are indicated in bold red text below as part of the pump station and force main flow statistics listed in Table 5-3. Additional values presented in bold are forcemain velocities that exceed the recommended range.

Table 5-3. Flows to Pump Stations, Buildout Conditions Planning Scenario					
PS	Current firm pumping capacity [a], mgd	Number of pumps	Future peak flow, mgd	FM size, in.	Maximum FM velocity [b], fps
Bayfront	1.70	2	3.10	8	7.5/13.7
Big Creek [c]	3.50	3	3.00	14	5.1/4.3
HMSC	2.00	2	0.80	8	8.9/3.5
Influent [c]	15.00	6	8.90	24	7.4/4.4
Northside	8.50	3	9.20	20–24	6.0/6.8
NW 48th Street [d]	1.76	2	1.76	10	5.0/5.0
Nye Beach	2.00	2	2.74	12	3.9/5.2
Schooner Creek [d]	0.92	2	0.92	8	4.2/4.1
SE Running Springs Drive	0.22	2	0.27	4	3.9/4.8

a. *The firm pumping capacity is based on PS operation without the use of the redundant pump(s).*

b. *The first number is the maximum velocity based on firm pumping capacity, the second number is the velocity based on the existing 10-year peak flow from the model.*

c. *The Influent PS has a design capacity greater than the future peak flow, as predicted by the modeling exercise. Though upgrades are not required based on capacity concerns, the City should still maintain regular inspections.*

d. *The NW 48th Street PS, Schooner Creek PS, and Schooner Creek FM are currently being retrofitted as part of the Agate Beach Improvement Project. These values represent their planned improvements.*

The Bayfront PS and Nye Beach PS lack the firm capacity to convey existing, 20-year, and buildout conditions peak flows; the Northside PS lacks firm capacity to convey the 20-year and buildout conditions peak flows and the SE Running Springs Drive PS lacks firm capacity to convey the buildout conditions peak flow.

The NW 56th Street Pump Station is located in a geologically unstable area. Though the station does not exceed parameters for flow or velocity it is recommended that it be included on the pump station upgrade list. Initial efforts should be focused on completing an alternative analysis to determine the best solution (e.g., stabilize the current infrastructure, relocate).

Timing for required station upgrades depends on the timing and type of future development. The City should monitor the flows at the pump stations and periodically assess the need to provide the increased pumping capacity.

As listed in Table 5-2 above, the velocities in most force mains are within acceptable limits with the exception of Bayfront and HMSC for future peak flows and firm pumping capacity, respectively.

Though the minor pump stations were not modeled as part of this planning effort, condition of each of the pump stations has been monitored by the City. The City has indicated that many are experiencing intermittent problems and/or nearing the end of their useful life. While each pump station has unique concerns, a rehabilitation program would be a useful in starting to repair and prevent deficiencies from occurring throughout the system.

Locations of the minor pump stations are shown in Figure 5-3.

Section 6

Capital Improvement Plan

This section presents the recommended CIP for the City's sanitary sewer collection system. The CIP is based on reviewing existing conditions and applying the results of the modeling effort. The CIP is intended to help the City make decisions on existing and potential expected deficiencies given growth and flow increases in the system. It also provides guidance for expanding the system to meet the City's future growth needs.

Capital improvements have been developed based on the buildout condition planning scenario. These include sewer replacements that will be required to convey future flows and sewer extensions and pump stations that will be required to provide new sewer service to areas of the city without sewer service and to areas that may be annexed by the City in the foreseeable future.

The recommendations contained herein should be updated as required to address future conditions that may differ from conditions used to develop this SSMP.

6.1 Existing Conditions Planning Scenario

The existing conditions planning scenario serves two general purposes:

- Project prioritization: In general, existing deficiencies should be addressed before those associated with future conditions.
- Rate/system development charges (SDCs): Upon acceptance of this SSMP, it is anticipated that the City will have a financial analysis performed to determine future sewer rates and SDCs. The financial analysis will depend, in part, on the excess capacity in the existing collection system that is available to serve growth.

System improvements recommended to address existing collection system capacity limitations are sized to convey buildout flows.

6.2 Capital Improvement Recommendations

This section describes the improvements recommended to address the capacity and known condition deficiency needs of the City-owned sanitary sewer system for the 20-year future conditions planning scenario and to provide new sewer service to areas of the city without sewer service and to areas that may be annexed by the City in the foreseeable future. The City's implementation of an I/I-reduction program may be sufficient to address the capacity needs of many of the sewers identified for replacement. Further analysis is required to determine where I/I reduction may be implemented cost-effectively.

6.2.1 Gravity Sewer Replacements

Individual sewer replacements were grouped into projects to expedite design- and construction-related activities. Typically, each project consists of several replacements. The projects were limited in size so that no single project would be too large for funding and bidding purposes.

Table 6-1 names the specific projects, defines the sewers to be replaced, and identifies the estimated project costs. Figures 6-1 and 6-2 provide an overview and detailed view of recommended pipe replacements, respectively. Included on Figure 6-1 are the pump station and force main improvement projects, based on capacity upgrade criteria only.

Table 6-1. Recommended CIPs: Gravity Sewer Improvements

Pipe ID	Length, LF	Existing diameter, in.	CIP diameter, in.[a]	CIP technology	Estimated cost, dollars [b]	Estimated project cost, dollars
(1) NE Avery Street						
7504-7045	258	14	18	Open cut	137,000	1,230,000
7045-7043	234	14	18	Open cut	124,000	
7043-7040	264	14	18	Open cut	140,000	
7040-7028	251	12	18	Open cut	133,000	
7028-7026	140	12	18	Open cut	74,000	
7026-7027	170	12	18	Open cut	90,000	
7027-7011	293	10	18	Open cut	155,000	
7011-7010	268	12	18	Open cut	142,000	
7010-7059	345	12	18	Open cut	183,000	
7059-7060	80	12	18	Open cut	42,000	
7060-7058	23	12	18	Open cut	12,000	
(2) NW Nye Street						
5023-5037	330	15	13.5	CIPP	109,000	1,140,000
5037-5040	122	15	13.5	CIPP	40,000	
5040-5043	204	15	13.5	CIPP	67,000	
5043-5513	329	15	13.5	CIPP	109,000	
5513-5520	340	15	18	Pipe burst	163,000	
5520-5542	328	15	18	Pipe burst	157,000	
5542-6253	333	15	18	Pipe burst	159,000	
6253-6256	225	15	18	Pipe burst	108,000	
6256-6257	109	15	18	Pipe burst	52,000	
6257-6258	80	16	18	Pipe burst	38,000	
6258-7057	145	16	18	Pipe burst	69,000	
7057-7058	76	16	18	Pipe burst	36,000	
7058-Northside PS	53	20	21	Open cut	31,000	
Total all sewer improvements						2,370,000

a. Pipe diameter reduction of 10% was assumed for CIPP rehabilitation.

b. Estimated costs include a 30% allowance for construction contingencies and a 20% allowance for engineering design and administration. See Appendix E for unit cost tables—assumes a depth of 10' per cost condition and 2' for gravity sewers.

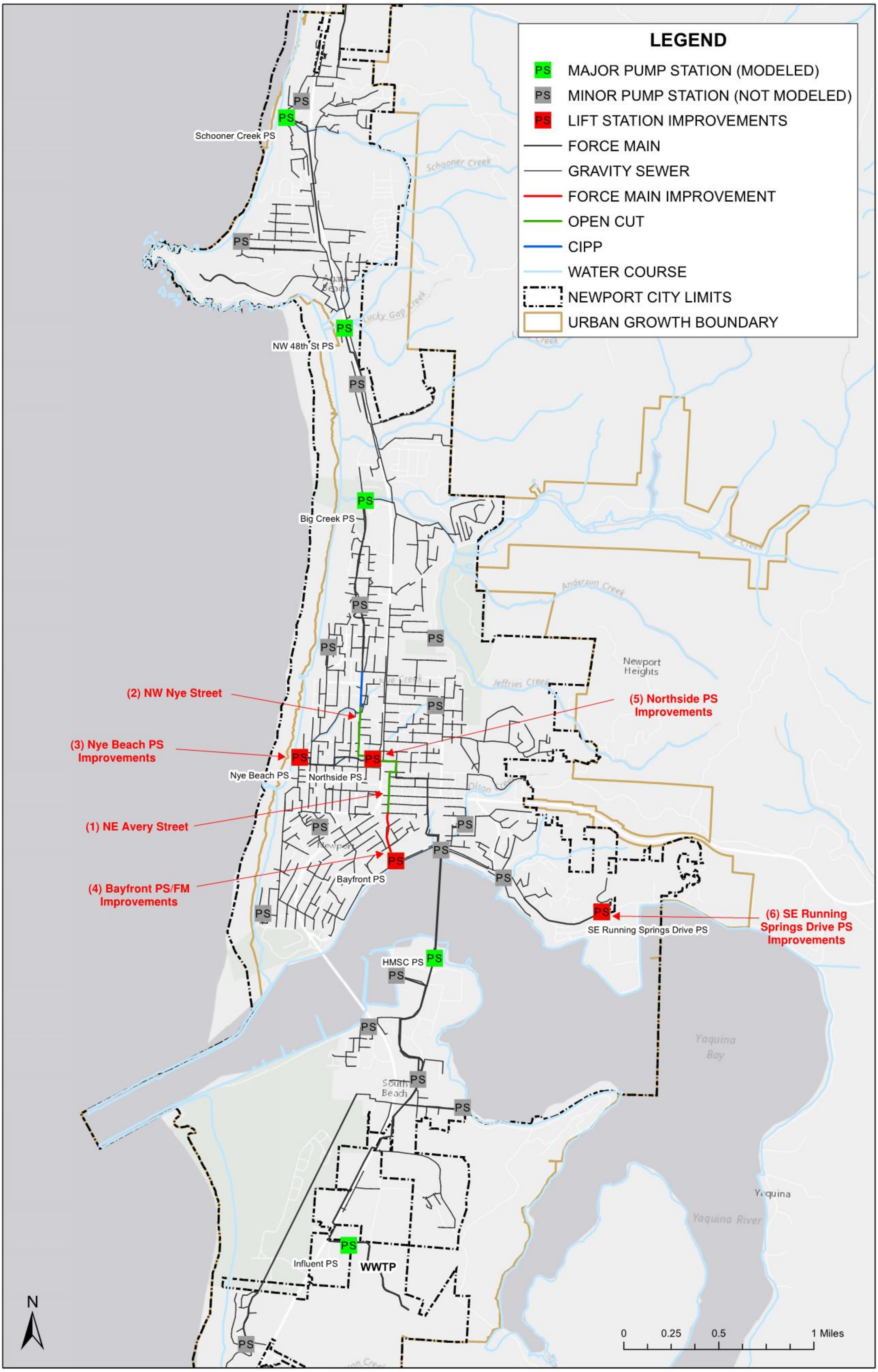

Figure 6-1. Capacity-based capital improvements summary

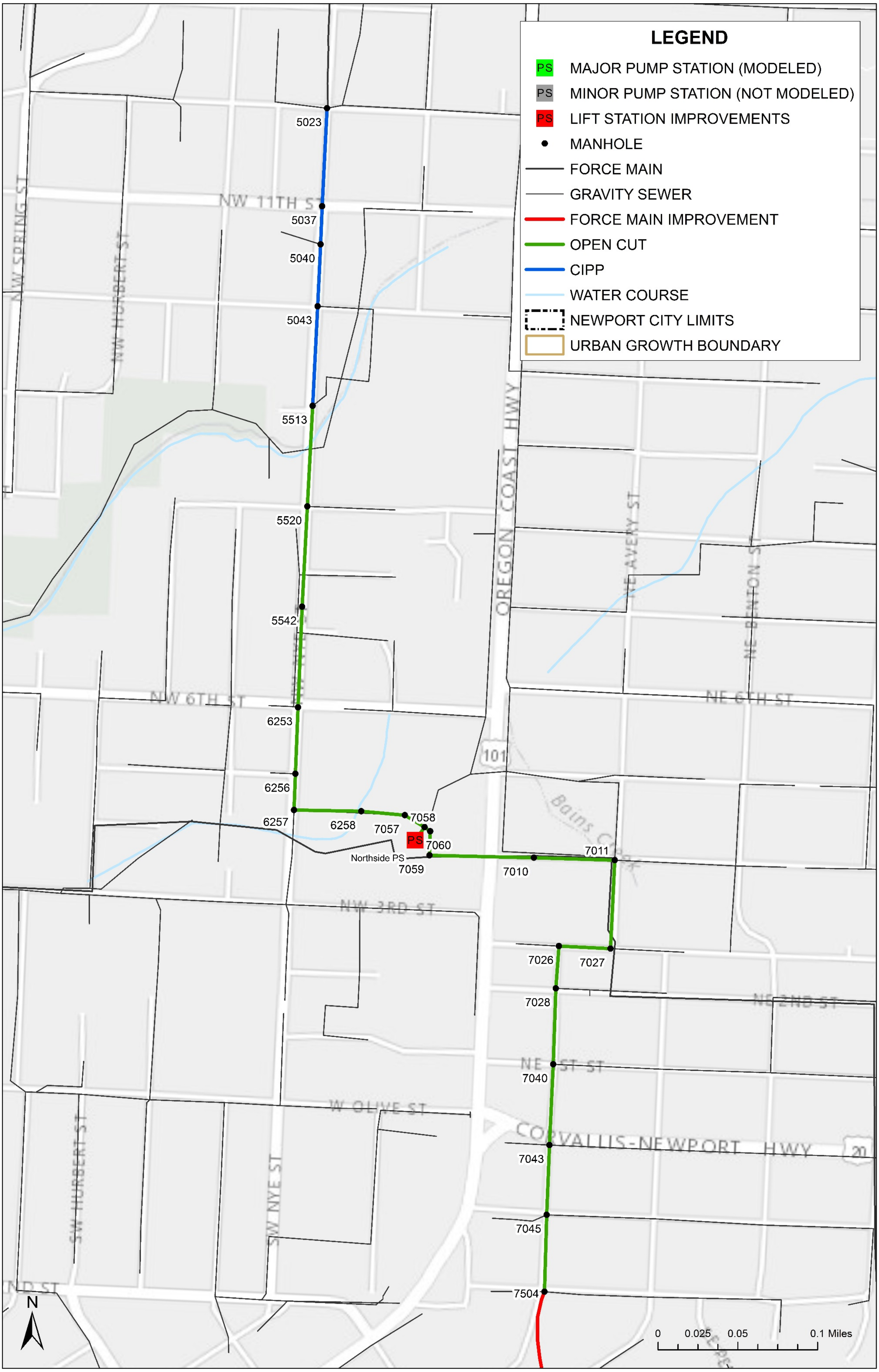

Figure 6-2. Capacity-based capital improvements: detailed view

6.2.2 Pump Station and Force Main Improvements

Four of the nine modeled pump stations were found to lack firm capacity for conveying the future buildout conditions peak flows: Nye Beach, Bayfront, Northside, and SE Running Springs. One pump station was identified to be at risk from unstable soil conditions.

One force main, Bayfront, will require upsizing—it is recommended that the pump station and force main be replaced at the same time to potentially benefit from economy of scale pricing, however, the City may want to postpone the installation of the new force main until later in the planning period once the buildout condition is met. Currently, that force main is appropriately sized but nearing the upper limit of acceptable peak velocities.

The HMSC force main appears to be undersized; however, flow is expected to be reduced in this area, which may mitigate concerns related to elevated force main velocities.

A summary of the costs required to provide the necessary improvements is listed in Table 6-2. Modeled design flow rates for sizing the pump stations and force mains are listed in Table 5-3. A breakdown of the pump station costs are included in Appendix H.

Table 6-2. Recommended CIPs: Existing PS and FM Improvements

PS	Description of improvement	Project number/name	Estimated cost of improvements, dollars [a]
Nye Beach	Upgrade PS firm capacity to 2.74 mgd	(3) Nye Beach	2,828,000
Bayfront	Upgrade PS firm capacity to 3.24 mgd	(4) Bayfront	3,224,000
Bayfront	Upgrade FM capacity to 14"	(4) Bayfront	490,000
Northside	Upgrade PS firm capacity to 9.2 mgd	(5) Northside	2,780,000
SE Running Springs Drive	Upgrade PS firm capacity to 0.27 mgd	(6) SE Running Springs Drive	1,178,000
SE Running Springs Drive	Realign 4" FM	(6) SE Running Springs Drive	330,000
NW 56th Street [b]	Study PS and upgrade	(7) NW 56th Street PS	1,347,000
Total all PS and FM improvements			11,357,000

a. Estimated costs include a 30% allowance for contingency, a 20% allowance for engineering design and administration, and a 25% allowance for contractor markups.

b. Not part of capacity-based upgrade criteria.

The City has one major pump station, Nye Beach, that uses a FM constructed partially of AC. EPA has identified asbestos as a hazardous material requiring special precautionary handling and disposal procedures. DEQ has developed a Fact Sheet with information about AC pipe—this Fact Sheet is provided in Appendix F.

6.2.3 Sewer Extensions

Sewer extensions are required to provide service to those areas that do not have City sewer service. Areas without sewer service include homes on septic systems, areas within the current UGB to be developed, and miscellaneous properties inside the city boundary that are not located near existing sewers.

Generally, sewer extensions are not funded by rates. Instead, most sewer extensions are funded by developers with potentially some of the costs being SDC-reimbursable. In areas of the city not currently connected to the sewer, Local Improvement Districts (LIDs) and special assessment districts may need to be formed to fund the projects. Developers and the general public who want more information on funding options should contact the City.

The following sections describe the sewer extension projects that the City anticipates.

New Development. The City has identified 20 areas for development in the 20-year and buildout conditions. A summary of these developments is provided in Table 2-2 and Figure 2-4. Fact sheets for these developments are provided in Appendix B.

Infill Development. The City maintains an Access database of parcels that are undeveloped, as shown in Figure 2-4.

Under the 20-year conditions, infill parcels were anticipated to be developed 30 percent. Because of the inability to distinguish between which parcels will be developed first, the flows were applied evenly across the northern portion of the collection system.

Under the buildout conditions, the flow was applied to the appropriate adjacent node in the collection system.

Septic Conversion. In the southern portion of the city, the Newport Municipal Airport and the Surfland neighborhood are currently served by a septic sewer system. The City plans on extending its sewer service out to the Surfland neighborhood and the Newport Municipal Airport.

A summary of the costs required to provide the necessary improvements is listed in Table 6-3.

Table 6-3. Recommended CIPs: Sewer Extension Improvements

Project	Description of improvement	Project no./name	Estimated cost of improvements, dollars [a]
Septic conversion	Construct new gravity system	(9) Surfland	4,620,000
	Construct new PS	(9) Surfland	1,000,000
	Construct new FM	(9) Surfland	612,000
Total all sewer extension improvements			**6,232,000**

a. Estimated costs include a 30% allowance for contingency and a 20% allowance for engineering design and administration.

A preliminary layout for the Surfland septic conversion is provided in Figure 6-3, below.

6.3 Continued Observation

The hydrologic/hydraulic (H/H) model identified sewers that are predicted to surcharge during the existing, 20-year, and buildout planning scenarios. The sewers experiencing surcharging are identified in Section 4 with a detailed list of all surcharged pipes included in Appendix C. Pipe upsizing is not recommended where there is at least 7 feet of freeboard below grade; this amount of surcharging was not deemed to be excessive because it typically does not result in basement backups or manhole flooding.

The H/H model assumes pipes are not restricted because of operational issues (e.g., I/I, debris, etc.) and have a consistent slope (i.e., do contain sags). It is recommended that the sewers identified with surcharging be observed during large wet-weather events to establish the maximum depth of water that occurs. If City staff observe water surface elevations that are higher than predicted by this SSMP, or deemed excessive by staff, then additional actions to alleviate the surcharging (e.g., CCTV inspection, maintenance, etc.) should be considered by the City.

Figure 6-3. Surfland septic conversion

6.4 Rehabilitation and Replacement Program

As a collection system ages, the structural and operational condition of the sewer system will decline as the number and type of defects in the piped system increase. If unattended, the severity and number of defects will increase along with an increased potential of sewer failure. Sewer failure is defined as an inability of the sewer to convey the design flow. It is manifested by hydraulic and/or structural failure modes. Hydraulic failures can result from inadequate hydraulic capacity in the sewer. Loss of hydraulic capacity can result from a reduction of pipe area because of accumulations of sediment, gravel, debris, roots, fats, oil, and grease, and structural failure. Also, a major loss of hydraulic capacity can be the result of excessive I/I or inappropriate planning for future growth that results in flows in excess of pipe capacity. Structural defects left unattended can lead to catastrophic failures such as pipe collapses and SSOs. Structural failures may start from common structural defects such as cracks, fractures, holes, corrosion, and joint separations. Both hydraulic and structural failures can have a significant negative impact on the community and the environment.

An R&R program is required to reduce the potential for sewer failures and to extend the useful life of the collection system. A proactive R&R program rehabilitates sewers prior to failure. Such a program extends the useful life of assets at minimum cost (since the cost of rehabilitation is typically half the cost of pipe replacement) and is even more economical when compared with the cost of repairing a failed sewer. The most frequently used sewer rehabilitation technologies are discussed in Appendix D.

The City should develop and implement an R&R program. It should be based on a sewer inspection and condition assessment program that assesses sewer and manhole condition. Sewer condition and other risk factors should be identified such that a priority ranking system is established for identifying the order in which sewers should be rehabilitated. The recommended system would be a risk-based approach for identifying when sewers should be rehabilitated. The risk-based approach considers the likelihood and consequences of sewer failure. The likelihood of sewer failure is based on the sewer's structural and hydraulic condition. The consequences of sewer failure are based on several factors, including emergency sewer repair costs, sewer location, environmental, and health impacts that could be realized should the sewer fail. A risk-based approach to implementing an R&R program helps ensure that capital dollars are spent where they will provide the greatest benefit.

The R&R program should be coordinated with the recommended sewer upsizing recommendations in this SSMP.

6.4.1 Inspection Program

The foundation of an R&R program is built on knowing the structural and operational condition of the collection system. EPA's proposed Capacity, Management, Operation, and Maintenance (CMOM) Program identifies a sewer inspection program as being an essential element of a proactive maintenance program and its complementary R&R program.

6.4.1.1 Pump Stations

The City currently conducts routine and limited pump station inspections. Because of the number of pump stations a comprehensive inspection is not possible given the current staffing. It is recommended that additional time, and if needed, additional staff be added to complete a thorough analysis of the condition and performance of pump stations. These inspections will provide useful information for identifying and prioritizing future pump station rehabilitation and/or replacement projects. An allowance for pump station inspections is included in the costs provided below.

In addition, force mains should be inspected given their lack of redundancy and high consequence of failure. Unlike gravity sewers, force main inspection technology costs can vary greatly depending on access, diameter, and material type. Progressive pigging, acoustic leak detection, and remote-field eddy current inspection are all tools that can be used while the force main is in operation and can be used to assess the condition of the force mains. These tools are relatively new and still somewhat expensive. A budgetary cost of $20/LF should be assumed for force main inspection. If a force main can be taken out of service, a lower cost CCTV inspection may be a good initial screening to determine if there are other issues, such as corrosion, pitting, holes, or leaks.

6.4.1.2 Gravity System

In 2015, the City developed an inspection program that systematically inspects its sanitary sewer collection system on a recurring 7-year basis. Because a majority of the City's system had not yet been inspected, the 2015 inspections included about 50,000 LF of pipe with the highest criticality (e.g., crosses under Highway 101, along the major spine of the system, etc.) but were not inspected in the last 5 years. In addition, pipes that are plastic (PVC or HDPE) were excluded from the initial inspections. The recurring 7-year program is meant to begin in 2016. Pipes inspected during 2015 can be excluded during the first cycle, from 2016 to 2018. For further detail on the location of the selected pipes for each year in the recurring cycle, see Figure 3-5. Programmatic recommendations are as follows:

- **2016**. Approximately 43,000 LF of sanitary sewers located west of U.S. Highway 101 between NW Olive Street and 21st Street. This group of pipes includes locations such as Newport Plaza, Nye Creek, Historic Nye Beach, and Wilson Square. The Nye Beach and North Side Pump Stations are also located within this group of pipes.
- **2017.** Approximately 40,000 LF of sanitary sewer located along U.S. Highway 101 and east between SE 2nd Street and NE 20th Street. This group of pipes contains locations such as U.S. Highway 20, Pacific Village, and Sea Towne.
- **2018.** Approximately 43,000 LF of sanitary sewers in SW Newport and includes locations such as Bay Bridge Retail District and City Center.
- **2019.** Approximately 42,000 LF of sanitary sewers located mainly in SE Newport with some pipes located in NE Newport as well. The pipes located in NE Newport are located east of Eads Street. Pipes in SE Newport include areas such as the Historic Bay front and the easternmost reaches of the sanitary sewer collection system.
- **2020.** Approximately 40,000 LF of sanitary sewers located in northern Newport. These pipes stretch north from Whaler's Village and Pacific Plaza to Lucky Gap. The Big Creek and 48th Street pump stations are located within this reach of pipes.
- **2021.** Approximately 41,000 LF of sanitary sewer in the northern end of Newport north of Lucky Gap Street. The group of pipes includes those around Schooner Creek pump station.
- **2022.** Approximately 31,000 LF of sanitary sewer located south of Yaquina bay.

Because this cycle does not account for any additional sewers that may be added to the City's sanitary sewer collection system, newer sewers can be added to the inspections in 2022 (which intentionally has a significantly smaller amount of footage than other years). This preliminary inspection cycle includes all sanitary sewers currently in the City's jurisdiction and is shown graphically in Figure 6-4. The total LF of sanitary sewer will be refined as the City continues to update its GIS database.

6.4.2 Condition Assessment

Once a sewer has been inspected, the observed defect information is used to assess both the structural and operational condition of the sewer. Both categories are important because a failure in either category can lead to sewer failure if the proper maintenance, repairs, and/or rehabilitation are not performed in a timely manner. For most sewer inspection and condition assessment processes, each observed defect is given a score or grade. The City uses the National Association of Sewer Service Companies' (NASSCO's) Pipeline Assessment and Certification Program (PACP), a widely accepted grading system. Each defect is assigned a grade ranging from 1 to 5, with 5 being the worst grade, as listed in Table 6-4. Then, PACP offers several ways of rating the condition of a sewer:

- Defect grade: The worst defect observed is used to grade the entire pipe. A pipe with one Grade 5 defect would be given a Grade 5 for either the structural or operational condition.
- Segment grade: The number of occurrences of each defect grade is multiplied by the value of the defect grade. For example, a sewer with two Grade 5 defects, and four Grade 4 defects, and no other defects would have a segment grade of 26. Some municipalities create a look-up table to convert the total conditional grade score into a 1 to 5 scale. Total grades are established for both the structural condition and operational condition.
- Pipe Rating Index (PRI): The segment grade is divided by the number of defect occurrences. Using the above example, the PRI would be 4.3 (26.0 divided by 6.0).

Table 6-4. Structural and Operational Condition Grades for Sewers

Condition grade	Grade description	Defect description	Structural condition grade implication	Operational condition grade implication
5	Immediate attention	Sewers requiring immediate attention	Collapsed or collapse imminent	Unacceptable infiltration or blockages; surcharging of pipe during high flow with possible overflows
4	Poor	Severe defects that will continue to degrade with likely failure in 5–10 years	Collapse likely in 5–10 years	Pipe at near surcharge condition during high flow; overflows still possible at high flows
3	Fair	Moderate defects that will continue to deteriorate	Collapse unlikely in near future; further deterioration likely	Surcharge or overflows unlikely but increased maintenance required
2	Good	Minor and few moderate defects	Minimal near-term risk of collapse, potential for further deterioration	Routine maintenance only
1	Excellent	No defects, condition like new	Good structural condition	Good operational condition

Figures 6-5 and 6-6 show the sewers that have been inspected to date (approximately 6 percent by length), along with the operational and structural condition grades. Grade 4 and 5 sewers should be the focus of the R&R program.

As additional inspections are performed and condition grades assigned, the City will develop a more complete and accurate understanding of existing pipe conditions. This information should be managed by the City with a computerized maintenance management system, GIS, or other software tool(s) so that the inspection information can be readily available to both engineering and maintenance staff. This condition information should be used for making informed decisions on the amount and type of maintenance that may be required and for identifying when to rehabilitate sewers and the type of rehabilitation such that the performance and condition of the collection system are maintained.

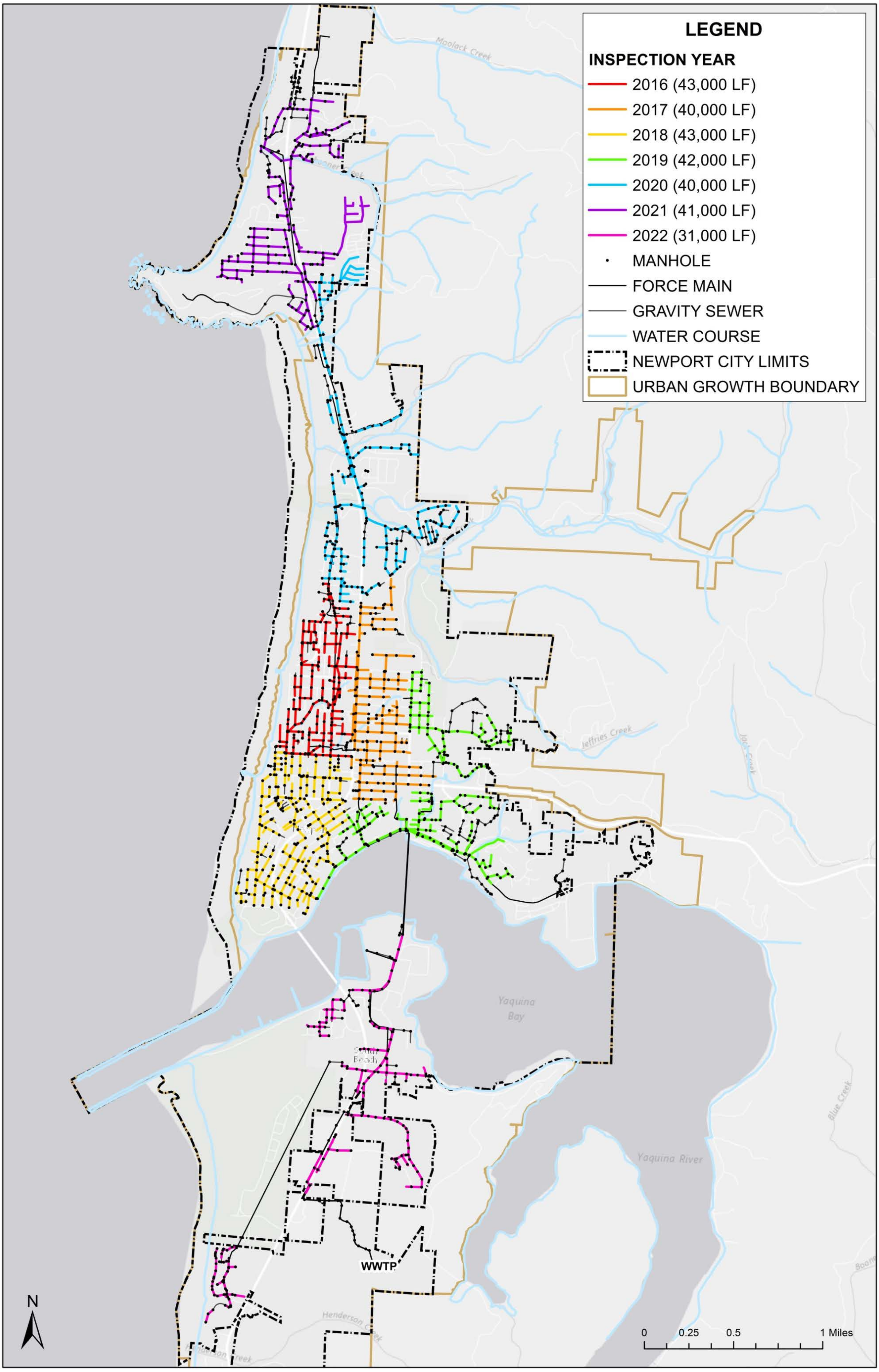

Figure 6-4. Sewer inspection program

Note: Inspection areas are from the City's 2015 Sewer Inspection Report. Project scope may change according to better available data.

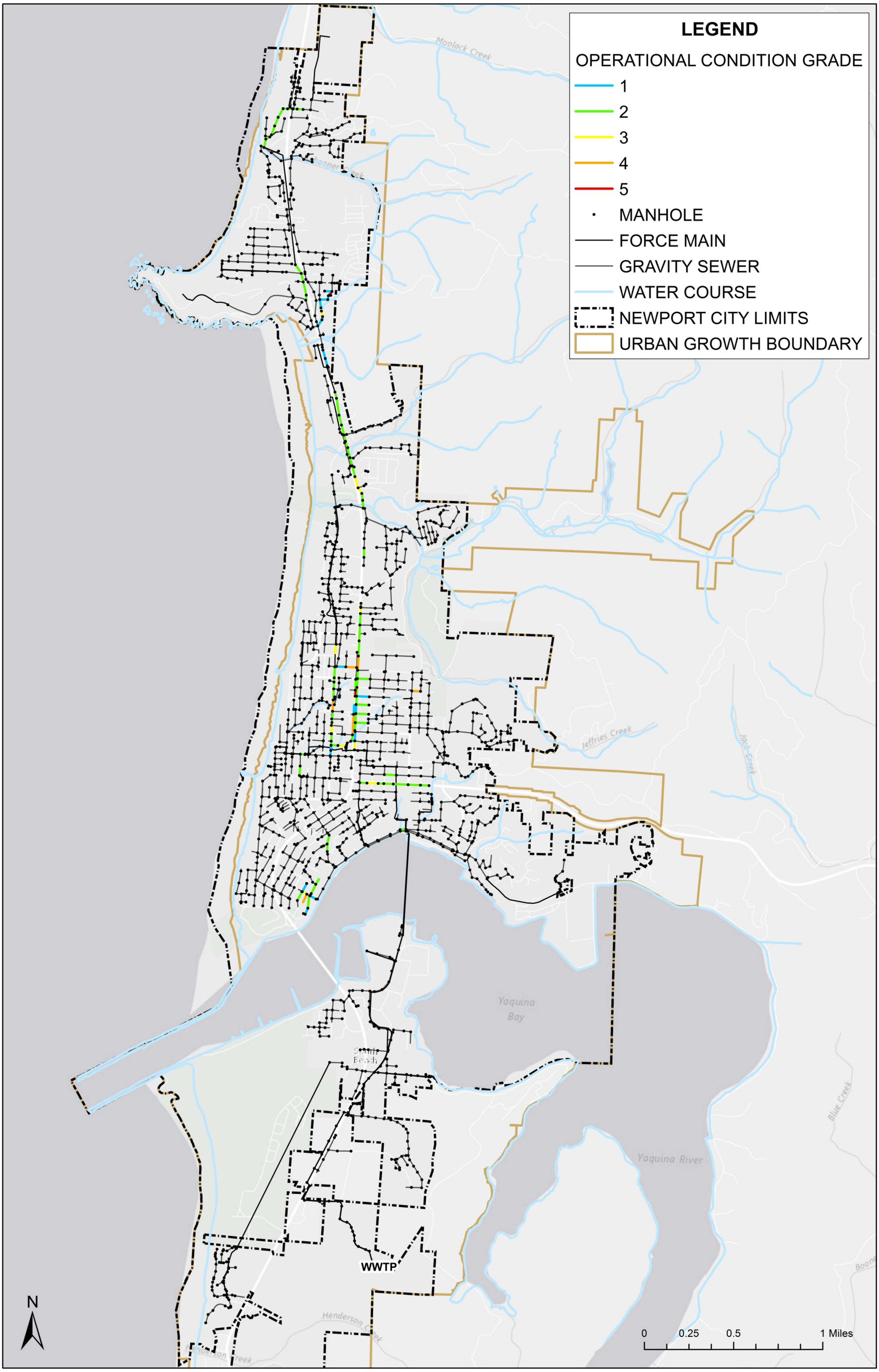

Figure 6-5. Inspection results: operational condition grades

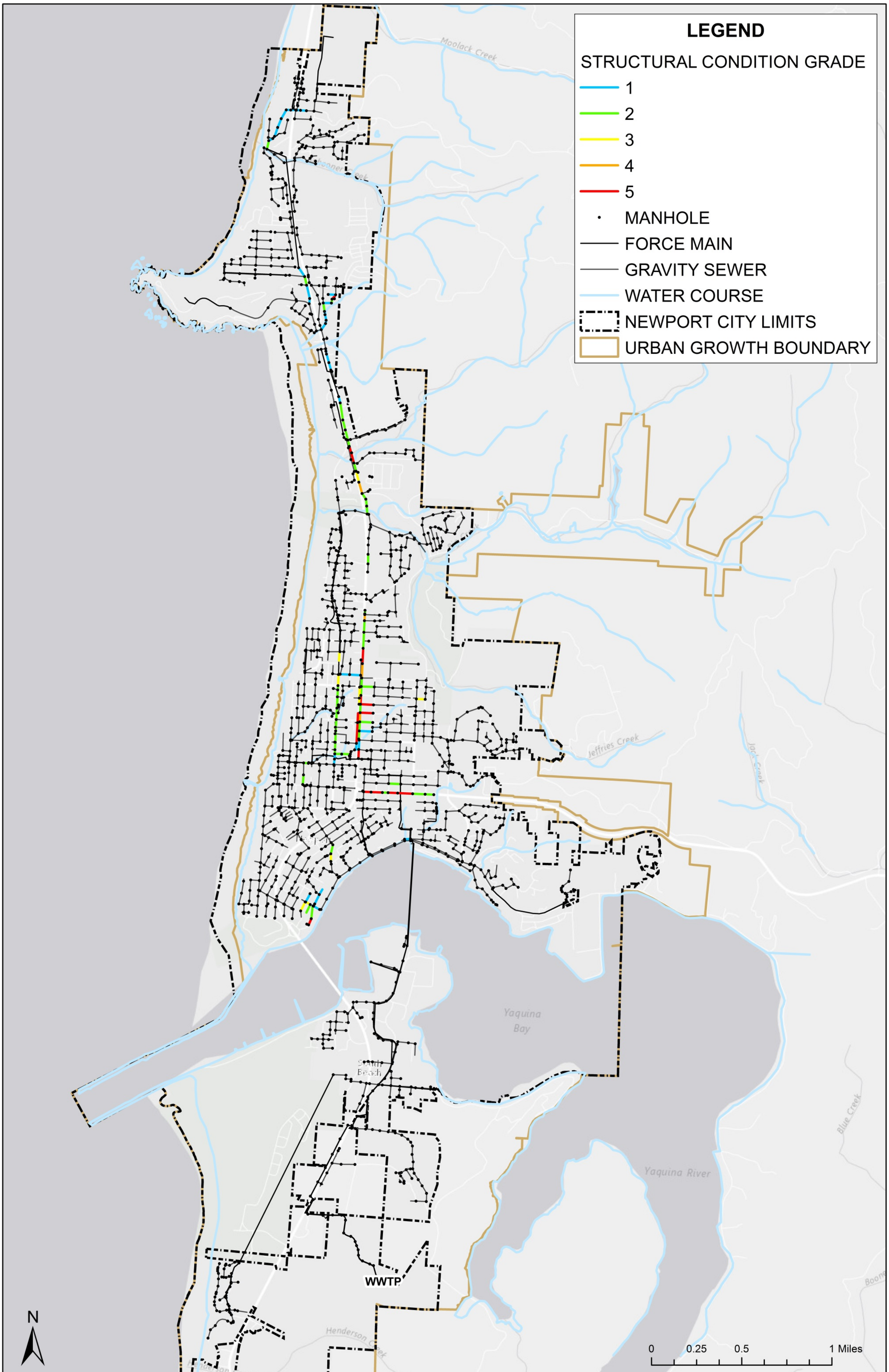

Figure 6-6. Inspection results: structural condition grades

6.4.3 Infiltration/Inflow Abatement

Reducing the amount of I/I in the collection system can improve the hydraulic capacity of the existing system such that some pipes may not need to be replaced to convey future flows. In addition, I/I reduction can help prevent some types of structural failures. Some cracked and broken sewers are the result of a condition called soil piping. Soil piping in this context is a loss of pipe bedding and backfill support because of small grain soil particles washing out of the supporting soils into the sewer as a result of infiltration at sewer cracks and separated joints. If these conditions are not addressed, sewers can fail, resulting in sinkholes, basement backups, and SSOs.

The I/I projects that come from the investigative work will include sewer R&R, service lateral replacement, and potentially the construction of new sanitary sewers.

Laterals must also be addressed for I/I control and to preserve structural integrity. In a program that addresses mains and laterals, laterals account for about 25 to 50 percent of the overall project cost depending on density of development. The City will need to determine how to fund lateral replacements. Many different lateral funding strategies are in use throughout the Pacific Northwest.

The purpose of the investigation is to determine if and where I/I can be removed from the system cost-effectively. For definition purposes, cost-effective I/I reduction is achieved when the cost of eliminating I/I from within a portion of a sanitary drainage basin is less expensive than improvements to the downstream conveyance and treatment systems. It is recommended that the City move forward with some of the recommended first steps of an I/I abatement program to gain additional understanding of I/I sources from within the city limits.

6.4.4 Rehabilitation and Replacement Program Implementation

The City should be implementing a repair and rehabilitation (R&R) program to address their aging collection system. While the focus of many R&R programs is to restore the structural integrity of existing sewers, such activities will also help reduce the amount of infiltration that finds its way into the collection system.

The City's GIS database identifies approximately 330,000 LF of gravity sanitary sewer. From the first 2 years of CCTV inspection, approximately 10 percent of the inspected pipes were rated as Grade 5 and an additional 4 percent of the inspected pipes were rated as Grade 4. The remaining inspected sewers were Grade 3, 2, 1 pipes. For the purposes of a high level R&R plan, it is assumed that Grade 5 pipes need to be open-cut replaced and Grade 4 pipes can be addressed through a combination of spot repairs and trenchless technologies such as pipe-bursting or cured-in-place lining. It is also assumed that Grade 3, 2, and 1 pipes will continue to deteriorate but if the City continues with their recurring inspection program, Grade 3, 2, and 1 pipes that become Grade 4 pipes can be addressed using the lower cost trenchless technologies. Since the City's system is approximately 50 years old and assuming that the useful life of a sanitary sewer is 100 years, once all Grade 5 and 4 pipes are addressed, the R&R program should address the remaining Grade 3, 2, and 1 sewers such that 2 percent is replaced or rehabilitated each year. The cost for R&R of force mains assumes replacement of all force mains over the next 50 years.

Most sewer rehabilitation technologies, including cured-in-place-pipe and pipe-bursting, are less expensive than complete replacement costs. The R&R program costs are based on an assumed $250 per LF for Grade 5 pipes, and $150 per LF for Grade 4 pipes. This assumption assumes that Grade 5 pipes will require open-cut replacement and that Grade 4 pipes will be through a combination of spot repairs and trenchless technologies.

The City should budget approximately $1M per year in 2016 dollars to the R&R program, assuming that 2 percent of its system per year will be rehabilitated. Table 6-5 presents a more detailed breakdown of the recommended R&R implementation strategy. The assumption that 2 percent will be rehabilitated is an approximate estimate based on information gathered from existing condition assessment information.

Years 1 through 16 should focus on the most severely deteriorated sewers, the Grade 5 sewers identified by the closed-circuit television (CCTV) inspections. The less deteriorated Grade 4 sewers should be addressed during years 5 through 16. As future inspections are conducted, additional Grade 4 and Grade 5 sewers will be identified. The LF listed in Table 6-8 for the unknown (i.e., yet to be inspected) Grade 4 and 5 sewers are estimated based on the distribution of grades for sewers inspected to date. These sewers are identified for R&R during years 1 through 16. The future inspections may find that the actual LF for each grade may vary from these projections. Also, the City should anticipate that additional R&R will be required in the future as the collection system ages.

Table 6-5. Costs for Recommended R&R Program Activities

Work item	R&R pipe, LF	2016 – 2031 R&R activities, 2016 dollars			
		2016 - 2019	2020 - 2023	2024 - 2027	2028 - 2031
Grade 5 (known)	4,990	$1,248,000	-	-	-
Grade 4 (known)	2,395	$359,000	-	-	-
Grade 5 (assumed)	22,954	$1,081,000	$2,329,000	$2,329,000	-
Grade 4 (assumed)	11,017	$311,000	$671,000	$671,000	-
Grade 1, 2, or 3(a)	288,644	-	-	-	$3,464,000
Force Mains(b)	46,500	$930,000	$930,000	$930,000	$930,000
Total Cost		$3,929,000	$3,930,000	$3,930,000	$4,394,000
Annual Cost		$982,000	$983,000	$983,000	$1,099,000

a. *Over time, pipes that are currently grade 1, 2, or 3 will escalate to being a Grade 4 pipe. It is estimated that the City will need to rehabilitate 2% of current Grade 1-3 pipes to maintain a sustainable inspection program. This is an estimated value; It is recommended that the City continues to evaluate the results of their inspection program to determine a refined R&R rate.*

b. *The force main R&R scope does not include the cost of replacing the Big Creek FM, NW 48th St FM, or Schooner Creek FM. These force mains were recently evaluated as part of the Agate Beach Improvement Project. In addition, the Northside, SE Running Springs Dr, and Bayfront force mains were excluded, as they are included as individual CIPs.*

Some of the pipe R&R projects may overlap with the sewers recommended for replacement due to hydraulic deficiencies. In addition, the R&R program should be structured to address the structurally- and operationally-deficient sewers including those sewers with excessive I/I. Table 6-8 does not include costs to construct new sanitary sewers to support downspout, foundation drain disconnects, or laterals.

Other factors that affect cost include level of data analysis to be performed, time of year that inspections are performed, and how much work is done in-house versus using outside consultants. Note that the City's existing CCTV program is included in this category. Table 6-6 also includes pump station inspections, as noted from above and rehab and rehabilitation costs for City selected minor pump stations. Tables 6-5 and 6-6 present annual known and assumed costs.

Table 6-6. Per Annum Costs for Recommended I&I Investigative Activities			
Work item	Quantity	Assumptions	Annual estimated cost, 2016 dollars
CCTV inspections	47,000 LF per year	7-year inspection cycle. Assume an average of $2.50/LF	117,500
Pump station inspections	25 total	Inspect pump stations (excluding SE 3rd Street PS), with smaller stations costing $10,000 and larger stations costing $20,000. Assume an average of $15,000/station.	15,000
Force main inspections	9,300 LF per year	7-year inspection cycle. Assume an average of $20/LF.	186,000
Minor PS R/R Program	20 years	A schedule should be established to conduct these improvements on an annual basis. Priority pump stations include, but are not limited to: • Embarcadero PS • SW Minnie St PS • Bayfront PS • NE 10th St PS	200,000
Total			**518,500**

6.5 System Development Charges

The purpose of the SDC is twofold: (1) to promote equity between new and existing customers, and (2) to provide a source of revenue to fund capital projects. An SDC refers to a one-time charge imposed on new customers as a condition of connection to the utility system.

SDC revenues provide a source of cash flow used to support utility capital needs; revenue can be used only to fund utility capital projects or pay debt service incurred to finance those projects.

In the absence of an SDC, growth-related capital costs would be borne in large part by existing customers. In addition, the net investment in the City's Sanitary Sewer Utility (Utility) already collected from existing customers—whether through rates, charges, and/or assessments—would be diluted by the addition of new customers, effectively subsidizing new customers with prior customers' payments.

To establish equity, an SDC should recover a proportionate share of the existing and future infrastructure costs from a new customer. From a financial perspective, a new customer should become financially equivalent to an existing customer by paying the SDC.

The City calculates the percent of a project funded by SDCs as follows:

$$Percent\ of\ Project\ Funded\ by\ SDCs = 100 * \frac{Future\ Peak\ Flow - Current\ Peak\ Flow}{Additional\ Capacity\ Required}$$

Table 6-7 provides a list of the CIP projects, related to capacity-based criteria, and their associated SDC funding amounts.

Table 6-7. CIP Projects: SDC Funding								
Project number	Description of improvement [a]	Current capacity, mgd	Current peak flow, mgd	Future peak flow, mgd	Additional capacity required, mgd	Percent of project funded by SDCs, %	Total project costs, $M	Costs funded by SDCs, $M
1	NE Avery Street	1.24	3.17	3.28	2.04	5.4	1.232	0.067
2	NW Nye Street	1.91	3.18	3.34	1.43	11.2	1.138	0.127
3	Nye Beach PS	2.00	2.67	2.74	0.07	9.5	2.828	0.269
4	Bayfront PS and FM	1.70	2.34	2.59	0.89	28.1	3.714	1.040
5	Northside PS	8.50	8.00	9.20	0.70	100.0	2.780	2.780
6	SE Running Springs Drive PS and FM	0.22	0.05	0.27	0.05	100.0	1.178	1.178

a. SE 3rd Street PS and NW 56th Street PS projects are not a capacity-based upgrade; thus, they are expected to not impact SDC charges.

6.6 CIP Implementation Schedule

The improvement projects recommended in the previous sections are summarized in Table 6-8, below. The project locations are shown in Figures 6-1 and 6-2. The anticipated years for performing the work are also shown in the recommended CIP tables. The City reserves the right to modify the priority based on flow conditions and funding.

Table 6-8. Cost of Recommended CIPs and Implementation Schedule				
Project number	Project name	Project description	Year completed	Estimated cost of improvements, 2016 dollars [a]
Gravity Sewer Improvements				
1	NE Avery Street	Upsize gravity sewer from the Bayfront FM to the Northside PS	5–10	1,230,000
2	NW Nye Street	Upsize and rehabilitate gravity sewer from the Big Creek FM to the Northside PS	1–5	1,140,000
Total all gravity sewer improvements				**2,370,000**
Major PS and FM Improvements				
3	Nye Beach PS	Upgrade PS firm capacity to 2.74 mgd	1–5	2,828,000
4	Bayfront PS	Upgrade PS firm capacity to 2.59 mgd	1–5	3,224,000
4	Bayfront PS	Upgrade FM to 14" diameter	1–5	490,000
5	Northside PS	Upgrade PS firm capacity to 9.2 mgd	5–10	2,780,000
5	Northside FM	A conservative cost estimate was assumed from previously chosen alternatives	5–10	1,500,000
6	SE Running Springs Drive PS	Upgrade PS firm capacity to 0.27 mgd	5–10	1,178,000
6	SE Running Springs Drive FM	Upgrade FM to 14" diameter	5–10	330,000
7	SE 3rd Street PS	Replace PS with a gravity line extending to SE 4th Street	10–15	310,000
7	NW 56th Street PS	PS is located in a geologically unstable area; conduct alternative analysis and implement project solution	10–15	1,347,000
Total all PS and FM improvements				**13,987,000**

Table 6-8. Cost of Recommended CIPs and Implementation Schedule

Project number	Project name	Project description	Year completed	Estimated cost of improvements, 2016 dollars [a]
Sewer Extension Improvements				
8	Surfland Septic Conversion	Construct new gravity system	15–20	4,620,000
8	Surfland Septic Conversion	Construct new PS	15–20	1,000,000
8	Surfland Septic Conversion	Construct new FM	15–20	612,000
Total all sewer extension improvements				**6,232,000**
Other Improvements				
9	Maintenance Program	Conduct a study to establish a cleaning schedule for sewer mains; currently the City has 19 sewer mains identified for regular cleaning.	1–5	20,000
10	Re-route building crossings	Re-route sewer mains that cross under buildings including: • Gravity system just east of NW Nye Street, north of NW 12th Street • Sewer main under Washington Federal Bank, 505 N Coast Highway (SSMH 7003 to 7002 to 7061) • Sewer main under house at 1819 NW Crestview Place (SSMH 4774 to 4787) • Sewer main under house at 270 SE Penter Lane (SSMH 7531 to 7533) The sewer main under the Newport Fire Station, 245 NW 10th Street (SSMH 5045 to 5518) will be addressed by the Nazarene Church Sewer Replacement project and is not included in this cost	10–15	760,000
Total all other improvements				**780,000**
Annual R&R Costs				
11	Sewer R&R Program (excluding PSs)	Rehabilitate sewers and FMs based on R/R implementation plan. Target Grade 5 and 4 sewers[b].	Annual	1,011,750
12	Inspection Program	Inspect 47,000 LF of gravity pipe per year	Annual	117,500
12	Inspection Program	Inspect 9,300 LF of force mains per year		186,000
12	Inspection Program	PS inspection program	Annual	15,000
13	Minor PS R&R Program	A schedule should be established to conduct these improvements on an annual basis. Priority PSs include, but are not limited to: • Embarcadero PS • SW Minnie Street PS • San Bay-O PS • NE 10th Street PS	Annual	200,000
Total all annual costs[b]				**1,530,000**
Total of 20-year CIP (without annual R&R costs, no inflation)				**23,369,000**
Total of 20-year CIP (with annual R&R costs, no inflation)				**53,969,000**

a. *Estimated costs include a 30% allowance for construction contingencies and a 20% allowance for engineering design and administration. PS costs include a 25% allowance for contractor markups. See Appendix E for unit cost tables—assumes a depth of 10' per cost condition 2 for gravity and sewer extensions.*

b. *Costs associated with this part of the CIP program are based on existing inspection data which was used to generate an assumed percent of the total system that will require R/R in the future. This approach assumes that existing Grades 2-4 will become Grade 5 or that new Grade 5 will be identified in later inspections, thus needing repair within 5-years of identifying. This approach carries some risk for pipes yet to be inspected, where Grade 5 pipe may currently exist in areas that will not be targeted for many years; thus, failure could prematurely occur and require emergency repairs. An alternate approach for consideration would be to complete a comprehensive inspection of the entire system and establish a more accurate understanding of Grade 5 deficiencies so that the plan can be revised to reflect actual versus assumed conditions. This approach may require more upfront costs, but has the potential of reducing future expenditures as the planning period advances.*

Table 6-9 presents the estimated costs for recommended CIPs based on 5-year periods. Annual averages for each category have been provided for quick reference. Increased spending, beyond the yearly average, is expected to be needed for the early phased planned projects.

Table 6-9. Estimated Annual Costs for Recommended CIPs, 5-year Periods			
Year completed	Planned project costs, per period, 2016 dollars	Annual R&R costs, per period, 2016 dollars	Total costs, per period, 2016 dollars
1–5	7,702,000	7,651,000	15,351,000
6–10	7,778,000	7,651,000	15,427,000
11–15	1,657,000	7,651,000	9,306,000
16–20	6,232,000	7,651,000	13,881,000
Average (per year)	1,168,000	1,530,200	2,697,800

Section 7

Limitations

This document was prepared solely for the City of Newport in accordance with professional standards at the time the services were performed and in accordance with the original contract between the City of Newport and Brown and Caldwell dated November 27, 2013, and as amended thereafter. This document is governed by the specific scope of work authorized by the City of Newport; it is not intended to be relied upon by any other party except for regulatory authorities contemplated by the scope of work. We have relied on information or instructions provided by the City of Newport and other parties and, unless otherwise expressly indicated, have made no independent investigation as to the validity, completeness, or accuracy of such information.

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Appendix A: Hydrologic/Hydraulic Model

The DVD provided herein contains the hydrologic/hydraulic models that were developed for the SSMP. The DVD includes EPA SWMM software to be used for viewing the information.

Appendix B: Future Development Areas

Appendix B contains Figure B-1. Future development for 20-year and build-out conditions, followed by detailed fact sheets of each development area.

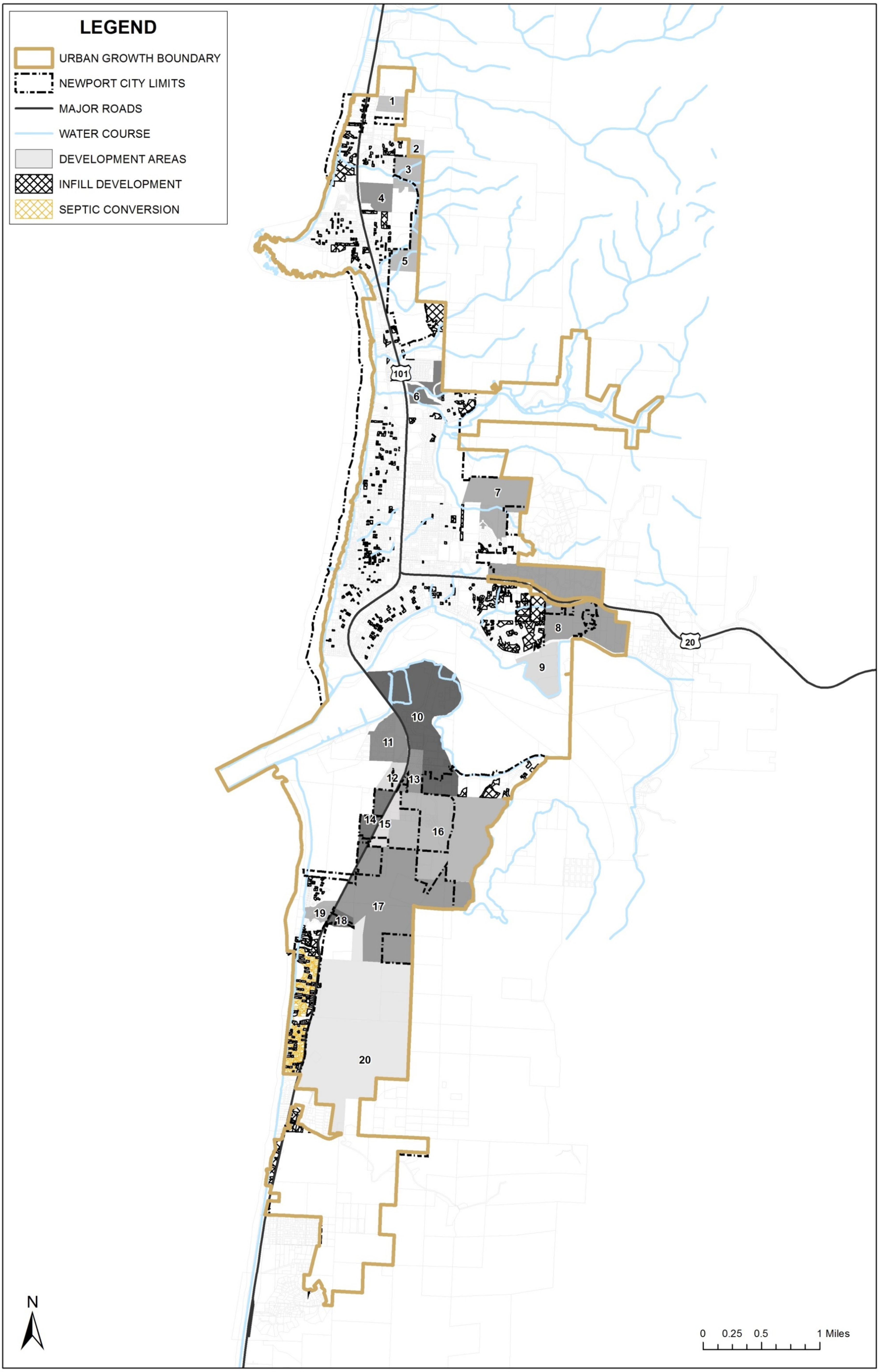
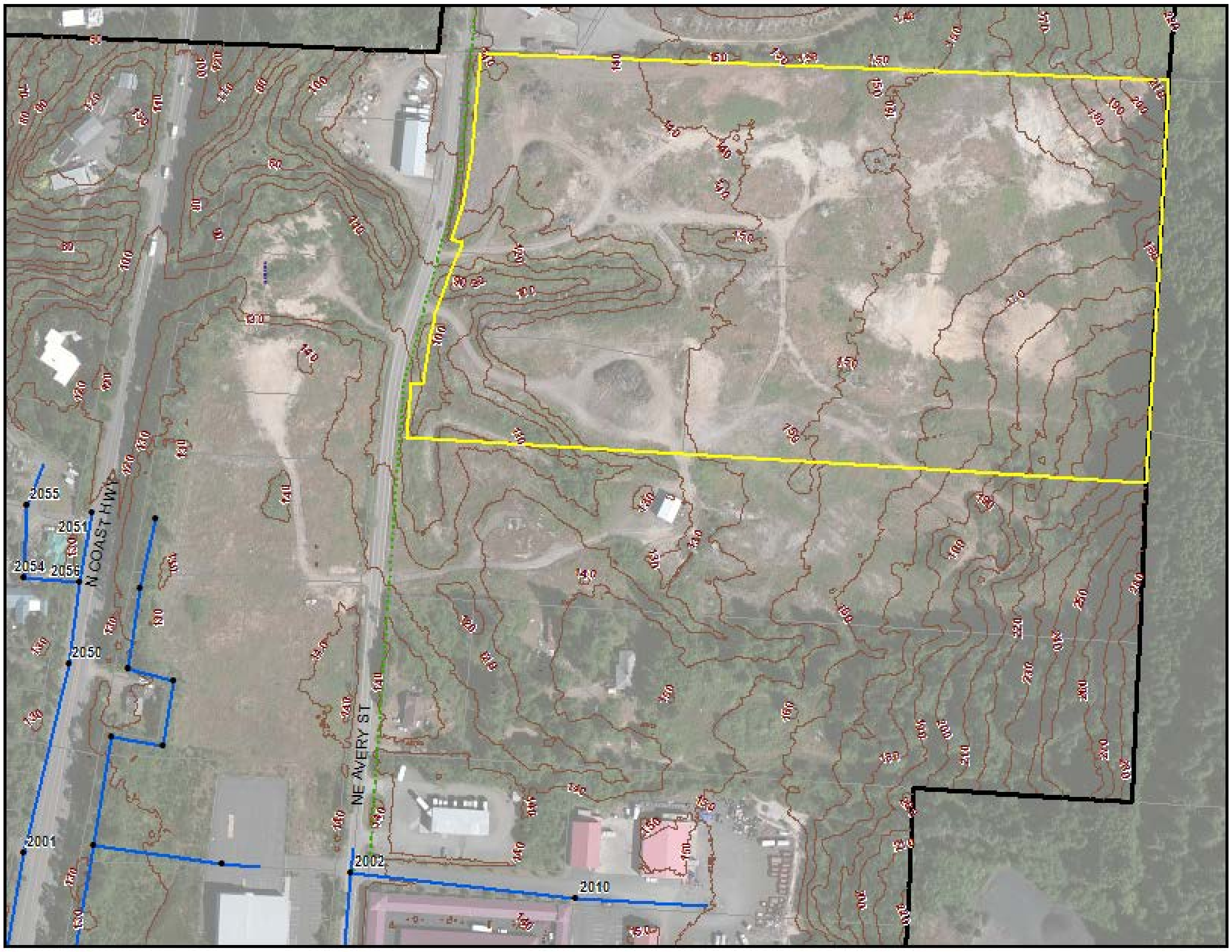


Figure B-1. Future development for 20-year and build-out conditions



Development ID: #1

Project Description

- A 30 acre light industrial development is expected to occur at NE Avery Street, just north of NE 73rd Street.
- Future development conditions were analyzed with the assumption that flow would be added to the system at MH 2002.

20-year and Build-out Development Conditions			
Development	New dwelling units	Flow, gpd	I/I
20-year development conditions			
• 30 acre light industrial development	0	60,000	30,000
Buildout development conditions			
No additional development is expected in buildout development conditions.	0	0	0

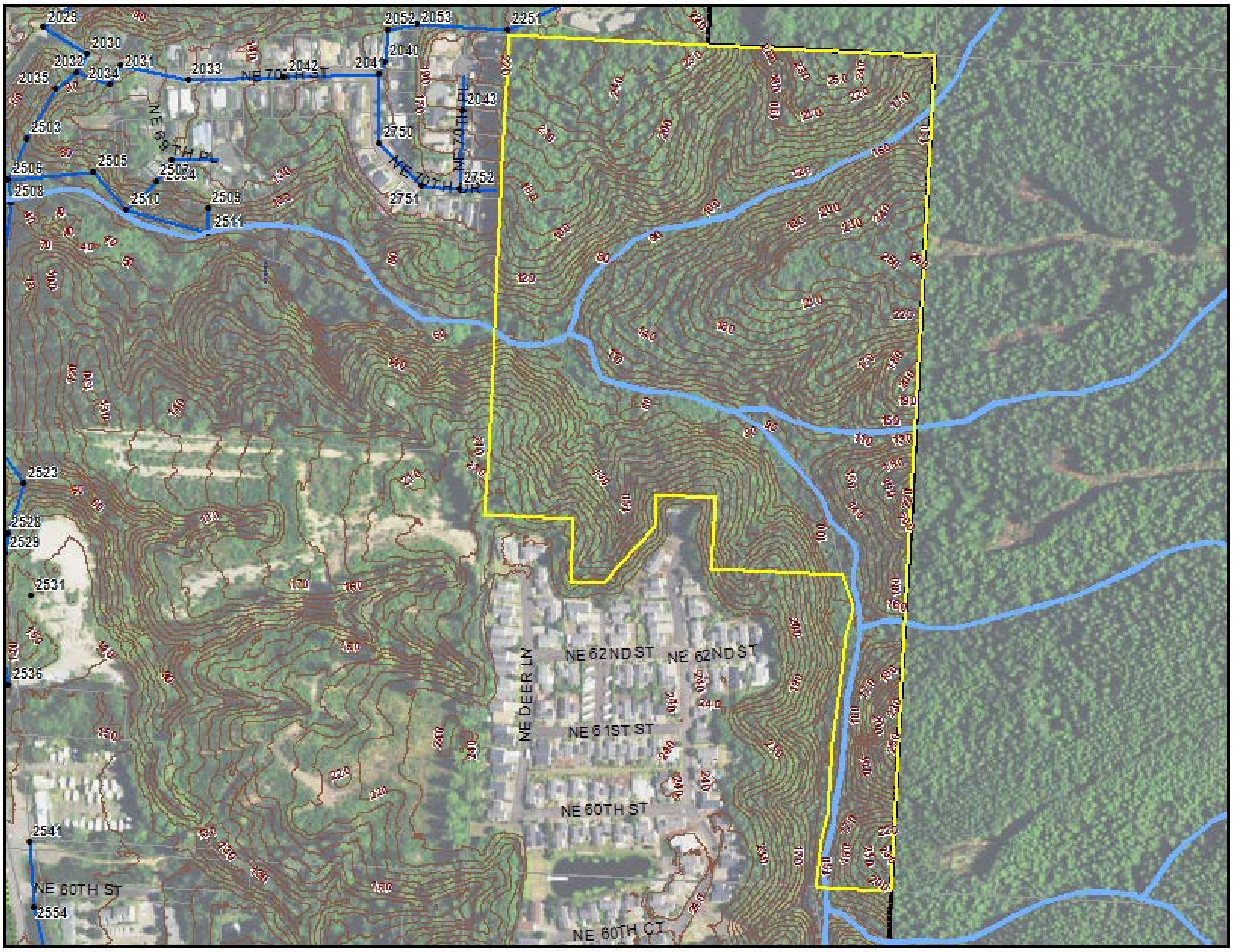
Brown AND Caldwell

Development ID: #2

Project Description

- A 6 acre annexation for a 48-unit assisted living facility is expected to occur to the east of NE 71st St and NE Echo Ct.
- Future development conditions were analyzed with the assumption that flow would be added to the system at MH 2024.

20-year and Build-out Development Conditions			
Development	New dwelling units	Flow, gpd	I/I
20-year development conditions			
• 6 acre annexation for 48 unit assisted living facility	0	4,800	4,800
Buildout development conditions			
No additional development is expected in buildout development conditions.	0	0	0



Development ID: #3

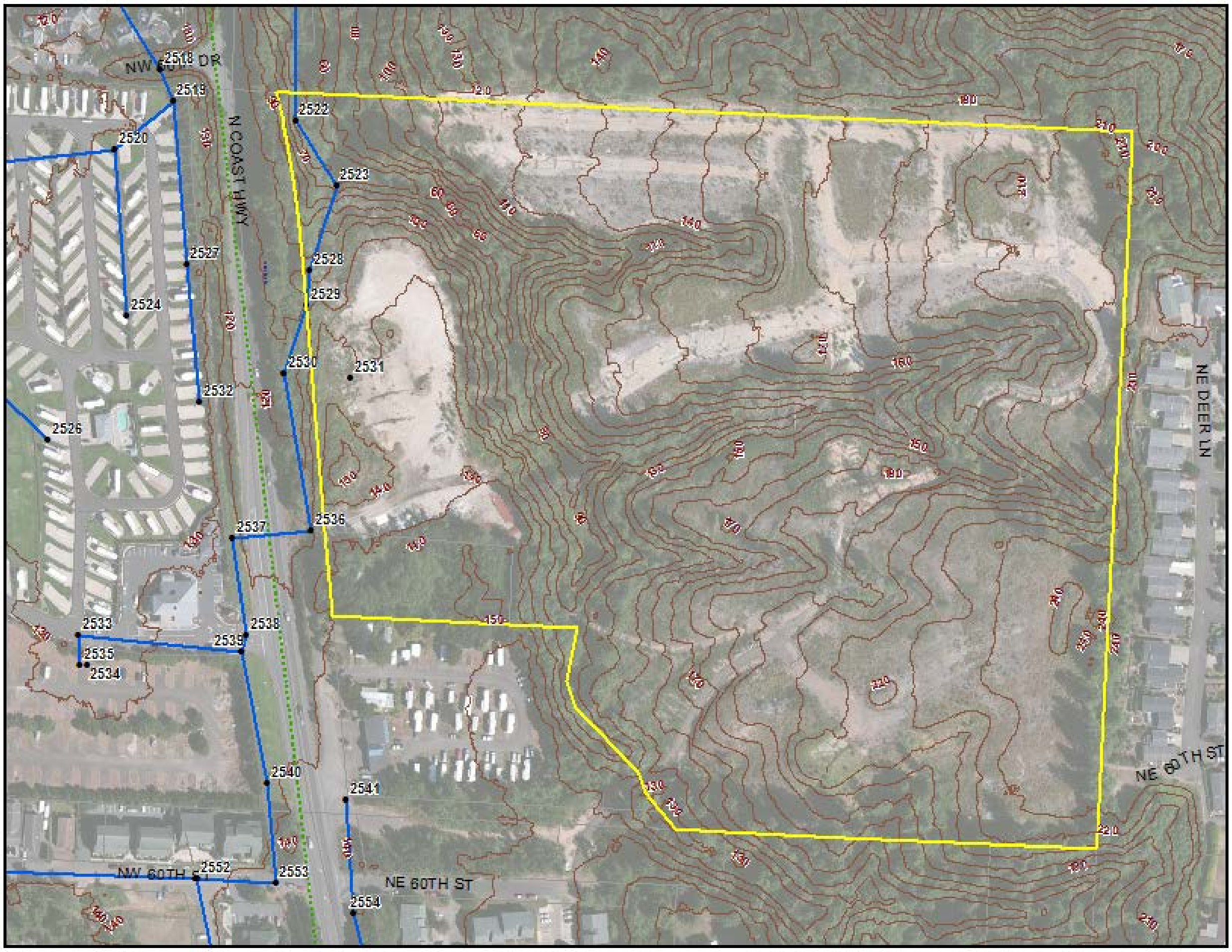
Project Description

- A 100-unit low-density residential development is expected to occur northeast of NE 62nd St and NE Deer Ln.
- Future development conditions were analyzed with the assumption that flow would be added to the system at MH 2024.

20-year and Build-out Development Conditions			
Development	New dwelling units	Flow, gpd	I/I
20-year development conditions			
• 50 low-density residential units[a, b]	50	10,950	10,000
Buildout development conditions			
• 50 low-density residential units[a, b]	50	10,950	10,000

a. *An average of 2.19 people per household was assumed.*

b. *Development densities specified in the NMC were used to determine the number of dwellings per acre. LDR = 5 dwellings per acre, MDR = 10 dwellings per acre, HDR = 10 dwellings per acre.*



Development ID: #4

Project Description

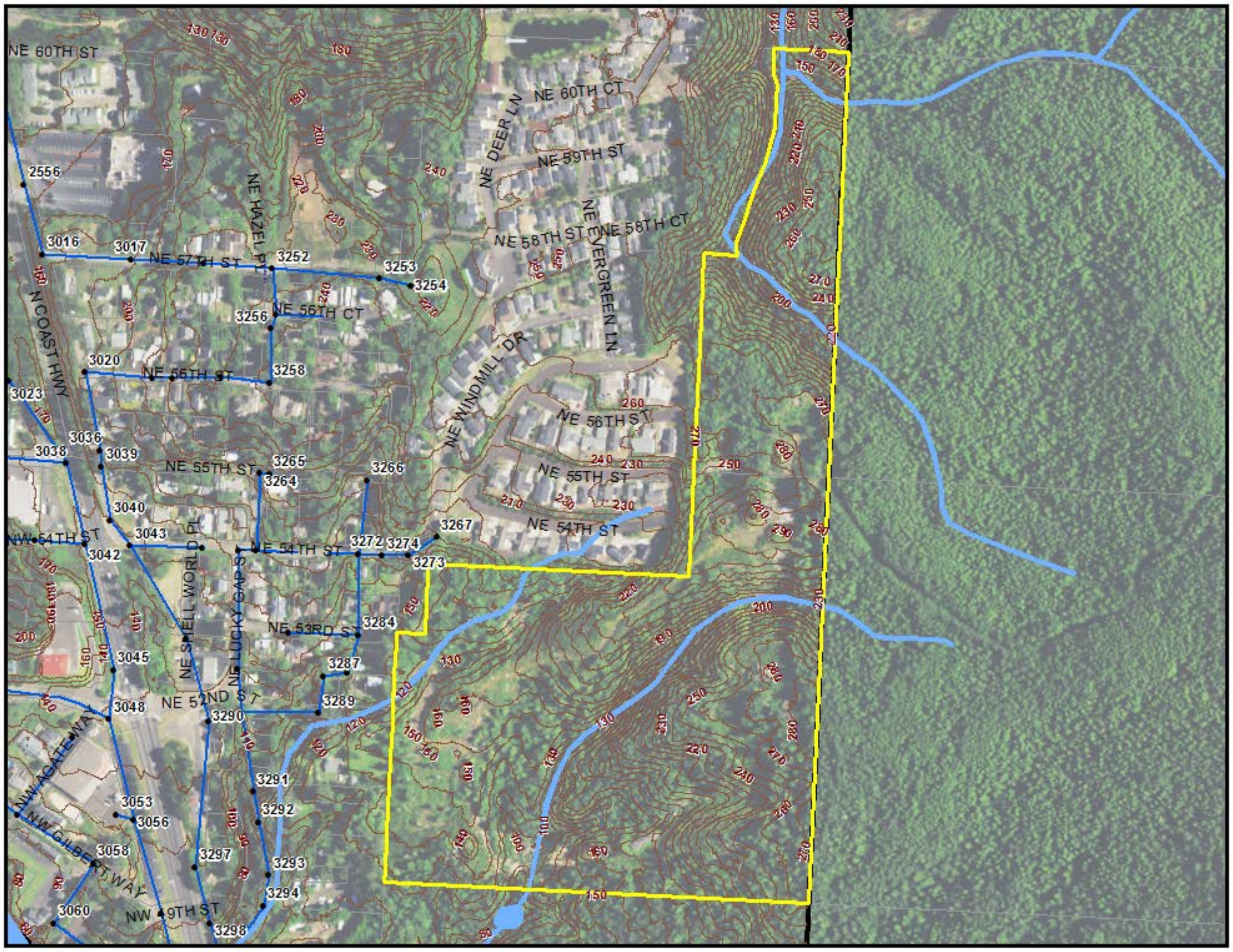
A 120 unit assisted living facility and a 170 unit medium-residential development is expected to occur west of Hwy 101, just north of NE 60th St.

Future development conditions were analyzed with the assumption that flow would be added to the system at MH 2024.

20-year and Build-out Development Conditions			
Development	New dwelling units	Flow, gpd	I/I
20-year development conditions			
• 120 unit assisted living facility • 170 medium-density residential units[a, b]	170	49,230	29,000
Buildout development conditions			
No additional development is expected in buildout development conditions.	0	0	0

a. *An average of 2.19 people per household was assumed.*

b. *Development densities specified in the NMC were used to determine the number of dwellings per acre. LDR = 5 dwellings per acre, MDR = 10 dwellings per acre, HDR = 10 dwellings per acre.*



Development ID: #5

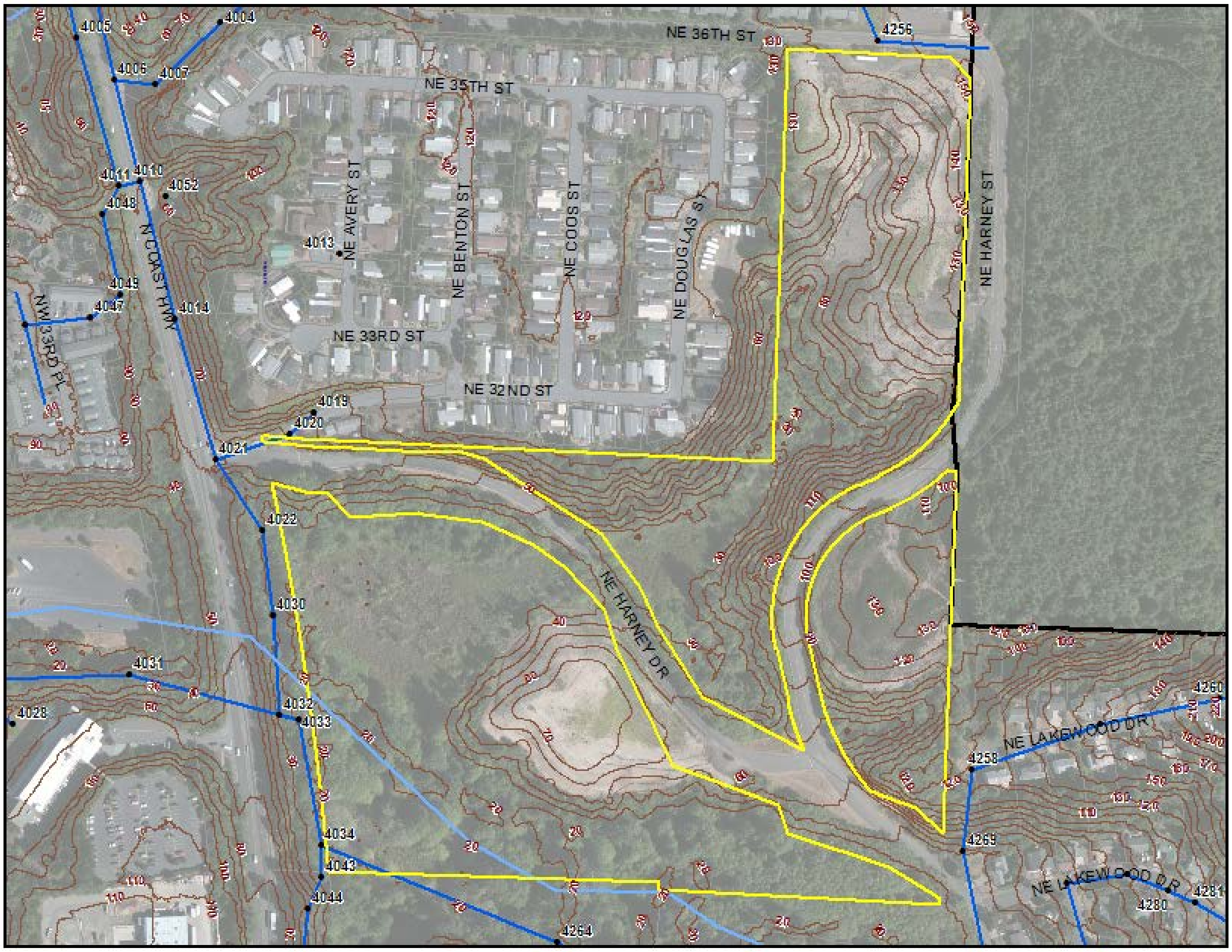
Project Description

A 100 unit low-density residential development is expected to occur east of NE Windmill Dr, between NE 60th Ct and NW 49th St. Future development conditions were analyzed with the assumption that flow would be added to the system at MH 3295.

20-year and Build-out Development Conditions			
Development	New dwelling units	Flow, gpd	I/I
20-year development conditions			
• 50 low-density residential units[a, b]	50	10,950	10,000
Buildout development conditions			
• 50 low-density residential units[a, b]	50	10,950	10,000

a. *An average of 2.19 people per household was assumed.*

b. *Development densities specified in the NMC were used to determine the number of dwellings per acre. LDR = 5 dwellings per acre, MDR = 10 dwellings per acre, HDR = 10 dwellings per acre.*



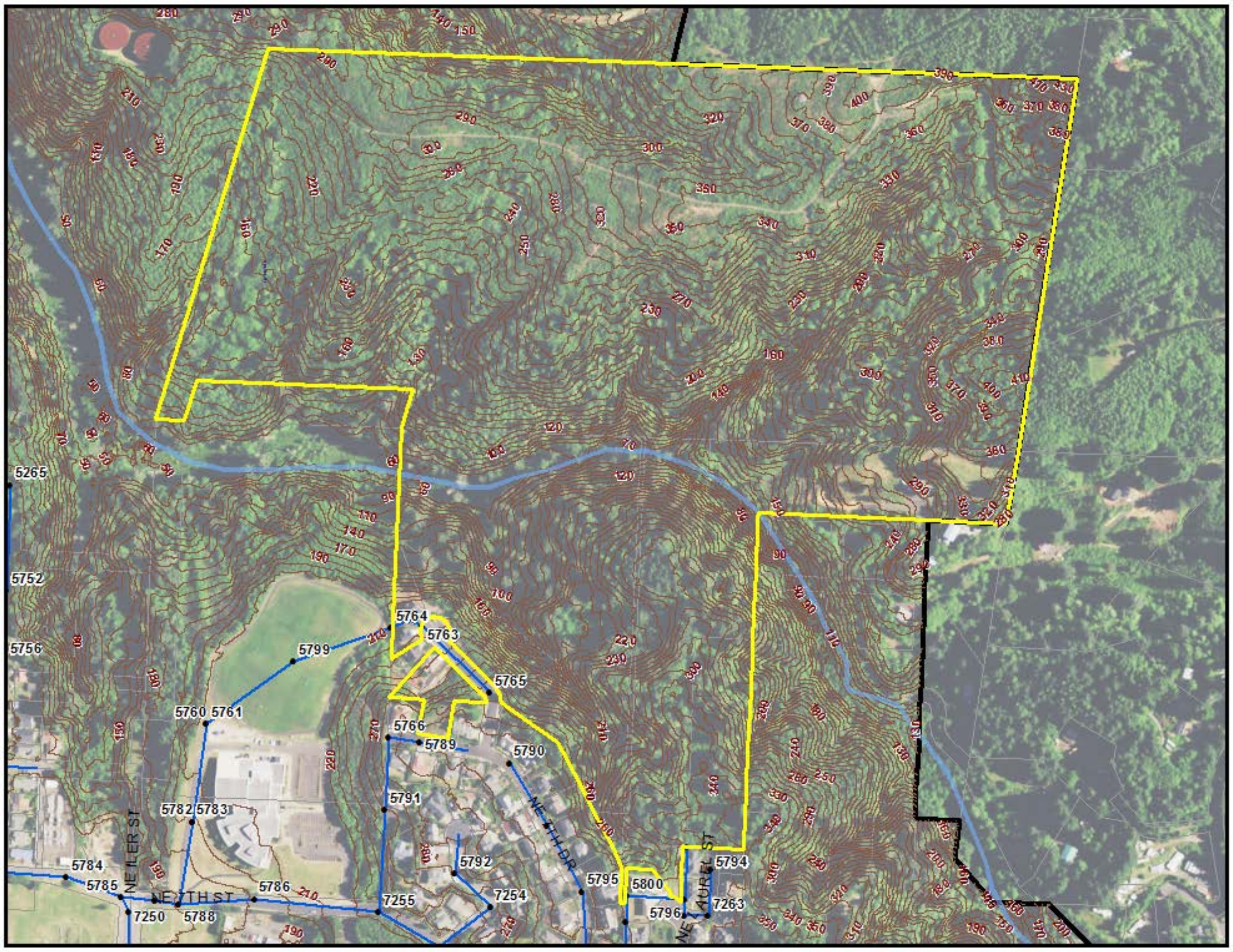
Development ID: #6

Project Description

- A 70-unit apartment (SW), 66-unit apartment (SE), and 100-unit apartment (NE) is expected to occur east of Hwy 101, between NE 36th St and NE Lakewood Dr.
- Future development conditions were analyzed with the assumption that flow would be added to the system at MH 4269.

20-year and Build-out Development Conditions			
Development	New dwelling units	Flow, gpd	I/I
20-year development conditions			
• 236 apartment units[a]	236	51,684	28,000
Buildout development conditions			
No additional development is expected in buildout development conditions.	0	0	0

a. *An average of 2.19 people per household was assumed.*



Development ID: #7

Project Description

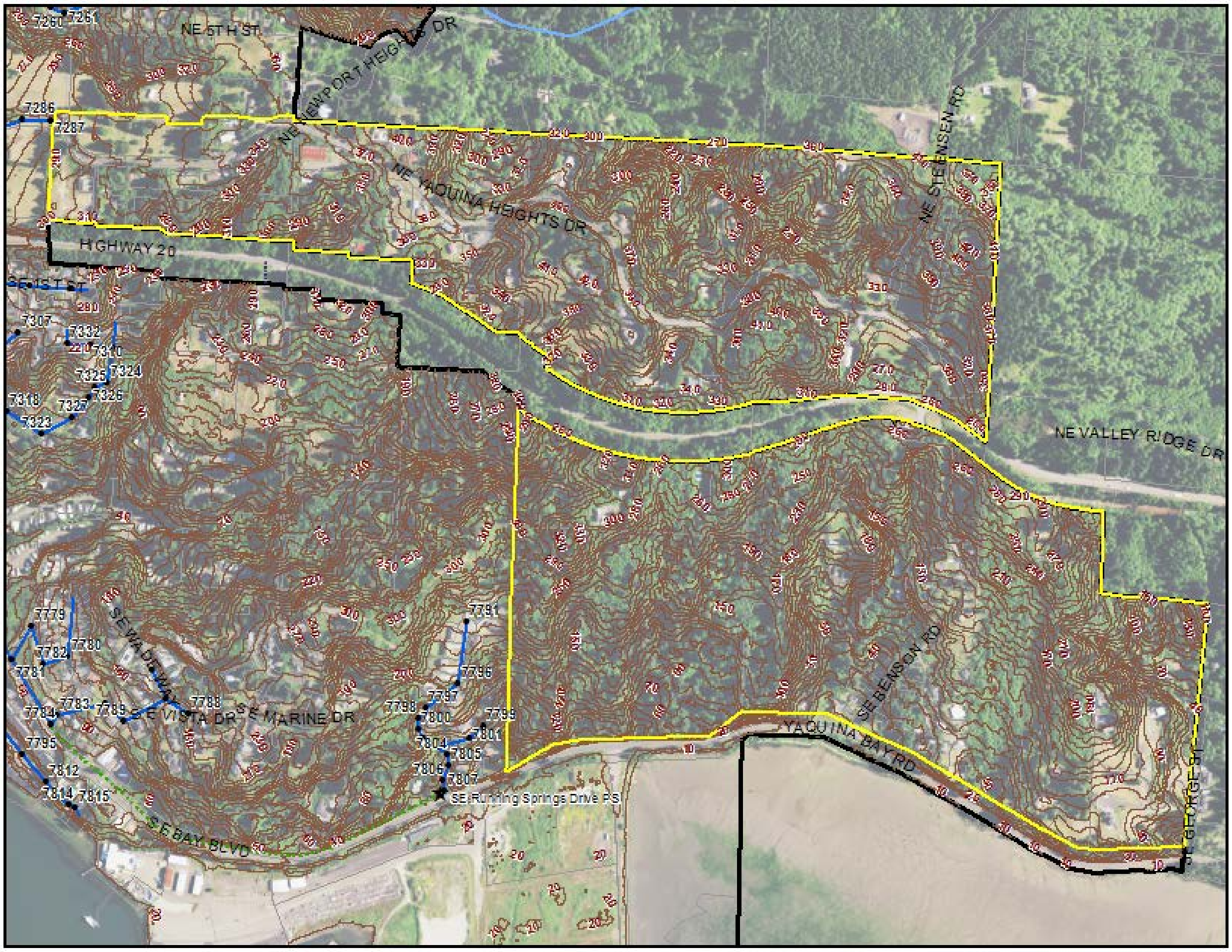
- A 77 acre, low-density residential development is expected to occur northeast of NE 7th St and of NE Iler St.
- Future development conditions were analyzed with the assumption that flow would be added to the system at MH 5788.

20-year and Build-out Development Conditions			
Development	New dwelling units	Flow, gpd	I/I
20-year development conditions			
• 38.5 acre low-density residential development[a, b, c]	96	21,024	24,000
Buildout development conditions			
• 38.5 acre low-density residential development[a, b, c]	96	21,024	24,000

a. *Assume 80% infill to account for steep-sloped terrain, roads, and right-of-ways.*

b. *An average of 2.19 people per household was assumed.*

c. *Development densities specified in the NMC were used to determine the number of dwellings per acre. LDR = 5 dwellings per acre, MDR = 10 dwellings per acre, HDR = 10 dwellings per acre.*



Development ID: #8

Project Description

- A 270 acre, low-density residential development is expected to occur north of Yaquina Bay Rd, between SE George St and NE Lincoln St.
- Future development conditions were analyzed with the assumption that flow would be added to the system at SE Running Springs Drive PS and MH 7040.

20-year and Build-out Development Conditions			
Development	New dwelling units	Flow, gpd	I/I
20-year development conditions			
• 135 acre low-density residential development[a, b, c]	56	12,264	28,000
Buildout development conditions			
• 135 acre low-density residential development[a, b, c]	56	12,264	28,000

a. *Assume 40% infill to account for steep-sloped terrain, roads, and right-of-ways.*

b. *An average of 2.19 people per household was assumed.*

c. *Development densities specified in the NMC were used to determine the number of dwellings per acre. LDR = 5 dwellings per acre, MDR = 10 dwellings per acre, HDR = 10 dwellings per acre.*

Development ID: #9

Project Description

- A 9 acre log yard, 48,000 sq ft of light industrial, 52,500 sq ft of waterfront commercial, and 103,000 sq ft of waterfront heavy industrial development is expected to occur at McLean Point. McLean Point is located south of Yaquina Bay Rd, near SE Running Springs Dr.
- Future development conditions were analyzed with the assumption that flow would be added to the system at SE Running Springs Dr PS.

20-year and Build-out Development Conditions			
Development	New dwelling units	Flow, gpd	I/I
20-year development conditions			
• 9 acre log yard (light industrial) • 1.1 acres (48,000 sq ft) light industrial development • 1.2 acres (52,500 sq ft) waterfront commercial development	0	21,400	11,300
Buildout development conditions			
• 12 acre (103,000 sq ft) waterfront heavy industrial	0	60,000	12,000

Development ID: #10

Project Description

- A 60,000 sq ft heavy industrial development, a 150,000 sq ft classroom/research facility, and a 10,000 sq ft commercial development are expected to occur east of Hwy 101, north of SE 40th Dr.
- Future development conditions were analyzed with the assumption that flow would be added to the system at MH 8136.

20-year and Build-out Development Conditions			
Development	New dwelling units	Flow, gpd	I/I
20-year development conditions			
• 1.4 acre (60,000 sq ft) heavy industrial development • 3.4 acre (150,000 sq ft) classroom/research facility (light industrial) • 0.2 acre (10,000 sq ft) commercial development	0	10,600	5,000
Buildout development conditions			
No additional development is expected in buildout development conditions.	0	0	0

Development ID: #11

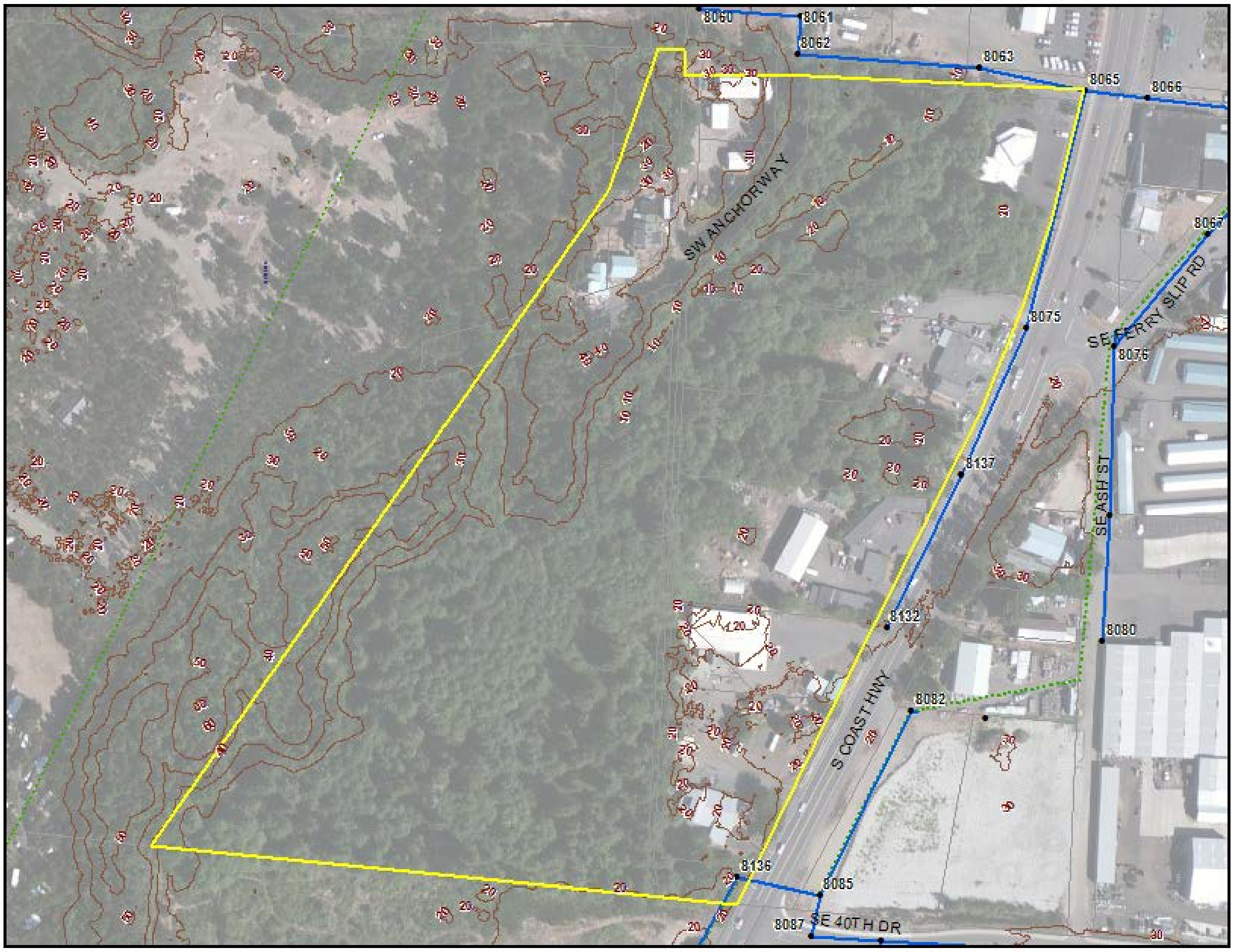
Project Description

- A 100,000 sq ft commercial development, an OMSI youth camp, and a 60 medium-density residential unit development are expected to occur to the west of Hwy 101, between SW Balone St and SW Jetty Way.
- Future development conditions were analyzed with the assumption that flow would be added to the system at the HMSC PS.

20-year and Build-out Development Conditions			
Development	New dwelling units	Flow, gpd	I/I
20-year development conditions			
• 2.3 acre (100,000 sq ft) commercial development • OMSI youth camp (assume 250 max occupancy) • 60 medium-density residential units[a, b]	60	40,440	33,300
Buildout development conditions			
No additional development is expected in buildout development conditions.	0	0	0

a. An average of 2.19 people per household was assumed.

b. Development densities specified in the NMC were used to determine the number of dwellings per acre. LDR = 5 dwellings per acre, MDR = 10 dwellings per acre, HDR = 10 dwellings per acre.

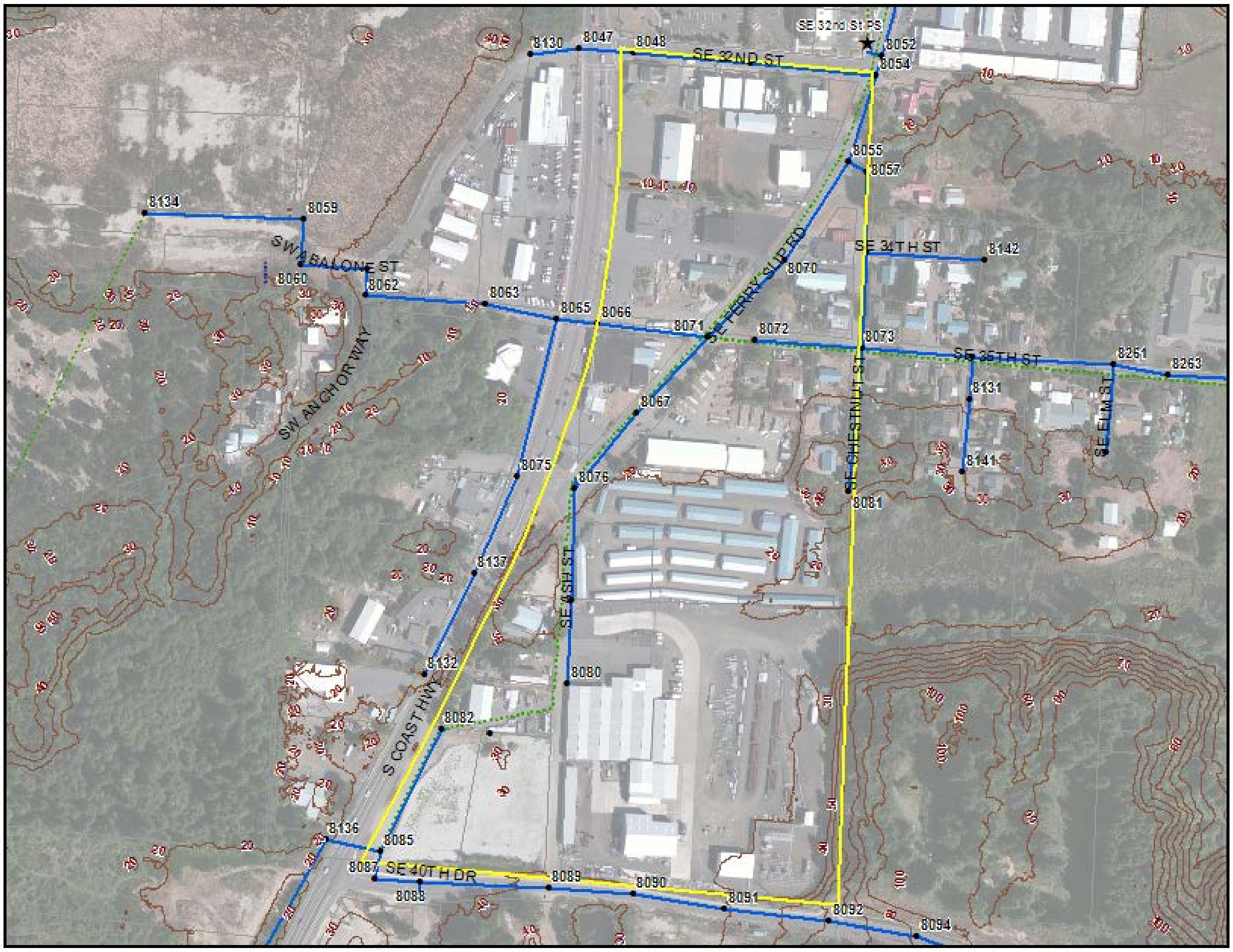


Development ID: #12

Project Description

- A 10,000 sq ft commercial development and a 10,000 sq ft light industrial development are expected to occur west of Hwy 101, near SE Ferry Slip Rd.
- Future development conditions were analyzed with the assumption that flow would be added to the system at the HMSC PS.

20-year and Build-out Development Conditions			
Development	New dwelling units	Flow, gpd	I/I
20-year development conditions			
• 0.2 acre (10,000 sq ft) commercial development • 0.2 acre (10,000 sq ft) light industrial development	0	600	400
Buildout development conditions			
No additional development is expected in buildout development conditions.	0	0	0

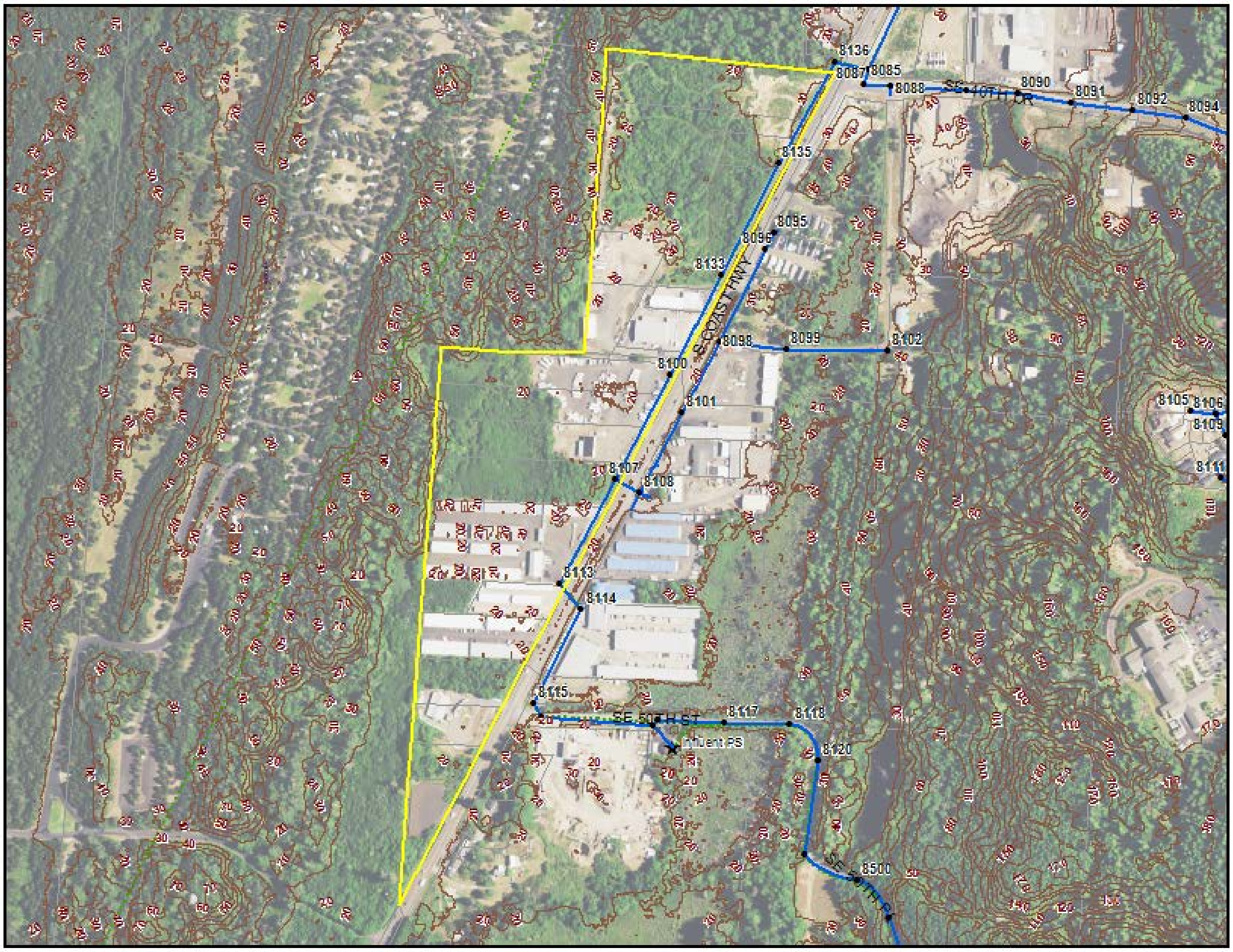


Development ID: #13

Project Description

- A 180,000 sq ft commercial development is expected to occur east of Hwy 101, between SE 40th Dr and SE 32nd St.
- Future development conditions were analyzed with the assumption that flow would be added to the system at the HMSC PS.

20-year and Build-out Development Conditions			
Development	New dwelling units	Flow, gpd	I/I, gpd
20-year development conditions			
• 4.1 acre (180,000 sq ft) commercial development	0	4,100	4,100
Buildout development conditions			
No additional development is expected in buildout development conditions.	0	0	0

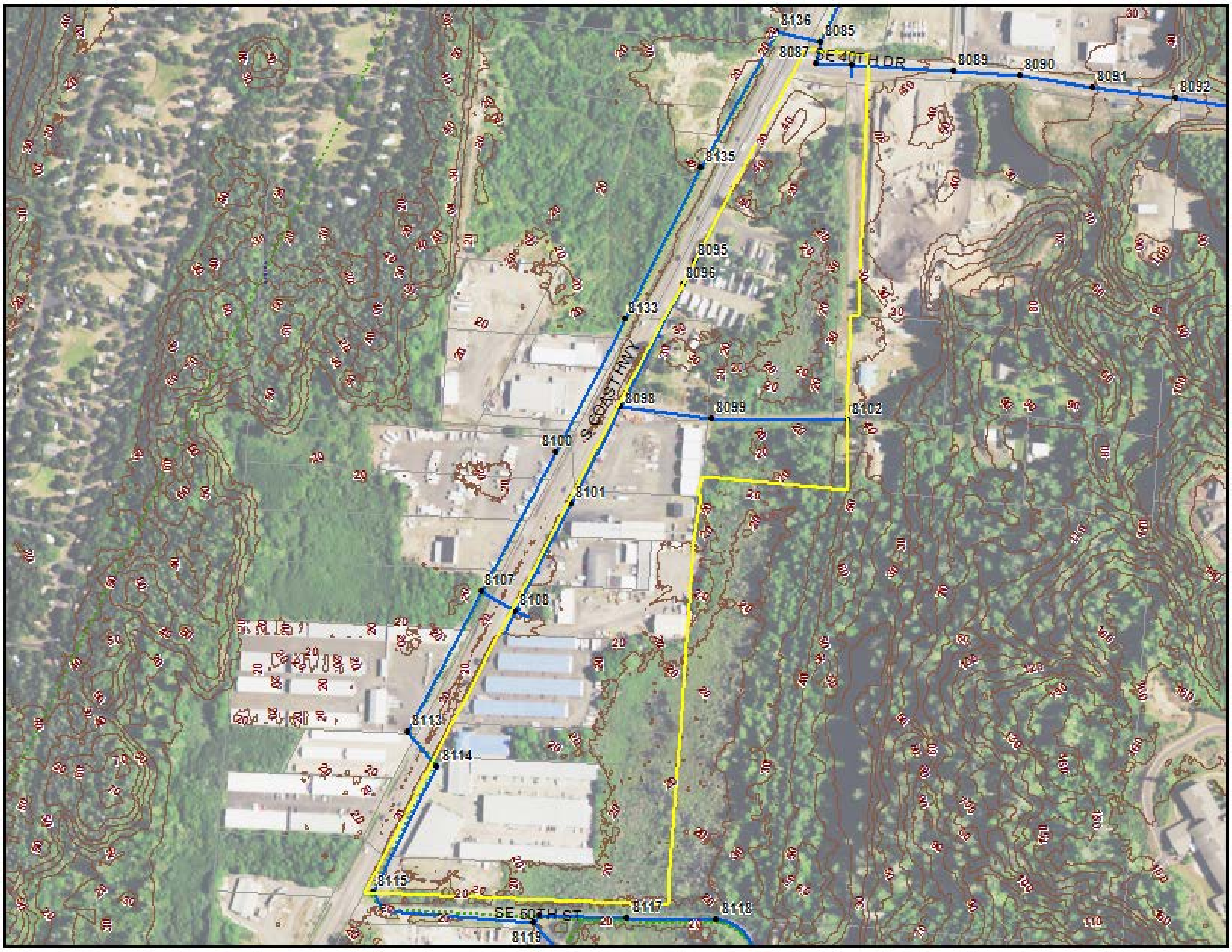


Development ID: #14

Project Description

- A 50,000 sq ft light industrial development and a 50,000 sq ft commercial development are expected to occur west of Hwy 101, just south of SE 40th Dr.
- Future development conditions were analyzed with the assumption that flow would be added to the system at MH 8136.

20-year and Build-out Development Conditions			
Development	New dwelling units	Flow, gpd	I/I
20-year development conditions			
• 1.1 acre (50,000 sq ft) light industrial development • 1.1 acre (50,000 sq ft) commercial development	0	3,300	2,200
Buildout development conditions			
No additional development is expected in buildout development conditions.	0	0	0

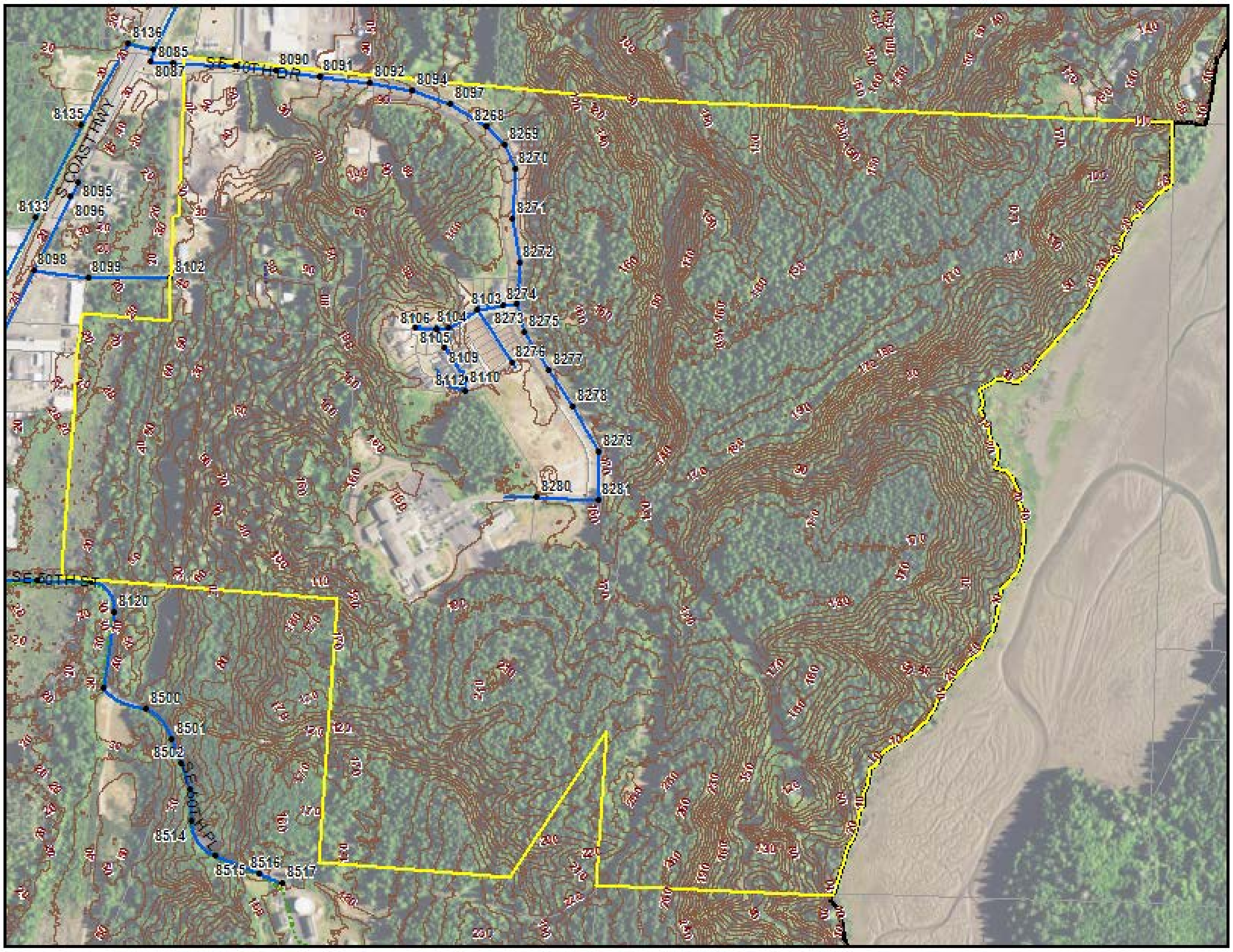


Project Name: Future Development #15

Project Description

- A 180,000 sq ft commercial development is expected to occur to the east of Hwy 101, between SE 50th St and SE 40th Dr.
- Future development conditions were analyzed with the assumption that flow would be added to the system at MH 8107.

20-year and Build-out Development Conditions			
Development	New dwelling units	Flow, gpd	I/I
20-year development conditions			
• 1.0 acre (180,000 sq ft) commercial development	0	1,000	1,000
Buildout development conditions			
No additional development is expected in buildout development conditions.	0	0	0



Project Name: Future Development #16

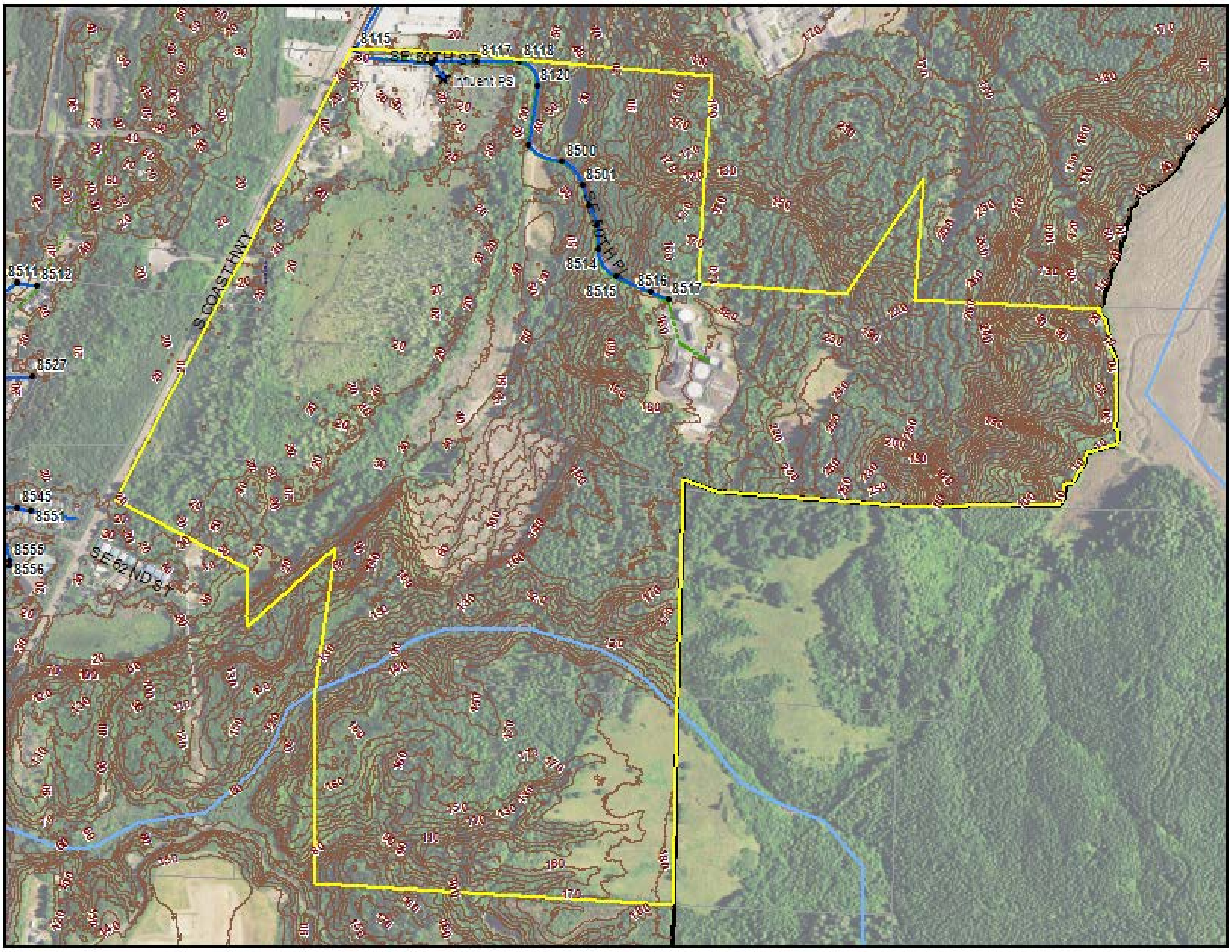
Project Description

- A 12.3 acre commercial development, 350 low-density residential units, and a 500 unit OSU student housing facility are expected to be developed southeast of Hwy 101 and SE 40th Dr.
- Future development conditions were analyzed with the assumption that flow would be added to the system at the HMSC PS.

20-year and Build-out Development Conditions			
Development	New dwelling units	Flow, gpd	I/I
20-year development conditions			
• 7 acre commercial development • 2.3 acre (100,000 sq ft) commercial development • 350 low-density residential units[a, b] • 500 unit OSU student housing development	350	60,067	129,300
Buildout development conditions			
• 3 acre commercial development • 650 low-density residential units[a, b]	650	145,350	133,000

a. *An average of 2.19 people per household was assumed.*

b. *Development densities specified in the NMC were used to determine the number of dwellings per acre. LDR = 5 dwellings per acre, MDR = 10 dwellings per acre, HDR = 10 dwellings per acre.*

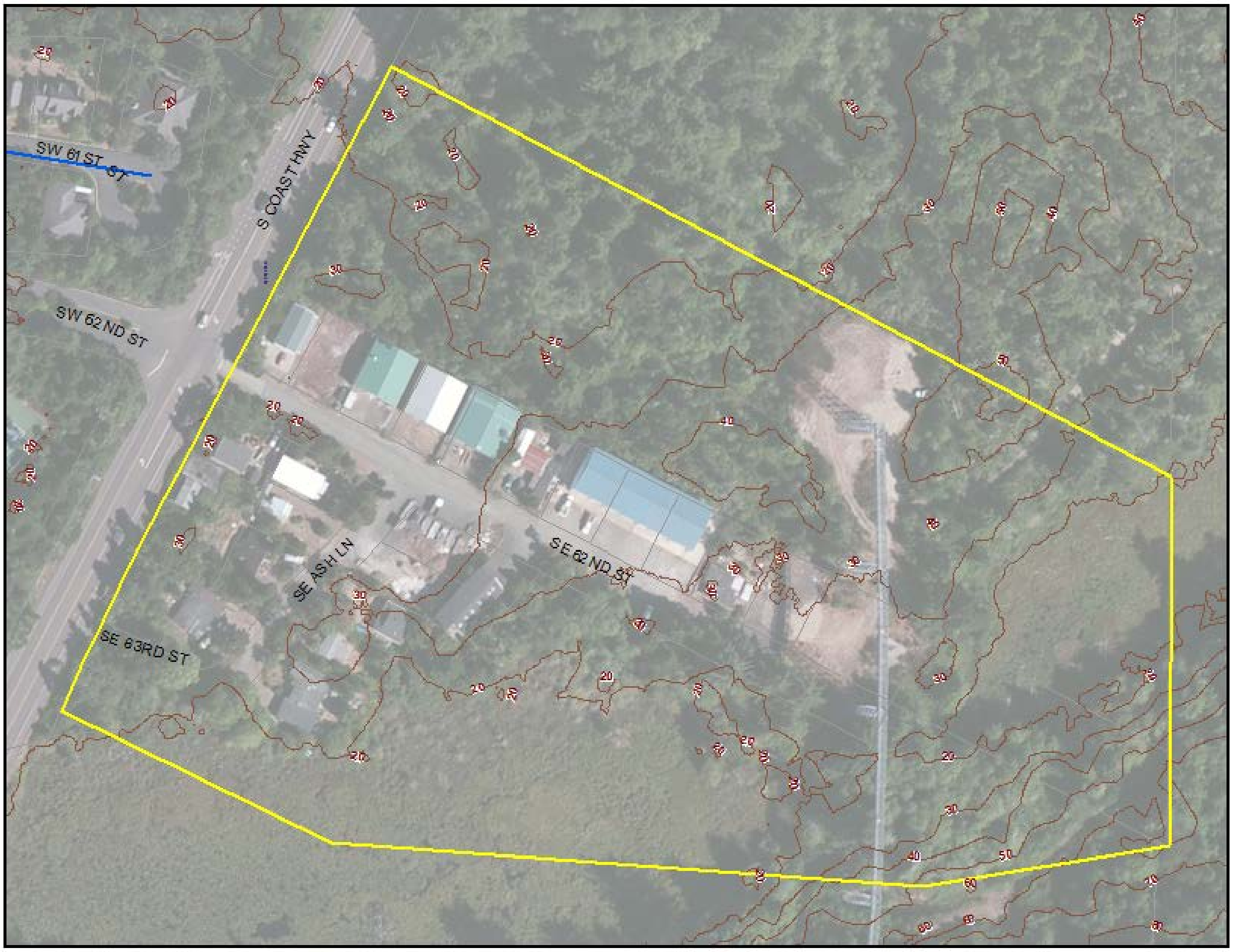


Project Name: Future Development #17

Project Description

- 3.3 acres of light industrial development is expected to occur to the east of Hwy 101, south of SE 50th Pl.
- Future development conditions were analyzed with the assumption that flow would be added to the system at the Influent PS.

20-year and Build-out Development Conditions			
Development	New dwelling units	Flow, gpd	I/I
20-year development conditions			
• 1.1 acre (47,450 sq ft) light industrial development	0	2,200	1,100
Buildout development conditions			
• 2.2 acre (94,900 sq ft) light industrial development	0	4,400	2,200



Project Name: Future Development #18

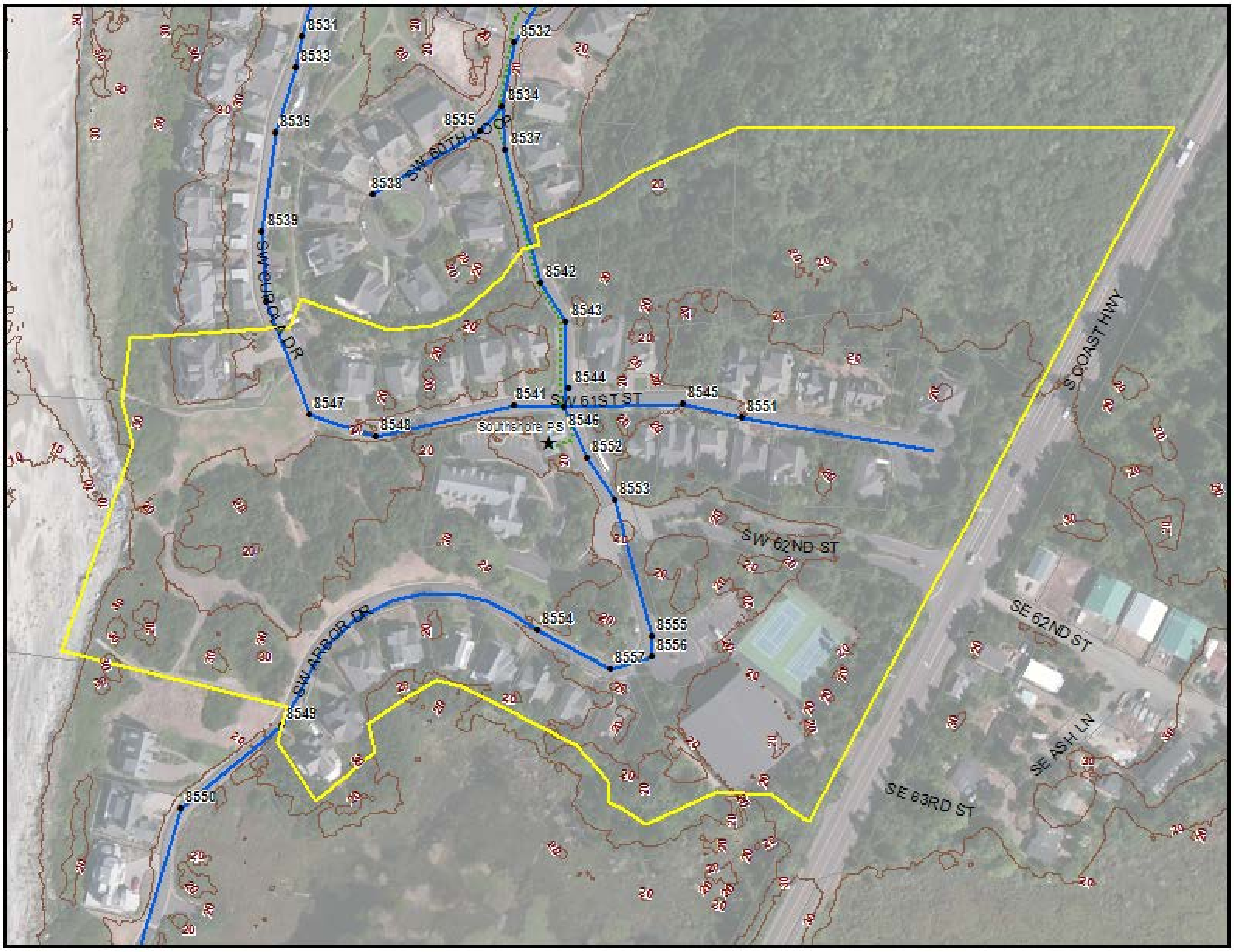
Project Description

- A 20,000 sq ft commercial development and a 3 unit low-density residential development are expected to occur east of Hwy 101, near SE 62nd St.
- Future development conditions were analyzed with the assumption that flow would be added to the system at the HMSC PS.

20-year and Build-out Development Conditions			
Development	New dwelling units	Flow, gpd	I/I
20-year development conditions			
• 0.5 acre commercial development • 3 low-density residential units[a, b]	3	1,157	1,100
Buildout development conditions			
No additional development is expected in buildout development conditions.	0	0	0

a. *An average of 2.19 people per household was assumed.*

b. *Development densities specified in the NMC were used to determine the number of dwellings per acre. LDR = 5 dwellings per acre, MDR = 10 dwellings per acre, HDR = 10 dwellings per acre.*



Project Name: Future Development #19

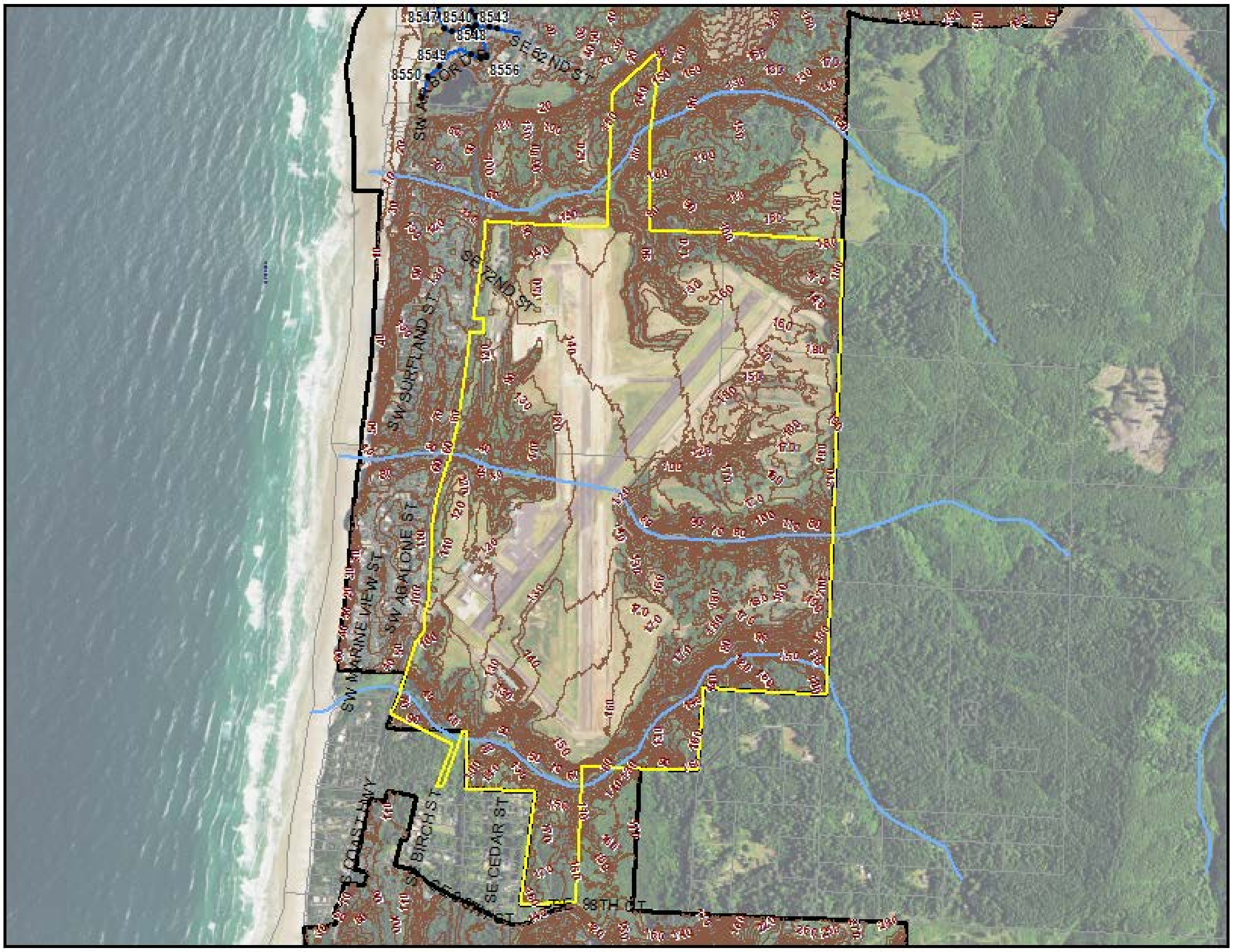
Project Description

- An 18 unit, low-density residential development is expected to occur west of the Hwy 101, near SE 62nd St.
- Future development conditions were analyzed with the assumption that flow would be added to the system at MH 8136.

20-year and Build-out Development Conditions			
Development	New dwelling units	Flow, gpd	I/I
20-year development conditions			
• 18 low-density residential units[a, b]	18	3,942	3,600
Buildout development conditions			
No additional development is expected in buildout development conditions.	0	0	0

a. An average of 2.19 people per household was assumed.

b. Development densities specified in the NMC were used to determine the number of dwellings per acre. LDR = 5 dwellings per acre, MDR = 10 dwellings per acre, HDR = 10 dwellings per acre.



Project Name: Future Development #20

Project Description

- The Newport Municipal Airport and a 20,000 sq ft light industrial development is expected to occur east of Hwy 101, between SE 98th St and SE 62nd St.
- Future development conditions were analyzed with the assumption that flow would be added to the system at the Influent PS.

20-year and Build-out Development Conditions			
Development	New dwelling units	Flow, gpd	I/I
20-year development conditions			
• 0.5 acre (20,000 sq ft) light industrial development • Newport Municipal Airport (assume 5 acre commercial development)	0	6,000	5,500
Buildout development conditions			
No additional development is expected in buildout development conditions.	0	0	0

Appendix C: Hydrologic/Hydraulic Model Results

Table C-1. Identified Gravity System Deficiencies

Appendix C

Hydrologic/Hydraulic Model Results

The results of the hydrologic/Hydraulic modeling are shown in Table C-1 below.

Table C-1. Identified Gravity System Deficiencies

Junction	Manhole depth, ft	10-year flow recurrence hydraulic capacity		
		Existing conditions	20-year conditions	Buildout conditions
4031	12.5	More than 7 ft freeboard	More than 7 ft freeboard	More than 7 ft freeboard
4035		-	-	Less than 7 ft freeboard
5009		-	More than 7 ft freeboard	More than 7 ft freeboard
5017		-	More than 7 ft freeboard	More than 7 ft freeboard
5022		More than 7 ft freeboard	More than 7 ft freeboard	More than 7 ft freeboard
7026	14.5	-	-	More than 7 ft freeboard
7027	7.6	-	-	Less than 7 ft freeboard
7028	15.8	More than 7 ft freeboard	More than 7 ft freeboard	More than 7 ft freeboard
7040	18.5	More than 7 ft freeboard	More than 7 ft freeboard	More than 7 ft freeboard
7043	13.6	More than 7 ft freeboard	More than 7 ft freeboard	Less than 7 ft freeboard
7045	9.1	Less than 7 ft freeboard	Less than 7 ft freeboard	Less than 7 ft freeboard
7504	5.6	Less than 7 ft freeboard	Less than 7 ft freeboard	Flooding
8136	13.1	More than 7 ft freeboard	More than 7 ft freeboard	More than 7 ft freeboard

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Appendix D: Rehabilitation and Replacement Technologies

Appendix D

Rehabilitation and Replacement Technologies

A variety of corrective action technologies are available for application to the City of Newport's (City's) sewer rehabilitation and replacement needs. This document describes the various technologies and presents cost information on those that are most appropriate for City use.

Open-Cut Pipe Materials

A number of pipe materials can be used to replace the City's existing sewers. Many of the structural defects observed in municipal sewers are due to available pipe materials, their susceptibility to corrosion and infiltration, and/or poor construction techniques. Brown and Caldwell (BC) recommends that candidate pipe materials satisfy the following criteria:

- They are resistant to the corrosive environment often found in sanitary sewers.
- They are resistant to erosion due to the conveyance of sand and grit.
- They have structural support adequate to support the expected design loads.
- They have joints that are watertight as required to prevent infiltration and the resulting loss of bedding and backfill material.
- They are readily available commercially.

Based on these criteria, several materials are recommended for the rigid and flexible classes of pipe.

Rigid Pipe Materials

Three rigid pipe materials meet the above criteria for replacement pipe:

- reinforced concrete pipe (RCP) with plastic corrosion-resistant liner
- vitrified clay pipe (VCP) with fiberglass joints and rubber gaskets
- polymer concrete pipe

Flexible Pipe Materials

Three flexible pipe materials meet the above criteria for replacement pipe:

- high-density polyethylene (HDPE) pipe
- poly-vinyl chloride (PVC) pipe, ≤ 24 inches in diameter
- centrifugally-cast fiberglass reinforced polymer mortar pipe, or Hobas®

All of the above are suitable options for the City. The selection of the project-specific appropriate pipe material(s) should be made during preliminary design.

Rehabilitation Technologies

A number of technologies are available for rehabilitating gravity sewers. Rehabilitation technologies can be fully structural (i.e., even if the existing pipe lost all its structural strength, the rehabilitation method could still support all live and dead loads) or non-structural (i.e., the existing host pipe must bear all structural loads). Some non-structural rehabilitation techniques extend the pipe's remaining life by stabilizing the pipe, either internally or externally.

The following paragraphs describe technologies for full pipe segment rehabilitation, point repair rehabilitation, and non-structural (stabilization) rehabilitation.

Full Pipe Segment Rehabilitation Technologies

Full pipe segment rehabilitation technologies are considered when the existing defects are located extensively throughout the pipe such that point or spot repairs are not feasible. Technologies that were considered for City use include cured-in-place pipe (CIPP), pipe bursting, spiral pipe renewal (SPR), sliplining, and pipe wrap.

CIPP

CIPP is a technology that has been in use in North America for almost 40 years. Rehabilitation is done by installing an uncured tube that is saturated with resin into an existing pipe. The existing pipe is used as a form as the tube is expanded against it and the resin is cured. All CIPP liners have four essential components: a flexible tube, a thermosetting resin that impregnates the tube, a method to install and expand the impregnated tube, and a method to cure (i.e., harden) the resin. The end result is a corrosion-resistant, jointless pipe that conforms to the geometry of the existing host pipe. CIPP can be installed with little to no excavation and it can be a fully structural repair or a non-structural repair, depending on design parameters. Of the various trenchless rehabilitation techniques, CIPP generally results in the least amount of internal diameter reduction due to its thin-walled, semi-tight-fit nature.

Installation of CIPP can be performed in difficult locations on almost any size pipe. However, pipes greater than 27 to 30 inches in diameter typically require the removal of the manhole top slab or cone to be rehabilitated with CIPP. Typical vehicle access requirements include large box trucks, boiler trucks, and possibly scaffolding constructed directly over the manhole. The pipe must be dry during installation, so bypass pumping is required. Installation time could take from a few hours to a week, depending on location and size. Figure D-1 shows examples of CIPP installation.

This technology is recommended for City consideration in the rehabilitation of sewers with adequate sewer capacity.

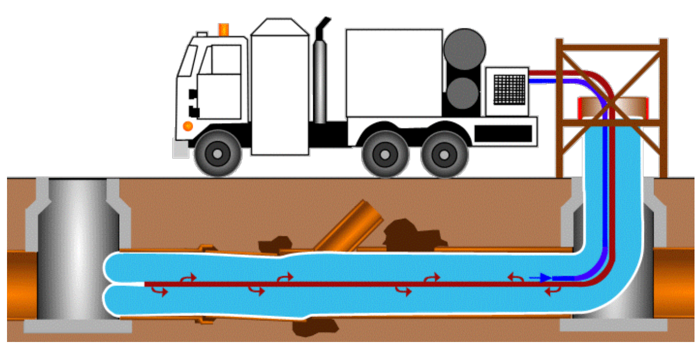

Figure D-1. Examples of CIPP installation

Pipe Bursting

Pipe bursting is a technology that involves the pulling of a bursting head to break apart or slice the existing pipe. As the head is pulled through the host pipe, a continuously-fused HDPE or PVC pipe is fed into the pipe directly behind the bursting head. The new pipe can be either the same size or slightly larger than the original. The end result is a fully structural, corrosion-resistant, jointless pipe that replaces the existing host pipe. Figure D-2 shows examples of pipe bursting installation.

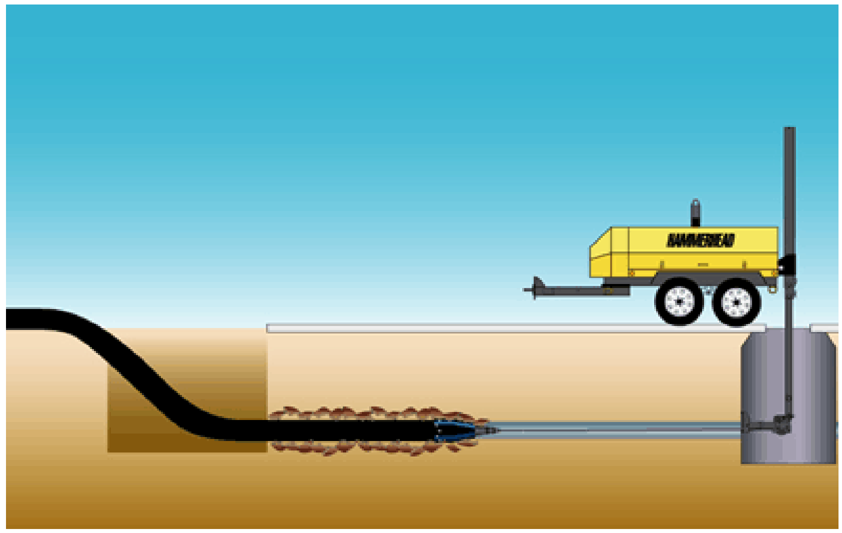

Figure D-2. Examples of pipe bursting installation

Pipe bursting requires some excavation and vehicle access. The new pipe must be inserted at one end using an excavated insertion pit, normally at the upstream manhole, which allows the new pipe to be pulled into the existing pipe without exceeding the HDPE or PVC pipe bending radii. The technology is generally limited to existing pipes 24 inches in diameter or smaller. In addition, the entire length of new pipe must be fully fused and laid out prior to insertion of the pipe, meaning that a long laydown area immediately adjacent to the insertion pit is required. The pipe must be dry during installation, so bypass pumping is required. Installation can take from a few hours to several days, depending on location and size. Suitability of ground conditions, potential for heave disturbing surface improvements or affecting pipeline grade, condition of host pipe including sags, and required diameter are all considerations for the design phase.

This technology is recommended for City consideration in the rehabilitation of sewers with adequate, or near-adequate, capacity.

Spiral-Wound Pipe (SPR)

SPR is a trenchless technology that involves the winding of a continuous strip of PVC or HDPE within an existing pipe. It can be performed on a wide range of existing pipe sizes, since the host pipe is used as a form for the wound pipe. The strips are interlocked and because SPR is not a tight-fit technology, the resulting annulus is filled with grout. Concerns regarding the structural capability of the PVC product have resulted in the development of HDPE with embedded steel reinforcement. The HDPE product is welded together in the field, whereas the PVC product uses a mechanical joint. The HDPE product has a thicker profile and reduces the internal diameter significantly more than does the PVC product. In general, use of SPR results in a much larger loss of hydraulic capacity than do some other techniques such as CIPP. However, the end result is a corrosion-resistant pipe that replaces the existing host pipe and can be installed with little excavation.

The winding machine is of significant size and requires the removal of a manhole at one end for larger pipes. The grout and pumps must be in the vicinity for filling the annular space between the newly wound pipe and host pipe. One major benefit of SPR is the ability to install the pipe during active flow conditions. However, the newer more structurally sound HDPE material requires field welding, so bypass pumping is recommended. Installation can take from a few hours to several days, depending on location and size. Figure D-3 shows examples of SPR installation.

While the SPR technique is used in some areas of the country, BC is not aware of its use in Oregon or the Northwest. Consequently, it is unlikely that local contractors are experienced in its application. This technology is not recommended for City consideration for rehabilitating sewers at this time. In the future, if contractor experience is found or developed within the area, the City should consider this technology as one of the rehabilitation alternatives.

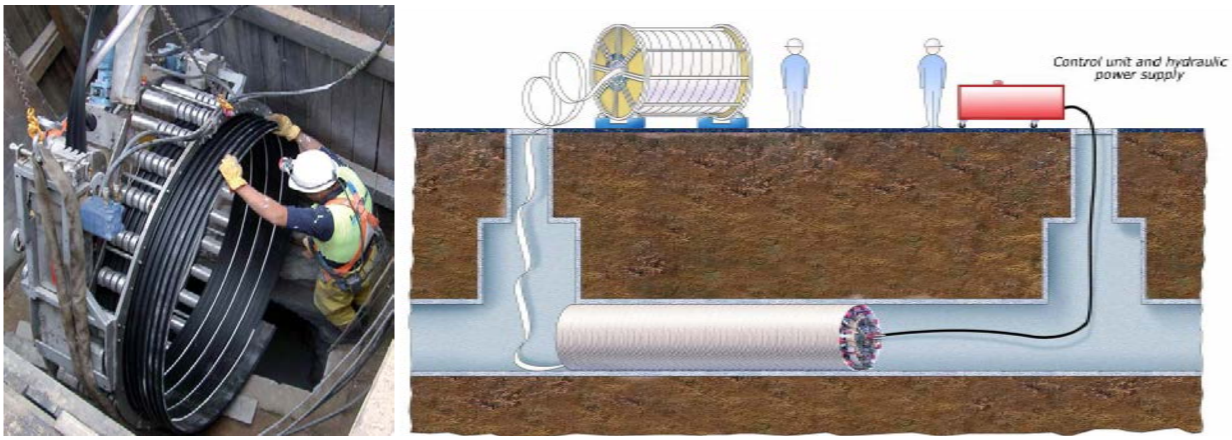

Figure D-3. Examples of SPR installation

Sliplining

Sliplining is a technology that involves the jacking or pulling of a smaller pipe inside the existing pipe. The pipe that is either jacked or pulled through the existing pipe must be able to withstand the forces exerted during the installation process. Common pipe materials used are fusible HDPE or PVC, fiberglass-reinforced pipe such as Hobas, and VCP. Because sliplining is not a tight-fit technology, the resulting annulus is filled with grout. Sliplining generally reduces the internal diameter of the pipe more than any other rehabilitation technology. The end result is a fully structural corrosion-resistant pipe that replaces the existing host pipe and can be installed with limited excavation.

Excavation is limited to an insertion pit that is required at one end of the pipe slated for rehabilitation. The grout and pumps must be in the vicinity for filling the annular space between the newly inserted pipe and host pipe. In addition, a laydown area must be provided for the new pipe and jacking/pulling equipment. Except in low flow cases, bypass pumping is required. Installation can take from a few hours to a week, depending on location and size. Figure D-4 shows examples of sliplining installation.

This technology is recommended for City consideration only in the rehabilitation of sewers with excess capacity.

Figure D-4. Examples of sliplining installation

Pipe Wrap

Pipe wrap is a new technology based on a technique used to reinforce above-grade structures such as bridges and building walls. A thin carbon-fiber-reinforced fabric is saturated with corrosion-resistant epoxy resin and is glued to the interior of the pipe. Existing pipe surface preparation and primer are required to obtain a bond between the resin-saturated fabric and the existing pipe. Man-entry is required for installation of pipe wrap; consequently, its use is limited to sewers 48 inches in diameter and larger. The resin fabric is less than 0.1 inch thick and therefore reduces the flow capacity only slightly.

Given the workability of the material and the man-entry installation, no excavation is required. Because the fabric is saturated with resin in the field, a small setup area is required to wet the fabric strips. The pipe must be dry during installation, so bypass pumping is required. Installation can take from a few days to several weeks, depending on location and size. However, given the unproven nature of the product and the lack of successful installations in the Northwest, pipe wrap is not recommended for City consideration at this time. This technology may become more viable in the future. Figure D-5 shows examples of pipe wrap installation.

Figure D-5. Examples of pipe wrap installation

Point Repair Rehabilitation Technologies

Spot or point repairs are recommended where defects are localized or not distributed throughout long sections of the sewer. All of the technologies presented in this section are recommended for City consideration in repairing sewers.

Cured-in-Place Point Repair

Spot or point repairs can be made using the same cured-in-place technology that is used for entire pipe segment rehabilitation. A flexible tube is impregnated with resin and inserted into the host pipe, but with point repairs the tube is shorter in length. Point repairs benefit from their trenchless nature, but because they are shorter and require significantly less material than full-length pipe segment CIPP, construction equipment and materials are greatly reduced. Bypass pumping is still required. Figure D-6 shows examples of cured-in-place point repair.

Figure D-6. Examples of cured-in-place point repair

Mechanical Point Repair (Link Pipe®)

Spot or point repairs can be made using a stainless steel or PVC sleeve that results in a close-fitting repair. For smaller diameter trunk lines (i.e., less than 30 inches) a stainless steel sleeve is used. The sleeve is positioned into place and the annular space is filled with grout. O-rings seal each end of the sleeve to the host pipe with ports located in the center of the sleeve used for filling the grout. For larger diameter trunk lines (i.e., 36 inches or greater) a hinged PVC repair is used. Hydraulic jacks are used to expand the PVC sleeve and O-rings are used to seal the edges. Grout is pumped into the annular space.

The end result is a structural, corrosion-resistant repair that can be installed with little to no excavation. Construction access involves the box truck, closed-circuit television (CCTV) truck, and potentially heavy equipment for the larger diameter repairs that require manhole cone or top slab removal. In all but the largest of pipe diameters, bypass pumping is not required. Figure D-7 shows examples of Link Pipe installation.

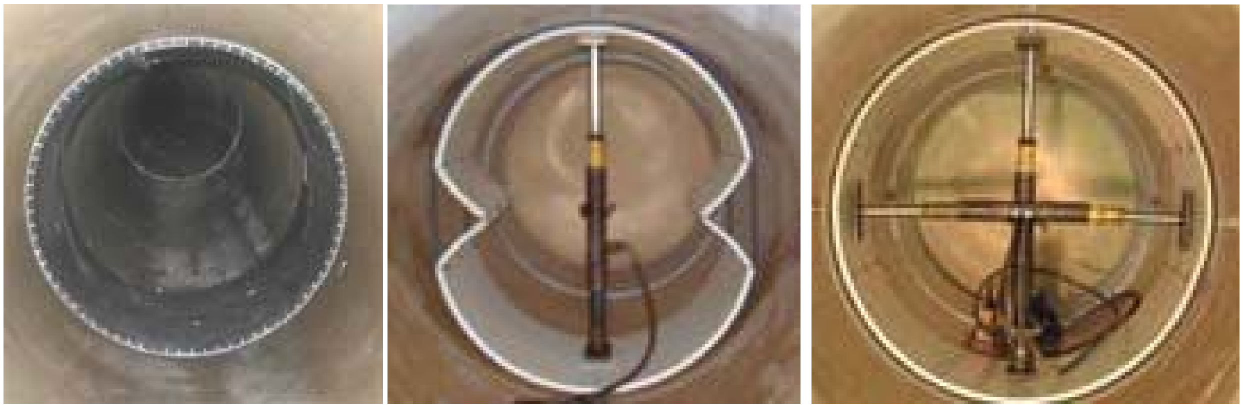

Figure D-7. Examples of Link Pipe installation
(left: stainless steel sleeve; middle and right: PVC link-pipe)

Non-Structural (Stabilization) Rehabilitation Technologies

Non-structural rehabilitation technologies focus on slowing or preventing further degradation of the pipe. Applicable technologies include injection grouting for stabilizing pipe bedding and backfill against soil loss and magnesium hydroxide application to slow hydrogen sulfide degradation.

Test and Seal (Injection Grouting)

Sewers with high levels of infiltration risk the loss of pipe bedding and backfill due to erosion into the pipe. Loss of pipe bedding can lead to pipe settlement and a resulting increase in pipe and joint cracks, fractures, and breaks. The characteristics of the soil are critical to the degree of soil loss experienced. Silts and fine sands experience the greatest amount of degradation. If not detected early, soil loss can lead to catastrophic failures, as shown in Figure D-8. The test and seal technology helps to locate and then seal leaky sewers.

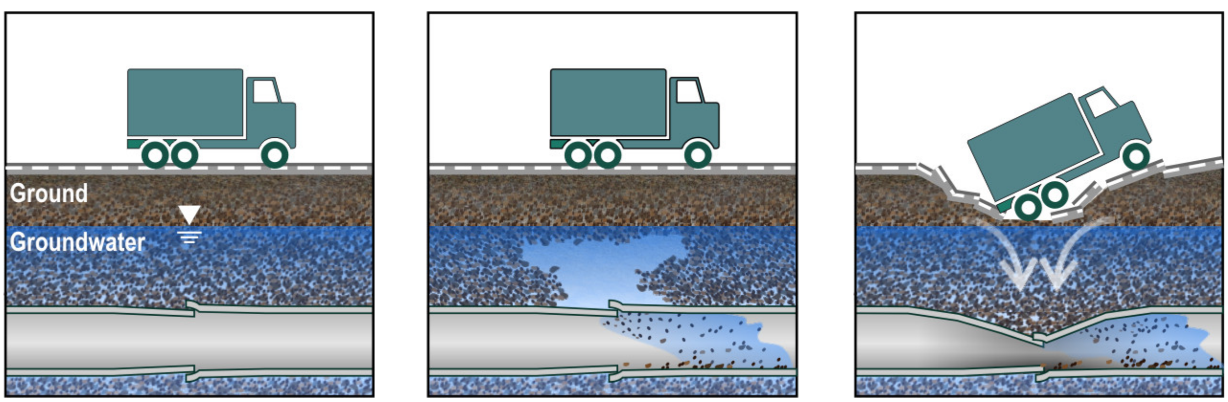

Figure D-8. Structural failure mechanism caused by infiltration at joints

The basic principle of grouting pipe lines is to test the joints by hydraulically applying a positive pressure to the joints, monitoring the pressure in the void, and monitoring the test medium flow rate. The test medium is usually air. The intent of joint testing is to identify sewer pipe joints that are not watertight and that can be sealed successfully by injecting chemical grout into the soils encompassing the pipe joint. Chemical grouts have little to no structural strength. They provide stabilization of pipe bedding and prevention of infiltration and the potential loss of fine-grained soils through leaking pipe joints.

Injection of grout is most effective when it is applied from an internal packer device that is placed inside the sewer pipe. The major support equipment includes a box truck that contains the hoses, chemical grout, air compressor, and CCTV equipment. Normally, the pipe can receive limited flow during this operation, such that bypass pumping may not be required except when flows are above the camera lens. In large diameter pipes, the size of the required packers is too large for standard manhole frame openings. In this case, the packers can be disassembled and then reassembled in the manhole if manhole component removal is undesirable.

Similarly, heavy infiltration can occur at manholes and cause loss of bedding around the manhole structure and influent/effluent pipes. This infiltration can be addressed via man-entry into the manhole, drilling a small hole into the manhole wall, and injecting chemical grout. Heavy vehicle access or excavation is not required, and the work can be done in live sewers with no bypass pumping. Figure D-9 depicts typical packer injection grouting installation.

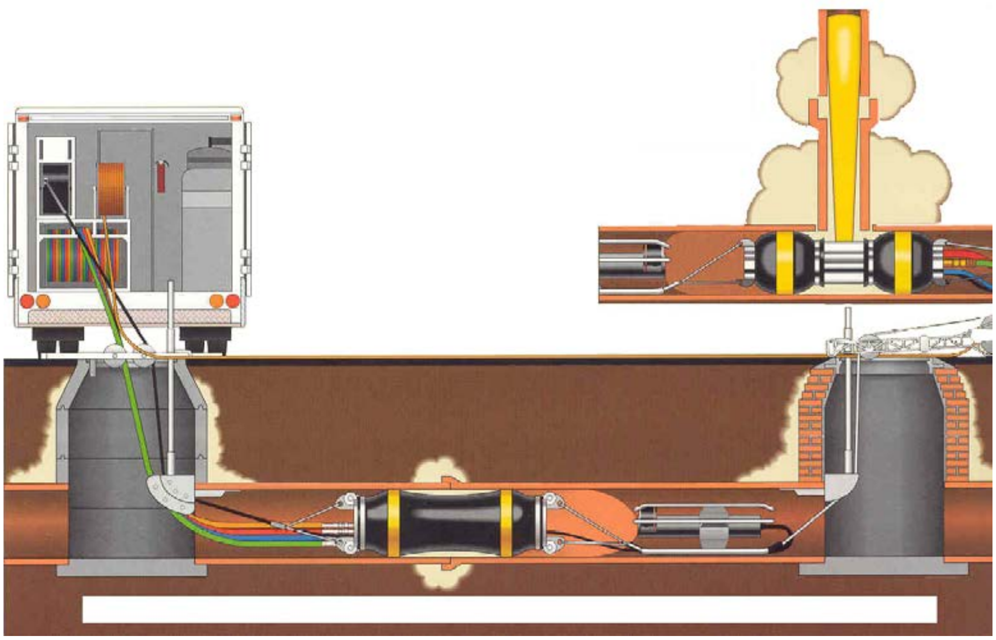

Figure D-9. Typical packer injection grouting installation

Magnesium Hydroxide Spraying

For corrosion issues, one way to slow the rate of corrosion is repeated magnesium hydroxide spraying on the exposed portions of the CSP. Magnesium hydroxide neutralizes acids that corrode the concrete and greatly slows the rate of corrosion, resulting in increased pipe life. Magnesium hydroxide should be applied at times of lowest flow to maximize the surface area exposed to corrosive gases. For City sewers, that would mean nighttime flows during the driest summer months. Magnesium hydroxide is spray-applied from a boat or crawler in the pipe, depending on flow conditions. No bypass pumping is required, and access to the upstream pipe manhole is preferable. A box truck similar in size to a grout truck is the only access required. Magnesium hydroxide spraying has been used successfully in other municipalities such as Phoenix and Los Angeles for recurring maintenance to extend pipe life. However, this technology has seen limited use in the Northwest. Therefore, there may not be contractors in this area who are familiar with its application. BC does not recommend consideration of this technology for use at this time. Figure D-10 illustrates the rate of corrosion as impacted by surface pH.

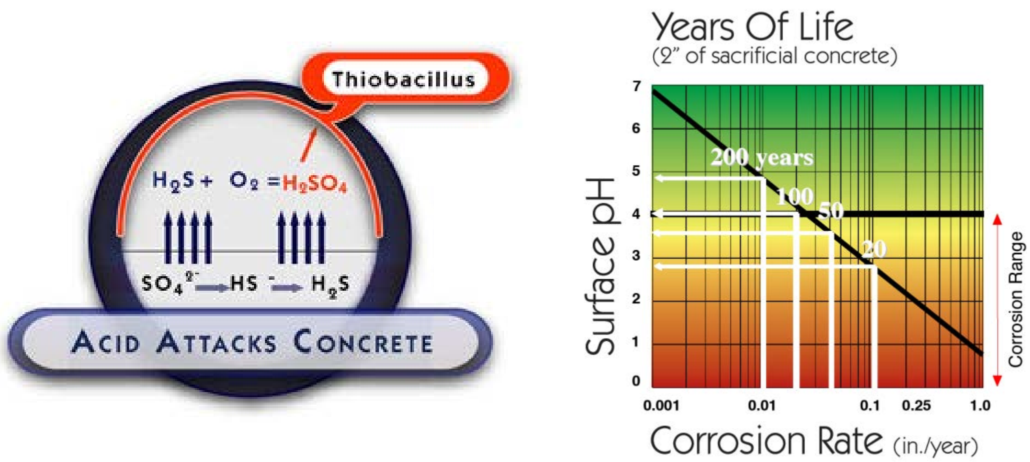

Figure D-10. Rate of corrosion as impacted by surface pH

Other Maintenance Activities

Regular maintenance is a proven way to extend pipe life. Accumulation of debris, roots, and grease can lead to hydraulic restrictions which can cause surcharging and stress on the pipe. Surcharging of older clay and concrete pipes that do not have watertight joints can lead to disturbance of the surrounding soils, potential loss of bedding and pipe support, and further deterioration.

Summary of Rehabilitation Technologies

Table D-1 summarizes the various options available for full pipe segment, pipe repair, and non-structural corrective actions.

Table D-1. Rehabilitation Options

Technology	Available pipe diameters	Structural	Bypass pumping required	Excavation required	Local contractors	Loss of hydraulic capacity	Appropriate for City sewers
Open-cut	All	Y	Y	Major	Y	N	Y
CIPP	All	Y	Y	Minor	Y	Minor	Y
Pipe bursting	≤ 24 inches	Y	Y	Moderate	Y	N	Y
SPR	All	Y	N	Minor	N	Moderate	N
Sliplining	All	Y	Y	Moderate	Y	Major	Y
Pipe wrap	≥ 48 inches	Unknown	Y	N	N	Minor	N
Link-pipe	All	Y	N	N	Y	Minor	Y
Magnesium hydroxide	All	N	N	N	Y	N	N
Test and seal	All (limited packer availability in > 42 inches)	N	N	N	Y	N	Y

Many of the above-described rehabilitation technologies are available as candidates for use on the City's sewers. For smaller diameter sewers (≤ 24 inches), cured-in-place and pipe bursting are the most frequently used and least costly technologies currently available. A cost savings of approximately 50 percent is typical when comparing the rehabilitation technologies presented in this document to open cut replacement costs.

Sewer capacity often influences rehabilitation and replacement decisions. Consequently, the SSMP should be referenced during the predesign phase of a project to ensure that the hydraulic capacity of a given sewer is considered as part of an informed rehabilitation and replacement decision-making process.

Other Inspection/Evaluation Technologies

While CCTV inspection is the primary technology used by most municipalities to inspect the sewer system, a number of other technologies exist that can be used to augment a CCTV inspection program. Typically, these would be used for specialized inspections where CCTV inspections do not perform well. Examples include the following: laser profiling, sonar, and ground-penetrating radar. The focus of this discussion will be on laser profiling.

Laser profiling is recommended in pipes where an accurate measurement of the pipe's internal diameter and shape are critical to the rehabilitation decision-making and design process. Although it is a relatively new technology, laser profiling has a number of practical applications in assessing sewer condition, including accurately determining the location and geometry of defects, verifying the level of deformation in flexible and non-flexible pipes, and determining the size of cracks in rigid pipes.

Figures D-11 through D-13 show images from a laser profiling inspection performed on a cast-in-place RCP. The pipe was constructed in the 1910s and is approximately 25 feet deep. As shown in Figure D-11, the pipe looks deformed, but it is difficult to assess the degree of deformity. In this case, information on the true dimensions of the pipe was critical since sliplining rehabilitation was being considered.

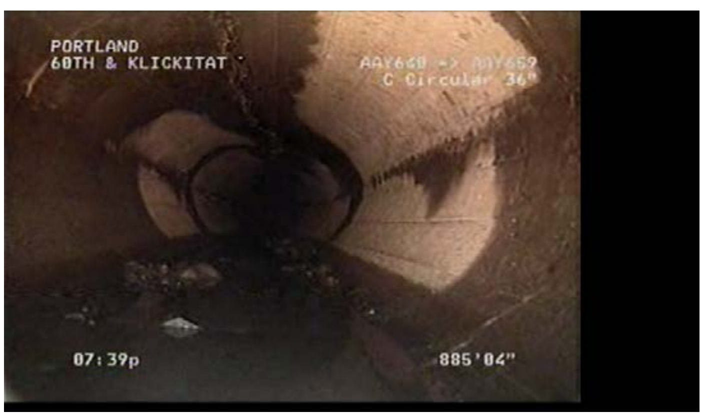

Figure D-11. Video image from laser profile inspection

Figure D-12 shows the laser projection on the wall of the pipe as captured by the inspection equipment's video camera. As shown on the screen capture, the true diameter of the pipe is determined for both the X and Y axes.

As shown in Figure D-13, the actual profile of the pipe is projected against the original shape. At one location on this pipeline, the 36-inch internal diameter pipe had only a 30-inch vertical (Y-axis) dimension.

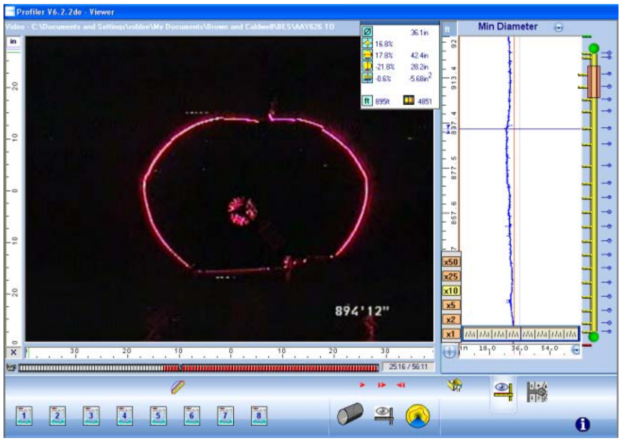

Figure D-12. Laser projection from laser profile inspection

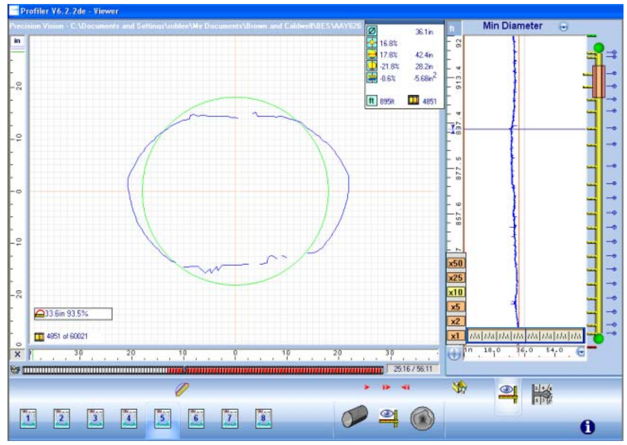

Figure D-13. Laser profile inspection results

For the City, use of laser profile technology is recommended for consideration only in specialized cases and for large-diameter lines.

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Appendix E: Basis of Sewer Replacement and Rehabilitation Costs

Appendix E: Basis of Sewer Replacement and Rehabilitation Costs

Appendix E

Basis of Sewer Replacement and Rehabilitation Costs

This appendix describes how the costs were estimated for developing the budgets of capital improvements. The total capital investment necessary to perform a project (i.e., engineering through construction) consists of expenditures for engineering services, construction, contingencies, and overhead items such as legal, contract administration, and financing. The various components of the capital costs are described below.

Cost Index

A good indicator of changes over time in construction costs is the *Engineering News Record (ENR)* 20-city Construction Cost Index (CCI), which is computed from prices of construction materials and labor. Cost data in this report are based on an *ENR* CCI of 10182, representing costs in February 2016. The costs provided in this SSMP should be adjusted based on the *ENR* CCI at the time that a project is being planned.

Construction Costs

Construction costs were prepared for improvements identified by the hydraulic modeling and the limited sewer condition assessment information. Construction costs presented below represent preliminary estimates of the materials, labor, and services necessary to construct the proposed projects. The cost estimates were prepared to be indicative of the cost of construction in the study area. It is important to recognize that changes during design and future changes in the cost of materials, labor, and equipment, will cause comparable changes in the estimated costs. Unit costs used in this SSMP were obtained from a review of pertinent sources of reliable construction cost information. Construction cost data given in this report are not intended to represent the lowest prices that can be achieved, but rather are intended to represent planning level estimates for budgeting purposes.

Engineering, Overhead, and Contingencies

Engineering and overhead are assumed to be 20 percent of the construction cost. Engineering services associated with typical projects include preliminary investigations and reports, site and route surveys, geotechnical explorations, preparation of drawings and specifications, construction services, surveying and staking, and sampling and testing of materials. These costs can vary considerably depending on the nature and complexity of the project. Additional engineering costs could be realized if additional geotechnical investigations are required and if environmental permitting and public involvement and notification activities are required. Also, these activities could impact the engineering and construction schedule.

Overhead charges cover items such as legal fees, financing expenses, administrative costs, and interest during construction.

The construction contingency used in this SSMP is 30 percent. The contingency is added after inclusion of the engineering and overhead costs. It is appropriate to allow for this degree of uncertainty due to the limited information available during the master planning level development of projects. Factors such as unknown geotechnical and groundwater conditions, utility relocation, and alignment changes are a few of the items that can increase project cost, for which it is wise to make allowance in preliminary estimates.

This SSMP used three pricing schedules for sewer construction. Each schedule is described as follows:

- *Price Condition No. 1: Off-street construction.* This condition includes pipe, pipe installation, excavation, import of all fill, hauling of all excavated material, manholes, trench safety, sump dewatering, and traffic control. In general, this condition is for the construction of sewers in future streets with no street restoration.
- *Price Condition No. 2: In-street construction, street restoration required*. This condition includes pipe, pipe installation, excavation, import of all fill, hauling of all excavated material, manholes, existing utilities, trench safety, sump dewatering, street restoration, and traffic control.
- *Price Condition No. 3: In-street construction, with significant dewatering required.* This condition is the same as Condition No. 2 with the inclusion of well point dewatering required to keep the trench dry for construction of the sewer. Actual dewatering costs can vary significantly with site conditions.

Tables E-1 through E-3 present unit costs for a range of pipe sizes and depths for the three construction condition schedules. Specialized construction techniques, such as pipe jacking or pipe boring work, are not included in any of the estimates. Most of the SSMP recommended improvements will be to replace sewers in existing streets; therefore, the Condition No. 2 pricing schedule is used accordingly unless other information is available for selecting one of the other pricing schedules.

Table E-1. Cost Per Foot of Installed Pipe

Price Condition No. 1

Size, inches	Depth of cover, feet			
	6	10	14	18
8	$ 185	$ 297	$ 431	$ 588
10	$ 202	$ 317	$ 454	$ 614
12	$ 222	$ 340	$ 481	$ 644
15	$ 256	$ 382	$ 530	$ 701
18	$ 300	$ 431	$ 584	$ 760
21	$ 330	$ 477	$ 647	$ 828
24	$ 382	$ 545	$ 730	$ 921
27	$ 423	$ 580	$ 756	$ 953
30	$ 455	$ 616	$ 798	$ 1,000
36	$ 524	$ 701	$ 897	$ 1,114
42	$ 610	$ 804	$ 1,012	$ 1,240
48	$ 708	$ 913	$ 1,130	$ 1,369

Table E-2. Cost Per Foot of Installed Pipe				
Price Condition No. 2				
Size, inches	Depth of cover, feet			
	6	10	14	18
8	$ 253	$ 381	$ 530	$ 703
10	$ 272	$ 403	$ 556	$ 732
12	$ 294	$ 428	$ 584	$ 764
15	$ 335	$ 478	$ 645	$ 834
18	$ 381	$ 530	$ 702	$ 896
21	$ 414	$ 580	$ 768	$ 967
24	$ 473	$ 656	$ 862	$ 1,073
27	$ 517	$ 694	$ 891	$ 1,109
30	$ 551	$ 733	$ 936	$ 1,158
36	$ 634	$ 836	$ 1,058	$ 1,300
42	$ 725	$ 945	$ 1,178	$ 1,432
48	$ 833	$ 1,065	$ 1,311	$ 1,577

Table E-3. Cost Per Foot of Installed Pipe				
Price Condition No. 3				
Size, inches	Depth of cover, feet			
	6	10	14	18
8	$ 357	$ 482	$ 630	$ 800
10	$ 376	$ 504	$ 655	$ 828
12	$ 398	$ 529	$ 683	$ 860
15	$ 435	$ 574	$ 735	$ 920
18	$ 482	$ 626	$ 792	$ 982
21	$ 515	$ 676	$ 859	$ 1,053
24	$ 588	$ 761	$ 957	$ 1,159
27	$ 632	$ 799	$ 987	$ 1,195
30	$ 666	$ 838	$ 1,031	$ 1,244
36	$ 742	$ 929	$ 1,136	$ 1,364
42	$ 876	$ 1,081	$ 1,300	$ 1,540
48	$ 984	$ 1,202	$ 1,433	$ 1,685

As the collection system ages, upgrades to existing lift stations may be required to improve reliability and expand hydraulic capacity. Costs to rehabilitate or replace an existing lift station vary considerably depending on the specific needs of each station. These needs were not established as part of SSMP development other than identifying if hydraulic improvements are required. Costs included in the capital improvement program are based on a hydraulic upgrade only unless otherwise noted.

Bypass Pumping Cost Table

The replacement of an existing sewer will require bypass pumping in most cases. Bypass pumping costs are not included in the per foot construction costs listed above. These costs must be calculated separately and are based on the flow rates in the sewer and the amount of time that pumping is required. Guidelines for these costs are listed in Table E-4. Several vendors are located within the study area that can provide current quotes, if requested.

Table E-4. Bypass Pumping Costs

Diameter, inches	Size of pump(s), inches[a]	Assumed flow rate, gallons per minute (gpm)[b]	Approximate pumping capacity, gpm	Monthly rate[c]
8 – 12	4	200 – 600	600	$7,000
15 – 18	6	1000 – 1,600	1,600	$10,500
18 – 24	12	1,600 – 3,600	3,800	$19,000
>24	Consider combinations of above sized pumps based on known flow rates in project pipes.			

a. *A variety of pump sizes most likely will be used for projects to accommodate actual flows. Pump sizes shown are based on 1/2 pipe full conditions. Full pipe and/or work during wet weather periods could require much larger pumps.*

b. *Flow rates shown are based on ½ pipe full conditions and average pipe slope. Assumed pipe flow in 18-inch pipe is slightly less than 1/2 pipe full conditions.*

c. *Costs were provided by Rain for Rent (Portland) and based on a 28-day (monthly cycle). Actual costs will vary depending on site conditions.*

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Appendix F: Asbestos Information for Asbestos-Containing Cement Pipe

Fact Sheet

Asbestos Information for Asbestos-Containing Cement Pipe

DEQ and Lane Regional Air Protection Agency, known as LRAPA, have specific rules regarding the handling, removal and disposal of asbestos-containing materials, commonly referred to as ACM. DEQ and LRAPA regulate ACM abatement to prevent asbestos fiber release and exposure.

Asbestos fibers are a respiratory hazard proven to cause lung cancer, mesothelioma, and asbestosis. Asbestos is a danger to public health and a hazardous air pollutant for which there is no known safe level of exposure.

If you perform replacement, repair or maintenance activities on cement asbestos water or sewer pipe, also known as AC cement pipe, you need to be aware of rules that may affect your ability to perform these activities.

DEQ's asbestos survey rule requires a thorough inspection by an accredited inspector to determine the presence of ACM in or on all public or private structures prior to any renovation or demolition activities. A copy of the asbestos survey is required to be onsite during all renovation or demolition activities and DEQ can request a copy of the asbestos survey. Asbestos consultants and many of the asbestos abatement contractors can provide this service. Factsheets are available regarding the asbestos survey requirements.

When the renovation activity involves a single material, such as the replacement of AC cement pipe, there are two options:

1. You may presume the cement pipe contains asbestos.
2. You can collect a sample of the cement pipe and have it analyzed at a laboratory. If analysis results identify that the cement pipe contains asbestos, the AC cement pipe must be properly handled.

In general, there are two types of ACMs:

- **Friable** ACM will easily release asbestos fibers when crushed. When AC cement pipe materials are damaged or mishandled, the material is considered friable. Only DEQ licensed asbestos abatement contractors and certified asbestos workers can handle, remove and dispose of friable ACM. DEQ has specific training courses available that meet these certification needs. A list of DEQ licensed asbestos abatement contractors and training provider information is available on DEQ's asbestos information page.

- **Nonfriable** ACM has a binder that holds the asbestos fibers within a solid matrix so asbestos fibers will not easily release unless mishandled, damaged, or in badly worn or weathered condition. AC cement pipe in good condition and removed properly is considered a nonfriable material. You do not need to be a DEQ licensed asbestos abatement contractor or a certified asbestos worker to perform nonfriable asbestos abatement. **However, the nonfriable materials must remain in nonfriable condition and predominantly whole pieces during the removal and disposal process**.

If you remove nonfriable AC cement pipe, follow the instructions in the DEQ nonfriable guidance document. In addition, an ASN 6 nonfriable project notification and fee are required to be submitted to the DEQ's Business Office five days prior to the start date of the project.

The asbestos rules prohibit abandoning AC cement pipe in the ground once it has been exposed. There are special cases that allow AC cement pipe to be left in the ground such as when the AC cement pipe is under an existing roadway or under a building. Contact an asbestos program staff for additional information.

Nonfriable asbestos-containing waste material, referred to as nonfriable ACWM, must be kept adequately wet during abatement. DEQ recommends packaging the nonfriable ACWM in leak-tight containers. The ACWM must be disposed of at a landfill permitted to accept asbestos waste and should be accompanied by an ASN 4 waste shipment report at the time of disposal.

Contact the landfill prior to delivering the nonfriable ACWM. Landfills can be more stringent than DEQ and may only accept ACWM by appointment.

DEQ
State of Oregon Department of Environmental Quality

Asbestos Program

www.oregon.gov

Contact Information:

Clackamas, Clatsop, Columbia, Multnomah, Tillamook and Washington Counties, call the **Northwest Region – Portland Office** at 503-229-5982, 503-229-5364 or 800-452-4011.

Benton, Lincoln, Linn, Marion, Polk and Yamhill Counties, call the **Western Region – Salem Office** at 503-378-5086 or 800-349-7677.

Jackson, Josephine and Eastern Douglas Counties, call the **Western Region – Medford Office** at 541-776-6107 or 877-823-3216.

Coos, Curry and Western Douglas Counties, call the **Western Region – Coos Bay Office** at 541-269-2721, ext. 222.

Crook, Deschutes, Harney, Hood River, Jefferson, Klamath, Lake, Sherman and Wasco Counties, call the **Eastern Region – Bend Office** at 541-633-2019 or 866-863-6668.

Baker, Gilliam, Grant, Malheur, Morrow, Umatilla, Union, Wallowa and Wheeler Counties, call the **Eastern Region – Pendleton Office** at 541-278-4626 or 800-304-3513.

Lane County, call the **Lane Regional Air Protection Agency** at 541-736-1056.

Last Updated: 3/29/16
By: Dottie Boyd

Maintenance and comparable activities limited to less than three square feet or three linear feet of ACM, provided the removal is part of a needed repair operation, may be exempt from certain rules. Contact an asbestos program staff for more information.

If you disturb or mishandle ACM and cause the public or the environment to be potentially exposed to asbestos fibers, you may be subject to a DEQ order with civil penalties in violation of rule or statute.

Copies of nonfriable guidance documents, factsheets, ASN forms, lists and other information is available on DEQ's asbestos information page.

Find DEQ's asbestos rules in Oregon Administrative Rules 340, Division 248. If you have questions or need technical assistance, contact an asbestos program staff. Additional information is available on DEQ's asbestos information page.

Alternative Formats

Alternative formats of this document can be made available. For more information call 503-229-5696, Portland, or call toll-free in Oregon at 1-800-452-4011, ext. 5696. Hearing-impaired persons may call 711.

Appendix G: City of Newport Municipal Code Resolutions

CITY OF NEWPORT

RESOLUTION NO. 3721

A Resolution Setting Wastewater Utility Rates
and Repealing Resolution No. 3680

Findings

A. The City of Newport operates a wastewater utility that collects and treats wastewater from properties within the city and to some properties outside of the city limits but within the city's urban growth area.

B. Newport Municipal Code Chapter 5.15 governs the operation and use of the wastewater utility. NMC Section 5.15.070 authorizes the City Council to set rates for wastewater service by resolution.

C. The rates established by this resolution are calculated to cover the costs of sewer service, including amounts to pay for the operation, maintenance, repair, necessary replacement, and improvement of the system, but do not generate revenue above what is needed for sound operation and management of the sewer system.

Based on these findings, the City of Newport resolves as follows:

Section 1. Metered Rates

The charges imposed in this Section 1 apply to properties that have sanitary sewer service.

A. Single-Family Residences and Duplexes within City Limits

The charge for sewer service for single-family dwellings and duplexes within city limits shall be $22.90 per month, plus $6.60 per 1,000 gallons of water usage. Sewer user charges for the months of June, July, August, and September shall not exceed the highest monthly sewer user charge for the first four months of the calendar year.

B. Multi-Family Residences, Commercial Properties, and Single-Family Residences and Duplexes outside of city Limits

The basic charge for service for residential properties with three or more dwelling units, for all commercial properties, and for single-family residences and duplexes outside of City limits shall be $22.90 per month plus $7.55 per 1,000 gallons of water usage.

An "Extra Strength Charge" of $0.30 per pound of biochemical oxygen demand applies to commercial properties users when the biochemical oxygen demand exceeds 300 parts per million.

The charges for monitoring sewage discharge shall be $15.80 per combined sample and $8.25 per test.

Section 2. Individually Determined Rate

Commercial customers that are legally disposing of all or part of their processing wastewater to an acceptable waterway in conformance with applicable federal, state, and city laws, regulations and permits shall have a sewer user charge established by the City Manager based on an individual determination of the impact of the property on the sewer system. The City Manager shall take into account, when establishing the sewer rate, the estimated quantity in gallons, as well as, any adverse treatment or maintenance costs that may be incurred by the city handling extra strength wastewater that is being returned to the city sanitary sewers.

Section 3. Septage

The rate for disposal of septage at the city's wastewater treatment plant shall be $0.18 per gallon.

Section 4. Class A Sludge Sales

Class A sludge manufactured at the city's wastewater treatment plant may be purchased for $2.00 per cubic yard.

Section 5. This Resolution repeals Resolution No. 3680 in its entirety.

Section 6. Effective Date

The effective date of this resolution is July 1, 2015. As applied to monthly bills, the change shall be based on the date of billing, not the date of service.

Adopted by the Newport City Council on June 15, 2015.

CITY OF NEWPORT

Sandra N. Roumagoux

Sandra N. Roumagoux, Mayor

ATTEST:

Margaret M. Hawker

Margaret M. Hawker, City Recorder

CITY OF NEWPORT

RESOLUTION NO. 3722

A Resolution Setting Utility Infrastructure Improvement Fees and Repealing Resolution No. 3681

Findings

A. The City of Newport operates water, wastewater, and stormwater utilities that provide services to properties within the city and to some properties within the city's urban growth boundary.

B. Newport Municipal Code Chapter 5.10 governs the operation and use of the water utility. NMC Section 5.10.200 authorizes the City Council to set charges for water service by resolution.

C. Newport Municipal Code Chapter 5.15 governs the operation and use of the wastewater utility. NMC Section 5.15.070 authorizes the City Council to set charges for wastewater service by resolution.

D. Newport Municipal Code Chapter 5.20 governs the operation and use of the stormwater utility. NMC Section 5.20.040 authorizes the City Council to set charges for stormwater service by resolution.

E. The rates established by this resolution are calculated to cover the costs of water, wastewater, and stormwater maintenance, repair, necessary replacement, and improvement of the system, but do not generate revenue above what is needed forthese improvements .

Based on these findings, the City of Newport resolves as follows:

Section 1. Utility Infrastructure Improvement Fee

A. The charges imposed in this Section 1 apply to properties that have metered city water service.

Each customer shall pay a monthly infrastructure improvement fee. The fees are set as follows:

Water Meter Size	Monthly Infrastructure Improvement
¾"	$ 6.95
1"	$ 13.85
1 ½"	$ 27.75
2"	$ 48.35
3"	$124.25
4"	$193.20
5" and larger	$441.70

Irrigation-only meters will be exempt from the Monthly Infrastructure Improvement Fee.

Section 2. This Resolution repeals Resolution No. 3681 in its entirety.

Section 3. Effective Date

The effective date of this resolution is July 1, 2015. As applied to monthly bills, the change shall be based on the date of billing, not the date of service.

Adopted by the Newport City Council on June 15, 2015.

CITY OF NEWPORT

Sandra N. Roumagoux

Sandra N. Roumagoux, Mayor

AITEST:

Margaret M. Hawker

Margaret M. Hawker, City Recorder

Appendix H: Major Pump Station Improvements Cost Breakdown

Appendix H

Major Pump Station Improvements Cost Breakdown

A breakdown of costs for major pump station improvements are listed in Tables H-1 through H-5 below.

Table H-1. Northside Pump Station Rough Cost

Description	Estimated cost of improvements, 2016 dollars
Demolition	100,000
New Pumps (installed)	
3 @ $150,000/each	450,000
Upgrade Electrical	
Power and VFDs	500,000
Controls/SCADA	100,000
Miscellaneous Concrete/Structural Modifications	50,000
Coatings, Miscellaneous Modifications	50,000
Bypass Pumping	75,000
Sequencing and Constraints	150,000
Subtotal	**1,475,000**
30% Contingency	442,500
Subtotal	**1,917,500**
Engineering and Administration @ 20%	383,500
Contractor Mark-Ups @ 25%	479,000
Total	**2,780,000**

H-2. Nye Beach Pump Station Rough Cost	
Description	Estimated cost of improvements, 2016 dollars
Demolition	100,000
New Pumps (installed)	
2 @ $150,000/each	300,000
Upgrade Electrical	
Power and VFDs	500,000
Controls/SCADA	100,000
Miscellaneous Concrete/Structural Modifications	50,000
Coatings, Miscellaneous Modifications	50,000
Bypass Pumping	100,000
Sequencing and Constraints	300,000
Subtotal	**1,500,000**
30% Contingency	450,000
Subtotal	**1,950,000**
Engineering and Administration @ 20%	390,000
Contractor Mark-Ups @ 25%	488,000
Total	**2,828,000**

H-3. Bayfront Pump Station Rough Cost	
Description	Estimated cost of improvements, 2016 dollars
Demolition	100,000
New Pumps (installed)	
2 @ $250,000/each	500,000
Upgrade Electrical	
Power and VFDs	600,000
Controls/SCADA	110,000
Miscellaneous Concrete/Structural Modifications	50,000
Coatings, Miscellaneous Modifications	50,000
Bypass Pumping	100,000
Sequencing and Constraints	200,000
Subtotal	**1,710,000**
30% Contingency	513,000
Subtotal	**2,223,000**
Engineering and Administration @ 20%	444,600
Contractor Mark-Ups @ 25%	556,000
Total	**3,223,600**

H-4. SE Running Springs Drive Pump Station Rough Cost	
Description	Estimated cost of improvements, 2016 dollars
Demolition	50,000
New Pumps (installed)	
2 @ $50,000/each	200,000
Upgrade Electrical	
Power and VFDs	150,000
Controls/SCADA	50,000
Miscellaneous Concrete/Structural Modifications	30,000
Coatings, Miscellaneous Modifications	20,000
Bypass Pumping	25,000
Sequencing and Constraints	100,000
Subtotal	**625,000**
30% Contingency	187,500
Subtotal	**812,500**
Engineering and Administration @ 20%	162,500
Contractor Mark-Ups @ 25%	203,000
Total	**1,178,000**

H-5. NW 56th Street Pump Station Rough Cost	
Description	Estimated cost of improvements, 2016 dollars
Demolition	50,000
New Pumps (installed)	
2 @ $100,000/each	200,000
Upgrade Electrical	
Power and VFDs	200,000
Controls/SCADA	75,000
Miscellaneous Concrete/Structural Modifications	40,000
Coatings, Miscellaneous Modifications	20,000
Bypass Pumping	30,000
Sequencing and Constraints	100,000
Subtotal	**715,000**
30% Contingency	214,500
Subtotal	**929,500**
Engineering and Administration @ 20%	185,900
Contractor Mark-Ups @ 25%	232,000
Total	**1,347,400**

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Appendix I: Bayside Sewer Rehabilitation Feasibility Study (November 2012)

Brown and Caldwell
6500 SW Macadam Avenue, Suite 200
Portland, Oregon 97239
Tel: 503-244-7005
Fax: 503-244-9095

Technical Memorandum

Prepared for: City of Newport

Project Title: Bayside Sewer Feasibility Study

Project No: 143172

Technical Memorandum No. 1

Subject: Bayside Sewer Rehabilitation Feasibility Study

Date: November 2, 2012

To: Tim Gross, P.E., City Engineer/Public Works Director

From: James R. Hansen, P.E., Project Manager

Copy to: Ted Jones, P.E., City of Newport, Senior Project Manager
John Ritchey, City of Newport, Wastewater Supervisor

Prepared by: Cameron Foucht, P.E., Project Engineer

Reviewed by: James R. Hansen, P.E., Project Manager

Limitations:

This document was prepared solely for City of Newport in accordance with professional standards at the time the services were performed and in accordance with the contract between City of Newport and Brown and Caldwell dated August 1, 2012. This document is governed by the specific scope of work authorized by City of Newport; it is not intended to be relied upon by any other party except for regulatory authorities contemplated by the scope of work. We have relied on information or instructions provided by City of Newport and other parties and, unless otherwise expressly indicated, have made no independent investigation as to the validity, completeness, or accuracy of such information.

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List of Tables

1. Background

This City of Newport (City) has retained Brown and Caldwell (BC) to identify and evaluate alternatives for repair or replacement of a section of 20-inch-diameter force main that is experiencing leaks under high flow conditions. The pipeline conveys raw sewage between the Northside Pump Station and the wastewater treatment plant (WWTP) located across Yaquina Bay. The scope of this Technical Memorandum (TM) is limited to a section of steel force main pipe (i.e., Bayside Sewer) installed on a steep slope above Yaquina Bay. City maintenance and engineering staff have reported leaks in the pipe during wet weather events and have made several repairs to the pipeline in recent years.

1.1 Existing Pipeline Materials and Construction

The pipeline is installed on a steep slope at a grade of 80 percent. Access to the pipe is very limited due to the steepness of slope. A concrete block secured to the top using pin piles keeps the pipe from sliding down the slope. The pipe is backfilled using a cement treated fill of unknown strength installed to a depth of 9 inches.

The pipeline is constructed as outlined in Table 1. Available shop drawings for the pipeline are included in Attachment A.

Table 1. Pipeline Materials

Pipe Type	Steel, unknown type, spiral weld, straight weld, or seamless
Joint type	Welded
Wall thickness	0.25-inch
Pipe diameter	20 inches
Interior coating	16-mil coal-tar epoxy coating
Exterior coating	50-mil polyethylene tape wrap

Each pipe segment is also fitted with an 8-5/8-inch-diameter port that was used to apply interior coatings after the field welds were completed.

1.2 Existing Hydraulic Conditions

A hydraulic profile for the pipeline was prepared by the design engineer and is included in Appendix A. Flow originating from the Northside Pump Station is pumped to the bluffs above Yaquina Bay where it then transitions to gravity flow and to a backwater pool used to drive flow under Yaquina Bay via an inverted siphon. Flows are then conveyed via gravity to the WWTP influent pump station located 2 miles south of the bay.

The Bayside section of pipe is under gravity flow at the top of the slope and is pressurized or surcharged at the bottom to provide a driving head for the downstream inverted siphon. The hydraulic grade line (HGL) indicates that this section of pipe will be surcharged to an elevation of 120 feet during a flow event of 8 million gallons per day. The actual amount of surcharge and pressures experienced may be greater depending on influences such as debris or grease buildup in downstream pipe segments and/or increases in pipe wall roughness from corrosion or abrasion from solids in the waste stream. In addition, if the air release valve at the top of the slope fails or is not maintained, additional pressures beyond hydraulic head may be experienced by the pipeline. BC recommends that any alternative be designed to withstand an internal pipe pressure of at least 60 pounds per square inch (psi) or 1.5 times the maximum expected pressure in this segment of the pipeline.

If the pipeline under the bay has never been cleaned or inspected, it is likely that debris or grease may have built up in the lower sections of the siphon, artificially increasing the HGL in the pipeline and surcharging the sewer to the top of the hill. The theoretical maximum pressure will be experienced at the bottom of the slope when the pipe has surcharged to the top of the hill. BC recommends that the entire pipeline be cleaned and inspected to verify the condition of the siphon and possibly reduce the pressures experienced at joints that have experienced failures in the past.

In this pipeline, a hydraulic jump occurs as flow hits the pool used to drive it through the inverted siphon. Turbulence at this transition can cause an increase in hydrogen sulfide (H_2S) generation within which can lead to premature failures in pipe materials from corrosion.

1.3 Existing Pipe Condition

The City has reported two welded joints that were corroded to the point of failure and were observed to be leaking during wet weather events. The failed joints were repaired by re-welding.

BC has performed a review of closed-circuit television (CCTV) video footage and photos provided by the City. The CCTV is a partial inspection and shows only a segment from the inspection port at STA 42+ 80 to the 90-degree horizontal bend at STA 43+58 as shown on Sheet 23 of the Record Drawings included in Attachment A of this TM.

On the video, the pipe appeared to be in good condition, except for the joints, with little evidence of corrosion or interior coating loss in visible sections of the pipe. Rust colored stains and corrosion can be observed coming from several un-opened inspection ports and a few of the welded pipe joints. BC recommends that full circumferential inspections of all joints be performed with flow in the pipe reduced to zero to confirm the full extent of the corroded joints.

Photos were provided that show loss of pipe wall material and corrosion at an unknown location in the pipeline. Figure 1 shows a corroded weld joint at an unknown location in the pipeline.

Figure 1. Welded steel pipe joint corrosion

2. Rehabilitation or Replacement Alternatives

Rehabilitation or replacement of the pipeline is required to ensure that it continues to operate without additional failures. The alternatives discussed below are preliminary and their ultimate feasibility may be subject to additional design or analysis.

All alternatives under consideration will require flow bypassing to perform the work. BC has not contemplated the details of flow bypassing for this analysis and assumes that a feasible bypass scenario exists for this pipeline.

2.1 Rehabilitation of Existing Welds and Coating

This alternative focuses on repairing and increasing the longevity of each joint as opposed to a repairing or replacing the entire pipeline. One option would be to expose the joints and wrap them with additional steel reinforcement material. There are six joints located on the anchor clock at the top of the slope and the 90-degree bend at the bottom. It is currently unknown how many of them would require rehabilitation and a comprehensive inspection using smart pigging technology is recommended to identify all defects to be repaired. Joints located in the anchor block at the top of the slope would not be accessible with this repair method and may require additional rehabilitation.

The cement treated backfill would need to be chipped away from the pipe and an excavation performed to expose each joint fully. The original amine-cured coal tar epoxy coating would need to be removed in the areas affected by the heat of new welds and reapplied through the existing 8-inch-diameter inspection ports. Figure 2 depicts this alternative.

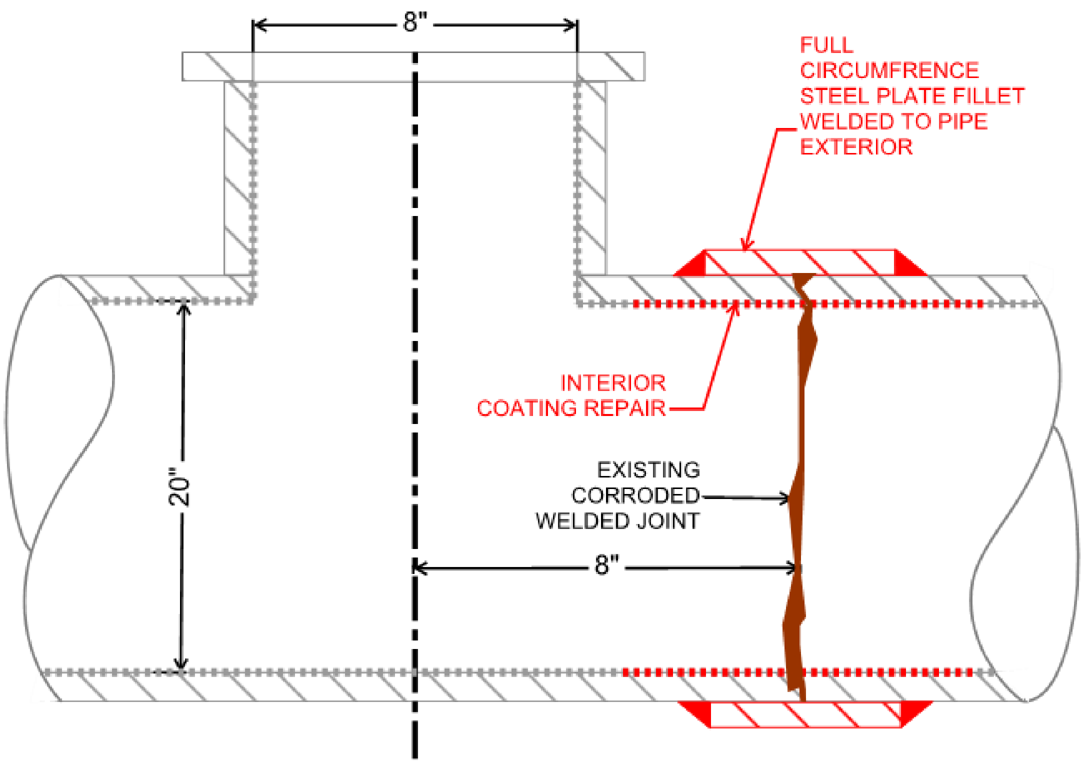


Figure 2. Welded steel pipe joint repair

(not to scale)

An alternative to welding a steel plate would be to pour a reinforced concrete closure collar around each joint and repair the interior corrosion protection coating. The original joint may continue to deteriorate over time and it will be more difficult to ensure that the concrete collar is watertight under the pressures experienced by the pipeline. Figure 3 depicts this alternative.

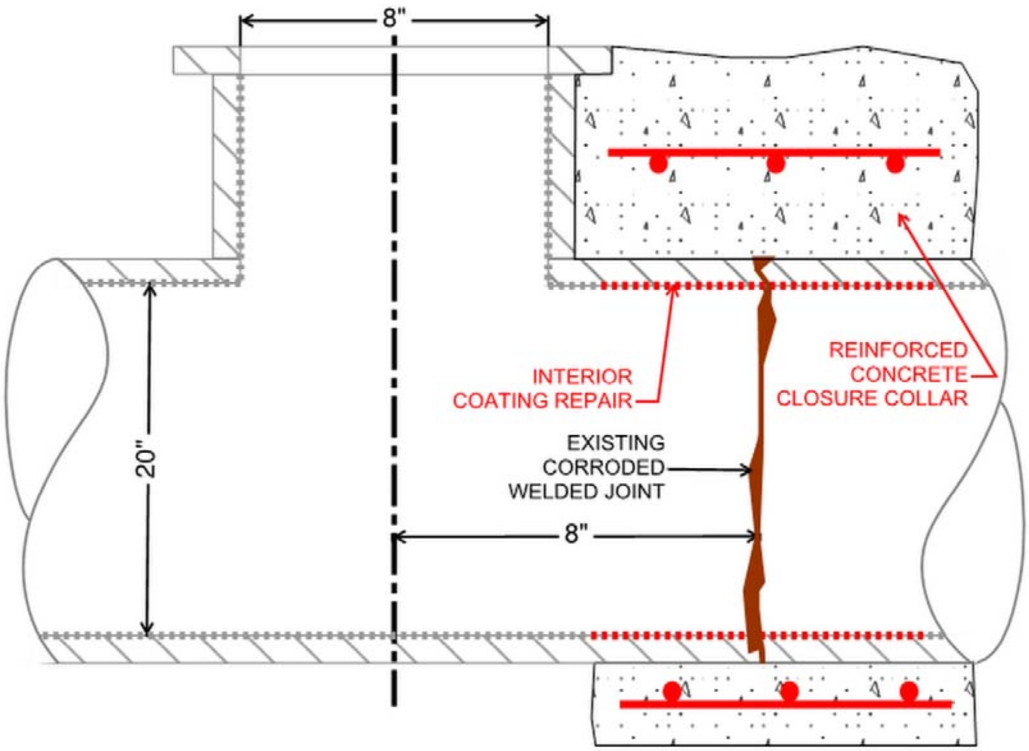


Figure 3. Concrete closure collar joint repair

(not to scale)

1. Cost: Capital costs likely would be $100,000 to $150,000. The estimate includes additional smart pig inspections and assumes that all six joints require rehabilitation and nothing is needed to repair the joints within the anchor block.

2. Implementation Schedule: This option can be implemented rapidly with minimal time for permitting, engineering design, and construction.

3. Advantages
   a. Low cost
   b. Minimizes impact to the existing slope by construction equipment and constructed features
   c. Anchor block modifications not required
   d. Additional pipe anchorage not required

4. Disadvantages
   a. Abrasion and corrosion would continue in the existing pipe as the thin interior corrosion protection coating continues to deteriorate over time and H_2S attacks the steel. For this reason, it may be a shorter-term solution than other alternatives.

b. Properly preparing the joints for coating may not be feasible through the existing ports. Inspection and confirmation of the coating repairs also would be difficult.

c. The existing pipe wall thickness is unknown. If the wall thickness currently is too thin, welding to the existing pipe may not provide an adequate joint and would not add to the remaining useful life of the pipe.

d. Rehabilitation would be limited to accessible joints only and would not repair or reinforce existing coating in pipe sections.

e. Access would be difficult for construction workers and equipment required to expose and repair the joints.

f. This alternative would not solve or mitigate H_2S generation within the pipeline.

2.2 Cured-in-Place-Pipe (CIPP) Lining

This alternative would remove sections of the existing pipe at the top and bottom of the slope so that a CIPP liner could be installed. The liner may be installed upstream of the anchor block at the top of the slope but the two bends would cause wrinkling in the liner and may be risky to install through the block. If the pipe section is removed downstream of the anchor block, the existing steel pipe also would need to be secured to prevent it from moving down the slope.

The foremost technical challenge with this option would be to seal the downstream CIPP termination against the 60 psi design head. Additionally, BC does not recommend reinstating any of the inspection ports because it would be almost impossible to provide a pressure-resistant method of sealing the CIPP liner at the inspection port hole.

1. Cost: Capital costs likely would be under $150,000.

2. Implementation Schedule: This option can be implemented rapidly with minimal time required for permitting, engineering design, and construction.

3. Advantages
   a. Low cost
   b. Minimizes impact to the existing slope by construction equipment and constructed features
   c. Modifications to anchor block modifications not required
   d. Increases service life of the entire pipeline rather than improvement of individual defects

4. Disadvantages
   a. Making a watertight transition from the CIPP to the existing steel pipe at the bottom of the slope that will resist the estimated internal hydraulic pressure would be challenging technically and may make this alternative infeasible as final design details are determined.
   b. The existing inspection ports would be abandoned, decreasing access for maintenance.
   c. The steel host pipe may continue to deteriorate from atmospheric corrosion sources and may become disconnected from the anchor block at the top of the slope. CIPP has low tensile strength and may be susceptible to elongation creep or failure if the host pipe begins to move down the slope.
   d. It would be difficult to rehabilitate a failed installation on the slope.
   e. Wrinkles at the bends would make video inspection and additional cleaning more difficult.

f. CIPP is not very abrasion resistant and may be susceptible to premature wall thickness deterioration from sand in the waste stream.

g. This alternative would not solve or mitigate H_2S generation within the pipeline.

2.3 Slip-Lining

Sections of existing pipe would be removed at the top and bottom of the slope and an high-density polyethylene (HDPE), poly-vinyl chloride (PVC), or other suitable pipe material would be slipped in to the existing host pipe. Up to 5 to 6 inches of inside diameter would be lost using this approach. However, this is not a concern due to the extreme slope that provides excess hydraulic capacity to this section of the pipeline. This option would address the steep section of pipe only and BC recommends that additional inspections be performed to verify the problem does not extend to other portions of the pipe, adjacent to or within the anchor block, or downstream of the 90 degree bend. If significant pipe wall deterioration is found at the upper connection, additional measures will be required to provide a sound connection point for the liner pipe. If significant corrosion is found within or upstream of the anchor block, CIPP rehabilitation may be appropriate to fully rehabilitate the pipe.

Special attention would need to be given to holding the existing pipe on the slope after detachment from the anchor block during construction. Additional temporary or permanent anchors may be required at the top of the slope as determined during the design phase. Figure 4 depicts this alternative.

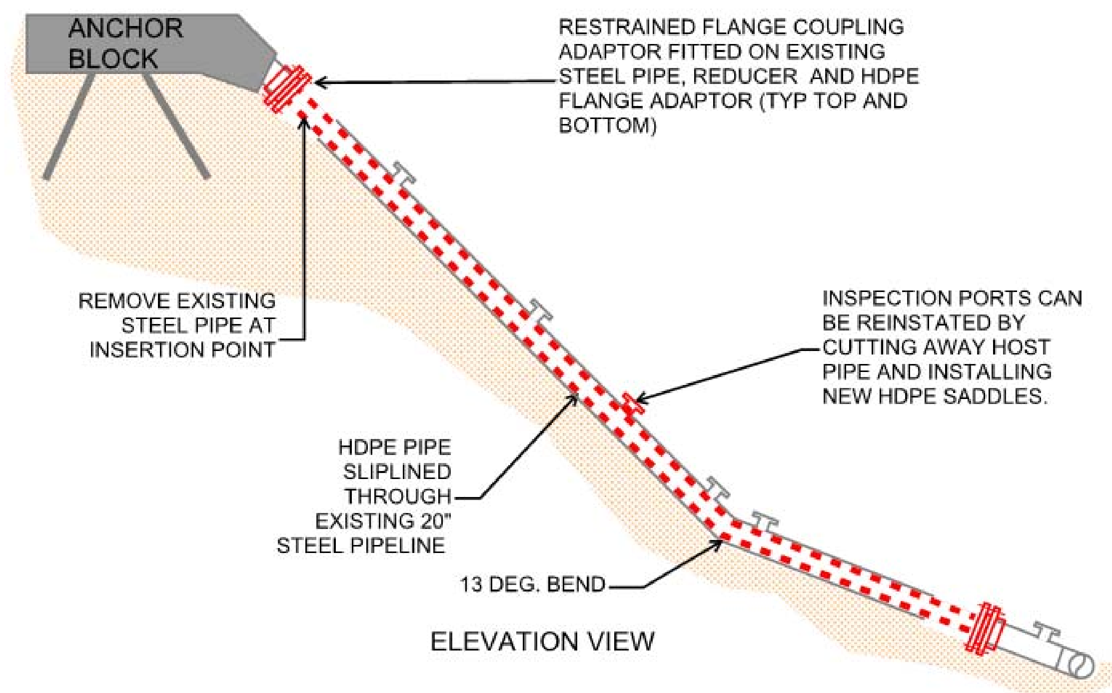


Figure 4. Slip lining schematic

1. Cost: Capital costs likely would be $150,000 to $200,000. The ultimate cost of this option would depend on the extent of corrosion which is currently unknown.

2. Implementation Schedule: This option can be implemented rapidly with minimal time required for permitting, engineering design, and construction.

3. Advantages
   a. Low cost
   b. Low impact to the existing slope by construction equipment and constructed features
   c. Abrasion-resilient pipe material
   d. Use of saddles installed on the new pipe to reinstate inspection ports

4. Disadvantages
   a. The existing host pipe would need to be cut at the top of the slope disconnecting it from the anchor block. Provisions would need to be made during construction to ensure that the pipe does not slide down the hill during and after construction.
   b. Connecting to the existing steel pipe at the upstream and downstream ends would be challenging technically. The connection would need to be strong enough to handle internal pressures and transfer tensile loads to the anchor structure at the top of the hill.
   c. It is likely that the existing anchorage structure would need to be retrofitted to accommodate this alternative.
   d. Deteriorated joints near or inside the anchor may not be rehabilitated using this method.
   e. This alternative would not solve or mitigate H_2S generation within the pipeline.

2.4 Parallel Alignment

A new pipe manufactured from ductile iron (DI), fiberglass reinforced plastic, PVC, HDPE, or other suitable pipe material would be constructed along a parallel alignment and a new anchor structure would be installed at the top of the hill to provide support for the new pipe. Unlike the other alternatives discussed above, this option would provide full replacement of the steel pipe from the upstream transition to DI pipe past the 90-degree bend at the bottom of the hill. Figure 5 depicts this alternative.

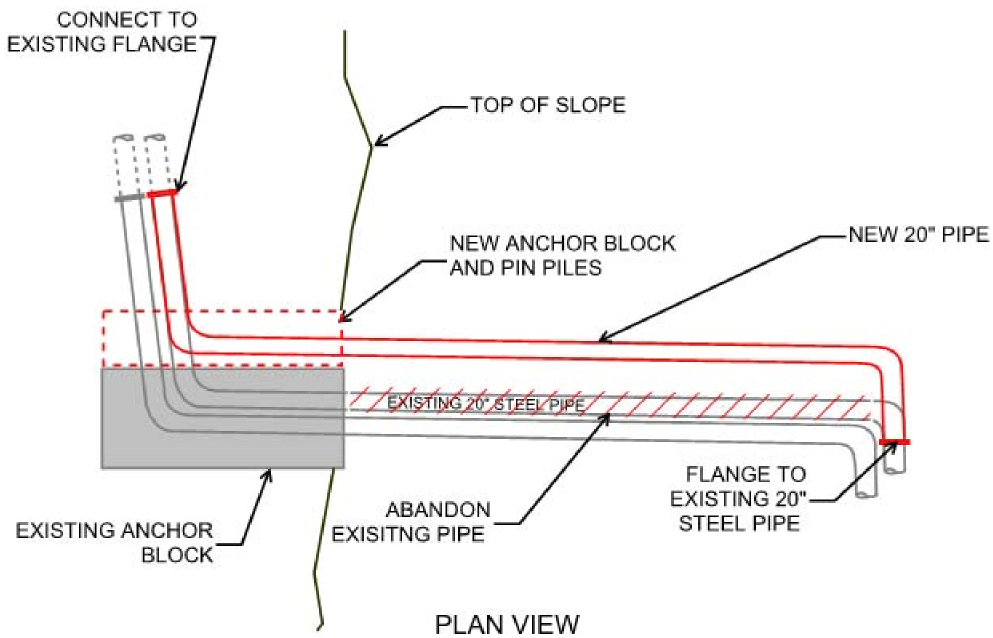


Figure 5. Parallel alignment schematic

1. Cost: Capital costs likely would be $200,000 to $300,000.

2. Implementation Schedule: Geotechnical explorations and design would take some time for this design to be implemented. The construction duration would be longer than previous options. In addition, procurement of additional easements may impact the schedule.

3. Advantages
   a. An entirely new pipe can be constructed with appropriate materials to withstand corrosion and abrasion from waste stream constituents and hydraulic pressures.
   b. The existing pipe and anchor block would remain undisturbed which may simplify design and construction.
   c. The steel pipe would be replaced from the flanged connection, as shown in Figure 5, removing the possibility of deteriorated joints within the anchor block or existing pipe.

4. Disadvantages
   a. More difficult construction conditions due to the steep slope
   b. More expensive than other options
   c. Would not solve or mitigate H_2S generation within the pipeline
   d. Lack of existing permanent easements and difficulty in procuring them

2.5 New Pipeline Constructed Along Alternate Alignment

This option proposes looking into alternative alignments that reduce the extreme slope of the current alignment. An alternate 2,850-foot alignment down Fogarty Street, as shown in Figure 6, would reduce grade from an average slope of around 45 percent with a maximum slope of 80 percent to a slope of 8 to 12 percent. This would allow broader pipe material selection, decrease the flow velocities, and subsequently decrease pipe loss due to abrasion. Ease of operations and maintenance and pipeline accessibility would be improved.

This is by far the most expensive solution to the problem, but may be the most durable and long lasting available. Difficult construction conditions also would be mitigated under this alternative.

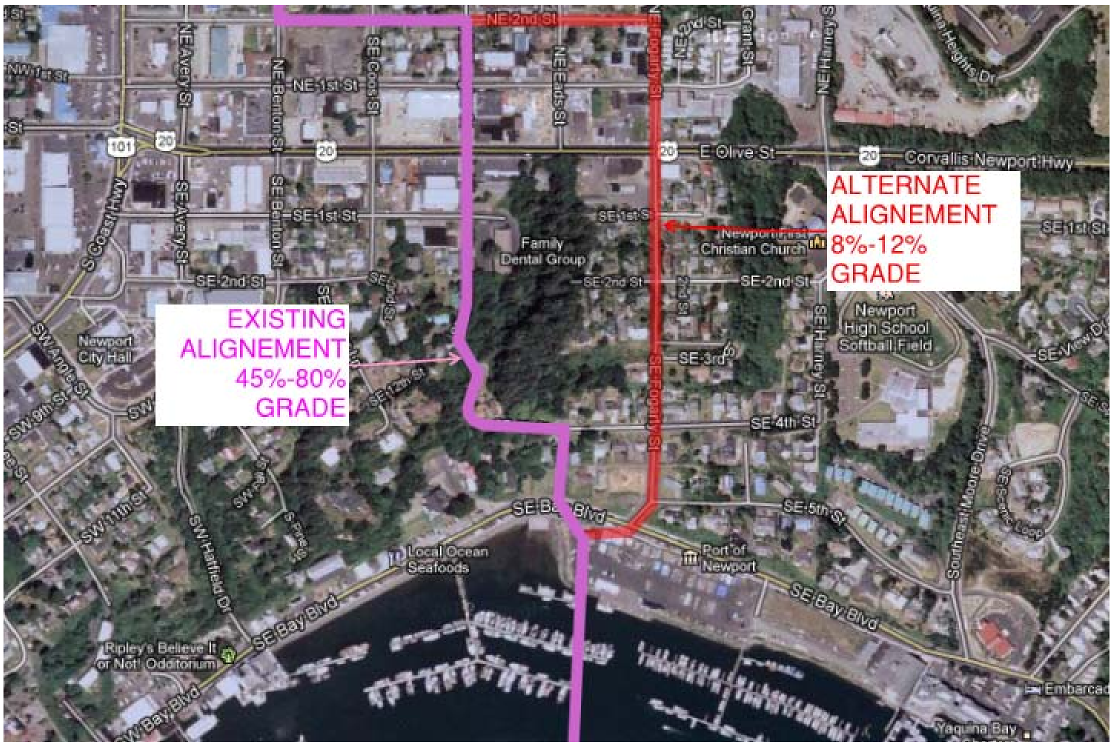


Figure 6. Alternate pipeline alignment

1. Cost: Capital costs likely would be $800,000 to $1.5 million.

2. Implementation Schedule: Geotechnical explorations, existing utility analysis, and design would be required for this alternative to be implemented. It would take longer than other alternatives and may take up to 8 to 12 months to design and construct.

3. Advantages
   a. An entirely new pipe would be constructed with appropriate materials to withstand corrosion and abrasion from waste stream constituents and hydraulic pressures.
   b. A wider variety of pipe materials are appropriate.
   c. H_2S generation would be reduced, increasing the pipeline's useful life.

   d. Velocities would decrease, reducing abrasion of the pipe wall and increasing the useful life of the pipeline.
   e. Maintenance would be easier.
   f. The entire steel section of pipeline would be removed from service, eliminating problems in the future.
   g. It would reduce engineering and construction risks and challenges associated with the steep slope.
   h. The pipeline could be constructed entirely within the public right-of-way, eliminating the need for easements.

4. Disadvantages
   a. More expensive than other options
   b. Unknown utility conflicts along the alignment that may make the proposed alignment infeasible
   c. May impact Northside Pump Station hydraulics and capacity

3. Next Steps and Recommendations

Prior to selecting a preferred alternative, BC requests that a workshop be held with City staff to further discuss and clarify the options presented in this TM and identify an overall strategy for the project moving forward.

Attachment A: Record Drawings and Shop Drawings

Record Drawings, CH2MHILL and Fuller Morris, 2-SBWWTP-01 Conveyance Pipelines & Pump Stations

Sheet 13. Overall Plan, Profile, and Hydraulic Grade Lines

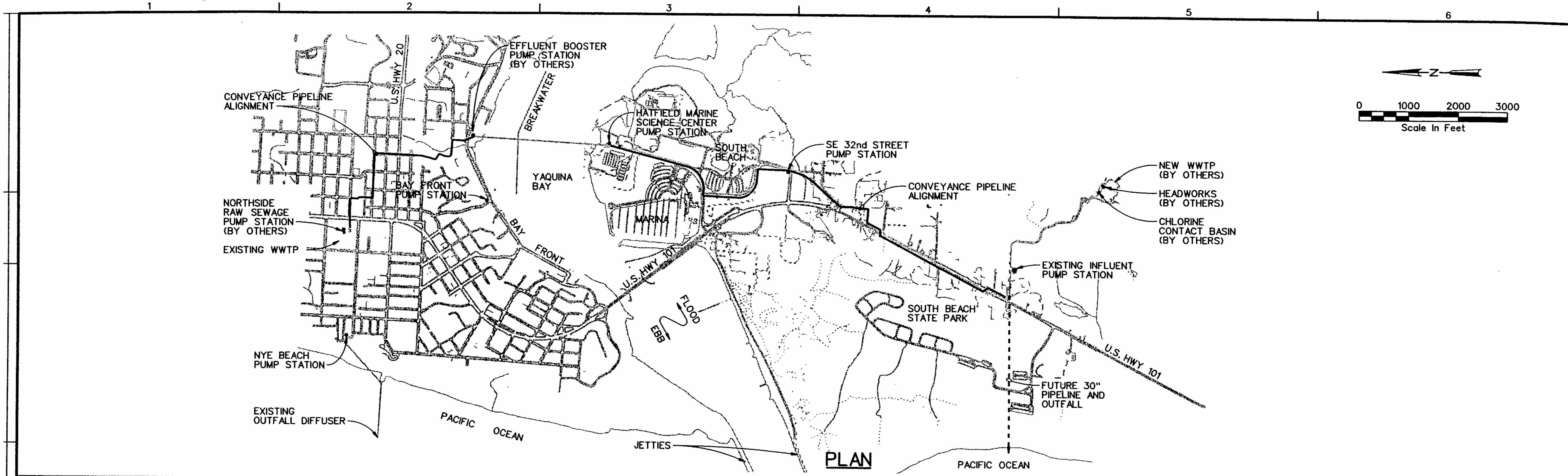
Sheet 23. Northside Welded Steel Pipe Plan and Profile

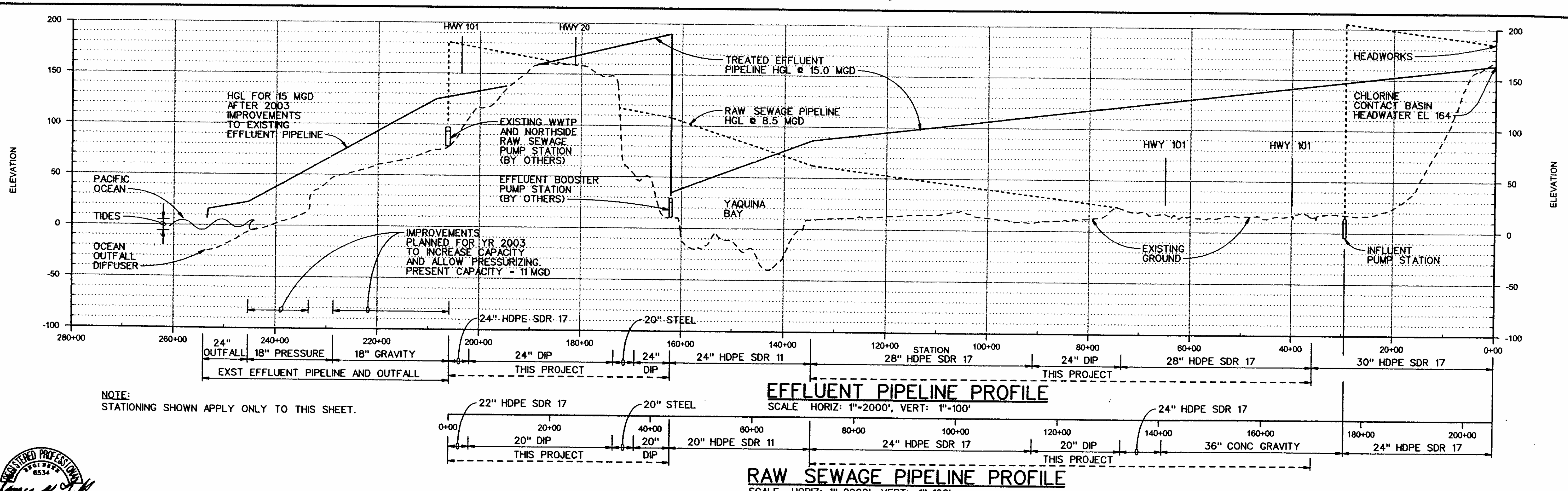
Sheet 24A. Northside Anchor Block Plan and Sections

Shop Drawings, West Coast Pipe Linings

Sheet 1 of 27. Steel Pipeline Shop Drawing Plan

Sheet 2 of 27. Mark 1A Pipe Spool Shop Drawing





NOTE:
STATIONING SHOWN APPLY ONLY TO THIS SHEET.

REGISTERED PROFESSIONAL ENGINEER 6534 OREGON JULY 14, 1986 JAMES K. FULLER
EXP. 12-31-01

DSGN	JK FULLER
DR	LG McCALL
CHK	RM BRACKEN
APVD	RM BRACKEN JK FULLER

NO.	DATE	REVISION	BY	APVD
1	12/03	Record Dwg. (See Statement on Sheet No. 1)	JKF	

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING.
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IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

FULLER & MORRIS Engineering, Inc.

CH2MHILL

CITY OF NEWPORT, OREGON
2-SBWWTP-01
CONVEYANCE PIPELINES
&
PUMP STATIONS

GENERAL
OVERALL PLAN, PROFILE AND HYDRAULIC GRADE LINES

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PROJ	150634

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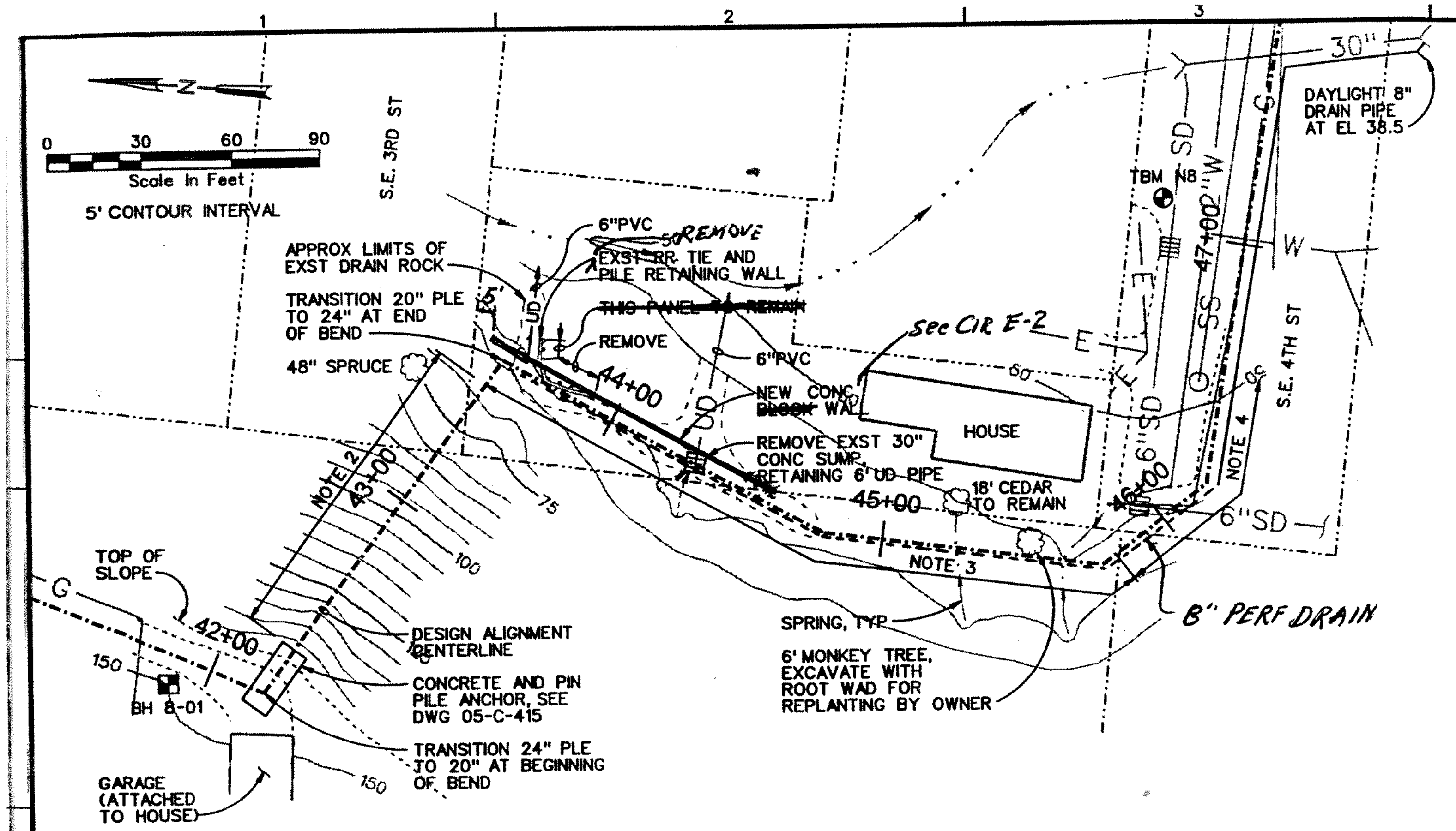
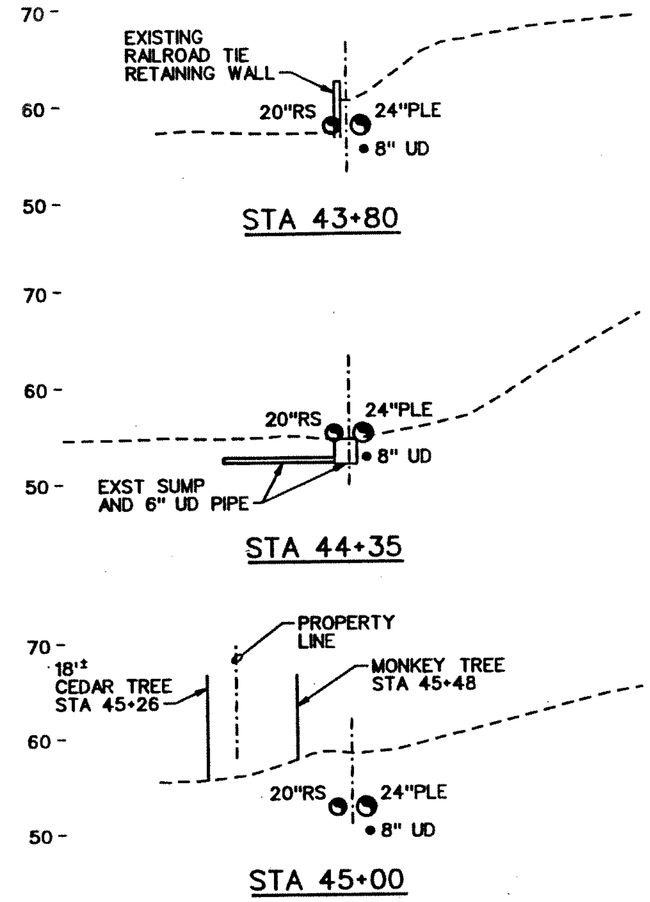


PLAN

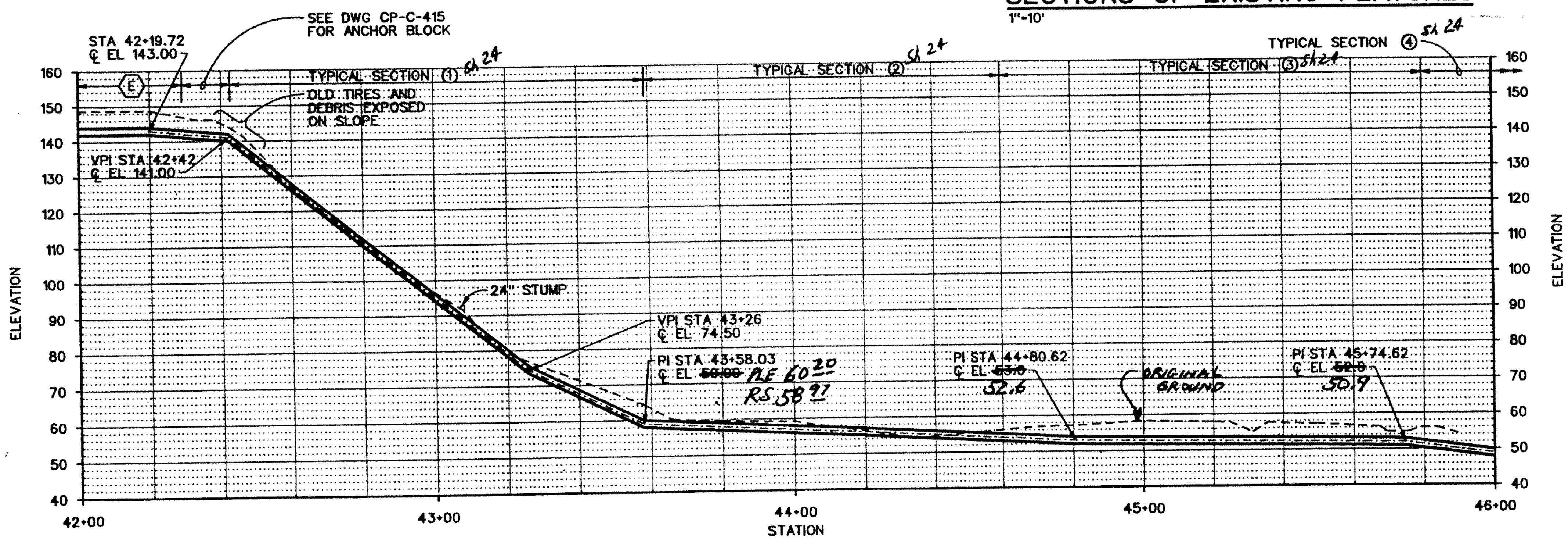


SECTIONS OF EXISTING FEATURES

1"=10'

NOTES:

1. GENERAL
   - A. REMOVE ALL CLEARING AND EXCAVATED NATIVE MATERIALS FOR DISPOSAL OFF SITE EXCEPT AS NOTED ON TYPICAL SECTIONS.
   - B. RETAIN AND REUSE EXISTING DRAIN ROCK FROM REQUIRED EXCAVATIONS, FOR TRENCH BACKFILL WHERE SHOWN.
   - C. RESTORE EXISTING GRAVEL SURFACES DISTURBED BY THE CONSTRUCTION.
2. STEEP SLOPE SECTION OF PIPELINE
   - A. ALL WORK SHALL BE CONDUCTED IN A MANNER TO MINIMIZE SOIL DISTURBANCE.
   - B. DO NOT DISTURB AREA BEYOND THE WIDTH OF THE ACTUAL TRENCH EXCAVATION.
   - C. NO WHEELED OR TRACKED EQUIPMENT WILL BE ALLOWED ON THE SLOPE.
   - D. ACCEPTABLE EQUIPMENT TO MOVE, REMOVE, POSITION, AND PLACE CONSTRUCTION MATERIALS WOULD INCLUDE A CABLE SYSTEM OPERATED FROM THE BOTTOM OR TOP OF THE SLOPE.
   - E. WRAP PIPE WITH TWO LAYERS OF GEOTEXTILE AS SHOWN ON TYPICAL SECTIONS.
3. SECTION OF PIPELINE PARALLELING TOE OF SLOPE
   - A. THIS SECTION OF PIPELINE TRAVERSES AN AREA OF HIGH GROUNDWATER AND SPRINGS WITH EXISTING DRAINAGE FACILITIES (UNDERDRAINS AND DRAIN ROCK) CONSTRUCTED BY OTHERS TO CONTROL THE WATER.
   - B. THE INTENT OF THE NEW CONSTRUCTION IS TO LEAVE UNDISTURBED, THOSE EXISTING DRAINAGE FACILITIES THAT ARE OUTSIDE THE IMMEDIATE TRENCHING LIMITS FOR THE NEW PIPE.
   - C. COMPLETE CONSTRUCTION OF THE NEW 8" PERFORATED DRAIN PIPE AND DRAIN ROCK FROM STATION 43+60 TO STATION 46+00 TO THE SUBGRADE ELEVATION OF THE NEW 20" AND 24" STEEL PIPE PRIOR TO CONSTRUCTION OF THE STEEL PIPE IN THIS SECTION.
4. SECTION OF PIPELINE IN STREET RIGHT-OF-WAY
   - A. THIS SECTION OF PIPELINE INCLUDES AN 8" DRAIN PIPE TO CARRY FLOW FROM THE NEW 8" PERFORATED DRAIN FOR DISCHARGE BESIDE THE 30" CULVERT NEAR STATION 47+70.



TRUE SCALE PROFILE

HORIZ AND VERTICAL: 1"=20'

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REGISTERED PROFESSIONAL ENGINEER 8534 OREGON JULY 15, 1988 JAMES K. FULLER

EXP. 12-31-01

DSGN G SILBERNAGEL	1	12/03	Record Dwg. (See Statement on Sheet No. 1)	JKF	
DR LG McCALL					
CHK JL McWADE	1	5/01	ADDENDUM NO. 1 (NEW DRAWING)	JKF	JKF
APVD RM BRACKEN JK FULLER	NO.	DATE	REVISION	BY	APVD

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FULLER & MORRIS Engineering, Inc.

CH2MHILL

CITY OF NEWPORT, OREGON
2-SBWWTP-01
CONVEYANCE PIPELINES
&
PUMP STATIONS

CONVEYANCE PIPELINES

NORTHSIDE WELDED STEEL PIPE
PLAN AND PROFILE

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DATE	APRIL 2001
PROJ	150634

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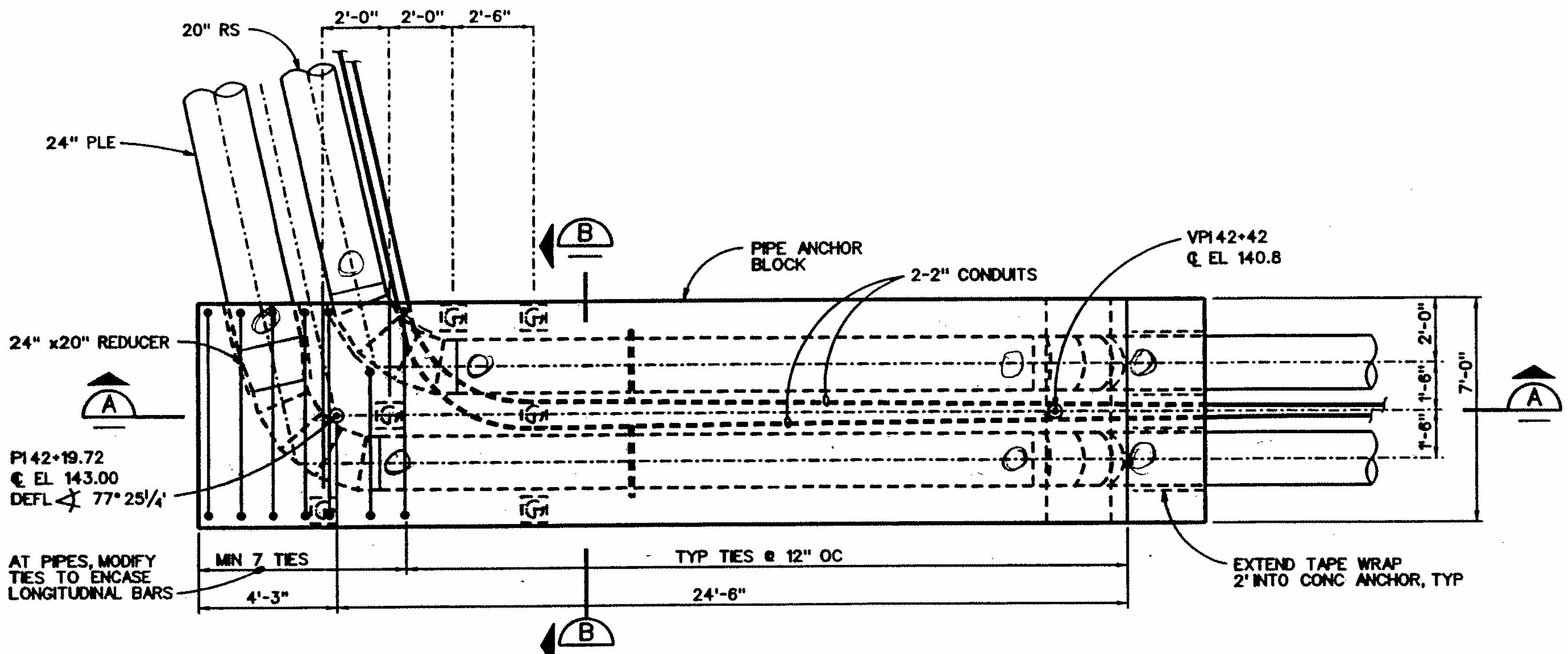
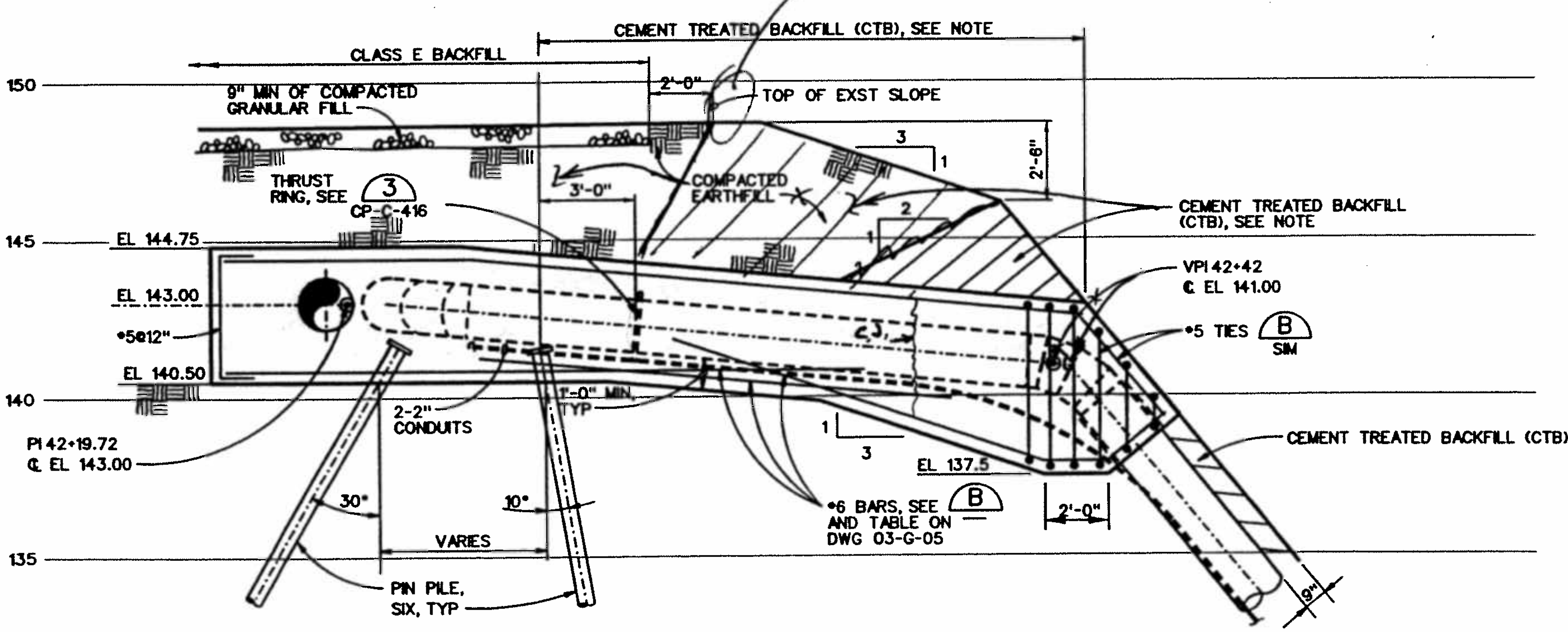


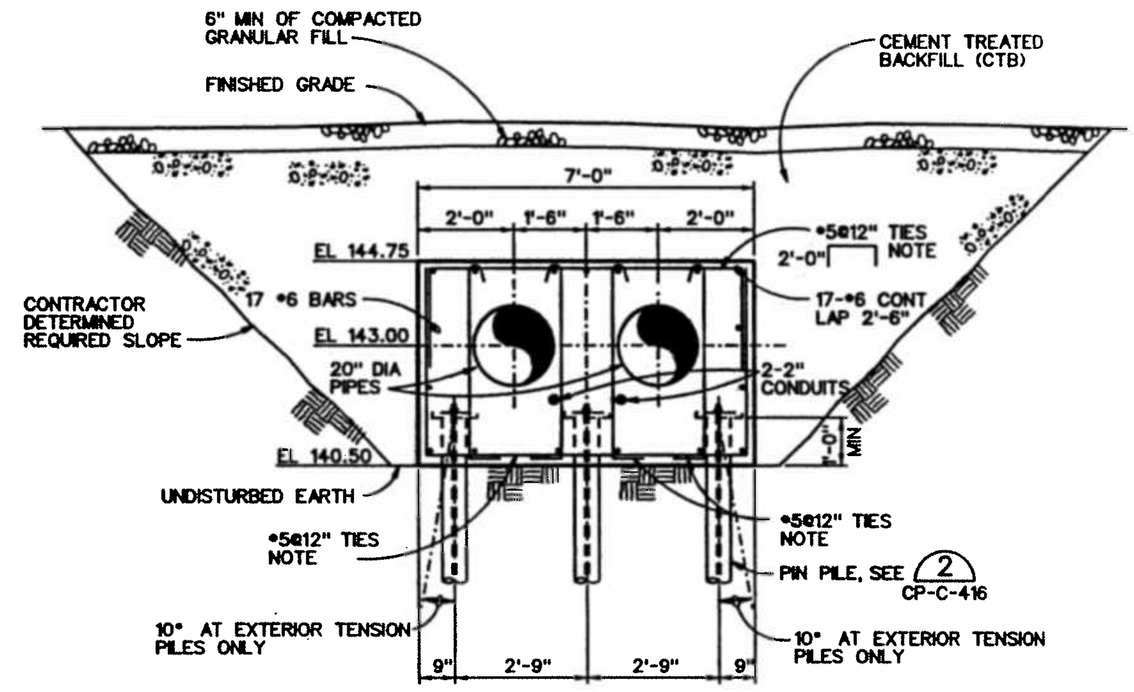
PLAN
⅜"=1'-0"

CURB & BOLLARDS PER CIR E-41



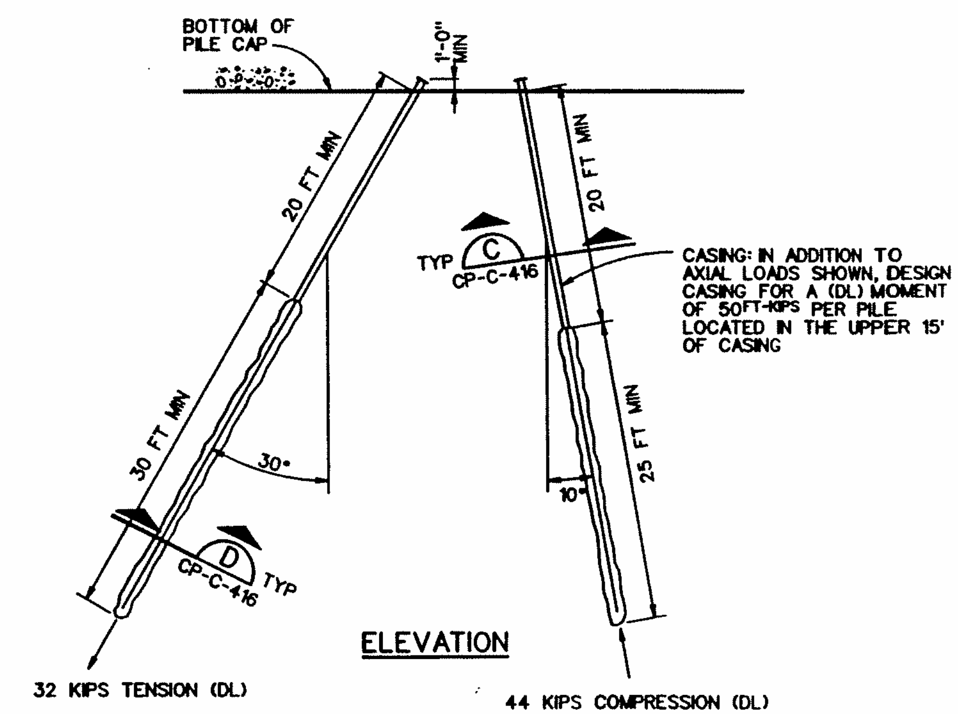
NOTE:
FILL ENTIRE TRENCH WITH CTB TO TOP OF ANCHOR BLOCK AND AS SHOWN ACROSS TOP OF TRENCH AND ANCHOR BLOCK.

SECTION (A)
⅜"=1'-0"



SECTION (B)
½"=1'-0"

NOTE:
AT PIPE BENDS, MODIFY ALL TIES TO ENCASE LONGITUDINAL BARS. SEE PLAN.



NOTES:
1. LOADS NOTED ARE DESIGN LOADS (DL) AS DEFINED IN SPECIFICATIONS SECTION 02368.
2. ONE SET OF THREE BENTS SHOWN.
3. DESIGN PIN PILE SYSTEM AS SPECIFIED IN SECTION 02368 ADDENDUMED.

PIN PILE CRITERIA (1)
⅛"=1'-0"

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REGISTERED PROFESSIONAL ENGINEER 8534 OREGON JAMES K. FULLER
EXP. 12-31-01

DSGN JK FULLER S FREY	1	12/03	Record Dwg. (See Statement on Sheet No. 1)	JKF	
DR DL KING	1	5/01	ADDENDUM NO. 1 (NEW DRAWING)	JKF	JKF
CHK JL McWADE	NO.	DATE	REVISION	BY	APVD
APVD RM BRACKEN JK FULLER					

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

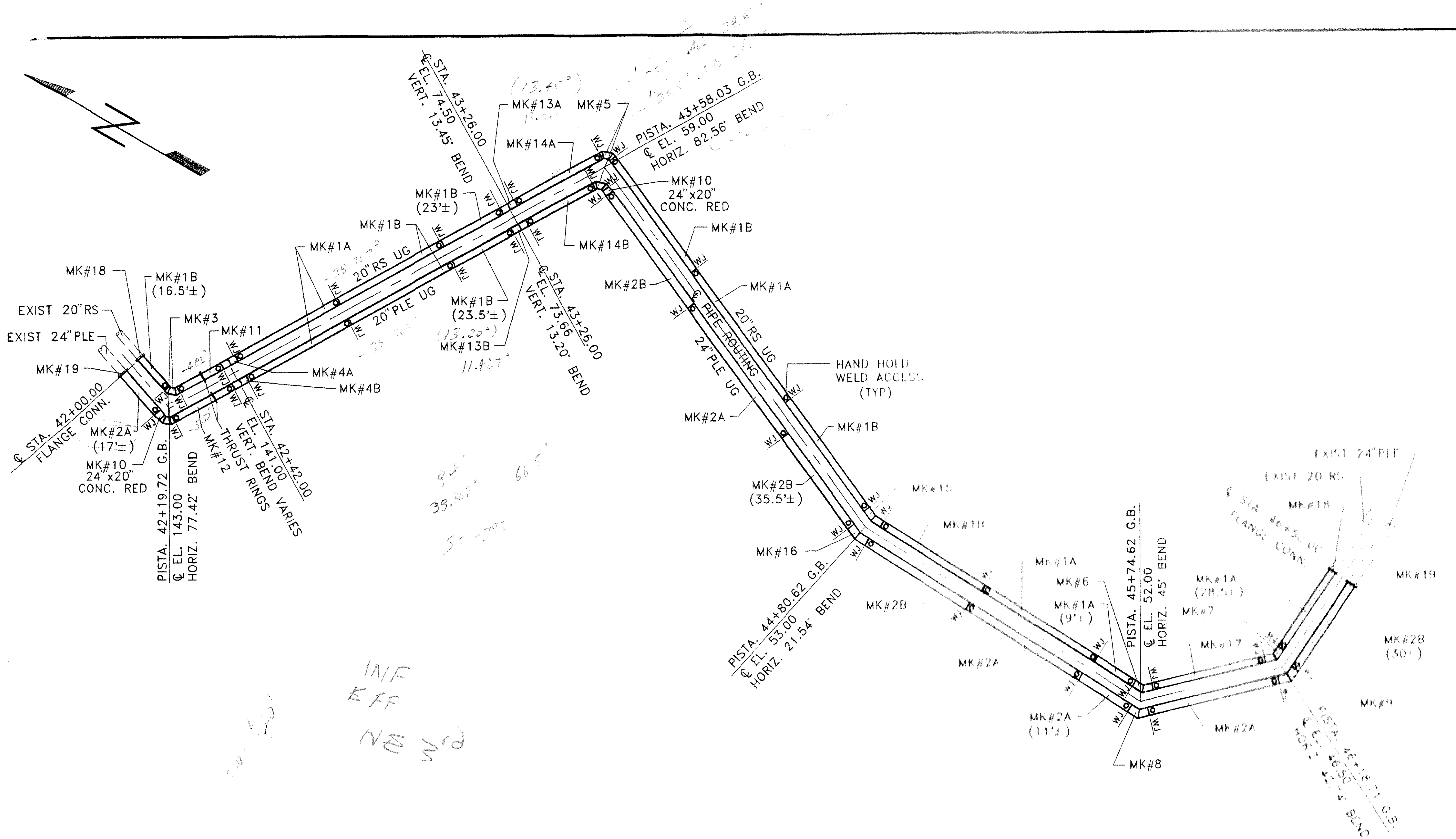
FULLER & MORRIS Engineering, Inc.

CH2MHILL

CITY OF NEWPORT, OREGON
2-SBWWTP-01
CONVEYANCE PIPELINES & PUMP STATIONS

CONVEYANCE PIPELINES
NORTHSIDE ANCHOR BLOCK PLAN AND SECTIONS

SHEET	24A
DWG	CP-C-415
DATE	APRIL 2001
PROJ	150634



WEST COAST PIPE LININGS, INC.

RIALTO, CALIFORNIA

(909) 356-5670

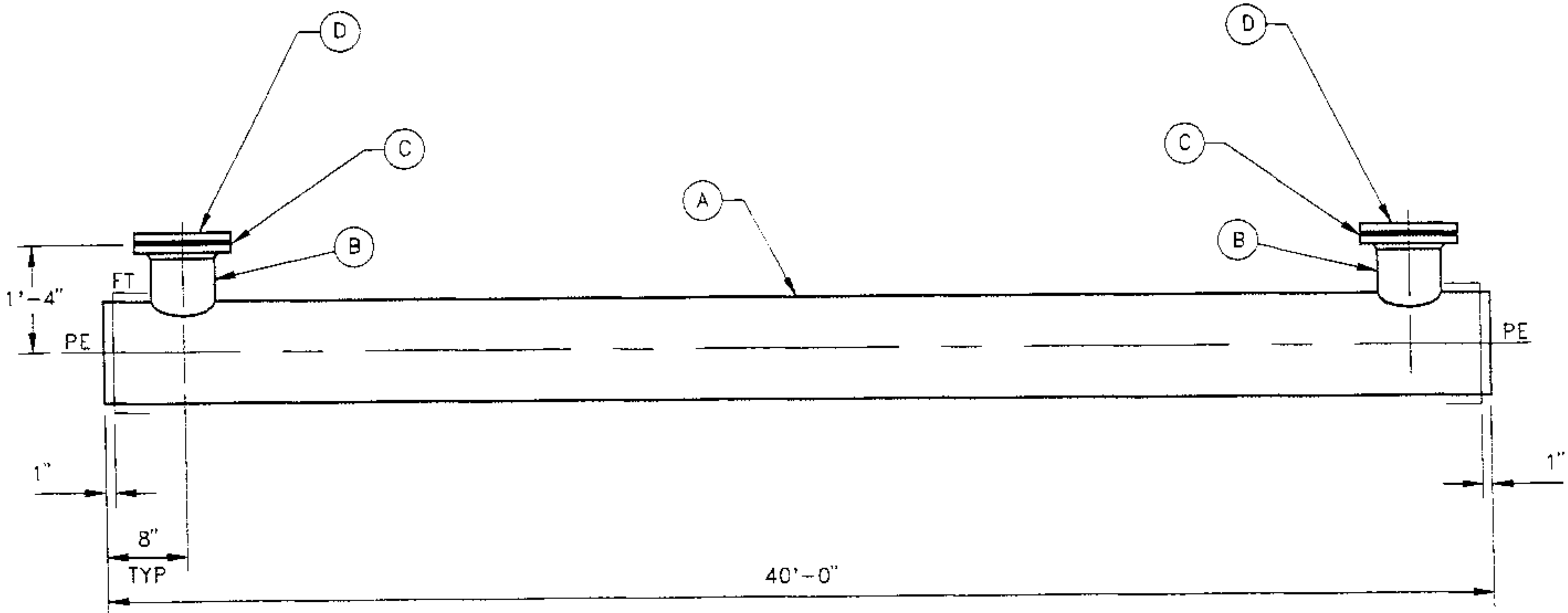
PROJECT	CONVEYANCE PIPELINES AND PUMP STATIONS
CUSTOMER	FULLER & MORRIS ENGINEERING, INC
DRAWN BY	MSD
SCALE	NONE
REV	PL1
PAGE NUMBER	1 of 27

CP-PL1

ITEM	QUANTITY	DESCRIPTION	REF. SPEC	REV.
A	40'-0"	20" OD x .250 WALL STEEL PIPE	C200	
B	1'-6"	8 5/8" OD x .250 WALL STEEL PIPE	A53B	
C	2	8"-150# FF S/O FLANGE	A105	
D	2	8"-150# FF BLIND FLANGE	A105	

INTERIOR LINING: COAL-TAR-EPOXY (16 MIL)	SPECIFICATION: AWWA C-210
EXTERIOR COATING: TAPE POLYKEN YG-III 50 MIL POLYETHYLENE WRAP	SPECIFICATION: AWWA C-214 & C-209
EXTERIOR COATING	SPECIFICATION

REF. DWG. PL1



5 REQUIRED

WEST COAST PIPE LININGS, INC.

RIALTO, CALIFORNIA
(909) 356-5670

PROJECT	CONVEYANCE PIPELINES AND PUMP STATIONS
CUSTOMER	FULLER & MORRIS ENGINEERING, INC.

DRAWN BY	SCALE	QUANTITY	MARK NO	PAGE NUMBER
MSD	NONE	5	1A	2 of 27

CP-1A