Scappoose Oregon

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Collection System Facilities Planning Study

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City Ordinance #895

KELLER ASSOCIATES

CITY OF SCAPPOOSE COLLECTION SYSTEM FACILITIES PLANNING STUDY UPDATE

REGISTERED PROFESSIONAL ENGINEER
87384PE
Emily Flock
OREGON
NOV. 13, 2018
EMILY C. FLOCK
EXPIRES: 12/31/21

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PREPARED BY:

KELLER ASSOCIATES

245 Commercial St SE, Suite 210
Salem, OR 97301
(503) 364-2002

PREPARED FOR:

SCAPPOOSE Oregon

City of Scappoose
33568 E. Columbia Ave
Scappoose, OR 97056
(503) 543-7185

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ACRONYMS, ABBREVIATIONS, AND SELECTED DEFINITIONS

AADF	average annual daily flow
ac	acre
AGS	aerobic granular sludge
ATS	automatic transfer switch
BID	business improvement district
BLM	Bureau of Land Management
BOD_5	5-day biochemical oxygen demand
BOR	Bureau of Reclamation
CCTV	closed circuit television
CDBG	community development block grants
CFR	Code of Federal Regulations
CIP	Capital Improvement Plan
CIPP	cured-in-place pipe
DEQ	Oregon Department of Environmental Quality
DMR	discharge monitoring report
DO	dissolved oxygen
EDU	equivalent dwelling unit
EPA	Environmental Protection Agency
FEMA	Federal Emergency Management Agency
fps	feet per second
ft	feet or foot
ft^2	feet squared or foot squared
ft^3	cubic feet or cubic foot
GIS	geographic information system
GPAD	gallons per acre per day
gpcd	gallons per capita per day
gpd	gallons per day
gpm	gallons per minute
HOA	hand/off/auto
HP	horsepower
hrs	hours
HRT	hydraulic retention time
I/I	infiltration and inflow
in	inch
KW	kilowatt
kwh	kilowatt hour
LF	linear foot
LID	local improvement district
MBR	membrane bioreactor
MG	million gallons
MGD	million gallons per day
mg/L	milligrams per liter
mL	milliliter
MLSS	mixed liquor suspended solids
mm	millimeter
MMF	maximum month flow

MPN	most probable number
N	nitrogen
NFPA	National Fire Protection Association
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollution Discharge Elimination System
NPS	National Park Service
NTS	natural treatment system
NTU	Nephelometric turbidity units
O&M	operation and maintenance
OH&P	overhead and profit
PDF	peak day flow
PHF	peak hour flow
pH	Hydrogen ion concentration (measure of the acidity or basicity)
PLC	programmable logic controller
ppcd	pounds per capita per day
ppd	pounds per day
psi	pounds per square inch
PVC	polyvinyl chloride
RAS	return activated sludge
SBR	sequencing batch reactor
SCADA	supervisory control and data acquisition
SCFM	standard cubic feet per minute
sf	square feet or square foot
SRF	state revolving fund
SRT	solids retention time
SU	standard unit
TDH	total dynamic head
TKN	total Kjeldahl nitrogen
TMDL	total maximum daily load
TN	total nitrogen
TP	total phosphorus
TSS	total suspended solids
US	United States
USA	United States of America
USDA	US Department of Agriculture
USDA-RUS	US Department of Agriculture, Rural Utilities Services
USFS	United States Forest Service
USFWS	US Fish and Wildlife Service
USGS	US Geological Survey
UV	ultraviolet radiation
VFD	variable frequency drive
VSS	volatile suspended solids
WAS	waste activated sludge
WWTP	wastewater treatment plant

EXECUTIVE SUMMARY

In 2019, the City of Scappoose, Oregon, contracted with Keller Associates, Inc. to complete a collection system facilities planning study update (CSFPS) for the City's sanitary sewer collection system. A facilities plan update for the wastewater treatment plant (WWTP) was completed in 2018 (2018 FPU, Carollo). This section summarizes the major findings of the CSPFS, including brief discussions of alternatives considered and final recommendations.

ES.1 PLANNING CRITERIA

Regulatory requirements, engineering best practices, and City-defined goals and objective form the basis for planning and design. The City's conveyance system will be sized for the projected 20-year peak instantaneous flow rates associated with the 5-year, 24-hour storm event. Pipes will be considered full and trigger improvements when the maximum depth exceeds two-thirds (2/3) of the full depth of the pipe in accordance with the City Design Standards. When sizing gravity collection systems, pipelines will be sized according to the City standards; pipe size shall be determined by using two-thirds (2/3) of the full depth of the pipe. Sewage pump stations will be designed to handle these flows with the largest pump out of service (defined as firm capacity).

ES.2 PLANNING CONDITIONS

ES.2.1 Study Area and Land Use

The study area coincides with the updated urban growth boundary (UGB) and is shown in Figure 1 (Appendix A). The wastewater system currently serves only those areas within the UGB. Build-out of the vacant properties within the UGB is not expected to occur during the current 20-year planning period. Keller Associates recommends that future development within the UGB provide adequate conveyance for connection of the upstream sewer basins.

ES.2.2 Demographics

The City's population has been increasing at an unsteady rate over the past few decades. Historical populations were obtained from records of the County and Portland State University (PSU). This study will use the population projections developed as part of the 2018 FPU, which are based on the population data and projections completed by collaborative efforts of the County and Portland State University (PSU). Table ES.1 shows the 2017 and 2035 populations from the FPU. The 2040 population projection used the 2035 population as a starting point for projections. The 2040 projection was calculated using an average annual growth rate (AAGR) of 1.2% from the 2017 PSU Coordinated Population Forecast document.

TABLE ES.1: POPULATION AND PROJECTIONS

Year	Population	Source
2017	7,610	Facilities Plan Update (Carollo, Mar 2018)
2035	10,461	Facilities Plan Update (Carollo, Mar 2018)
2040	11,104	Projected Using AAGR of 1.2%

Note: Coordinated Growth Rates (AAGR) from PSU Coordinated Population Forecast 2017-2067 Columbia County.

Future land use and flow projections for the 20-year planning period were developed using criteria and methodology based in the 2018 FPU (Chapter 2.6-2.8). The City's Community Development Center (CDC), which includes the planning and engineering departments, provided locations within the City UGB that are anticipated to be developed during the 20-year planning period. These future growth areas, with respective City zoning designation, are presented in Figure 6. Existing, buildout, 20-yr growth, and 2040 acreages by land use type are summarized in Table ES.2

TABLE ES.2: EXISTING, BUILDOUT AND 2040 LAND USE

Land Use Designation[1]	Existing Acreage (ac)[1]	Buildout Acreage (ac)[1]	20-Yr Growth Acreage (ac)	2040 Acreage[2]
Airport Employment	201	518	158	359
Commercial	171	179	4	175
General Residential	323	176	-	323
Industrial	23	267	122	145
Manufactured Home	72	86	7	79
Public Lands	18	262	122	140
Suburban Residential	290	868	289	579
Total	***1098***	***2356***	***703***	***1,800***

[1]2018 FPU (Table 2.5)

[2]Adjusted to reflect unconstrained acreages from 2017 Housing Needs Analysis

The 2017 Housing Needs Analysis (HNA) was used to adjust the buildout acreages from the FPU to more accurately represent the acreage estimated with associated 20-year growth as these estimates remove constrained land due to wetlands, floodplain, and steep slopes. Flow factors (estimated average wastewater generated from land use types) from the FPU were used as a basis and adjusted to account for the HNA land constraint adjustments. Further discussion of the revised projections is provided in Section 1.3.

ES.2.3 Wastewater Flows

The wastewater flow analysis from the 2018 FPU was used to provide design flows and flow projections for the planning period. Flows for 2040 were projected from the 2035 flows using the population growth summarized in the previous section and unit flows based on the 2018 FPU. The FPU used the methods recommended by the Oregon DEQ in "Guidelines for Making Wet-Weather and Peak Flow Projections for Sewage Treatment in Western Oregon" and historical data to develop design flows in the City's system (summarized in Section 1.4).

As mentioned previously, flow projections for the 20-year planning period were developed using criteria and methodology based in the 2018 FPU (Chapter 2.6-2.8). Design flows and projected 2035 flows from the FPU were used as the basis for projected 2040 flows. Population growth, 20-year growth acreages, and large customer projections (as described in Section 1.3) were used to develop 2040 projected system flows. Table ES.3 shows the design and flow projections for the 20-year planning period.

TABLE ES.3: DESIGN AND PROJECTED FLOWS (MGD)

	Design Flow (MGD)[1]	Projected Unit Flow (gpcd)	Projected Flows (MGD)[2]	
Year	2017	2017	2035	2040
Population	7,610	7,610	10,461	11,104
ADWF	0.646	85	0.956	1.01
AWWF	0.878	115	1.30	1.37
$MMDWF_{10}$	0.871	114	1.22	1.29
$MMWWF_5$	1.200	158	1.68	1.78
$PDAF_5$	2.770	364	3.88	4.11
PIF_5	3.96	520	5.56	5.89

1. Design flows and 2035 projected flows are from 2018 Scappoose Facilities Plan Update.

2. 2035 projected flows are from 2018 FPU and 2040 projected flows based on design flows and population projections.

ES.3 COLLECTION SYSTEM EVALUATION

ES.3.1 Pump Station Evaluation

There are seven pump stations in the Scappoose collection system and one that services the Miller WTP (see Figure 7 for locations). Smith Road Pump Station is the largest; with a triplex system and an existing capacity of 1,100 gpm per pump. It pumps through approximately 1,600 feet of 12-inch force main. The other six pump stations are each similarly-sized, smaller, duplex systems. Spring Lake has a firm capacity of 160 gpm; Keys Landing has a firm capacity of 120 gpm; both Highway 30 and Seven Oaks have firm capacities of 150 gpm; Charles T Parker has a firm capacity of 398 gpm; and East Airport has a firm capacity of 336 gpm. A general inventory of the pumping facilities was completed and is summarized in Chapter 2. Several issues were identified at each of the lift stations; recommendations to correct these issues are summarized in Chapter 2.

ES.3.2 Pipeline Condition and Capacity Evaluation

Scappoose's gravity collection system includes approximately 32 miles of gravity pipelines ranging from 4- to 30-inches in diameter and approx. 1.4 miles of force mains (Figure 7). Currently, approximately half of all flow goes through the Smith Road Pump Station to reach the WWTP.

Approximately half of the collection system pipes are concrete, and half are PVC. These material types provide a good indication of the age of the sewer lines; with concrete pipes generally installed from the 1930s into the 1980s, and PVC pipe installed thereafter. There are also a couple of ductile iron, cast iron, and unknown material sections throughout town. Improvements and additions to the original wastewater collection system have been completed throughout its lifespan. The City's current system includes approximately 700 manholes.

Portions of the system were smoke tested to identify sources of infiltration and inflow (I/I) in 2016. These portions tested, as well as problem locations found, are summarized in Appendix C.

A GIS-based computer model (InfoSWMM Suite 14.7, Update #1) of the collection system was built and exercised to evaluate capacities of the system's trunk lines. Model results (Figures 11 and 12) were used to determine capacity-related problems that exist in the system for the design criteria and flow scenarios analyzed. Several areas of town experience flows that exceed the existing capacity of the pipelines during storm events.

ES.4 COLLECTION SYSTEM IMPROVEMENTS

The following summarizes the alternatives and recommended improvement projects to the City's collection system:

ES.4.1 Collection System Alternatives

Three collection system alternatives were considered to address capacity deficiencies in the Smith Road Pump Station Basin: Alternative 1, which includes continuing Keys WTP operations during daytime and upsize existing trunk lines; and Alternative 2, which includes shifting Keys WTP operations to nighttime, low sewer flows and upsize existing trunk lines necessary; Alternative 3, which includes installing a new trunk line across town along SW Maple Street and rehabilitating existing lines parallel to South Scappoose Creek. All of these improvements also include a new pipeline north of Veterans Park that would allow the City to abandon the South Scappoose Creek crossing on the north side of the park (referred to as the Kucera line) as well as upsizing existing pipes on Smith Road.

In addition to the alternatives described above to address capacity limitations in the Smith Road Pump Station Basin, improvements to address the remaining capacity limitations in the system were evaluated. Other alternatives reviewed for these limitations were found to be not feasible or cost prohibitive. Improvements to address deficiencies include upsizing the existing pipelines in the following locations.

- High School Way Basin trunk line
- Laurel and 3rd Streets
- Tyler Street
- Wagner Court
- Miller WTP Improvements
- Columbia Avenue at the WWTP

ES.4.3 Recommended Collection System Improvements

Alternative 2 was evaluated to have the lowest cost of the alternatives and was selected as the preferred alternative to address deficiencies in the Smith Road Pump Station Basin. The Columbia Avenue pipe at the WWTP was excluded from the CIP because the project is included in the Priority 2 projects of the 2018 FPU. The location and extents of all recommended improvements are summarized in the collection system Capital Improvement Plan (CIP) (Figure 15). Priority 1 improvements are intended to correct existing deficiencies and are recommended to be completed as soon as funding allows; Priority 2 improvements address future growth.

ES.5 CAPITAL IMPROVEMENT PLAN

ES.5.1 Summary of Opinion of Probable Costs

Table ES.4 presents the 20-year CIP. Projects are organized by priority. Opinion of probable costs reflect planning-level estimates and should be refined in the subsequent pre-design and design phases of implementation. Priority 1 improvement expenses are anticipated to occur over the 4-5 years. Priority 2 are primarily triggered by growth.

TABLE ES.4: 20-YEAR CAPITAL IMPROVEMENT PLAN[1]

ID #	Item	Total Estimated Cost (2020)	SDC Growth Portion %	SDC Growth Portion Cost	City's Estimated Portion
Priority 1 Improvements					
1.1	Smith Road Pump Station	$ 883,000	24%	$ 215,000	$ 668,000
1.2	WTP Improvements and Smith Rd	$ 908,000	40%	$ 364,000	$ 544,000
1.3	Laurel and 3rd St	$ 594,000	18%	$ 109,000	$ 485,000
1.4	Old Portland Rd	$ 1,398,000	10%	$ 145,000	$ 1,253,000
1.5	High School Wy to Elm St	$ 1,412,000	12%	$ 165,000	$ 1,247,000
1.6	Dutch Canyon Rd	$ 285,000	2%	$ 5,000	$ 280,000
1.7	Pump Station Improvements (Springlake and HWY 30 PS)	$ 84,000	36%	$ 30,000	$ 54,000
Total Priority 1 Improvements (rounded)		***$ 5,564,000***		***$ 1,033,000***	***$ 4,531,000***
Rate Impact (20 yr, 1.6%)					***$ 8.70***
Priority 2 Improvements					
2.1	4th St to Smith Rd Pump Station	$ 958,000	13%	$ 126,000	$ 832,000
2.2	Tyler St	$ 303,000	13%	$ 40,000	$ 263,000
2.3	Wagner Ct	$ 126,000	100%	$ 126,000	$ -
2.4	Pump Station Improvements (Keys Landing and Seven Oaks PS)	$ 149,000	36%	$ 53,000	$ 96,000
2.5	Miller WTP Improvements	$ 49,000	36%	$ 17,000	$ 32,000
Total Priority 2 Improvements (rounded)		***$ 1,585,000***		***$ 362,000***	***$ 1,223,000***
Rate Impact (20 yr, 1.6%)					***$ 2.35***
TOTAL COLLECTION SYS. IMPROVEMENTS COSTS (rounded)		**$ 7,149,000**			**$ 5,754,000**

Notes:

1. The opinion of probable cost herein is concept level information only based on our perception of current conditions at the project location and its accuracy is subject to significant variation depending upon project definition and other factors. This estimate reflects our opinion of probable costs at this time and is subject to change as the project design matures. This cost opinion is in 2020 dollars and does not include escalation to time of actual construction. Keller Associates has no control over variances in the cost of labor, materials, equipment, services provided by others, contractor's methods of determining prices, competitive bidding or market conditions, practices or bidding strategies. Keller Associates cannot and does not warrant or guarantee that proposals, bids, or actual construction costs will not vary from the cost presented herein.
2. All costs in 2020 Dollars. Costs include mobilization (5%), contractor overhead and profit (OHP; 15%), contingency (30%), engineering and construction management services (CMS; 20-30%), and legal, administrative, and permitting services (2%).
3. The Capital Improvement Plan does not include annual pipeline replacement, pipeline cleaning and inspection, and lift station maintenance budgets. These budgets are discussed in Section 6.6.

ES.5.2 Budget and Rate Impacts

Funding for the recommended system improvements may come from any number of sources. This section presents potential user rate impacts if priority improvements are funded through a low-interest loan with debt service payments (20 year, 1.6%) made through a user rate increase. Table ES.5 outlines the potential residential user rate impacts and assumes a flat rate increase to all 2,553 sewer EDUs. Actual rate impacts will vary depending on the City's rate structure, available system development charge (SDC) funds, existing budget surplus, funding source(s), potential grants, project phasing, and terms of the loan. A separate user rate study may be warranted to complete a more detailed evaluation of potential user rate impacts.

TABLE ES.5: POTENTIAL USER RATE IMPACT

	Annual Payment (20 years, 1.6%)	User Rate Increase	User Rate Total
Existing User Rate	$ -	$ -	$ 55.96
Prioritiy 1 Improvements	$ 266,520	$ 8.70	$ 64.66

ES.5.3 Other Annual Costs

In addition to the capital improvement costs presented in the CIP, Keller Associates recommends the following for consideration in setting annual budgets:

- Collection system replacement/rehabilitation needs: City should eventually budget an additional $717,500/year (to be either contracted out or completed using City crews).
- Collection system cleaning and CCTV needs: following the timeline described in Section 6.1.2, the City should budget approximately $112,000/year.

ES.5.4 SDCs

The City's current sewer System Development Charge (SDC) for a single-family home is $4,276.04. The sewer SDC is typically divided into two components: reimbursement and growth. The scope of this study included estimating the SDC eligibility for each identified capital improvement. It is the intent that this information will be utilized by the City's financial consultant to update the City's SDCs. The estimated SDC eligibility for each identified capital improvement is shown in Table ES.4.

ES.5.5 Financing Options

Financing and incentive options that may assist with offsetting costs associated with implementing the CIP include, but are not limited to: user rate increases, SDCs, DEQ State Revolving Fund Loan Program, Oregon Infrastructure Finance Authority grants and loans, USDA Rural Utilities Services loans and grants, direct state loans, revenue bonds, general obligation bonds, US Economic Development Administration grants, and Energy Trust of Oregon.

CHAPTER 1 – PROJECT PLANNING

The City of Scappoose owns and operates a municipal sewage collection system and a wastewater treatment plant (WWTP). The City had a Facilities Plan Update (FPU) for the treatment process and the WWTP completed in 2018. The purpose of this collection system facilities planning study (CSFPS) is to assess the needs of the City for the wastewater collection system, evaluate if the existing pipe network and lift stations can meet those needs, and provide a long-term plan to implement improvements to the collection system so the needs of the City can be met. The CSFPS will coordinate relevant planning criteria with the FPU, including population and flow projections, to maintain consistency in the City's planning for the entire wastewater system.

This CSFPS describes the conditions, flows, and problems in the existing collection system; analyzes the hydraulic flow data; and provides recommendations for improvements to the collection system over the 20-year planning period.

1.1 LOCATION

The study area consists of all areas within the City of Scappoose Urban Growth Boundary (UGB). Figures 1 and 2 in Appendix A show the land use, the existing service areas, the topography, and the floodplains in the study area. The study area slopes generally to the east toward the WWTP and eventually the Multnomah Channel. Sections of the western side of the City slope toward the South Scappoose Creek, which is a tributary of the Multnomah Channel.

1.2 ENVIRONMENTAL RESOURCES PRESENT

An inventory of the existing environmental resources is summarized below, which will be used to consider the environmental impacts of alternatives. The factors analyzed in this section include land use, prime farmland, and formally classified lands; earthquake hazards; floodplains; wetlands; cultural, biological, water, and coastal resources; and socio-economic conditions.

1.2.1 Land Use/Important Farmland/Formally Classified Land

Land use in the study area is shown in Figure 1 (Appendix A). Figure 3 in Appendix A shows the County soils shapefile farmland designation in the area. The majority of the city is designated by the National Resources Conservation Service (NRCS) as Prime Farmland, although it is currently zoned and used for other purposes.

1.2.2 Earthquake Hazards

Figure 4 (Appendix A) illustrates the relative earthquake hazard map produced by the Oregon Department of Geology and Mineral Industries for the Saint Helens-Columbia City-Scappoose Urban Area. This map shows one Zone A (highest hazard) area on the west side of Scappoose. There are areas of Zone B (intermediate to high hazard) and Zone C (low to intermediate hazard) determinations surrounding the Zone A area.

1.2.3 Floodplains

The Federal Emergency Management Agency (FEMA) publishes flood insurance studies that classify land into different flood zone designations. As illustrated in Figure 2 (Appendix A), some portions of the study area are located inside the 100-year and 500-year floodplains of Scappoose Creek and Jackson Creek. The WWTP is just outside the FEMA mapped 100-year floodplain.

1.2.4 Wetlands

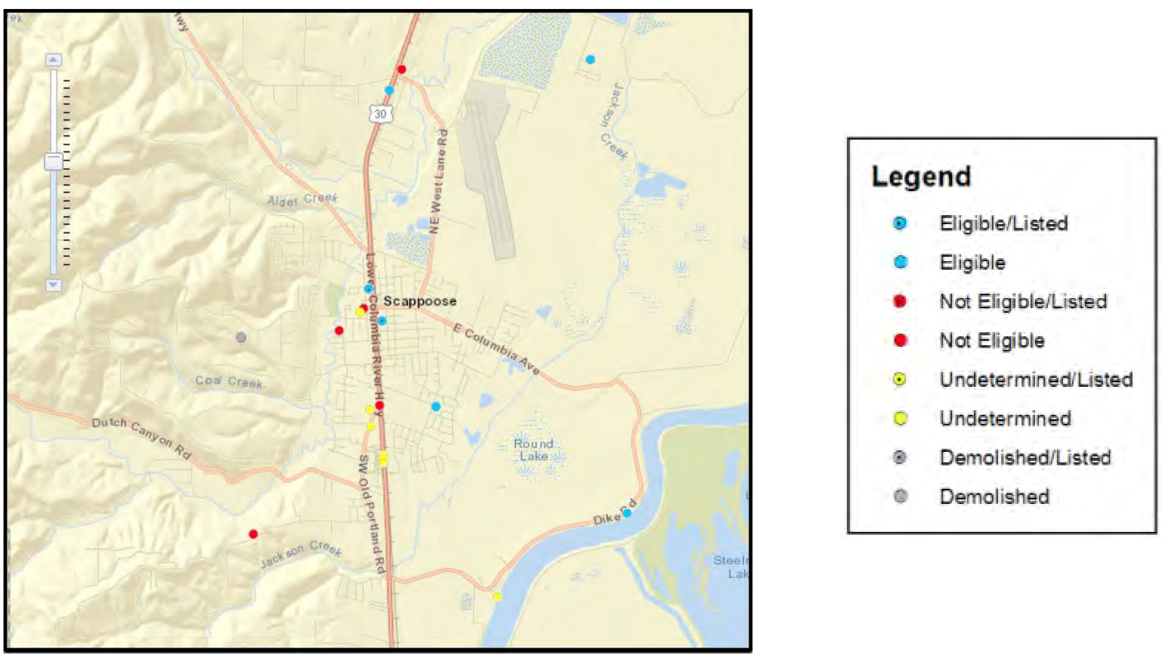
The Oregon Department of State Lands (ODSL) keeps an inventory of local wetland areas in Oregon. The City of Scappoose has a completed Local Wetland Inventory from December 1998. Wetland delineation was not within the scope of this project, so the ODLS Local Wetland Inventory and the U.S. Fish and Wildlife National Wetlands Inventory (Figure 5, Appendix A) were used to determine wetland areas that could potentially be impacted. There are a number of small wetland areas around Scappoose Creek and the eastern edge of the City.

1.2.5 Cultural Resources

The State Historic Preservation Office (SHPO) maps above-ground cultural resources on their website. According to the SHPO website, there are eleven structures listed as “eligible”, and five structures listed as “undetermined”, cultural resources within the UGB. The map from the SHPO website is shown as Chart 1-1.

The SHPO also keeps track of underground cultural resources. They only provide information from their database to professional archaeologists, with one exception: They will provide information for small project areas if given the complete legal description of the project location, a United States Geological Survey (USGS) map of the project area, and a description of the project and ground disturbance. The SHPO should be consulted as part of the design process of any proposed recommendation.

CHART 1.1: ABOVE-GROUND CULTURAL RESOURCES



1.2.6 Biological Resources

The Pacific Northwest Interagency Special Status / Sensitive Species Program lists the endangered, threatened, and sensitive species for the state and county by Bureau of Land Management (BLM) district. The City of Scappoose lies within the Salem BLM District. Endangered species in the district include the fender’s blue butterfly, Columbian white-tailed deer, Bradshaw’s desert parsley, and Willamette Valley daisy. The fish in the Salem district that are listed as sensitive or threatened include the cutthroat trout (vulnerable), chum salmon (critical), coho salmon (endangered), steelhead (critical), and chinook salmon (critical).

1.2.6 Water Resources

North and South Scappoose Creeks flow together into Scappoose Creek in the study area. The creek ends in Scappoose Bay, which subsequently joins the Multnomah Channel north of the City. The WWTP outfalls into the Multnomah Channel. As of the most recent listing in 2012, the Multnomah Channel is 303(d) listed by DEQ for dissolved oxygen, mercury, and temperature. There are no wild or scenic rivers in the study area.

1.2.7 Coastal Resources

There are no coastal areas within the study area.

1.2.8 Socio-Economic Conditions

The population in the area is primarily (91%) Caucasian, according to the 2010 census. Hispanics make up 5% of the population. The median household income is $79,401 (in 2018 dollars), which is 33% higher than the state average. The improvements will provide mutual benefit to all sanitary sewer customers and improve the overall economic vitality of the area.

1.2.9 Miscellaneous Issues

Other environmental resources considered were air quality and soils. Scappoose is not located in an area designated as an air maintenance or nonattainment area by DEQ. A soils map is provided in Figure 3 (Appendix A); soils in the area are generally silt loam.

1.3 POPULATION TRENDS AND 20-YEAR GROWTH

This study will use the population projections developed as part of the 2018 FPU, which are based on the population data and projections completed by collaborative efforts of the County and Portland State University (PSU). Table 1-1 shows the 2017 and 2035 populations from the FPU. The 2040 population projection used the 2035 population as a starting point for projections. The 2040 projection was calculated using an average annual growth rate (AAGR) of 1.2% from the 2017 PSU Coordinated Population Forecast document.

TABLE 1.1: POPULATION AND PROJECTIONS

Year	Population	Source
2017	7,610	Facilities Plan Update (Carollo, Mar 2018)
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2040	11,104	Projected Using AAGR of 1.2%

Note: Coordinated Growth Rates (AAGR) from PSU Coordinated Population Forecast 2017-2067 Columbia County.

Future land use and flow projections for the 20-year planning period were developed using criteria and methodology based in the 2018 FPU (Chapter 2.6-2.8). The FPU estimates the City will reach buildout conditions in 2067 and provides land use acreages for buildout. Linear interpolation was used to estimate the land use acreages for 2040. The 2017 Housing Needs Analysis (HNA) was used to adjust the buildout acreages from the FPU to more accurately represent the acreage estimated with associated 20-year growth as these estimates remove constrained land due to wetlands, floodplain, and steep slopes. Flow factors (estimated average wastewater generated from land use types) from the FPU were used as a basis and adjusted to account for the HNA land constraint adjustments. Existing, buildout, 20-yr growth, and 2040 acreages by land use type are summarized in Table 1.2. The associated flow factors, flow from 20-year growth, and 2040 flow projections by land use type are summarized in Table 1.3. Estimated locations of 20-year growth areas were provided by the City Planning Department and are shown on Figure 6.

TABLE 1.2 EXISTING, BUILDOUT AND 2040 LAND USE

Land Use Designation[1]	Existing Acreage (ac)[1]	Buildout Acreage (ac)[1]	20-Yr Growth Acreage (ac)	2040 Acreage[2]
Airport Employment	201	518	158	359
Commercial	171	179	4	175
General Residential	323	176	-	323
Industrial	23	267	122	145
Manufactured Home	72	86	7	79
Public Lands	18	262	122	140
Suburban Residential	290	868	289	579
Total	***1098***	***2356***	***703***	***1,800***

[1]2018 FPU (Table 2.5)

[2]Adjusted to reflect unconstrained acreages from 2017 Housing Needs Analysis

TABLE 1.3 20-YEAR GROWTH FLOW PROJECTIONS

Land Use Designation[1]	20-Yr Growth Acreage (ac)	2040 Acreage[2]	Flow Factor (gpad)[2]	Flow from Growth (mgd)	Flow from Growth (gpm)	2040 System Flow (mgd)
Airport Employment	158	359	90	0.014	10	0.03
Commercial	4	175	950	0.004	3	0.17
General Residential	-	323	810	0.010	7	0.27
Industrial	122	145	1,200	0.147	102	0.17
Manufactured Home	7	79	780	0.010	7	0.07
Public Lands	122	140	-	-	-	-
Suburban Residential	289	579	727	0.130	90	0.26
Total	***703***	***1,800***		***0.314***	***218***	***0.97***

[1]2018 FPU (Table 2.5)

[2]Adjusted to reflect unconstrained acreages from 2017 Housing Needs Analysis

In addition to the 20-year growth acreages described above, large customer projections were identified in the 2018 FPU. Projections for these customers were developed individually based on the type of development. The total ADWF from these customers is estimated at 0.14 MGD. Customers and estimated flows are summarized in Table 1.4. The City identified the locations of these customers and are reflected in Figure 6 growth areas.

TABLE 1.4 LARGE CUSTOMER PROJECTIONS

Large Customer	# of students/ employee/...	Flow Unit	ADWF (gpd)	ADWF (gpm)
Community College	500 students (next 2 years)	15 gpd/student	7,500	5
	1500 students (by 2035)	15 gpd/student	22,500	16
50 acres of Hotels	200 rooms	150 gpd/room	30,000	21
Metallurgy R&D - 10 acres	50 employees	30 gpd/employee	1,500	1
42 acres of light industrial	-	900 gpad	37,800	26
50 acres of light/heavy industrial	-	900 gpad	45,000	31

Source: 2018 FPU, Table 2.6

1.4 WASTEWATER FLOWS

The wastewater flow analysis from the 2018 FPU was used to provide design flows and flow projections for the planning period. Flows for 2040 were projected from the 2035 flows using the population growth summarized in the previous section and unit flows based on the 2018 FPU. The FPU used the methods recommended by the Oregon DEQ in "Guidelines for Making Wet-Weather and Peak Flow Projections for Sewage Treatment in Western Oregon" and historical data to develop design flows in the City's system (summarized in Table 1-6). The design flows used in this study are defined in the following sections. Additional details of the flow analysis can be found in Chapter 1.5 of the FPU.

1.4.1 Average Dry-Weather Flow (ADWF)

The average dry-weather flow (ADWF) is the average daily flow for the period of May through October.

1.4.2 Average Wet-Weather Flow (AWWF)

The AWWF is the average daily flow for the period encompassing November through May.

1.4.3 Maximum Month Average Dry-Weather Flow ($MMDWF_{10}$)

The DEQ defines the $MMDWF_{10}$ as the maximum monthly average dry weather flow with a 10% probability of occurrence. This typically represents the rainiest summer month of high groundwater. Since Oregon DEQ states that May is typically the maximum month for the dry-weather period of May through October, selecting the May 90% precipitation exceedance most likely corresponds to the maximum month during the dry-weather period for a 10-year event.

1.4.4 Maximum Monthly Average Wet-Weather Flow ($MMWWF_5$)

The $MMWWF_5$ represents the highest monthly average during the winter period of high groundwater. Since Oregon DEQ states that January is typically the maximum month for the wet-weather period of January through April, selecting the January 80% precipitation exceedance most likely corresponds to the maximum month during the wet-weather period for a 5-year event.

1.4.5 Peak Day Flow ($PDAF_5$)

The peak day flow ($PDAF_5$) represents the maximum daily average flow associated with a 5-year storm event.

1.4.6 Peak Instantaneous Flow (PIF_5)

The peak instantaneous flow (PIF_5) is defined by the DEQ as the peak hour flow sustained for one-hour during a 5-year storm event.

1.4.7 Infiltration and Inflow (I/I)

Infiltration and inflow (I/I) is storm water or groundwater that enters the sanitary sewer system. I/I can come from a variety of sources, such as storm sewers connected to the sanitary sewer, storm inflow through manhole lids, and groundwater infiltration into cracked/broken pipelines and services. The peak hour flow compared to the base flow (average dry weather flow) is an indication of I/I influence in the system. The system-wide peaking factor for peak day flow to base flows is 4.56 (2018 FPU). I/I exists in the system and contributes to high peak hour flows. Some communities in western Oregon experience peak flows in excess of 10 times the base flow.

The City does not have a formal program to remove I/I; instead, pipeline lining and replacement projects are completed as budget allows. Large defects discovered during CCTV inspection are given priority. New, future construction should experience less I/I due to the use of newer and more watertight sewer components and improved construction practices. It is recommended the City continue to monitor, identify, and seek to reduce/eliminate sources of I/I in the system.

1.4.8 Projected Flows

As mentioned previously, flow projections for the 20-year planning period were developed using criteria and methodology based in the 2018 FPU (Chapter 2.6-2.8). Design flows and projected 2035 flows from the FPU were used as the basis for projected 2040 flows. Population growth, 20-year growth acreages, and large customer projections (as described in section 1.3) were used to develop 2040 projected system flows. These flows are summarized in Table 1.5.

TABLE 1.5: DESIGN AND PROJECTED FLOWS (MGD)

	Design Flow (MGD)[1]	Projected Unit Flow (gpcd)	Projected Flows (MGD)[2]	
Year	2017	2017	2035	2040
Population	7,610	7,610	10,461	11,104
ADWF	0.646	85	0.956	1.01
AWWF	0.878	115	1.30	1.37
$MMDWF_{10}$	0.871	114	1.22	1.29
$MMWWF_5$	1.200	158	1.68	1.78
$PDAF_5$	2.770	364	3.88	4.11
PIF_5	3.96	520	5.56	5.89

1. Design flows and 2035 projected flows are from 2018 Scappoose Facilities Plan Update.
2. 2035 projected flows are from 2018 FPU and 2040 projected flows based on design flows and population projections.

1.5 PLANNING CRITERIA

The City's conveyance system will be sized for the projected 20-year peak instantaneous flow rates associated with the 5-year, 24-hour storm event. It should be noted, efforts to reduce I/I in the collection system could further extend the service population. Pipes will be considered full and trigger improvements when the maximum depth exceeds two-thirds (2/3) of the full depth of the pipe in accordance with the City Design Standards. When sizing gravity collection systems, pipelines will be sized according to the City standards; pipe size shall be determined by using two-thirds (2/3) of the full depth of the pipe. Sewage pump stations will be designed to handle these flows with the largest pump out of service (defined as firm capacity).

The evaluations performed as part of this planning study are used to prioritize recommended improvements to address deficiencies in the collection system. These improvements are organized into the Capital Improvement Plan (CIP) and include the System Development Charge (SDC) percent eligibility. For the collection system model evaluation, pipe surcharging was not allowed.

1.6 COMMUNITY ENGAGEMENT

The Scappoose community had the opportunity to engage in the planning process by participating in City Council meetings. The final CSFPS was presented to the City Council for approval and adoption.

CHAPTER 2 – EXISTING COLLECTION SYSTEM FACILITIES

This chapter contains a description and evaluation of the existing wastewater collection system, including pump stations and pipelines, for the City of Scappoose.

2.1 LOCATION MAP

Maps of the existing collection system are included in Figures 7 and 8 (Appendix A). The wastewater facilities are all located within the City limits.

2.2 HISTORY

The majority of the collection system was constructed in 1972 of concrete pipe. Most of the pipe installed since that time has been polyvinyl chloride (PVC). There are small segments of ductile iron and cast iron pipes in the system.

2.3 SYSTEM DESCRIPTION

The wastewater collection system consists of approximately 32 miles of gravity mains, 1.4 miles of force mains, and seven pump stations that discharge to the wastewater treatment plant (WWTP). The pipelines range from 4 to 30 inches in diameter. There are approximately 700 manholes in the City's collection system. Figure 7 (Appendix A) illustrates the pipe diameters and Figure 8 illustrates the pipe material in the City's collection system. Currently, over half of the City's wastewater is pumped at least once prior to the WWTP headworks.

2.4 PUMP STATIONS

There are seven pump stations in the Scappoose collection system. See Figure 7 for locations of the pump stations. The Smith Road Pump Station is the largest of the pump stations. The remaining six pump stations are smaller. Keller Associates visited five of the pump station sites in 2015 and reviewed record drawings of all pump stations to complete a general inventory of facilities. Pump station inventories are summarized in Table 2-1. Appendix B includes available data such as pump curves, design parameters, and other data resources. More detailed discussions of each pump station follow.

TABLE 2.1 – PUMP STATION INVENTORY

	Smith Road	Spring Lake	Keys Landing	Highway 30	Seven Oaks	Charles T Parker	East Airport
PUMP STATION							
Type	Wet-well, dry-well, triplex pump system	Wet-well, submersile, duplex pump system	Wet-well, surface-mounted, duplex pump system	Wet-well, surface-mounted, duplex pump system	Wet-well, surface-mounted, duplex pump system	Wet-well, submersible, duplex pump system	Wet-well, submersible, duplex pump system
Pump Type	Vertical, variable speed, non-clog centrifugal (Crane Deming model 7196-4x4x12x3)	Submersible, constant speed, centrifugal (Wilo Model FK17.1-6/8KEx)	Horizontal, constant speed, self-priming centrifugal (Hydromatic model #183)	Horizontal, constant speed, self-priming centrifugal (Hydromatic model #183)	Horizontal, constant speed, self-priming centrifugal (Hydromatic model #183)	Submersible, constant speed, centrifugal (Flygt Model NP3127HT)	Submersible, constant speed, centrifugal (Flygt NP3127HT)
Capacity* (gpm)	Each pump: 1,100 gpm @ approx. 28 ft. TDH	Each pump: 160 gpm @ approx. 26 ft. TDH	Each pump: 120 gpm @ approx. 46 ft. TDH (with 13 ft. suction lift)	Each pump: 150 gpm @ approx. 42 ft. TDH (with 19 ft. suction lift)	Each pump: 150 gpm @ approx. 45 ft. TDH (with 16 ft. suction lift)	Each pump: 398 gpm @ approx. 55 ft. TDH	Each pump: 336 gpm @ approx. 59 ft. TDH
Pump HP (each)	15hp @ 1200 rpm (460V, 60 Hz, 3 ph)	2.85hp @ 1140 rpm (230V, 60 Hz, 1 ph)	5hp @ 1750 rpm (230V, 60 Hz, 3 ph)	7.5hp @ 1800 rpm (230V, 60 Hz, 3 ph)	7.5hp @ 1750 rpm (230V, 60 Hz, 3 ph)	11hp @ 1720 rpm (480V, 60 Hz, 3 ph)	10hp @ 1750 rpm (480V, 60 Hz, 3 ph)
Level Control Type	Pressure level transducer in wet well	Pressure transducer with backup high level float	Four (4) Mercury level sensors	Ultrasonic transducer, backup floats	Four (4) Mercury level sensors	Pressure transducer, backup floats	Ultrasonic transducer, backup floats
Overflow Point	Existing manhole just west of pump station	At pump station	At pump station	At pump station	At MH just north of pump station	At pump station	At pump station
Overflow Discharge	To creek west of pump station	To Spring Lake	To residences near pump station	To storm system at HWY 30 and then into Jackson Creek	To residences near pump station	To road	To road
Auxiliary Power Type	Permanent diesel generator	Portable generator	Portable generator	Portable generator	Portable generator	Permanent diesel generator	Permanent diesel generator
Location	inside pump station	At WWTP	At WWTP	At WWTP	At WWTP	at pump station	at pump station
Output	60 kW	17 kW	17 kW	17 kW	17 kW	50 kW	50 kW
Fuel Tank Capacity (gal)	120	100	100	100	100	260	260
Transfer Switch	Automatic	Manual	Manual	Manual	Manual	Automatic	Automatic
Alarm Telemetry Type	Autodialer and red light outside	Autodialer	Autodialer and red light outside	Autodialer and red light outside	Autodialer and red light outside	Autodialer	Autodialer
Originally Constructed	1972	1993	1996	1996	1996	2019	2019
Year(s) Upgraded	2001	2001 and 2003, 2020	NA	NA	NA	NA	NA
Wet Well Diameter (ft)	6	7	6	8	7	6	8
Wet Well Net Storage (gal)	634	432	528	2,237	1,315	5,075	8,600
FORCE MAIN							
Length, Type	Approx. 1,600 ft. of 12-inch Ductile Iron	Approx. 1,726 ft of 4-inch PVC	Approx. 550 ft of 4-inch PVC	Approx. 250 ft of 6-inch C900	Approx. 1,565 ft. of 4-inch C900 PVC	Approx. 1,915 ft. of 4- & 6-inch C900 PVC	Approx. 3,955 ft. of 6- & 10-inch C900 PVC
Profile, Continuously Ascending (Yes/No)	Yes	Yes	Yes	Yes	No	No	No
Discharge Location	MH at intersection of Burlington Northern RR and Laurel Street	MH at 6th Street and Seven Oaks Drive	MH on SW Keys Road at end of SW Keys Landing Way	MH on SW Dutch Canyon Road off Columbia River HWY	MH at 6th Street and Seven Oaks Drive	MH at Wagner Court	MH at Crown Zellerbach Rd and Bird Road
Air Release Valves	None	None	None	Yes	Yes	Yes	Yes
Vacuum Release Valves	None	None	None	Yes	Yes	Yes	Yes
Sulfide Control System	None	None	Yes	Yes	Yes	None	None

*Capacity as reported in O&M Manuals

Smith Road Pump Station

The Smith Road Pump Station is the largest pump station in the system and is located near the intersection of NW 1st Street and EJ Smith Road. The pump station is fully fenced and consists of a 6-foot diameter wet well with a pressure level sensor and a high level float switch, a dry well with three 15 HP vertical mounted centrifugal pumps, a float switch to alarm if there is flooding in the dry well, and a sump pump to remove any water that collects in this area. Confined space entry is required to enter the dry well. In a separate masonry structure is a pump station control panel and a permanent standby generator with automatic transfer switch. The station was upgraded from a duplex to a triplex pumping station in 2001. Three new pumps, a level sensing device, control panels, a permanent stand-by power generator and a concrete structure to house the generator were installed during the upgrade. The SCADA system, Mission Controls, sends alarms to the operators. Also, a red-light alarm is located on the outside of the dry well (though this has not been tested and City staff do not know if it is operational).

Smith Road Pump Station

The pumps operate in a duty-duty-standby configuration and discharge through a 12-inch force main. The pumps rotate through duty-duty-standby operation so all three pumps are run regularly and equally. The pump motors are soft start and controlled by the level in the wet well as measured by the pressure level sensor. The operator can adjust the level settings in the pump station programmable logic controller (PLC) for the pump on and off settings. Alarms are activated by the pressure level sensor readings for low and high wet well levels. A float switch activates an overflow alarm. The City has tested the level sensor, floats, and alarms and they are all functioning properly. The pumps are nearly 20 years old and are in need of replacement. The City plans to replace the pumps in the next year.

Keller Associates analyzed the pump run time data from the past three years to assess capacity. If the pump station runs two pumps for more than 20 hours per day, or if it cannot pass the peak instantaneous flow with one pump offline, the pump station is considered to be undersized. During the last three years, the maximum individual pump run time was 19.6 hours/day. Based on model results, the current peak flow through Smith Road PS during a 5-year, 24-hour storm is 1,500 gpm. The firm capacity of the pump station should be able to handle the peak flow. Each pump in the pump station is rated for 1,100 gpm, the firm capacity of the Smith Road PS is stated as 2,200 gpm in the Operation and Maintenance (O&M) manual. Pump tests should be completed to verify the firm capacity of the pump station. Based on the information provided, the pump station is nearly at capacity for current peak design flows. Pump run time should continue to be watched and the City may consider beginning design of capacity upgrades now, so they are complete for pump replacement in the next year or two.

The operational volume of the pump station is approximately 425 gallons. The duty pump runs for approximately 1-2 minutes under normal flow conditions to empty the operational volume. During peak flow days, the pumps have recorded a total of 200 starts per day. This number of starts can cause the motors to overheat and indicates that the wet well operating volume is inadequate. The City should evaluate options to increase operating volume or decrease the starts of pumps with variable frequency drives (VFD) to alleviate this strain on the pumps. The pump runs approximately once an hour during the lowest flows of the day.

The pump station is located within the mapped 100-year flood plain. However, record drawings show the elevation of the top of the dry well as approximately 0.3 feet above the 100-year flood elevation (recorded as 46.66 feet in the record drawings). The elevation of the wet well rim is not shown on the record drawings. A survey should be completed to confirm the existing pump station access is indeed above the 100-year base flood elevation.

According to City Staff, the pump station has overflowed in the past due to grease buildup. The pump station overflows to a nearby manhole at the east end of Laurel Street, which consequently overflows out the top of the manhole and into the street. Since the manhole is near Scappoose Creek, an overflow could negatively impact the creek's water quality.

A number of deficiencies were noticed with the Smith Road Pump Station. These deficiencies and recommendations to correct them are provided below.

Deficiencies

- Pumps are nearing end of useful life.
- Small operating volume. High number of pump starts per day.
- Pump station is nearing capacity.
- Access hatch is heavily corroded.
- Confined space entry required to access and maintain pump and motor equipment.
- Grease builds up.
    - Heavy grease ring in wet well.
- No pre-screening.
- Exterior red light and audible alarms have not been tested.
- One of the blowers for the fan in the dry well does not work.
- Bypass is missing cap for cam fitting.

Recommendations

With all the deficiencies listed above, it is recommended the pump station be completely replaced or have major upgrades including converting to a submersible pump station.

Spring Lake Pump Station

The Spring Lake Pump Station is located near the intersection of Westlake Drive and SE 6th Street. The pump station was recently upgraded in 2020. The pump station consists of the wet well with pressure transducer level control, backup high-level float switch, two submersible pumps, and a control panel. In 2020, pumps, power transfer switch, and controls were replaced as well as a new valve vault.

The gravity lines draining to the pump station are all private lines except one 8-inch diameter line. The pumps are controlled by the pressure transducer using a lead on, lag on, and pump off operational strategy. There is a high-level float as a backup alarm. In the event of a power outage, an alarm is sent to the operator via Mission Controls. The pump station has a manual power transfer switch with receptacle. In the event of a power failure, a 17 kW portable generator, normally housed at the WWTP, can be transported to the site and connected to the receptacle for backup power.

Spring Lake Pump Station

The O&M manual states that the pump capacity is 160 gpm. In the three-year pump run time history analyzed (2012-2015), the maximum pump run time in one day was 13.8 hours. This indicates the pump station is likely not undersized for the current demand. There have been no known issues with the pump station overflowing or with pumps running continuously for an extended period of time. The pump station overflow discharges directly into Spring Lake. Spring Lake and any in-stream activities immediately downstream would be negatively affected, if an overflow occurred.

The pump station has historically not operated well and alarms are consistently sent to City staff. Since the new pumps have been installed the number of alarms sent to operators has decreased. Grease buildup and rag issues in the wet well still occur. City staff have the grease removed from the surface of the wet well every three months. City staff also report heavy paper products in the wet well. City believes this comes from the east inlet line (private line) that may have bellies or sags, which cause buildups and can overwhelm the wet well when released to pump station. The new pumps have been handling the flow fine without issue since installation.

During this study, City staff noted that the force main has a high point prior to discharging to the gravity collection system. Keller Associates staff recommended testing the pump station for a potential air lock scenario occurring in the force main, which could cause the pumps to operate outside of their normal efficiencies. Keller Associates recommends performing these tests and installing an air release/vacuum valve if air locks are a problem. If future work is completed on the force main, changing the discharge location to 6th and Fredrick Streets to shorten the force main length and reduce TDH should be evaluated.

A number of deficiencies were noticed with the Spring Lake Pump Station. These deficiencies and recommendations to correct them are provided below.

Deficiencies

- Possibility for air lock in force main.
- Grease builds up in the wet well.
- Heavy paper products in influent to pump station.
- No, permanent backup power.

Recommendations

- Perform test(s) to assess whether there is air lock in the pump station force main. Install an air release valve at the high point of the force main profile.
- Establish pre-treatment program to prevent grease from reaching the collection system.
- Perform a review of the electrical system and check that all equipment meets compliance standards.
- Inspect the east inlet line for bellies or sags and recommend rehabilitation as necessary.

Keys Landing Pump Station

Keys Landing Pump Station

The Keys Landing Pump Station is located near the intersection of Keys Landing Way and SW Keys Road. The pump station is a package unit and was constructed in 1996. The pump station consists of the wet well with four float switches; two surface-mounted, 5 HP, horizontal centrifugal pumps; and a control panel. The station has a pinch valve that drains the discharge line after it is done pumping. The wet well is wider at the base than the top. Both pumps were rebuilt in 2014.

The pumps are controlled by the float switches using a lead on, lag on, and pump off operational strategy. The top-most float switch is used to trigger a high-level alarm. Mission Controls sends alarms to the operator. A red alarm light is also located on the outside of the pump station, though it has not been tested recently. In the event of a power outage, an alarm is sent via Mission Controls.. The pump station has a manual power switch with a receptacle. In the event of a power failure, a 17 kW portable generator, normally housed at the WWTP, can be transported to the site and connected to the receptacle for backup power. City staff has indicated that they have ample time to respond during power outages, and the system model results suggest it would take hours before an overflow would occur. There have been no known issues with the pump station overflowing or with pumps running continually for an extended period of time. In the three-year pump run time history analyzed (2012-2015), the maximum run time was 2 hours a day. This indicates the pump station has adequate capacity.

City exercises the pumps every other week and this has reduced the number of alarms the pump station sends. The second pump has had a history of losing prime. The O&M manual states that the pump capacity is 120 gpm. There have been some odor complaints for this pump station. The pump station overflow, at the nearest gravity manhole, is currently plugged to prevent odors. City staff report that due to site conditions (icy roads, etc.), it can be difficult to get access to the pump station in the winter to hook up the portable generator in the case of a power outage. The pump station is located relatively close to the Keys Landing Water Treatment Plant (WTP). City staff have discussed using stand-by power available at the WTP for this pump station.

A number of deficiencies were noticed with the Keys Landing Pump Station. These deficiencies and recommendations to correct them are summarized below.

<u>Deficiencies</u>

- Occasional odor concerns in summer.
- Overflow is plugged to alleviate odor concerns.
- Heavy corrosion on wet well piping.
- The second pump does not stay primed.
- Difficult to bring portable generator to site, particularly in winter.
- Clamshell door does not stay open on its own; needs to be propped up.

Recommendations

- Address odor control to allow for opening overflow.
- Clean and coat piping in wet well and valve vaults as necessary.
- Change operation to alternate between pumps more frequently to balance run times.
- Assess feasibility to coordinate with WTP to get stand-by power for the pump station.
- Repair clamshell door so that it remains open without support.
- Perform a review of the electrical system and check that all equipment meets compliance standards.

Highway 30 Pump Station

The Highway 30 Pump Station is located near the intersection of Highway 30 and Dutch Canyon Road. The pump station is a package unit constructed in 1996. The pump station consists of the wet well with a ultrasonic level transducer and backup float switches; two surface-mounted, 7.5 HP, horizontal centrifugal pumps; a pinch valve in a separate vault; and a control panel. Both pumps were rebuilt in 2014. The station had a new flow sensor installed and wash water plumbed to a yard hydrant in 2015. There is also a sulfide control system including a 1/4HP air compressor at the pump station.

Highway 30 Pump Station

The operation and alarms for the pump station are similar to the Keys Landing Pump Station. The pump station has a manual power transfer switch and receptacle that can be connected to a portable generator, similar to the Spring Lake and Keys Landing Pump Stations. If the pump station were to overflow, it would occur at the first manhole upstream. The discharge would flow into the storm system on Highway 30, which then flows to Jackson Creek. There have been no known issues with the pump station overflowing or with pumps running continuously for an extended period of time. The O&M manual states that the pump capacity is 150 gpm. In the three-year pump run time history analyzed (2012-2015), the maximum run time was 7.2 hours a day. The pump station has adequate capacity.

The Highway 30 Pump Station collects wastewater from a number of commercial sources. The wet well consistently has grease buildup issues. The station is also susceptible to damage from cars because of its proximity to Highway 30. Minor corrosion was noted on pipes on the suction side of the system during the site visit.

A few deficiencies were noted with the Highway 30 Pump Station. These deficiencies and recommendations to correct them are summarized below.

Deficiencies

- Heavy grease in wet well.
- Minor corrosion on pipes.
- Vulnerable to traffic collisions from highway.

Recommendations

- Use pretreatment program to address grease buildup.
- Clean and coat piping in wet well and valve vaults as necessary.
- Install approved ODOT traffic barriers to protect station from traffic collisions.
- Perform a review of the electrical system and check that all equipment meets compliance standards.

Seven Oaks Pump Station

The Seven Oaks Pump Station is located near the intersection of Seven Oaks Drive and SE 9th Street. The pump station is a package unit constructed in 1996. The pump station consists of the wet well with four mercury float switches; two surface-mounted, 7.5 HP, horizontal centrifugal pumps; and a control panel.

The operation and alarms for the pump station are similar to the other two, smaller pump stations (Keys Landing and Highway 30). There have been no known issues with the pump station overflowing or with pumps running continuously for an extended period of time. The O&M manual states that the pump capacity is 150 gpm. In the three-year pump run time history analyzed (2012-2015), the maximum runtime was 3.7 hours a day, thus the pump station has adequate capacity. Should there be an overflow, the pump station would overflow first at the manhole located north of the pump station at the intersection of Seven Oaks Drive and SE 9th Street.

Seven Oaks Pump Station

According to City staff, the pump station operates well and there are fewer issues than with other pump stations. A few deficiencies were noted with the Seven Oaks Pump Station. These deficiencies and recommendations to correct them are summarized below.

Deficiencies

- Foam insulation around bottom of clam shell is coming unglued.
- Minor corrosion on control panel and pumps.
- Heavy corrosion on pipes in wet well (except discharge pipe).
- Heavy grease on top layer of pipe.

Recommendations

- Repair insulation on bottom of clam shell covering.
- Clean and coat piping in wet well and valve vaults as necessary.
- Use pretreatment program to address grease buildup.

- Perform a review of the electrical system and check that all equipment meets compliance standards.

Charles T Parker and East Airport Pump Stations

The Charles T Parker (CTP) and East Airport Pump Stations have recently been installed. They are operable, but currently have little to no flow to the stations. The CTP Pump Station is located at the end of Charles T Parker Way. The East Airport Pump Station is located east of the airport.. Both stations are anticipated to service the industrial growth in the airport industrial areas. The pump stations were both designed and constructed by Romtec Utilities. They have similar equipment and operations. The pump stations consist of a wet well, two submersible 10 HP centrifugal pumps, valve vault, permanent onsite generator, and control building. CTP Pump Station also has a pig launch/force main vault. East Airport Pump Station includes a flow meter in a separate vault. Both stations have two force mains installed for future expansion. East Airport wet well is sized for a third, future pump for expansion. Additional equipment specifications for the pump stations are listed in Table 2.1 Pump Station Inventory.

The operation and alarms for the pump station are controlled by Allen-Bradley Micrologixs systems. There have been no known issues with the pump station as they are not operating regularly at this time. Infiltration and groundwater cause the CTP Pump Station to run occasionally. The O&M manuals state that the pump design flow for CTP is 398 gpm and for East Airport is 336 gpm. Should there be an overflow, the pump stations would overflow at the pump station sites.

There are currently no deficiencies at these pump stations.

2.5 PIPELINES AND MANHOLES

Figures 7 and 8 summarize the size and material of each type of gravity sewer line. The type of sewer pipe is a good indicator of the age of the sewer lines. Most of the concrete pipes in the City were installed in the 1970’s and the PVC pipes were installed in the 1990’s and more recently. Approximately 48% of Scappoose’s wastewater pipelines are concrete, with the remainder PVC. Concrete pipe is susceptible to corrosion, while PVC is inert. Eventually, all concrete pipe should be replaced or rehabilitated.

Inflow and infiltration

Inflow (direct entry of runoff into the sanitary sewer system through openings, illicit connections, or storm sewer interconnections) and infiltration (entry of groundwater into the sanitary sewer through cracks in pipes and unsealed manholes) are common in Scappoose. This is evidenced by the flow increases in the wet, high groundwater season and the discrepancy between wet weather and dry weather flows entering the treatment plant.

As part of the initial data collection of this project in 2016, steps were taken to begin to identify sources of I/I using flow monitoring data and smoke testing. Continued use of this and other methods, such as CCTV and night-time monitoring, will assist the City in pinpointing sources of I/I and prioritizing pipeline rehabilitation/replacement activities. The following section describes smoke testing methods and the findings in more detail.

Smoke Testing

Smoke testing had not previously been performed, so the City elected to have portions of the gravity collection system smoke tested as part of the planning effort in 2016. Flow monitoring data, age and material of pipes, and knowledge from City staff were used to prioritize areas of the City for smoke testing.

Keller Associates worked with City staff to smoke test sections of the gravity sanitary sewer pipelines in the City between July 20th - 27th, 2016. Areas of the City that were smoke tested are shown on in Appendix C and include 96,300 linear feet of pipelines.

Smoke introduced into the sanitary sewer system should only be released from nearby manhole and cleanout pick holes and plumbing vents on buildings. Smoke found to be emitting from other locations is a sign that water may be entering the sanitary sewer system in these locations. Overall, there were not a lot of unexpected locations found to be releasing smoke. The problem areas located during smoke testing are summarized in Appendix C, along with photographs for each identified problem area. Roughly half of the problems found while smoke testing were related to open or broken cleanout caps. There were a few cross connections identified, including roof and driveway drains. In addition, a few manholes were smoking around the rims or elsewhere on the manhole collar. There were a handful of cases where smoke was found inside houses; most of these were likely a result of dry P-traps. Recommended action to correct identified problems are also summarized in Appendix C.

Steinfeld Plant's Gravity Line

The 8-inch concrete gravity main running along SE Elm Street from SE 1st Street to SE 4th Street previously serviced the Steinfeld plant. The plant closed by 2001 and the property was developed into residential property which is now the only user type on this gravity pipeline. The 1,350-foot section of pipe was CCTV inspected in August 2011 and these video inspections were reviewed as part of this study.

The CCTV logs reveal that there is some surface deterioration on the bottom third, but not significant scouring. The scouring appears similar to scouring on other CCTV inspections completed in the area. The CCTV operator identifies a number of small to medium offset joints throughout the length, which create sags identified by the operator. The inspection logs indicate the line is in good condition. There are no major defects seen in the CCTV inspections. The scope of this study did not include any other CCTV inspection video reviews.

2.6 COLLECTION SYSTEM COMPUTER MODEL

This section summarizes the wastewater collection system model development process and existing collection system hydraulic analysis. It outlines the model construction and model calibration process, and documents existing deficiencies. Improvements to address these deficiencies are presented in Chapter 4.

2.6.1 Model Selection

InfoSWMM Suite 14.7, Update #1, was selected as the modeling software for this project. InfoSWMM is a fully dynamic model which allows for evaluation of complex hydraulic flow patterns.

2.6.2 Model Creation

The model built in 2016 was used as the basis for this model update. GeoSolve, Inc. is a GIS consulting firmed hired by the City to maintain the Scappoose GIS database. Information from this database was used to update pipe diameter and invert elevation data that has changed since the 2016 model creation.

Trunk lines with diameters of 10-inches and larger were modeled. Any pipes that connect the trunk lines together were also modeled regardless of their diameter. Figure 10 in Appendix A shows the modeled lines in the system. Several queries were conducted to reveal anomalies in the data. These included reverse slope pipes, changes in pipe size, and uncommon configurations in the pipe network. Anomalies were discussed with City personnel, additional field work was completed, and appropriate changes were made to the model. The City reviewed existing pipe size and added infrastructure to the model. The primary additional infrastructure added since 2016 includes pipe upsizing and extensions in the airport industrial area, the CTP and East Airport pump stations, and upsizing of the 21-inch line on Columbia Avenue to 30-inch diameter.

Pump Stations

The Smith Road, Highway 30, Spring Lake, Seven Oaks, CTP, and East Airport pump stations were included in the model. Keys Landings pump station was not included because it handles a small amount of flow and does not connect to a 10-inch or larger line. The pump station wet well dimensions and set points were taken from the operations and maintenance (O&M) manuals, then checked by system operators. The O&M manual pump curves and duty points were used in the model to characterize the pump station pumps.

2.6.3 Model Calibration

Model loads refer to the wastewater flows that enter the sewer collection system. These loads are comprised of wastewater collected from individual services (base flows), plus groundwater infiltration and storm water inflows (I/I). As part of this study, flow monitoring was completed during the wet weather period from December 2019 into January 2020. Flow monitoring data was collected at various manholes throughout the system to help calibrate the model. Six monitoring sites were selected, dividing the system into basins. Figure 9 in Appendix A shows a map of flow meter locations and basins. The basins were used to characterize flows throughout the system. The collected data was analyzed along with continuous precipitation data to establish typical 24-hour patterns, average flows at each site, and gauge rainfall influence in the system. Both dry weather and wet weather periods were used for loading and calibration efforts. Loads for the model were developed and calibrated in several stages as described below.

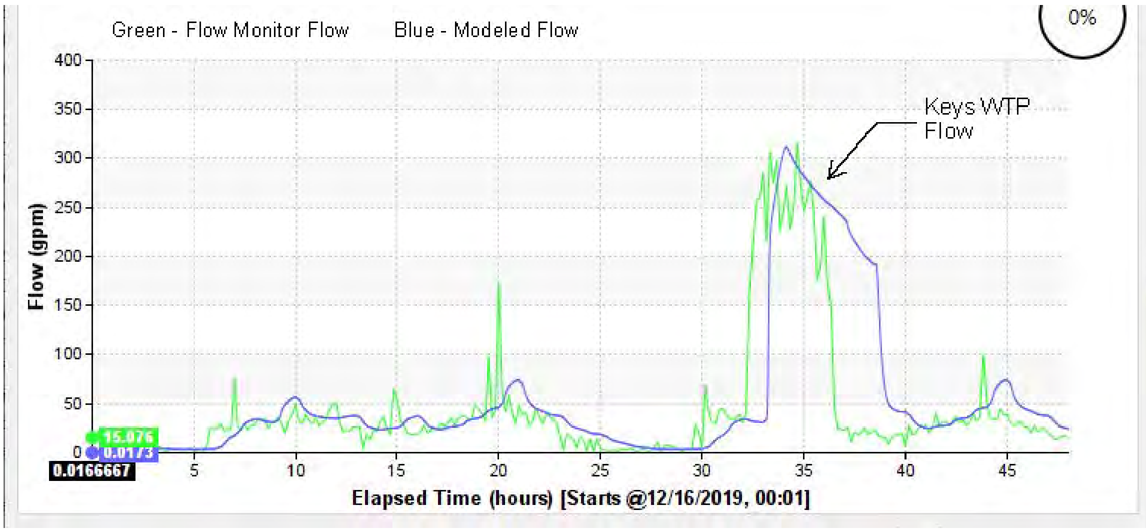
Dry Weather Calibration

For a starting point, base flows were estimated using GIS address data to provide spatial distribution of equivalent dwelling units (EDU) and dry weather flow per capita criteria. An average dry weather flow was assigned to each modeled manhole based on the EDU contributing to the manhole.

A period of five dry days (none or trace amounts of rainfall) was analyzed from the flow monitoring data. A typical day was selected for each site, which was utilized to develop a diurnal flow pattern for the basin. These typical patterns were assigned to all existing flows within the basin corresponding to the monitoring site.

In addition to calibrating the model at various locations within the collection system, total modeled influent flows at the Wastewater Treatment Plant (WWTP) were also compared to the targeted design average daily flow. An example of calibration results is shown in Chart 2-1. The blue line shows the model results and the green line show flow monitoring data collected. The large increase in flow around hour 32 is the Keys WTP backwash contribution to the sewer system. The maximum WTP load conditions seen in the system were discussed with operators and modeled to reflect these conditions.

CHART 2.1 – SAMPLE DRY CALIBRATION SITE 6

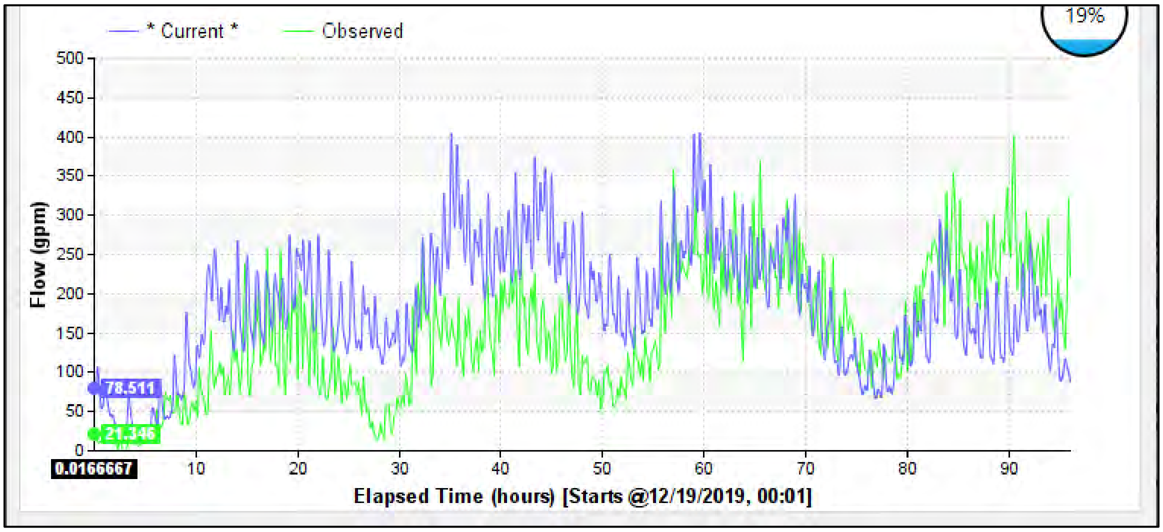


A secondary set of flow monitoring was completed in April as development of the existing system model showed lower flows from monitoring data at Sites 4 and 5 than the WWTP discharge monitoring reports (DMR). The flow monitoring completed in 2016 also showed significant flow in the system downstream of Sites 4 and 5 in comparison with the DMR records. Monitoring was completed at three additional locations on Columbia Avenue for 1-3 days to assess contributions from the connecting lines between Sites 4 and 5 and the WWTP. The monitoring indicated additional flows from the Bird Road and the Miller Subdivision with portions of I/I contributing. It is recommended the City continue to investigate I/I in this lower portion of the collection system as part of the City-wide I/I reduction efforts.

Wet Weather Calibration

The RTK method was used for rainfall-derived infiltration and inflow (RDII) prediction. Rainfall data with the 24-hour period with the highest cumulative and highest intensity rainfall during the period of flow monitoring was utilized to calibrate wet weather flows. The storm event was entered into InfoSWMM. RTK parameters were then adjusted to match model results with flow monitoring data. Total modeled influent flows at the WWTP were compared to the targeted design average daily flow in addition to calibrating the model at various locations within the collection system. Example calibration is shown in Chart 2-2.

CHART 2.2 – SAMPLE WET CALIBRATION SITE 6



Design Storm

The design storm for model evaluation was the 5-year, 24-hour storm event. A standard 24-hour NRCS rainfall distribution for a Type 1A storm was used. The rainfall for the 5-year, 24-hour storm event from NOAA isopluvial maps is 2.8 inches (matches the rainfall event used in the FPU). This was used as the multiplier for the Type 1A storm hyetograph. The existing system, calibrated model was run with the design storm event and daily and peak flows at the WWTP were compared to the planning criteria $PDAF_5$ and PIF_5 (Table 1.4). The maximum day and peak flows were lower than the planning criteria. Reviewing flow monitoring and DMR data, the wet weather storm event used for calibration had very dry antecedent conditions and the RDII response matched these conditions. The planning criteria and 5-year storm event account for wet antecedent conditions and high groundwater as are typical for large storm events in the area. Additional infiltration was added to the overall system to represent wet antecedent conditions and further calibrate the 5-year design storm response. Appendix D contains a summary of the data and results used for modeling and evaluation purposes.

2.6.4 Existing System Capacity Limitations

The calibrated model was exercised to determine the effects of a 2020 peak day flow event on the system. Figure 11 in Appendix A illustrates the utilized capacity of the existing system. The figure is color-coded to show a gradation of pipes based on utilized capacity (e.g., red = flowing at >100% capacity, orange = flowing at 85-99% of capacity, yellow = flowing at 67-84% capacity, etc.). As stated in Chapter 1, the planning criteria for undersized pipelines is 67% capacity or more. The manholes shown in orange experience surcharging and represent the greatest risk for backing up services and possible overflows. The majority of pipes at higher capacities are located on the Smith Road trunk line, downstream of the Smith Road PS force main discharge, and the High School Way basin (trunk line up along Old Portland Road and down to Elm Street).

None of the manholes in the model show potential sanitary sewer overflows, but there is surcharging present at some locations (Figure 11). Surcharging in these locations has been noted by City staff. There are three locations on SW Old Portland Road where pipes surcharge a few inches above pipe crown. The most recent CCTV inspection of this line show there are a number of sags along the line that are likely causing the surcharged conditions and should be resolved when the pipeline is upsized.

2.6.5 Pipeline Conditions

In-field pipeline material condition inspection and review were not included as part of this report. However, it is important to note that one of the basic assumptions of the hydraulic model is that all of the lines are free from physical obstructions such as roots and accumulated debris. Such maintenance issues, which certainly exist, must be discovered and addressed through consistent maintenance efforts. The modeled capacities discussed in this chapter represent the capacity assuming the sewer lines are in good working order.

2.7 20-YEAR COLLECTION SYSTEM PERFORMANCE

This section summarizes 20-year (2040) flow projections and the model evaluation of 2040 future system expansion, and documents anticipated future deficiencies. Improvements to address these deficiencies are presented in Chapter 4.

2.7.1 Future Flow Rate Projections & Model Scenarios

Future loads were distributed based on City projected residential, commercial, and industrial growth over the 20-year planning period and in alignment with the Housing Needs Analysis for the City. The projected growth areas are shown in Figure 6. Flows per land use for projected growth areas were aligned with the flow factors used in the FPU. Future flow contributions from growth areas were projected using area and land use factors. Additional flow was allocated for future large industrial users as directed by City staff and in alignment with the FPU projected flows. WTP flows (for both Miller Road Plant and Keys Landing Plant) were assumed to remain the same in the future. Projected system flows are presented in Table 1-4 and match the FPU.

Flow for each growth area identified in Figure 6 was added to the closest modeled manhole to allocate future flows. Additional gravity mains were added to the model and evaluated for carrying increased flows from these growth areas to the system. These are identified in Figure 6. In addition, City-provided contour data was used to assess potential pump stations required to provide sewer service to areas within the UGB. These general locations are shown in Figure 6. Buildout areas and the most current Buildable Lands Study available, should be taken into account during the design of any of these proposed pump stations. The future model was run to analyze the effects of future growth on the system in 2040.

2.7.2 Future System Capacity Limitations

Modeling results (Figure 12) show that most of the pipelines at or above capacity are in similar areas as the existing system evaluation. Additional pipes along 4th Street and Em Watts Road are undersized for future flows and surcharging occurs on the line. The High School Way basin has slightly higher utilized capacities, but the general areas undersized are largely unchanged between 2020 and 2040. The pipeline along Tyler Street has sufficient capacity for current flows, but needs to be upsized for 20-year flows. The pipeline downstream of the CTP Pump Station force main discharge is undersized for future flows.

2.7.3 WTP Impacts

WTP flows (for both Miller Road Plant and Keys Landing Plant) were assumed to be the same for existing and future evaluations. The flows used in the existing system are conservative and represent the largest volumes of backwash and filter-to-waste as provided by City operators. The Keys WTP significantly impacts the capacity of the western line to handle system flows. Both existing and future models were evaluated if WTP flows were automated and released to the sewer system over an extended period during the night when system flows are lowest. Figures 13 and 14 show the existing and future capacity evaluation with nighttime WTP flows. As illustrated in both figures, removing WTP flows from the sewer or shifting them to periods of low flow, would significantly increase the system capacity for sewer base flows. It is recommended that the water treatment plants develop a plan to recycle the wash water to reduce water use, as well as evaluate automated systems to allow for backwash flows to be released during nighttime flows. These recommendations will be included in the alternatives presented in Chapter 4.

2.8 CITY ORDINANCES & PRETREATMENT

Chapter 13.12 of the Municipal Code outlines City regulation of the sewer service system. Fats, oils, and grease (FOG) currently cause problems in the system by clogging and backing up pipes and pump stations. Many of the pump stations accumulate FOG and require maintenance to remove FOG build up. FOG can build up and clog pipelines as well. City staff are aware of a number of food establishments that do not have FOG interceptors and there are no regular inspections of those that are installed in the City. Section 13.12.050 D states that grease, oil, and sand interceptors shall be provided when, in the opinion of the City Manager or designee, they are necessary for the proper handling of liquid wastes. This ordinance can be used to require that all food establishments, new or existing, in the City install FOG interceptors. The City could add language to the ordinance to require as a minimum, all food establishments and any other type of commercial or small industrial establishments, have and maintain an interceptor.

FOG interceptors will not be effective if they are not properly cleaned and maintained. The owner is responsible for maintaining “continuously efficient operation at all times” according to City code. In order to ensure that this happens, the City should consider implementing some type of inspection program to monitor and enforce cleaning and maintenance of interceptors. The City could revise this section of City code to require cleaning and maintenance on a specific time schedule. Part of the inspection program could involve establishments to submit regular cleaning and service reports. The City may also want to encourage the use of a pumping company that is part of the Preferred Pumper Program, which ensures that cleaning and maintenance meet regional standards. Companies registered with the Preferred Pumper Program certify that they will follow pump-out criteria. More information on preferred pumpers can be found at http://preferredpumper.org/.

Section 13.12.120 outlines the violation and penalty procedures. When a violation of the code occurs, a written notification stating the nature of the violation and a reasonable time limit to remedy the violation is sent to the user. If the violation is not corrected within the stated time limit, the person is guilty of a misdemeanor and upon conviction can be fined a maximum of $200 per violation. Each day the violation continues is considered a separate violation. As comparison, the City of Sheridan also has a $200 maximum for each violation, while the City of St. Helens has a maximum of $2,000 for each violation.

Industrial users are addressed separately in Chapter 13.16 of the municipal code. Currently, the City does not have any identified industrial users. The projected growth of the City is anticipated to bring a number of potential industrial users to the City in the near future. Currently, the ordinance allows the City to require pretreatment facilities as deemed necessary by the City Manager to comply with the requirements of the chapter. The violation penalty is a fee up to $500 per day as the violation continues. The City Manager can issue a cease and desist order with a time schedule and preventative or remedial actions that must be followed. If the user fails to comply, the City can take actions deemed necessary including immediate severance of the sewer connection. The ordinance also covers minimum compliance with state and federal regulations; substance limitation revisions; general discharge prohibitions; dilutions; accidental and unlawful discharges; City development of a fee structure; general administration of permits; and analysis, reporting, and monitoring requirements. The City should review the sewer system industrial user ordinance and make any desired adjustments in anticipation of new industrial users moving into the City.

2.9 FINANCIAL STATUS OF EXISTING FACILITIES

See Chapter 6 for the financial status of existing facilities.

2.10 WATER/ENERGY/WASTE AUDITS

The City completed a baseline energy evaluation with support from Columbia River Public Utility District (PUD) and Energy Smart Industrial (ESI) in 2019 (Appendix E). The evaluation was part of a multi-year Strategic Energy Management (SEM) engagement to address operations and maintenance opportunities and improve the effectiveness of previously implemented action items. The City continues to work on the SEM and track energy performance and savings.

The City has not completed any recent water or waste audits.

CHAPTER 3 – NEED FOR PROJECT

3.1 HEALTH, SANITATION, AND SECURITY

The Clean Water Act of 1972 provides the primary regulations for water quality in the waters of the United States. It requires that point source contributions to surface waters obtain a discharge permit (currently permits are issued from Oregon DEQ as NPDES permits). These permits determine the conditions for discharge into surface waters. Oregon DEQ provides information about other Clean Water Act items, including the status of receiving streams, beneficial uses, and waste load allocations from the TMDL in the NPDES Fact Sheet for Scappoose. DEQ will update the fact sheet during the process of renewing the discharge permit. Additional information on compliance with the NPDES permit for Scappoose can be found in the 2018 FPU.

Other issues regarding public health, sanitation and security involve events when untreated or undertreated effluent overflows onto the ground or is discharged to surface water. There have not been any recent overflows in the Scappoose wastewater system.

All seven pump stations in the collection system are secured by either clam shell covers or a locked gate and barbed wire fence. The WWTP is also secured by a locked gate and barbed wire fence.

3.2 AGING INFRASTRUCTURE

Aging infrastructure is an issue for Scappoose. Approximately half of the collection system is concrete pipe, which is often susceptible to wear damage, cracking, root intrusion, and other problems associated with older, brittle materials. Infiltration will increase due to aging pipes, and is already an issue. Details of the system deficiencies are discussed in Chapter 2 of this report.

3.3 SYSTEM DEFICENCIES

Collection system deficiencies, including pump stations, are discussed in detail in Chapter 2. A summary of system-wide deficiencies is included below.

Smith Pump Station

Smith Pump Station has a small operating volume causing flow to back up into the gravity mains and pumps to have a high number of starts per day. The pump station is near or at capacity based on pump run time for 2019. The pumps are nearing the end of their useful life. The access hatch is heavily corroded, there is grease build up in the wet well, and one of the blowers for the fan in the dry well does not work.

Spring Lake Pump Station

There is potentially an air lock in the force main. Grease and paper products in influent have been an issue in the past.

Keys Landing Pump Station

One pump does not stay primed; however, the City has changed to exercising the pumps weekly and reduced the number of alarms received from the pump station. There have been odor problems at the station. The wet well piping has heavy corrosion. It is difficult to get the portable generator on site; particularly in winter. The clam shell door does not stay open on its own.

Highway 30 Pump Station

This station is vulnerable to traffic collisions from the highway. There is heavy grease in the wet well and minor corrosion on the pipes.

Seven Oaks Pump Station

There is heavy grease on top layer of the pipe, heavy corrosion on pipes in the wet well, and minor corrosion on the control panel and pumps. There is a small section of foam insulation on the bottom of the clam shell that is coming unglued.

Charles T Parker and East Airport Pump Stations

Theses pump stations were recently constructed and there are currently no deficiencies at the stations.

Collection System

The Smith Road Pump Station basin trunk lines and High School Way basin trunk line are undersized for current and future planning flows and cause surcharge sites. Laurel and 3rd Streets downstream of the Smith Road Pump Station force main discharge are undersized for current and future flows. The last pipe segment from Columbia Avenue into the WWTP headworks is undersized. The trunk line on SE Tyler Street is at or above capacity for 2040 flows. The line on Wagner Court downstream of the Charles T Parker Pump Station force main discharge is undersized for 2040 flows.

3.4 REASONABLE GROWTH

Wastewater facility improvements are needed to stay ahead of growth due to potential increased population and new construction. Chapter 1 of this report discussed population growth projections including customers served and the wastewater flows associated with this growth. The collection system will have to be expanded to accommodate the potential growth in the planning period. These improvements, where possible, will be proportionately funded by the new growth through the use of system development charges (SDCs).

CHAPTER 4 – ALTERNATIVES CONSIDERED

This chapter discusses alternatives that were considered to address the collection system deficiencies mentioned in Chapter 2. It also includes planning criteria and environmental and constructability considerations.

4.1 PLANNING CRITERIA

The planning criteria used for this collection system facilities planning effort are summarized as follows. The City's conveyance system will be sized for the projected 2040 peak instantaneous flow rates associated with the 5-year, 24-hour storm event, which is 5.9 MGD (2040 PIF_5 in Table 1.4). The City decided that the criteria for requiring improvements is when pipes have less than 33% remaining capacity (max flow depth/full depth (d/D) greater than 67%). Recommended improvements will be sized to flow at 67% capacity or less for the 2040 peak flows to allow for additional growth for the life of the pipe and in accordance with the City design standards. Additionally, it should be noted that efforts to reduce I/I in the collection system could further extend the lifetime of the pipeline with regards to capacity.

4.2 ALTERNATIVES DESCRIPTION

Alternatives are described and discussed below. Maps of the alternatives are included below. Overall planning level project cost estimates for alternatives are presented in Chapter 5. For each set of alternatives, there is also an unstated option to do nothing and make no changes. This option perpetuates existing deficiencies and increases the risk of surcharging, overflows, environmental damages, DEQ violations, and subsequent fines.

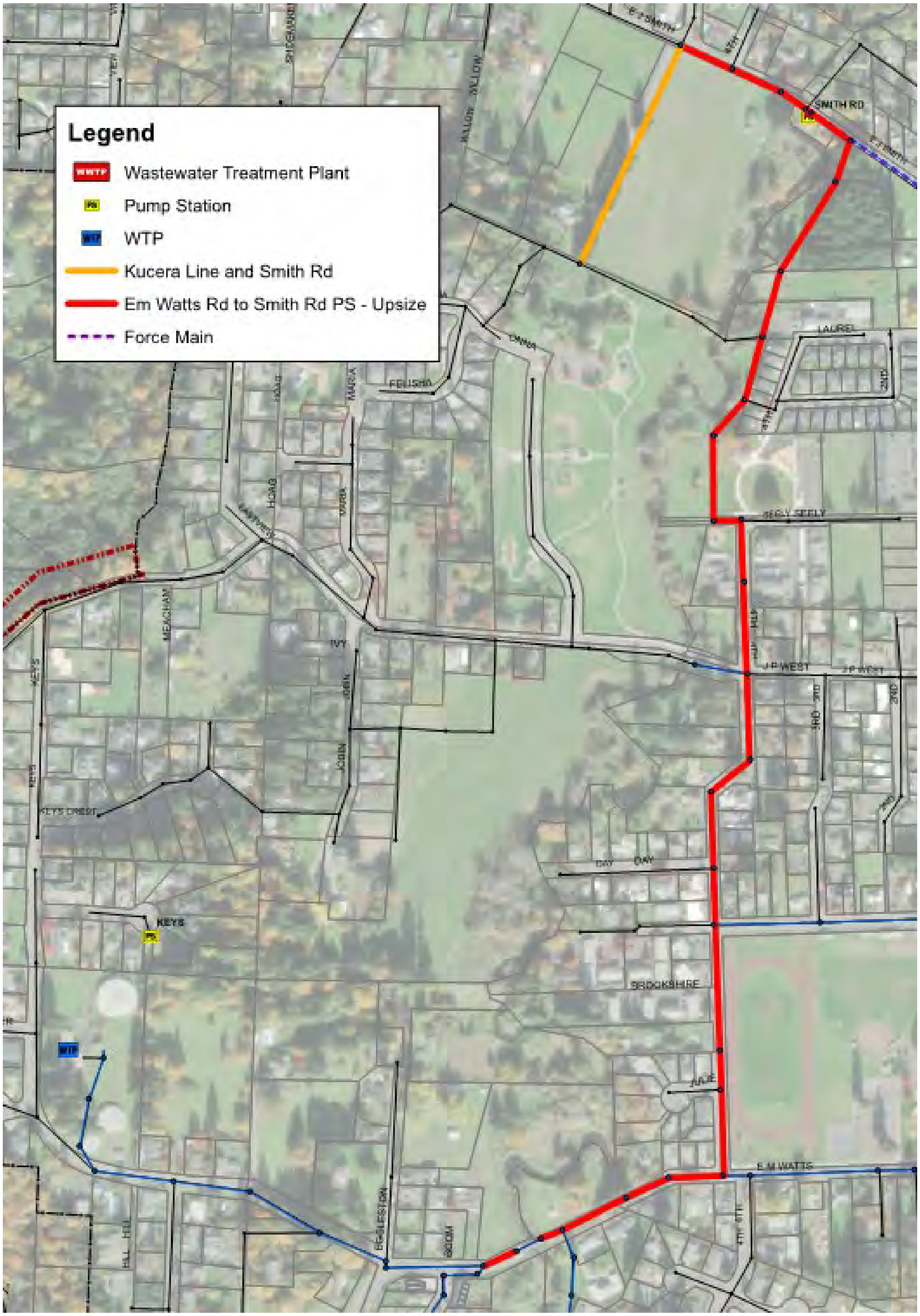
Smith Road Pump Station Basin

The City has identified the potential to abandon the creek crossing on the north side of Veterans Park by running a pipeline north across the open field from MH0418 to MH0400 on Smith Road and 5th Street (referred to as the Kucera line). The City has already completed a survey for this alignment. Alternatives 1 and 2 discussed below, include the new Kucera line, abandoning the creek crossing, and upsizing the line along Smith Road from 5th Street to the Smith Road Pump Station to a 15-inch diameter pipe with the last section to the pump station being an 18-inch diameter pipe. It should be noted that this last section extends under the creek and will require a boring. Alternative 3 discussed below, includes the new Kucera line, abandoning the creek crossing, and upsizing the line along Smith Road from 5th Street to the manhole east of the creek crossing to a 12-inch diameter pipe. The last sections to the pump station (including the creek crossing) would not be upsized from existing size. However, this would result in the creek crossing (existing 10-inch line) being smaller than the upstream pipe diameter (upsized to 12-inch).

Alternative 1 – Continue WTP Operations and Upsize Existing

This alternative requires upsizing of the 12-inch pipeline parallel to Scappoose Creek and along SW 4th Street from SW EM Watts Road to the Smith Road Pump Station if the Keys WTP continues to operate with backwash flows during high system flows in the morning. The existing undersized pipes are highlighted in Figures 11 and 12 (Appendix A). Alternative 1 includes upsizing the red colored pipes shown in Figure 4.1 (next page), extending from EM Watts Road to Smith Road Pump Station as well as NW up Smith Road from the pump station. A portion of the line is located in close proximity to the South Scappoose Creek. Replacement of this pipeline may require additional bank stabilization work. The new, Kucera line is shown in orange in Figure 4.1. This alternative includes approximately 4,800 LF of pipe being upsized to 10-, 15-, and 18-inch diameter pipe.

FIGURE 4.1 – ALTERNATIVE 1



Alternative 2 – Shift WTP Operations to Night and Upsize Existing

This alternative evaluates required upsizing on the 12-inch pipeline parallel to Scappoose Creek and along SW 4th Street if the Keys WTP automates operation to allow for backwash flows to be released during nighttime, low flow periods. WTP flows could be adjusted to release at various rates between approximately 10 pm - 7 am to minimize peak flows to the collection system. The undersized pipes with the nighttime Keys WTP flows are illustrated in Figures 13 and 14 (Appendix A).

Alternative 2 includes the colored lines in Figure 4.2 (next page). This alternative could be split into two projects – the new Kucera line and improvements on Smith Road (orange lines in Figure 4.2), followed by improvements from 4th St to the Smith Road Pump Station (light and dark blue lines in Figure 4.2). The improvements from 4th Street to the Smith Road Pump Station approximately 1,100 LF of pipe being upsized to 15- and 18-inch diameter pipe (dark blue Figure 4.2) as well as cured-in-place-pipe rehabilitation of the remaining line (light blue Figure 4.2). Trenchless technology along this portion could provide cost savings to open trench replacement because of proximity to the creek bank.

Alternative 3 – Construct New HWY 30 Crossing at Maple Street and Shift WTP Operations to Night

This alternative evaluates the option to construct a new crossing under HWY 30 and the railroad at Maple Street. Flow from 4th Street south of Maple Street would be directed through the new crossing and continue by gravity to Columbia Ave at Jay Davis Lane. An overflow would be provided at 4th and Maple Street for flow to go to the Smith Road pump station if the manhole surcharges sufficiently. This alternative includes approximately 5,000 LF of new 12-inch pipe from 4th and Maple Streets to the connection on Columbia Ave at Jay Davis Lane. The improvements would bore under the highway and railroad. The extents of the alternative are shown in Figure 4.3 (two pages down). This alternative may include easement acquisition on the Jay Davis property to connect the new pipeline from the end of Maple Street to Jay Davis Lane.

This alternative was reviewed with both daytime and nighttime WTP flows. The daytime WTP flows require pipe upsizing along 4th Street and EM Watts south of the new pipeline at Maple Street. This additional pipeline is anticipated to be more costly than improvements at the Keys WTP to allow for automated flow metering during nighttime flows. The improvement extents (Figure 4.3) include Keys WTP improvements. Alternative 3 provides an opportunity for the City to re-route flows by gravity to the WWTP. This would reduce the flow going through the Smith Road Pump Station, which would reduce O&M costs and could provide cost reductions to Smith Road Pump Station capital improvements.

This alternative also includes rehabilitation of the trunk line parallel to the creek by CIPP or similar trenchless methods to reduce creek impacts as shown by light green pipes in Figure 4.3.

FIGURE 4.2 – ALTERNATIVE 2

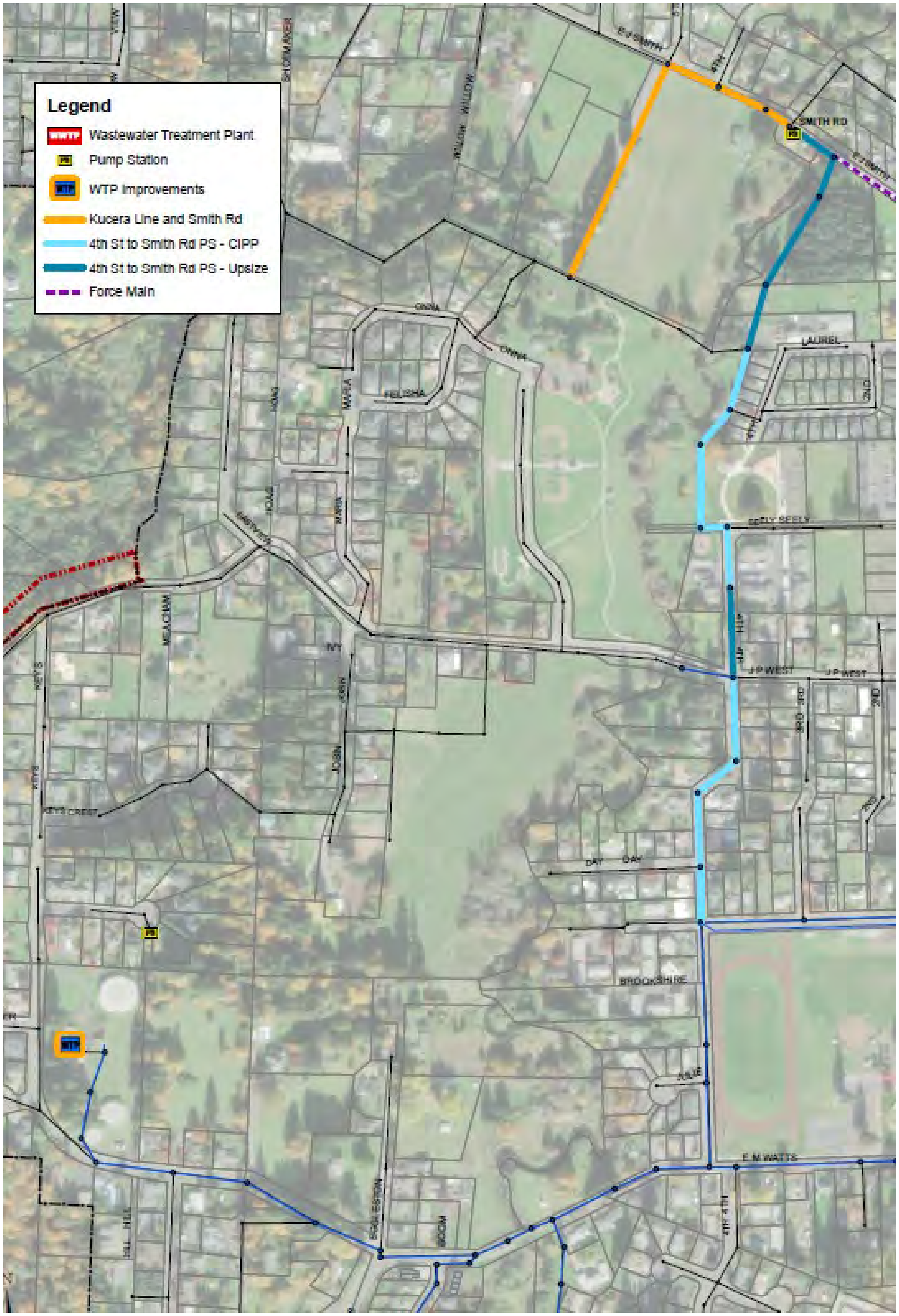
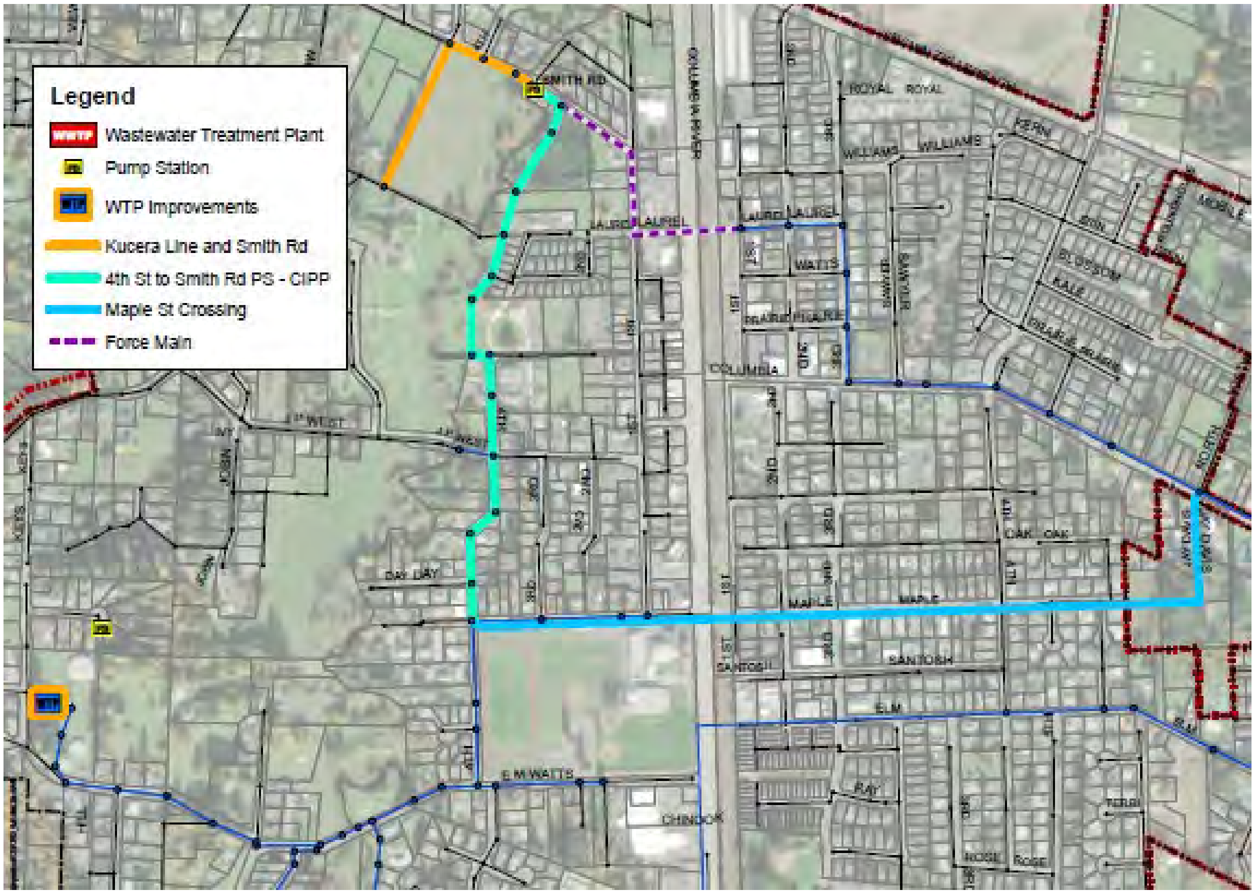


FIGURE 4.3 – ALTERNATIVE 3



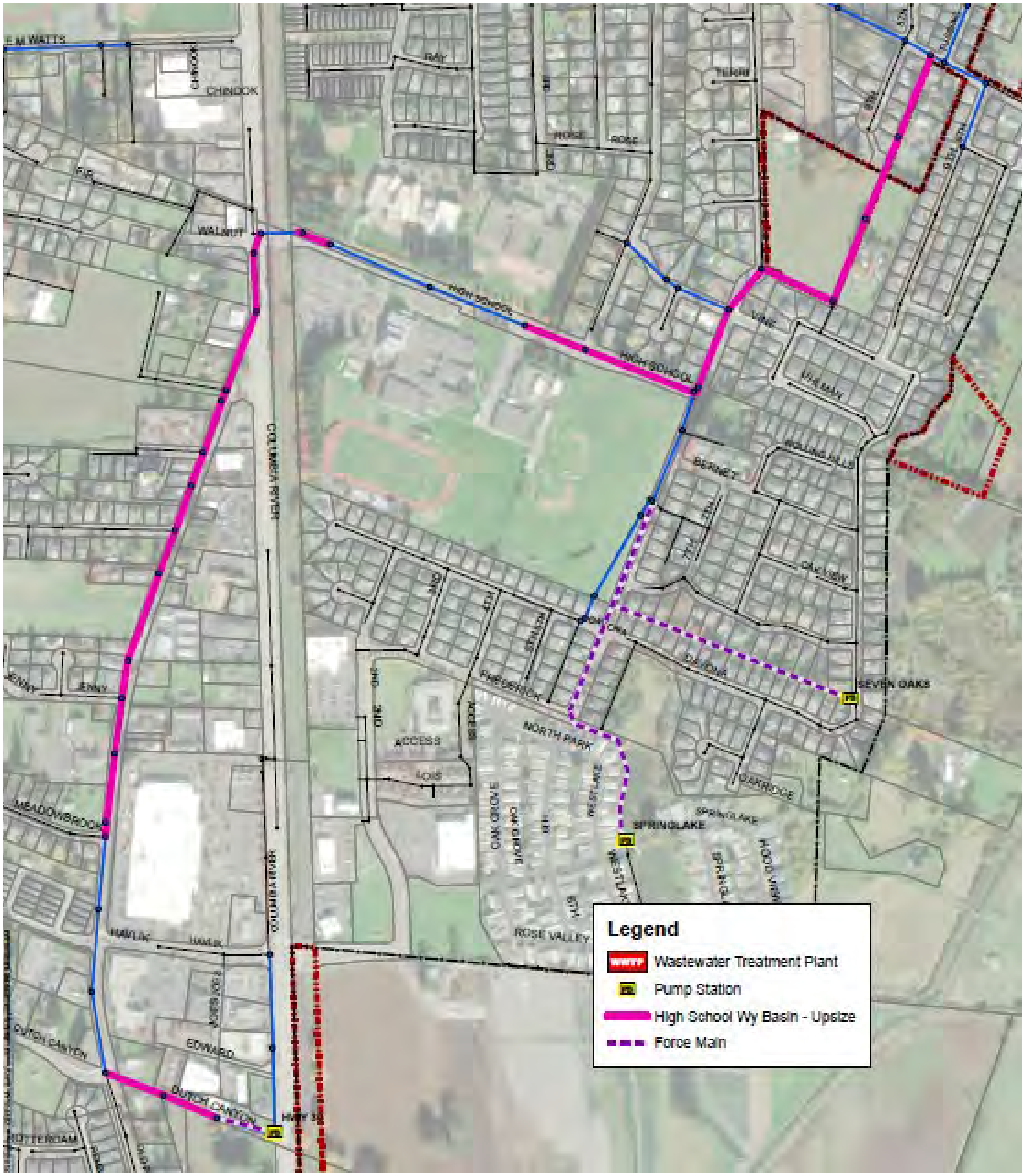
4.3 ADDITIONAL IMPROVEMENT DESCRIPTION

In addition to the alternatives described above to address capacity limitations in the Smith Road Pump Station Basin, improvements to address the remaining capacity limitations in the system were evaluated. Other alternatives reviewed for these limitations were found to be not feasible or cost prohibitive. For each set of improvements, there is also an unstated option to do nothing and make no changes. This option perpetuates existing deficiencies and increases the risk of surcharging, overflows, environmental damages, DEQ violations, and subsequent fines. The additional improvements are described in the following sections.

High School Way Basin - Upsize Existing

These improvements address required upsizing of the existing line to alleviate capacity issues along the High School Way Basin trunk line. Improvements would include approximately 4,200 LF of 10-inch pipe and 2,100 LF of 15-inch pipe. This option includes approximately 500 LF of work along HWY 30. The extent of improvements is shown on Figure 4.4 (next page). A second highway/railroad crossing was reviewed as an option for improvements. However, discussions with the City revealed that construction along the highway and existing utilities adjacent to the highway make this option not feasible and cost prohibitive.

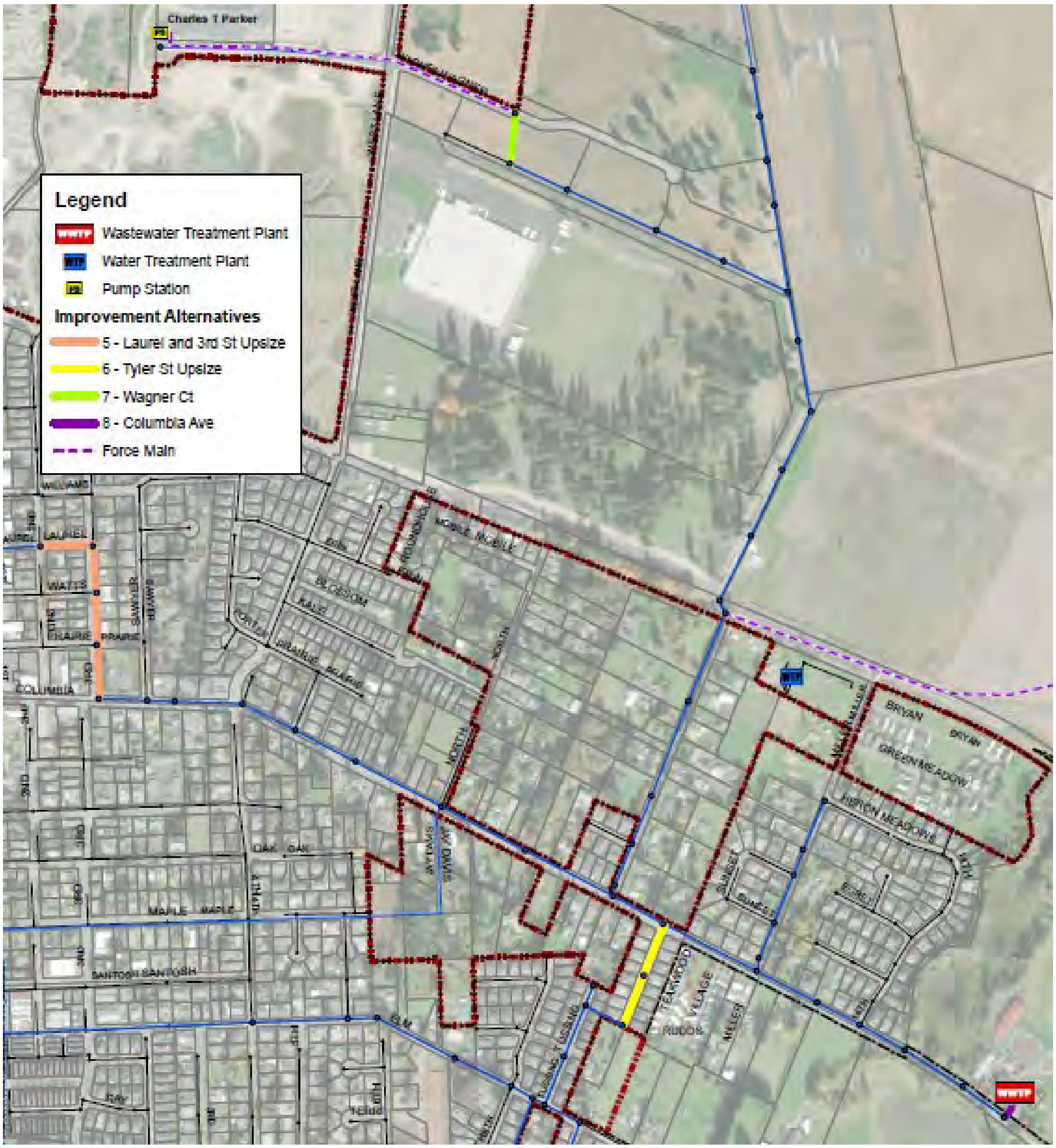
FIGURE 4.4 – HIGH SCHOOL WAY BASIN IMPROVEMENTS



Miscellaneous Improvements

There are four additional locations that require improvements to address system capacity limitations – Laurel and 3rd Streets, Tyler Street, Wagner Court, and Columbia Avenue at the WWTP. The improvement locations are shown in Figure 4.5 (next page). Parallel pipelines and a force main extension were considered for Laurel and 3rd Streets improvements, but ultimately these options were assessed to be unfeasible or cost prohibitive. When these improvements are designed, review of the Smith Road Pump Station should be included to determine if there could be any cost savings to the City by combining projects. If force main improvements are needed for Smith Road Pump Station, a force main extension to 3rd Street and Columbia Avenue could provide cost savings. At this stage of planning, the problem area on Laurel and 3rd Streets is best suited to upsize existing pipes. The Laurel and 3rd Street improvements include approx. 1,100 LF of upsizing.

FIGURE 4.5 – ADDITIONAL IMPROVEMENTS



The capacity limitations on Tyler Street and Wagner Court are best suited for upsizing existing pipes. The Tyler Street Improvements include approx. 600 LF of upsizing. The Wagner Court improvement is the 300 LF pipeline downstream of the Charles T Parker Pump Station force main discharge manhole.

The Columbia Avenue improvement is the final, 70-foot pipe segment into the WWTP headworks. This improvement alleviates capacity issues in the segment, but it has minimal impact on the capacity of the rest of the Columbia Avenue trunk line. This project is included in the Phase 2 improvements in the 2018 FPU with headworks improvements. The cost to upsize this section of pipe is not included in the collection system capital improvement projects (CIP) as it is included in the 2018 FPU cost estimates.

For all pipeline upsize projects, the existing line can be upsized or a parallel line can be constructed. The pipe age and condition of existing pipes should be evaluated before the option of a parallel line is considered as it may be more cost effective to replace the line to extent useful life. There are also options to use trenchless technologies such as pipe bursting, cured-in-place-pipe installation, or slip lining. Under the right circumstances, these approaches can be less costly than the open cut construction approach. Keller Associates recommends that each pipeline segment be evaluated during the preliminary design phase to determine the optimum replacement strategy. This effort includes a careful review of CCTV conditions and other site constraints, and should be completed as part of the concept or pre-design phase of pipeline rehabilitation / replacement projects.

4.4 MAP

Maps of the existing collection system are provided in Figures 7 and 8 (Appendix A). The various alternatives are shown in the figures presented above.

4.5 ENVIRONMENTAL IMPACTS

Potential impacts of the alternatives to the environmental resources presented in Chapter 1 are described below.

Land Use / Prime Farmland / Formally Classified Lands

No proposed projects will occur on prime farmland that is not already used for other purposes.

Floodplains

As shown in Figure 2, some portions of the study area (including the wastewater treatment plant) are located inside the 100- and 500-year floodplains of the Multnomah Channel. None of the alternatives would create new obstructions to the floodplain.

Wetlands

None of the alternatives are located in wetland areas (Figure 5).

Cultural Resources

None of the alternatives would interfere with the above-ground cultural resources identified by the State Historic Preservation Office.

Biological Resources

Several fish in the Salem BLM District are listed as sensitive or threatened; however, no in-stream work is anticipated with any of the alternatives, so no fish species would be disturbed. Endangered species in the district include the fender's blue butterfly, Columbian white-tailed deer, Bradshaw's desert parsley, and Willamette Valley daisy. It is unlikely that any of the plants exist on the proposed project sites since the areas have been previously disturbed and paved or landscaped. If the butterfly or deer is found, further investigation would be undertaken to determine the necessary mitigation measures.

Water Resources

Modifications to the collection system would reduce the risk of overflows and potential to spill into waterways. Alternatives 1 and 2 both include the abandonment of a creek crossing, which reduces the risk of leaks or breaks that would discharge wastewater into the creek directly. The upsize at Smith Road Pump Station is recommended to be bored so impacts to the creek are minimized. There are no other alternatives that involve stream crossings.

Socio-Economic Conditions

None of the alternatives would have a disproportionate effect on any segment of the population. Equitable wastewater facilities would be provided to all people within the City, limited only by physical geography and overall City budget – rather than by economic, social, or cultural status of any individual or neighborhood.

4.6 LAND REQUIREMENTS

The City would need to purchase easements for Alternative 3 for the new HWY 30 crossing at Maple Street and along the Jay Davis property near Columbia Ave. The other alternatives and improvements presented in this chapter do not require the City to purchase new easements.

4.7 POTENTIAL CONSTRUCTION PROBLEMS

The depth of the water table and subsurface rock may affect construction of the alternatives. However, subsurface investigations were not within the scope of this project.

The project area's soil is typical for the area and would require construction techniques normally used to effectively manage excavation, dewatering, and sloughing issues that may arise in Columbia County. Construction plans for any of the alternatives would also include provisions to control dust and runoff.

4.8 SUSTAINABILITY CONSIDERATIONS

Sustainable utility management practices include environmental, social, and economic benefits that aid in creating a resilient utility.

Water and Energy Efficiency

Alternative 2 could potentially decrease water and energy usage depending on the changes made at the WTP. If the WTP can recycle some of their backwash flows, the water usage would decrease. If the flows are recycled or treated and divert away from the sewer, the energy usage at Smith Road Pump Station could decrease with the decreased flows.

Alternative 3 could potentially decrease energy usage at Smith Road Pump Station as some of the flow from the trunk line will flow by gravity in the new Maple Street crossing. This flow would not be pumped through the Smith Road Pump Station.

Green Infrastructure

Reducing the WTP flows to the sewer has potential to decrease usage at the WTP through recycling or use for other beneficial uses.

Other

The line from 4th Street to the Smith Road Pump Station runs parallel to the South Scappoose Creek. Constructability, cost, and impacts to the creek should be evaluated during the predesign phase to assess the optimal replacement strategy and impacts to the creek during construction.

CHAPTER 5 – SELECTION OF AN ALTERNATIVE

Alternatives were considered to address deficiencies noted in the previous sections. Detailed descriptions of each alternative are included in Chapter 4. Advantages, disadvantages, and comparative costs (where applicable) are presented for evaluating each alternative. The planning level cost estimates presented include common improvements between multiple alternatives. Detailed opinion of probable costs for each alternative are presented in Appendix F.

5.1 COMPARATIVE ANALYSIS (COSTS AND NON-MONETARY FACTORS)

5.1.1 Alternative 1 – Continue WTP Operations and Upsize Existing

Alternative 1 includes maintaining WTP operations as existing and upsizing existing trunk line from EM Watts to the Smith Road Pump Station. This alternative also includes improvements on Smith Road and the new Kucera line to eliminate the creek crossing on the north side of Veteran's Park. Figure 4.1 in Chapter 4 highlights improvements included in this alternative. The pipeline improvements include the section of pipeline that was exposed in the South Scappoose Creek bank in previous years due to flooding events. There could be additional creek bank stabilization required with this alternative. A preliminary opinion of probable cost is summarized in Table 5.1. This alternative is anticipated to include the highest peak flows going into the Smith Road Pump Station (in comparison to Alternatives 2 and 3) and thus is expected to have higher O&M costs associated with these higher flows.

5.1.2 Alternative 2 – Shift WTP Operations to Night and Upsize Existing

Alternative 2 includes modifying WTP operations to automatically meter WTP flows to the sewer system at night, during periods of low flow. This alternative would include upsizing the existing trunk line from SW 4th and Maple Streets to the Smith Road Pump Station, approximately 3,500 linear feet less upsizing compared to Alternative 1 due to shifting WTP operations to night-time. This alternative also includes improvements on Smith Road and the new Kucera line to eliminate the creek crossing on the north side of Veteran's Park similarly to Alternatives 1 and 3. Figure 4.2 in Chapter 4 highlights improvements included in this alternative. A preliminary opinion of probable cost is summarized in Table 5.1 with the costs of splitting the project as discussed in Chapter 4 included. The Keys WTP improvements to automate and control backwash flows at night are included in the Alternative 2 estimate (in the Keys WTP & Smith Road Improvements phase). This alternative anticipates higher peak flows going into the Smith Road Pump Station when compared with Alternative 3, but less than Alternative 1. Thus, it is anticipated that O&M costs for Alternative 2 will fall somewhere between Alternatives 1 and 3.

5.1.3 Alternative 3 – Construct New HWY 30 Crossing at Maple Street and Shift WTP Operations to Night

Alternative 3 includes improvements to the Keys WTP to meter flows to the sewer during nighttime, low flows and constructing a new gravity pipeline on Maple Street crossing under the highway and railroad. This alternative also includes improvements on Smith Road and the new Kucera line to eliminate the creek crossing on the north side of Veteran's Park. Alternative 3 includes trenchless lining of the existing 12-inch line from SW 4th and Maple Streets to the Smith Road Pump Station as this pipeline is nearing the end of its useful life. The extents of the alternative are shown in Figure 4.3 in Chapter 4. A preliminary opinion of probable cost is summarized in Table 5.1. This alternative has the lowest flow to the Smith Road Pump Station and thus lowest O&M costs for operating the pump station. The new gravity line would add additional linear feet of pipeline to the system that would require maintenance. If existing services are reconnected to the new line and not run parallel, the additional linear feet of pipeline would be minimized.

TABLE 5.1 – SMITH ROAD PUMP STATION BASIN ALT. COST ESTIMATES

Improvement	Project Estimate (Rounded)
Alternative 1	$ 3,261,000
Alternative 2	$ 1,866,000
Alternative 3	$ 4,014,000

The recommended alternative to address capacity limitations in the Smith Road Pump Station basin is Alternative 2, shift Keys WTP flows to nighttime, low flow periods and upsize the existing line. This alternative has the lowest capital cost of the alternatives and impacts the shortest length of pipeline. The improvements can be separated into two phases. The first including WTP, Kucera line, and Smith Road improvements. The second phase would include upsizing and rehabilitation from SW 4th and Maple Streets to the Smith Road Pump Station.

5.1.4 High School Way Basin Improvements – Upsize Existing

As presented in Chapter 4, multiple alternatives to address capacity limitations in the High School Way Basin were not evaluated because of feasibility or costs. Improvements to the basins include upsizing the existing line on Old Portland Road, High School Way, and 6th Street to Tussing Way along the east trunk line. Improvements would include approximately 4,200 LF of 10-inch pipe and 2,100 LF of 15-inch pipe. This alternative includes approximately 500 LF of work along HWY 30. The extents of the alternative are shown in Figure 4.4 in Chapter 4. The project has been separated into three main sections – Old Portland Road, High School Way to Elm St, and Dutch Canyon Rd. The associated opinion of probable costs of these improvements are shown in Table 6.3. As the City begins projects in these areas, projects could be combined to provide potential cost savings to the City. Detailed cost estimates are in Appendix F.

5.1.5 Miscellaneous Improvements

Additional improvements include Laurel and 3rd Streets, Tyler Street, and Wagner Court as described in Chapter 4 and improvements at Miller WTP. The improvements at Miller WTP include adding automation and controls to the backwash pumps to facilitate nighttime discharge of the backwash water to the sewer system to reduce peak flows in the sewer line. The associated opinion of probable costs of these improvements are shown in Table 6.3. As the City begins projects in these areas, projects could be combined to provide potential cost savings to the City. Detailed cost estimates are in Appendix F.

CHAPTER 6 – PROPOSED PROJECT (RECOMMENDED ALTERNATIVES)

This section consists of the recommended plan to address the wastewater collection system deficiencies identified in previous chapters. A location map showing the improvements to the collection system is shown in Figure 15 (Appendix A).

6.1 PRELIMINARY PROJECT DESIGN

6.1.1 Collection System

The proposed collection system projects are summarized below.

- Smith Road Pump Station improvements
- WTP nighttime flows, Kucera new pipeline, Smith Road pipeline upsizing
- 4th Street to Smith Road Pump Station pipeline upsizing and rehabilitation
- High School Way basin pipeline upsizing
    - Old Portland Road pipeline
    - High School Wy to Elm St pipeline
    - Dutch Canyon Road pipeline
- Laurel and 3rd Streets pipeline upsizing
- Tyler Street pipeline upsizing
- Wagner Court pipeline upsizing
- Additional Pump Station improvements

Detailed project descriptions are included in Chapter 5. Detailed opinion of probable cost for each project can be found in Appendix F.

6.1.2 Pipeline Cleaning and CCTV

Cleaning and CCTV inspection work has been subcontracted out in the past. The City currently cleans and inspects 20-25% of the collection system each year. The City has not experienced challenges with debris buildup or conditions that require more frequent cleaning and inspection. If areas are identified as problematic, the City may want to clean and inspect these areas every year or two, or more regularly if required. Areas with adverse grades or large sags may require more frequent attention.

It is recommended the City use a consistent reporting format, such as PACP, for video inspections. The PACP format, or similar, provides the City an industry standard, objective analysis and allows the condition of the same pipe to be compared over time. This could be helpful in tracking the deterioration of pipes, completing preventative maintenance activities, and identifying and correcting problems before a pipe fails.

6.1.3 Service Lines

Service lines can be a major source of I/I. Identifying leaky service lines should be a part of regular CCTV inspection work. Additional evaluations of service line conditions should be completed in anticipation of mainline rehabilitation work.

6.1.4 Flow Monitoring

In addition to CCTV inspection, it is recommended the City begin a flow monitoring program to better pinpoint I/I sources and further calibrate the sewer model. Keller Associates recommends that the City complete periodic flow monitoring for areas where I/I are suspect. Flow monitoring could also include night-time monitoring during storm events.

6.1.5 Pipeline Replacement Program

As degrading pipe sections and I/I problems are identified through CCTV monitoring and flow monitoring, Keller Associates recommends that these areas be corrected. Pipeline and manhole replacement and rehabilitation needs are likely to increase as the sanitary sewer collection system ages.

Keller Associates recommends the City begin budgeting for replacement/rehabilitation of an average of 2,300 feet of the collection pipeline system each year. This amount would allow replacement of the entire system within approx. 75 years, the estimated useful life of pipelines. Concrete pipes in the system should be replaced first. The linear feet of pipeline and number of manholes replaced annually is an average and should be adjusted based on future CCTV and other maintenance records. The costs associated with funding an on-going replacement and rehabilitation program are summarized in Table 6.1 and discussed further in Section 6.6.

TABLE 6.1: REPLACEMENT BUDGETS

Item	Lifespan	Cost/Year
Pipelines	75 year	$ 519,000
Manholes	50 year	$ 109,000
Cleanouts	50 year	$ 4,000
Laterals/Cleanouts	50 year	$ 85,500
	Total	**$ 717,500**

Manhole rehabilitation and service line repairs should be coordinated with pipeline rehabilitation work. Priority pipeline replacements/rehabilitation work identified in the CCTV inspections could be funded from this program. Emphasis should be placed on areas where pipe conditions pose the largest threat of sanitary sewer surcharging or a more immediate threat of collapse. Wherever possible, coordinate construction activities with planned roadway projects to minimize construction costs.

6.1.6 Pump Station Improvements

Pump station improvements are included in the detailed opinion of probable costs (Appendix F). Smith Road, Springlake and Highway 30 pump station improvements are in Priority 1. The Keys Landing and Seven Oaks pump station modifications are part of Priority 2. The opinion of probable costs are summarized in Table 6.2 below. It is recommended that at the end of useful life for each Highway 30, Seven Oaks, and Keys Landing pump stations, evaluations be completed to assess the benefits and cost of converting the stations to submersible pump stations. This could improve future maintenance access to pumps and associated piping and valving.

TABLE 6.2: PUMP STATION IMPROVEMENT ESTIMATES

Pump Station Improvements	Project Estimate (Rounded)
Smith Road Pump Station	$ 883,000
Springlake	$ 46,000
Highway 30	$ 38,000
Seven Oaks	$ 44,000
Keys Landing	$ 105,000

6.2 SUSTAINABILITY CONSIDERATIONS

6.2.1 Water and Energy Efficiency

The proposed Priority 2 improvements along 4th St to the Smith Road Pump Station is anticipated to reduce I/I flows to the pump station, which would provide energy savings at the pump station. Other pipe replacements may also reduce I/I flows in the system and could provide energy savings at the WWTP.

6.2.2 Green Infrastructure

Recommendations of this report include reducing I/I. This diverts storm water to its natural course instead of it ending up in the sanitary sewer, and eventually the WWTP. Reducing I/I also decreases associated energy required to carry and treat the water.

6.2.3 Other

The proposed alternatives reduce peak flows through the collection system by removing WTP sewer contributions to periods of low flow. This results in lower capacity demands on pipelines, pump stations, and the treatment plant.

6.3 ENGINEER’S OPINION OF PROBABLE COST

The summary of the Scappoose collection system improvement costs is in Table 6.3 (Capital Improvement Plan (CIP)). The percent SDC eligibility factored in the existing design flow, existing capacity, and capacity after the improvements are completed. The amount of capacity that can be utilized for future connections is divided by the future capacity in 2040. For projects that did not have an increase in flows, the percent SDC eligible is derived from the percent growth in population over the 20-year planning period. Costs shown are planning-level estimates and can vary depending on market conditions; they shall be updated as the project is further refined in the project development, pre-design, and design phases. Individual project sheets for Priority 1 projects are included in Appendix H. Each project sheet consists of a project objective, description, location map, and cost estimate.

TABLE 6.3: 20-YEAR CAPITAL IMPROVEMENT PLAN

ID #	Item	Total Estimated Cost (2020)	SDC Growth Portion %	SDC Growth Portion Cost	City's Estimated Portion
Priority 1 Improvements					
1.1	Smith Road Pump Station	$ 883,000	24%	$ 215,000	$ 668,000
1.2	WTP Improvements and Smith Rd	$ 908,000	40%	$ 364,000	$ 544,000
1.3	Laurel and 3rd St	$ 594,000	18%	$ 109,000	$ 485,000
1.4	Old Portland Rd	$ 1,398,000	10%	$ 145,000	$ 1,253,000
1.5	High School Wy to Elm St	$ 1,412,000	12%	$ 165,000	$ 1,247,000
1.6	Dutch Canyon Rd	$ 285,000	2%	$ 5,000	$ 280,000
1.7	Pump Station Improvements (Springlake and HWY 30 PS)	$ 84,000	36%	$ 30,000	$ 54,000
Total Priority 1 Improvements (rounded)		***$ 5,564,000***		***$ 1,033,000***	***$ 4,531,000***
Rate Impact (20 yr, 1.6%)					***$ 8.70***
Priority 2 Improvements					
2.1	4th St to Smith Rd Pump Station	$ 958,000	13%	$ 126,000	$ 832,000
2.2	Tyler St	$ 303,000	13%	$ 40,000	$ 263,000
2.3	Wagner Ct	$ 126,000	100%	$ 126,000	$ -
2.4	Pump Station Improvements (Keys Landing and Seven Oaks PS)	$ 149,000	36%	$ 53,000	$ 96,000
2.5	Miller WTP Improvements	$ 49,000	36%	$ 17,000	$ 32,000
Total Priority 2 Improvements (rounded)		***$ 1,585,000***		***$ 362,000***	***$ 1,223,000***
Rate Impact (20 yr, 1.6%)					***$ 2.35***
TOTAL COLLECTION SYS. IMPROVEMENTS COSTS (rounded)		**$ 7,149,000**			**$ 5,754,000**

Notes:

1. The opinion of probable cost herein is concept level information only based on our perception of current conditions at the project location and its accuracy is subject to significant variation depending upon project definition and other factors. This estimate reflects our opinion of probable costs at this time and is subject to change as the project design matures. This cost opinion is in 2020 dollars and does not include escalation to time of actual construction. Keller Associates has no control over variances in the cost of labor, materials, equipment, services provided by others, contractor's methods of determining prices, competitive bidding or market conditions, practices or bidding strategies. Keller Associates cannot and does not warrant or guarantee that proposals, bids, or actual construction costs will not vary from the cost presented herein.
2. All costs in 2020 Dollars. Costs include mobilization (5%), contractor overhead and profit (OHP; 15%), contingency (30%), engineering and construction management services (CMS; 20-30%), and legal, administrative, and permitting services (2%).
3. The Capital Improvement Plan does not include annual pipeline replacement, pipeline cleaning and inspection, and lift station maintenance budgets. These budgets are discussed in Section 6.6.

6.4 PROJECT SCHEDULE

An estimated schedule for Priority 1 improvements is shown in Table 6.4. Individual schedules for each project will be further refined at a later date by the City during the pre-design phase for each proposed improvement. Costs presented here are planning-level estimates. Actual costs may vary depending on market conditions and must be updated as projects are further refined in the project development, pre-design, and design phases.

TABLE 6.4: PRIORITY 1 CAPITAL IMPROVEMENT PLAN

ID #	Item	Total Estimated Cost (2020)	Opinion of Probable Costs (2020) 2021	2022	2023	2024
Priority 1 Improvements						
1.1	Smith Road Pump Station	$ 883,000	$ -	$ 883,000	$ -	$ -
1.2	WTP Improvements and Smith Rd	$ 908,000	$ -	$ 181,600	$ 726,400	$ -
1.3	Laurel and 3rd St	$ 594,000	$ -	$ 118,800	$ 475,200	$ -
1.4	Old Portland Rd	$ 1,398,000	$ -	$ -	$ 279,600	$ 1,118,400
1.5	High School Wy to Elm St	$ 1,412,000	$ -	$ -	$ 282,400	$ 1,129,600
1.6	Dutch Canyon Rd	$ 285,000	$ -	$ -	$ 57,000	$ 228,000
1.7	Pump Station Improvements	$ 84,000	$ -	$ 84,000	$ -	$ -
Total Priority 1 Improvements (rounded)		***$ 5,564,000***	***$ -***	***$ 1,267,400***	***$ 1,820,600***	***$ 2,476,000***

Note: The opinion of probable cost herein is concept level information only based on our perception of current conditions at the project location and its accuracy is subject to significant variation depending upon project definition and other factors. This estimate reflects our opinion of probable costs at this time and is subject to change as the project design matures. This cost opinion is in 2020 dollars and does not include escalation to time of actual construction. Keller Associates has no control over variances in the cost of labor, materials, equipment, services provided by others, contractor's methods of determining prices, competitive bidding or market conditions, practices or bidding strategies. Keller Associates cannot and does not warrant or guarantee that proposals, bids, or actual construction costs will not vary from the cost presented herein.

6.5 FINANCIAL STATUS OF EXISTING FACILITIES

The financial information statement for the City of Scappoose sewer utility is located in Appendix G. This information includes the latest two resolutions regarding sewer rates. The current basic residential rate is $55.96 plus commodity per month. Estimated total wastewater fund resources for the 2020-2021 fiscal year are approximately $5,056,130. The annual charges for services are estimated to be $2,171,125 of the $5,056,130.

Annual O&M costs for the wastewater system, separated by type of expense, are also shown in Appendix G. For the 2020-2021 fiscal year, the estimated total expenditures for the wastewater fund is approximately $4,265,130.

The City took out construction loans for the sewer utility in 2011 and 2014. The 2011 loan is through DEQ with 0.00% interest that will mature in 2031. Its balance as of July 1, 2020, was $185,231. The 2014 loan is a $700,000 loan from US Bank, with an interest rate of 2.47%. That loan matures in 2021 and has a balance (as of July 1, 2020) of $100,000. The annual debt service of both loans is $119,803. The DEQ loan has a holding or reserve requirement of one half of the average annual debt service – $8,821. The US Bank loan does not have any holding requirements.

The City plans to take out a loan from the DEQ Clean Water State Revolving Fund (CWSRF) for $6,430,00 to cover Phase I of the WWTP improvements. The loan is anticipated to be for 30 years at 2.01% interest amortized over a 15-year period with an annual fee of 0.5% of the outstanding loan amount. There is the opportunity for $500,000 of principal forgiveness at the completion of the project. The City anticipates the first payment for this loan will be due in spring of 2021 of an estimated $180,000. The required loan reserve is estimated to be around $250,000.

6.6 ANNUAL OPERATING BUDGET

An itemized annual operating budget for the fiscal year 2020-2021 is provided in Appendix G. Additional information on budget specifics can be found in the following sections.

6.6.1 Potential User Rate Impacts

The existing sewer rate schedule consists of a monthly flat rate fee of $55.96 per EDU plus commodity. Operators indicate that commodity fees typically constitute 4% of system fees. The current number of EDUs is 2,553.

The rate impacts assume that none of the existing revenue/budget can be used annually to offset future capital improvements or sewer rehabilitation/replacement budgets. The City will continue to evaluate this as individual projects progress.

Table 6.4 shows the existing and potential monthly charge for sewer services for one EDU. Funding for the recommended system improvements may come from any number of sources. This section presents potential user rate impacts if priority improvements are funded only through a low-interest loan with debt service payments (20-year, 1.6%) made through a user rate increase. Calculations for the user rate impact are referenced in Appendix G. The user rate impacts assume that SDC funds or commercial/industrial development contributions will be available for Priority 1 (urgent need). The user rate impacts also assume, as directed by City staff, there is no surplus in the annual budget contributing to the annual debt service payment.

In the event that grant funds, low-interest loans, or principal forgiveness could be obtained, then the user rate impacts would be less than those illustrated in Table 6.5. Keller Associates recommends that the City actively pursue these opportunities in order to mitigate user rate impacts.

TABLE 6.5: USER RATE IMPACT

	Annual Payment (20 years, 1.6%)	User Rate Increase	User Rate Total
Existing User Rate	$ -	$ -	$ 55.96
Prioritiy 1 Improvements	$ 266,520	$ 8.70	$ 64.66

The anticipated user rate impacts presented in Table 6.5 do not account for recommended replacement/rehabilitation or short-lived asset replacement budgets. These budget items will require further analyzing by the City's financial consultant as part of a full-rate study. The rate impacts for pipeline replacement/rehabilitation are usually delayed until after the capital improvement plan for the collection system is completed. This is due to the fact that the CIP should be replacing more than the average linear footage recommended for the annual replacement/rehabilitation. Keller Associates does not anticipate that future collection system improvements will increase the City's O&M requirements. In fact, with new facilities and pipelines, it may be the case that maintenance demands for the collection system could decrease slightly. It should be noted that all costs are in 2020 dollars. The City currently increases user rates by the Engineering News-Record (ENR) Construction Cost Index (CCI) for the 20-City Annual Average, which historically has been approximately 3%.

6.6.2 System Development Charges

The City's current sewer System Development Charge (SDC) for a single-family home is $4,276.04. The sewer SDC is typically divided into various components: reimbursement, growth, and administrative. The scope of this study included estimating the SDC eligibility for each identified capital improvement. It is the intent that this information will be utilized by the City's financial consultant to update the City's SDCs. The estimated SDC eligibility for each identified capital improvement is shown in Table 6.3.

6.6.3 Annual O&M Costs

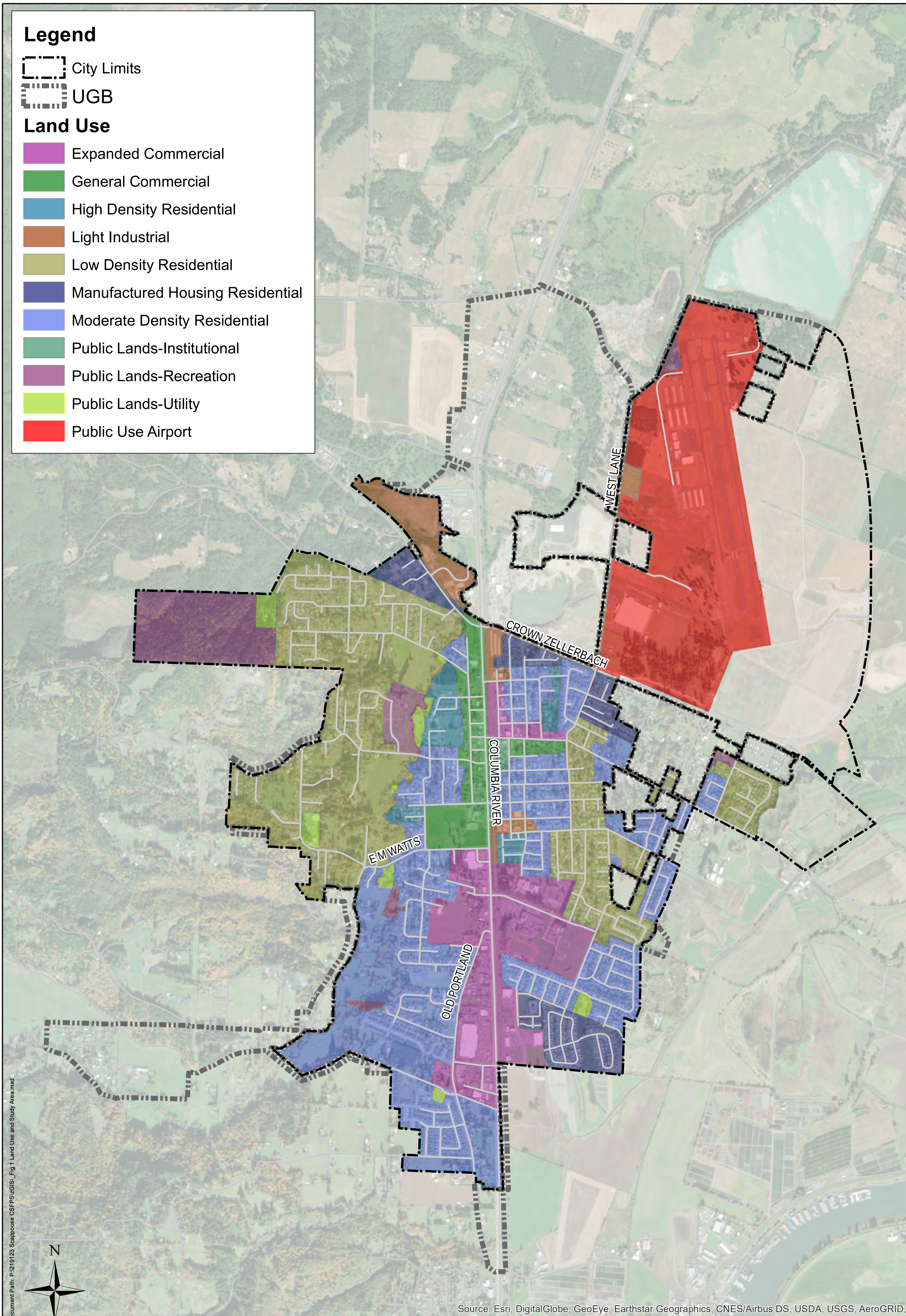
In addition to the capital improvement costs presented in Table 6.3, the following expected annual operating costs are recommended for consideration in setting annual budgets:

- Additional collection system replacement/rehabilitation needs: City should eventually budget an additional $717,500/year (to be either contracted out or completed using City crews).
- Collection system cleaning and CCTV needs: following the timeline described in Section 6.1.2, the City should budget approximately $112,000/year.

Report Appendices

Appendix A

Figures



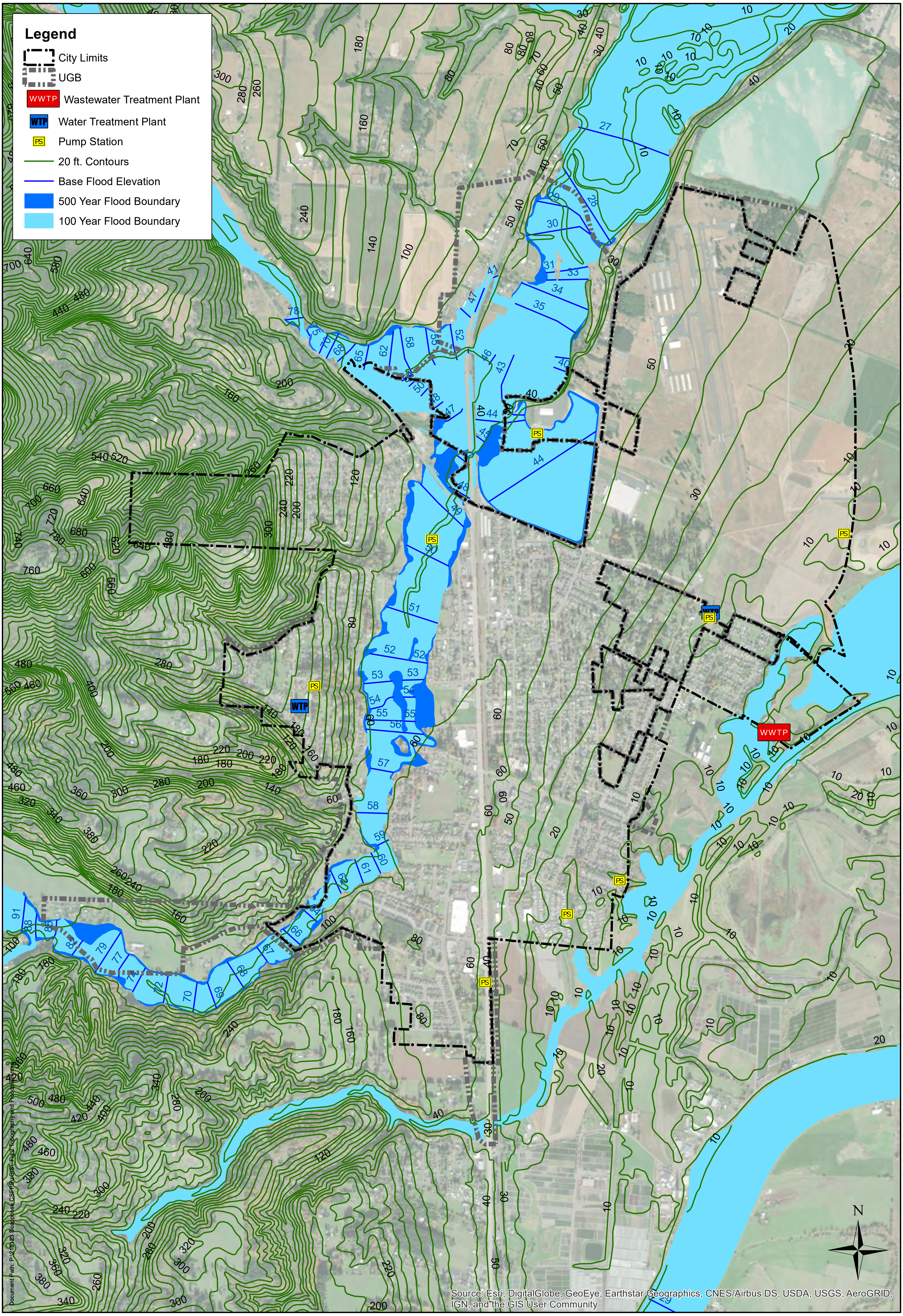
KELLER ASSOCIATES

Land Use and Study Area

Collection System Facilities Planning Study

Figure 1

City of Scappoose, OR
January 2021



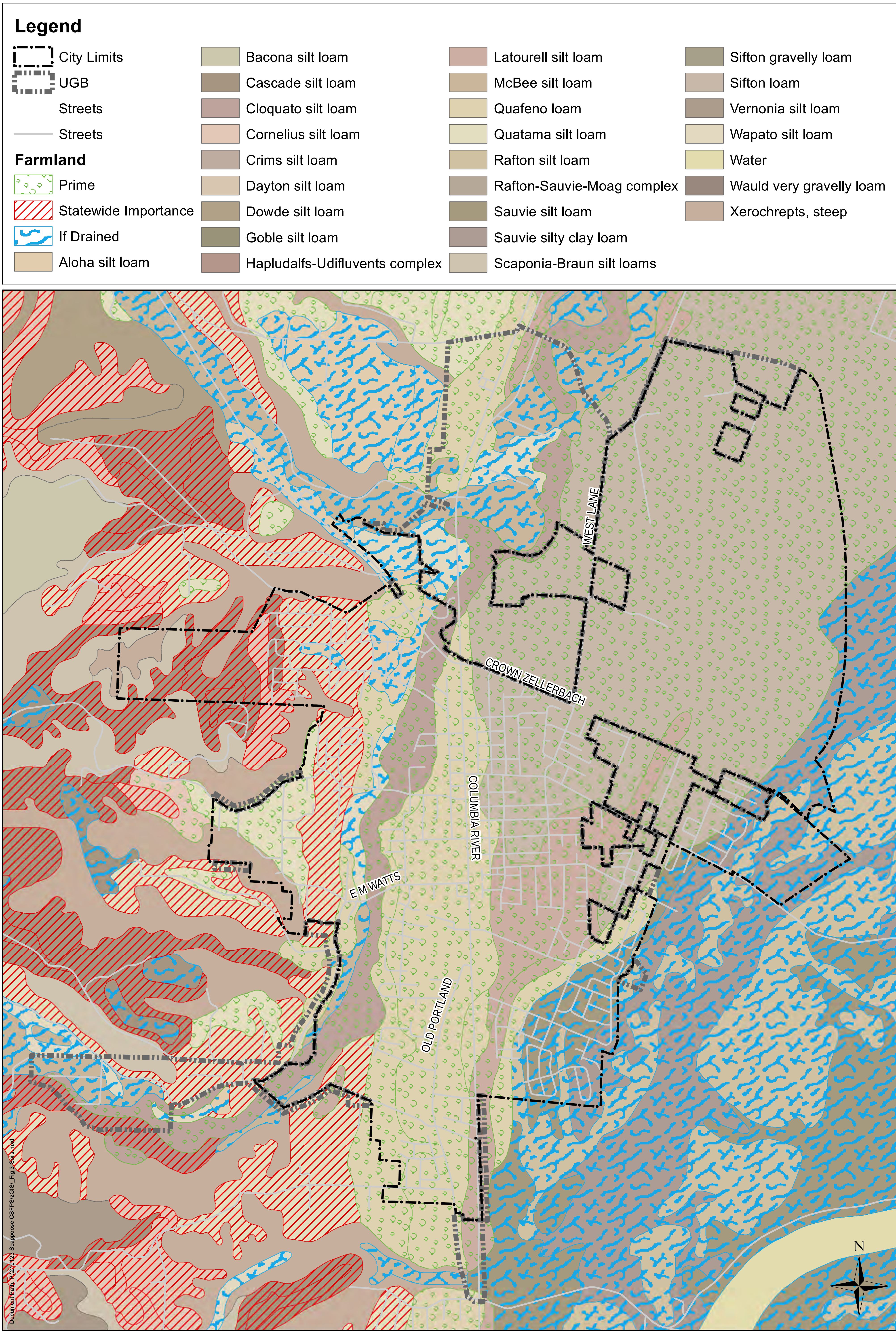
KELLER ASSOCIATES

Topography and Floodplain

Collection System Facilities Planning Study

Figure 2

City of Scappoose, OR
January 2021

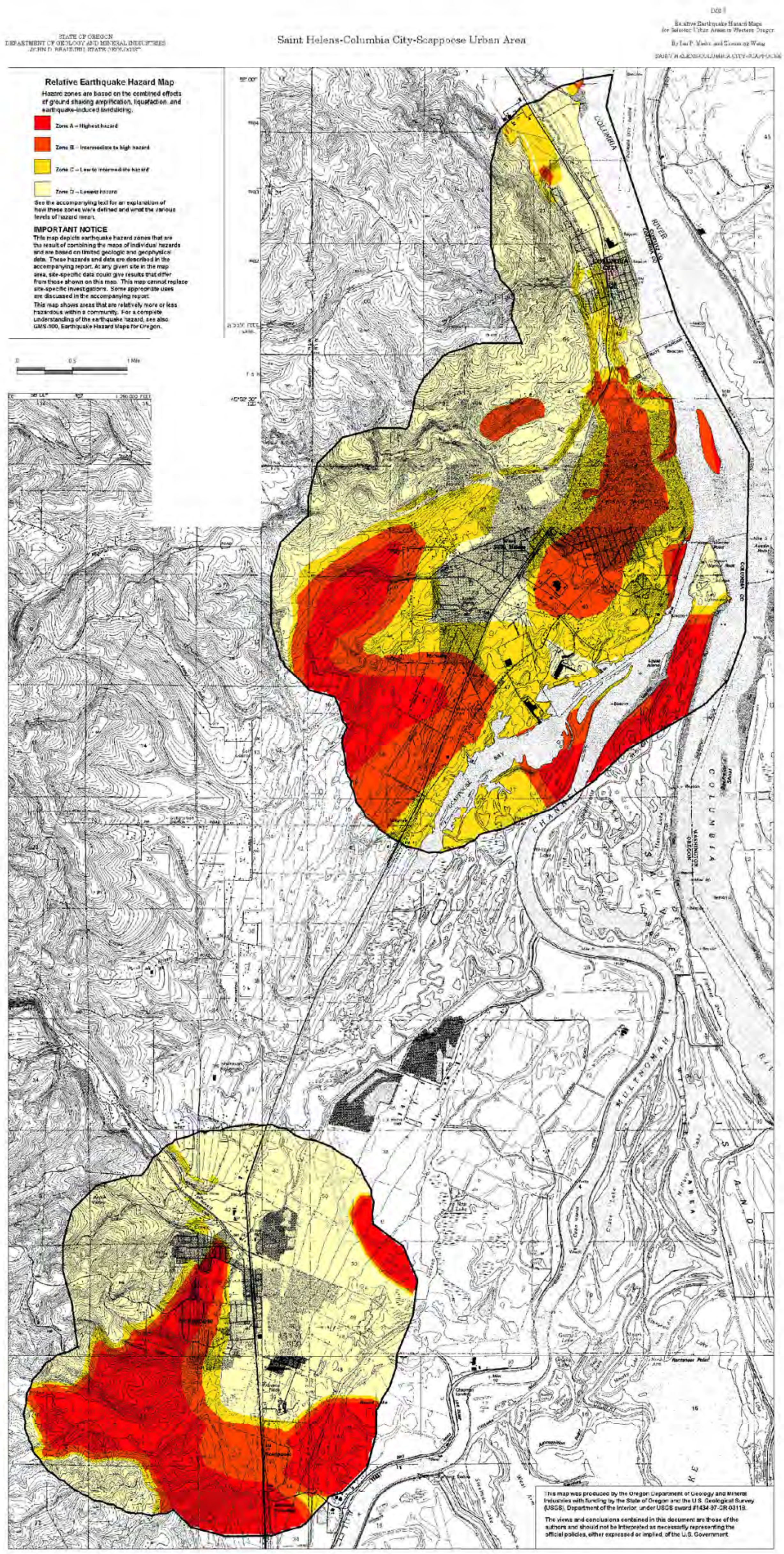


Soils

Collection System Facilities Planning Study

Figure 3

City of Scappoose, OR
January 2021



Document Path: P:\219123 Scappoose CSFPS\zGIS_Fig 4 Relative Earthquake Hazard.mxd

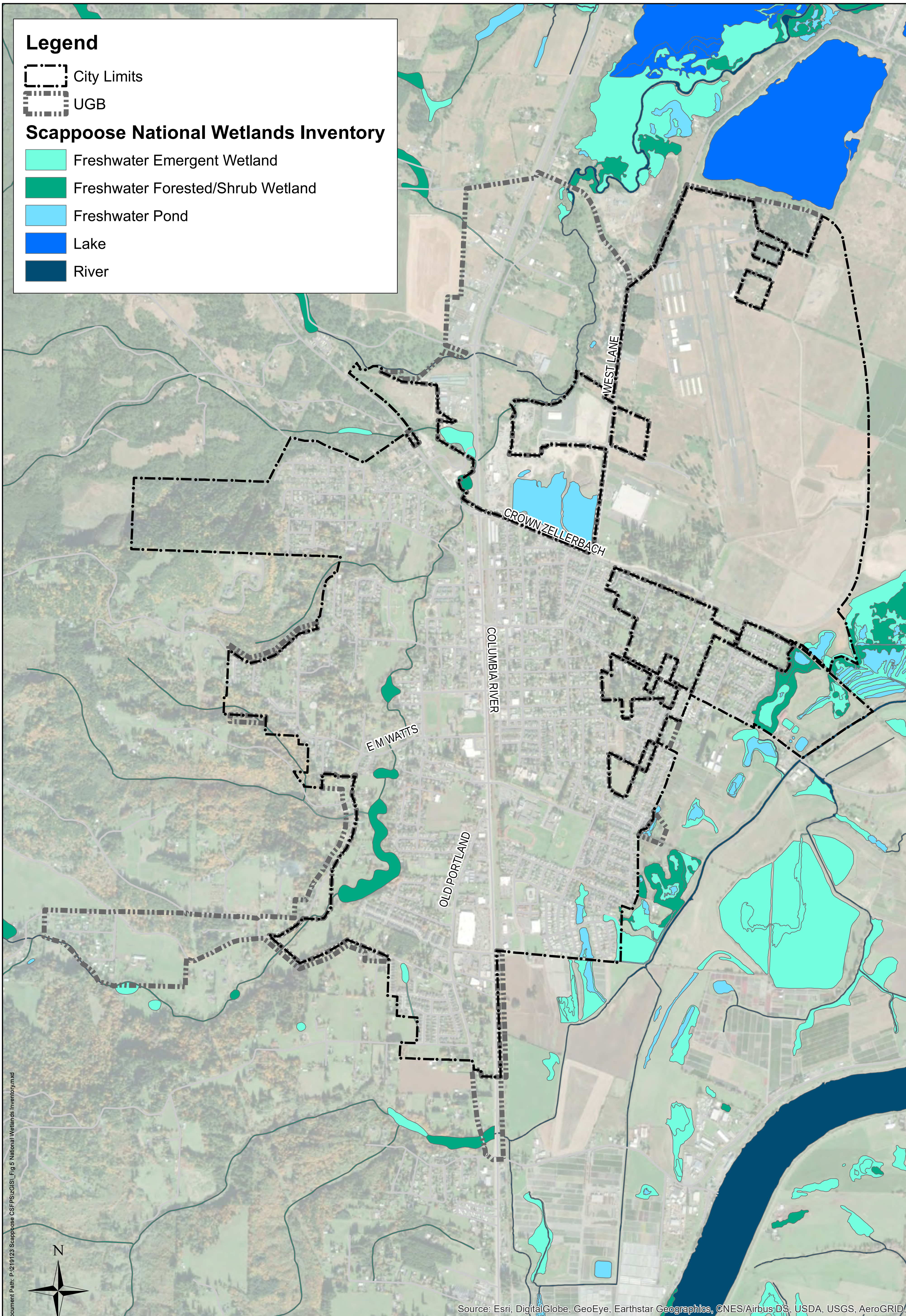
KELLER ASSOCIATES

Relative Earthquake Hazard

Collection System Facilities Planning Study

Figure 4

City of Scappoose, OR
January 2021



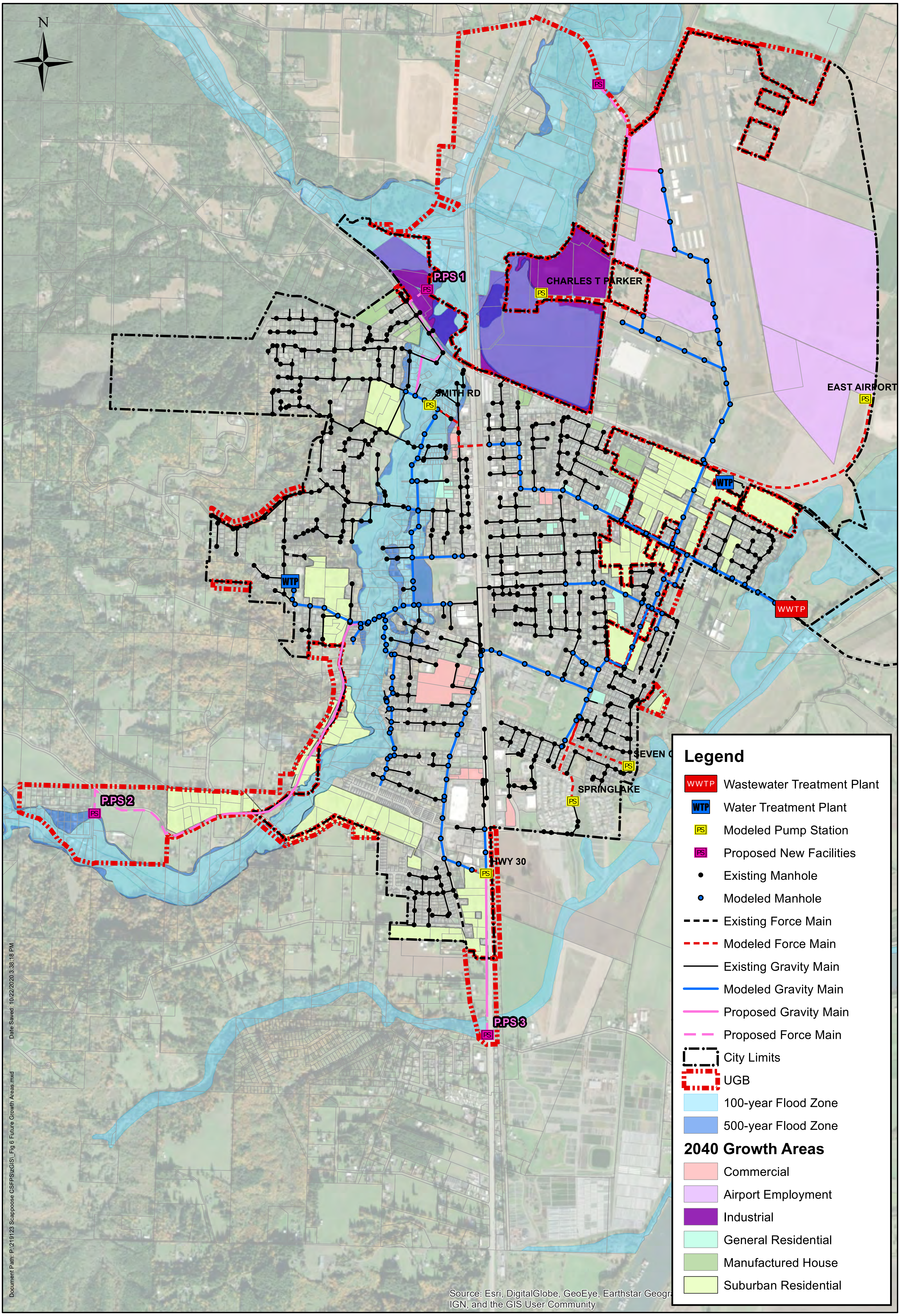
KELLER ASSOCIATES

National Wetlands Inventory

Collection System Facilities Planning Study

Figure 5

City of Scappoose, OR
January 2021



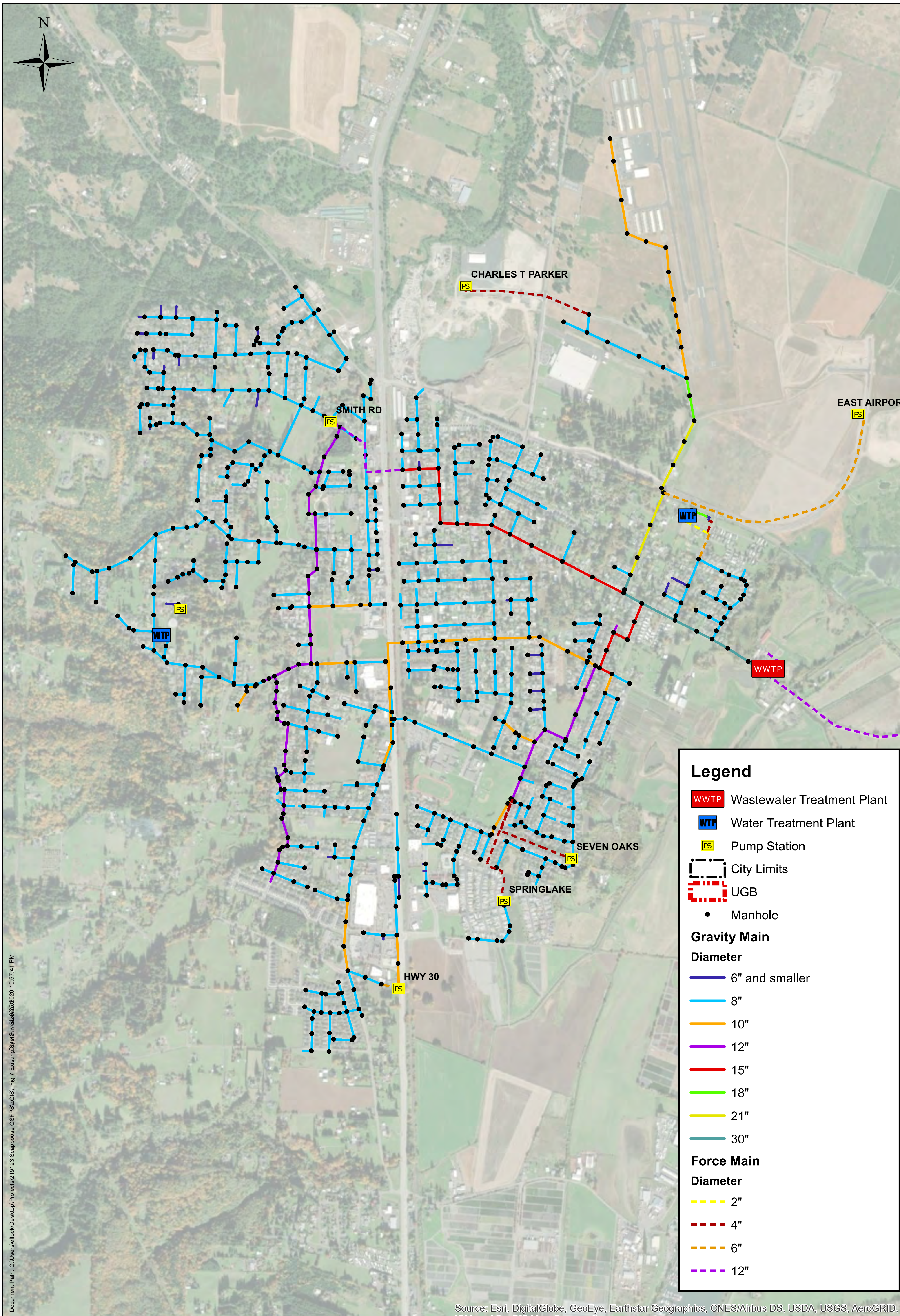
KELLER ASSOCIATES

2040 Growth Areas

Collection System Facilities Planning Study

Figure 6

City of Scappoose, OR
January 2021



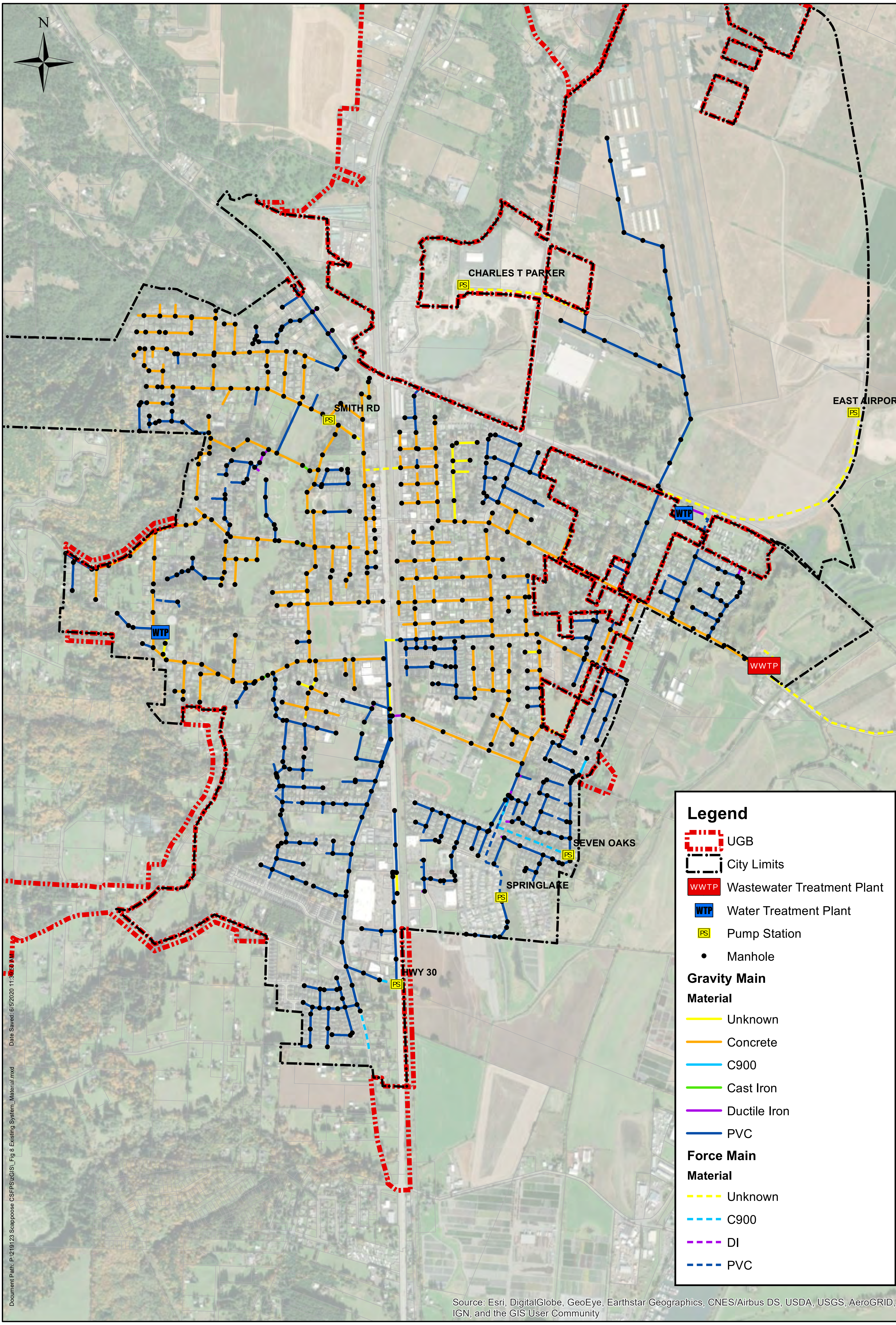
KELLER ASSOCIATES

Existing System - Pipe Size

Collection System Facilities Planning Study

Figure 7

City of Scappoose, OR
January 2021



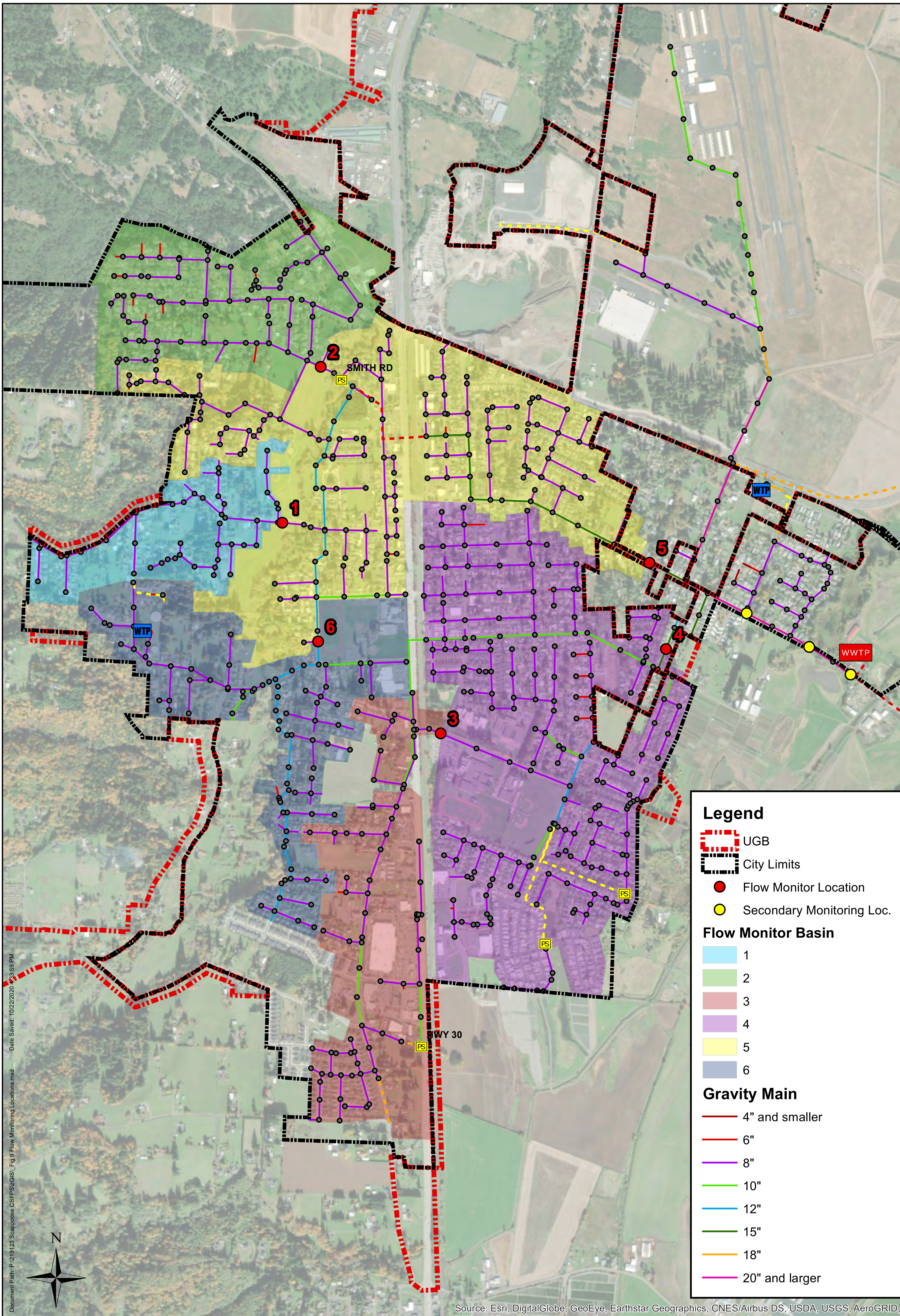
KELLER ASSOCIATES

Existing System - Pipe Material

Collection System Facilities Planning Study

Figure 8

City of Scappoose, OR
January 2021



KELLER ASSOCIATES

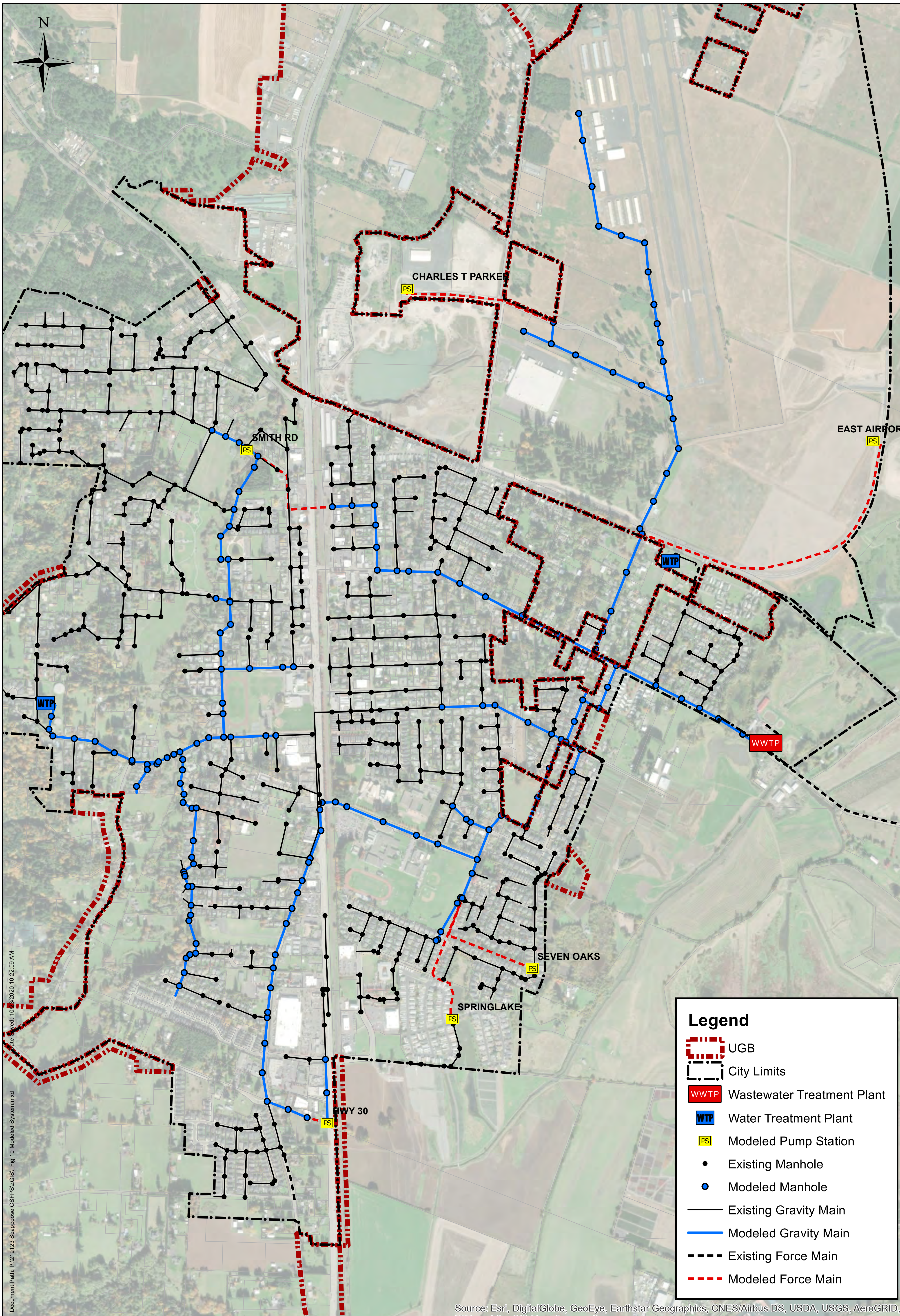
Flow Monitor Locations

Collection System Facilities Planning Study

Figure 9

City of Scappoose, OR

January 2021



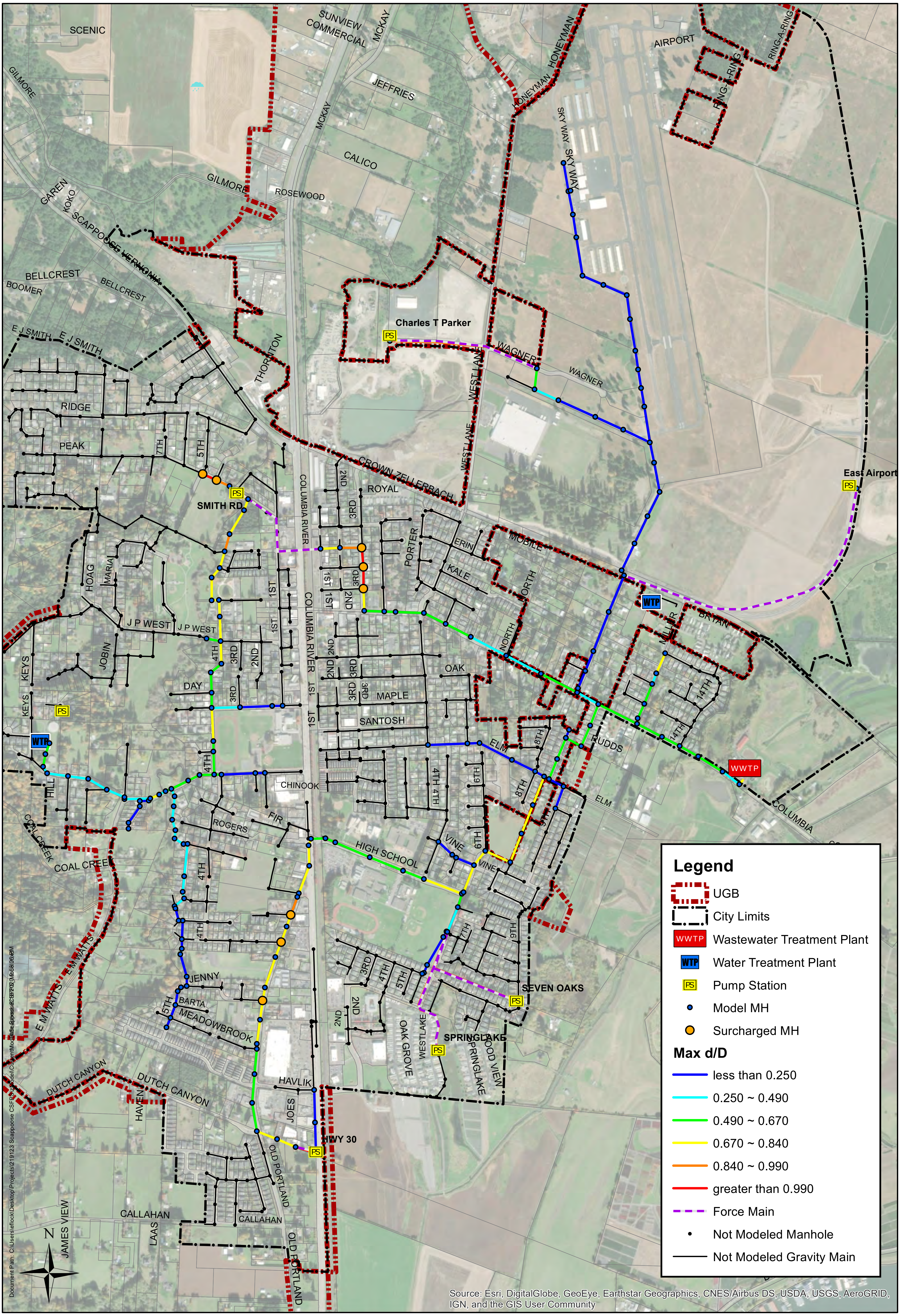
KELLER ASSOCIATES

Modeled System

Collection System Facilities Planning Study

Figure 10

City of Scappoose, OR
January 2021



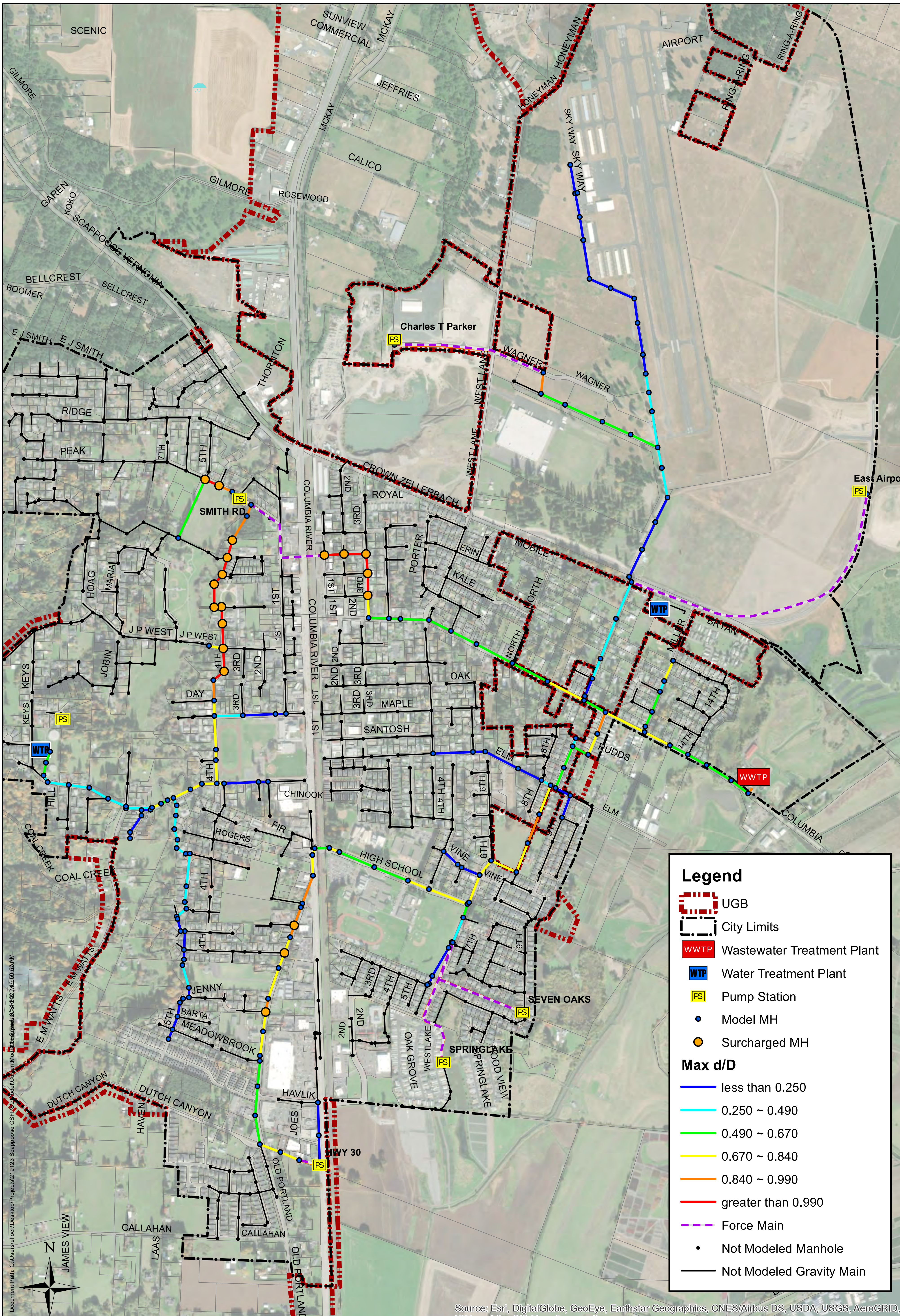
KELLER ASSOCIATES

Existing (2020) System Evaluation

Collection System Facilities Planning Study

Figure 11

City of Scappoose, OR
January 2021



KELLER ASSOCIATES

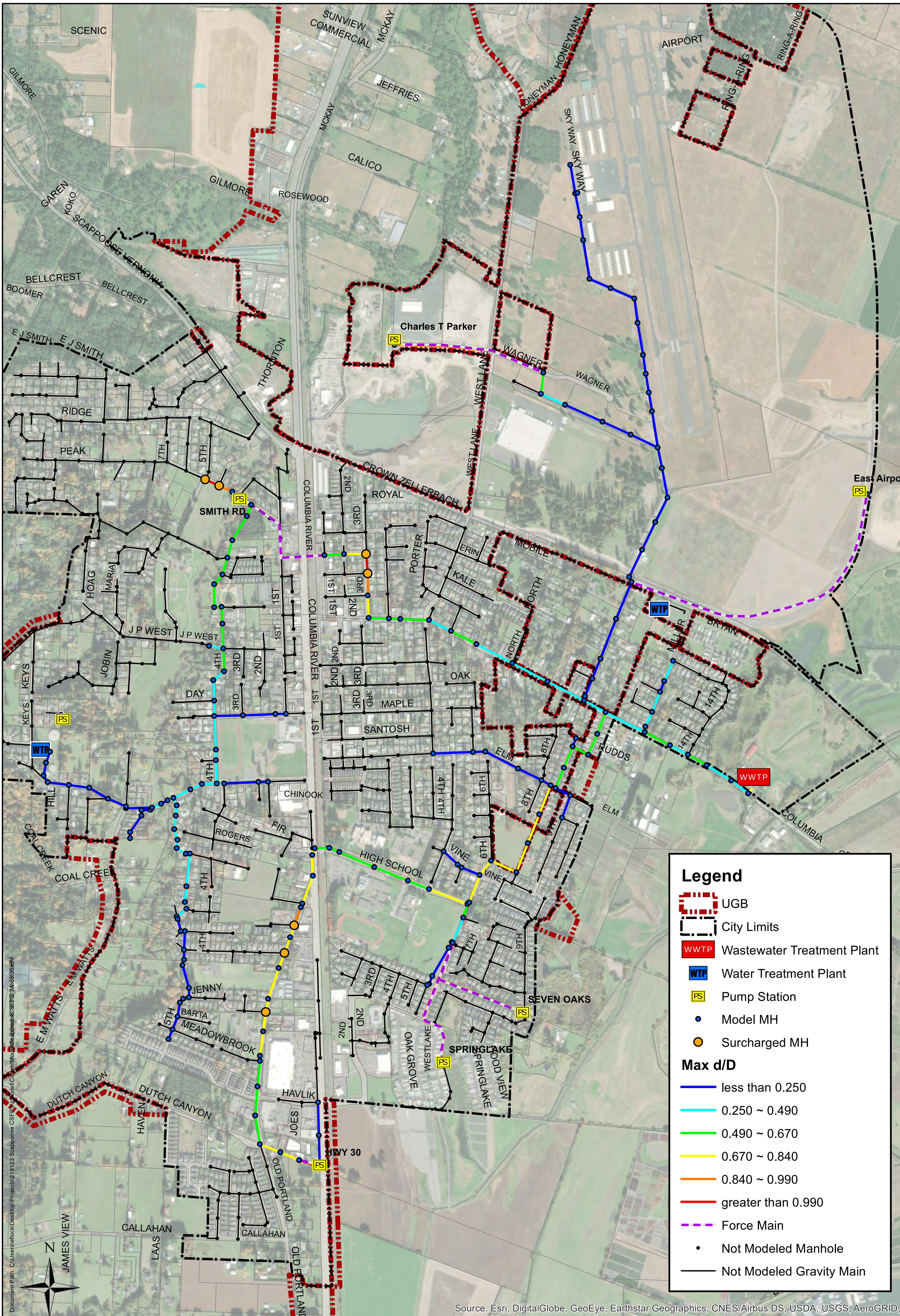
Future (2040) System Evaluation

Collection System Facilities Planning Study

SCAPPOOSE

Figure 12

City of Scappoose, OR
January 2021



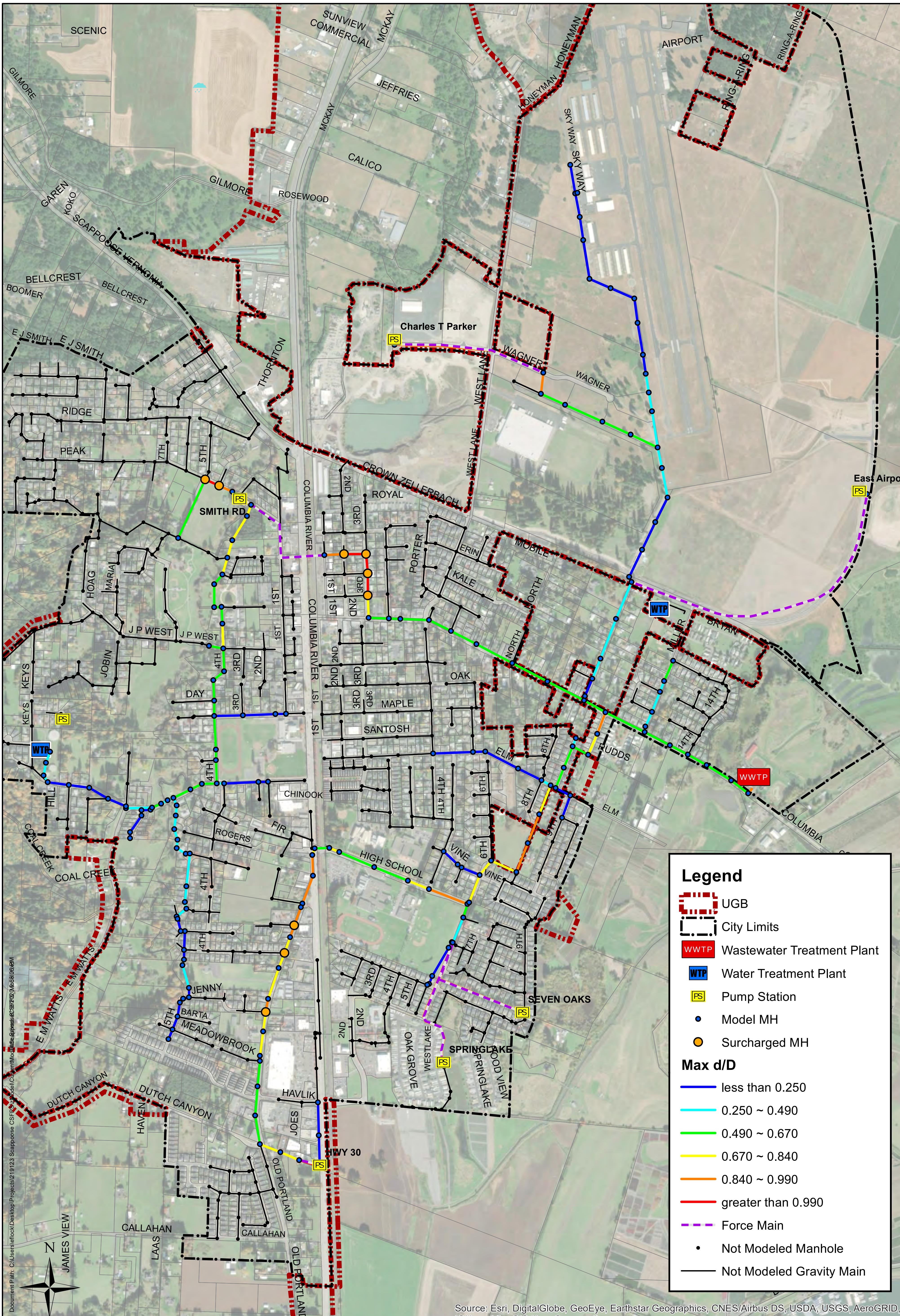
KELLER ASSOCIATES

Night WTP Flows - 2020 Evaluation

Collection System Facilities Planning Study

Figure 13

City of Scappoose, OR
January 2021



KELLER ASSOCIATES

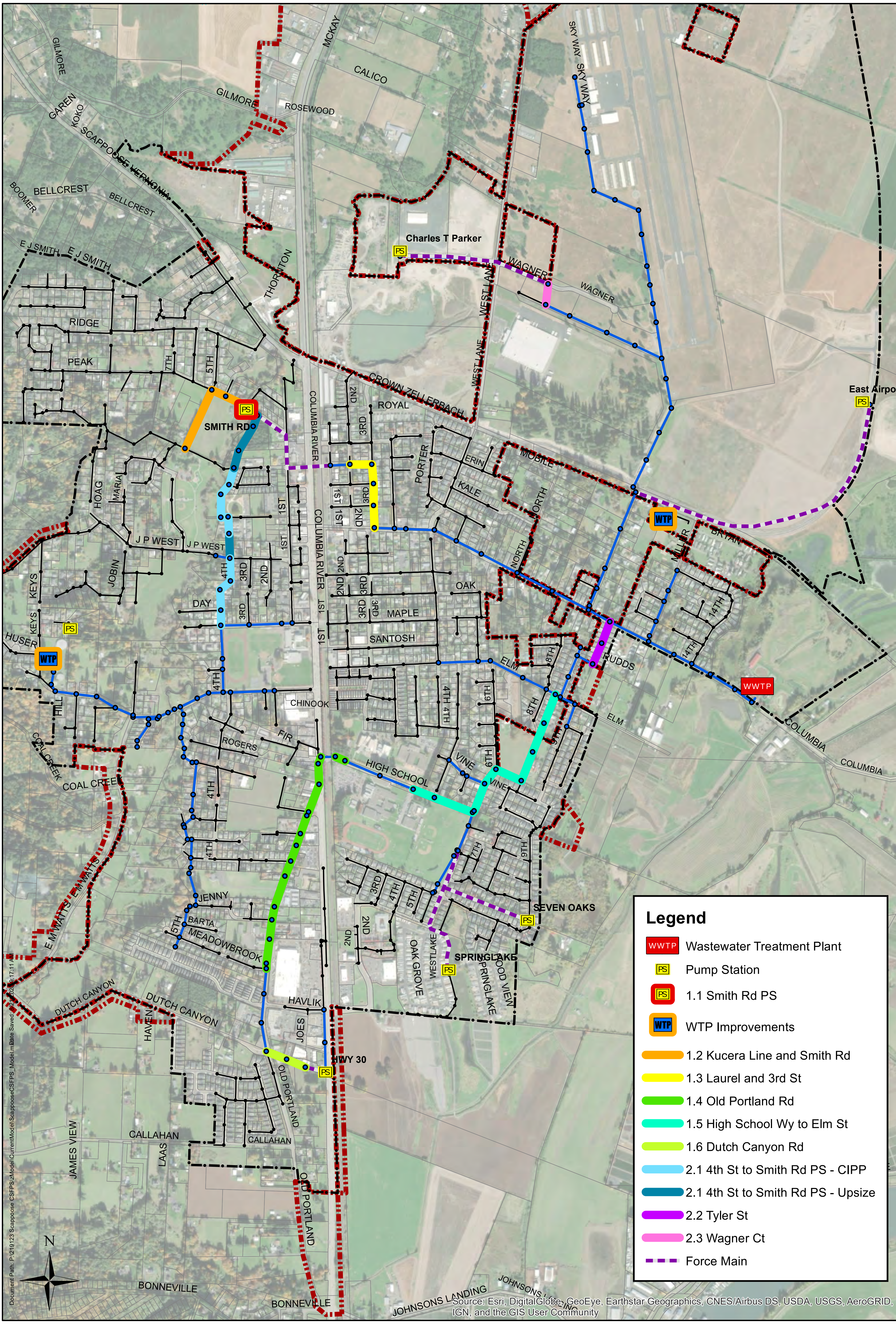
Night WTP Flows - 2040 Evaluation

Collection System Facilities Planning Study

Figure 14

City of Scappoose, OR

January 2021



2040 Collection System CIP

Collection System Facilities Planning Study

Figure 15

City of Scappoose, OR
January 2021

Appendix B

Pump Information

Smith Road Pump Station

TRIANGLE PUMP AND EQUIPMENT INC.

Equipment Approval Data　　　　　　　　Date 7/13/99

Project Smith Rd Wastewater Pump Station/Scappoose

Customer Emerald Construction　　　　　Order No

Engineer KCM

Equipment Ref 15140 Pumps

We request your approval to supply the following described equipment for the above referenced project:

Three (3) **Crane Deming** figure 7196, size 4 x 4 x 12 x 3, vertical, frame mounted, flexible coupled, dry pit, non clog sewage pumps with floor mounting stands, 6" x 4" suction elbows, motor mounting stands, couplings, 15 HP, 1150 RPM, 3/60/460 VAC TEFC invertor duty rated motors, factory certified tests, spare parts & start up service.

Proposed pumps will have the standard double mechanical seal (with carbon verses ceramic faces) with seal flush/lubrication system including tap from pump discharge through filter to feed stuffing box.

May we have your approval?

Cordially,

Harold R Clayton
President

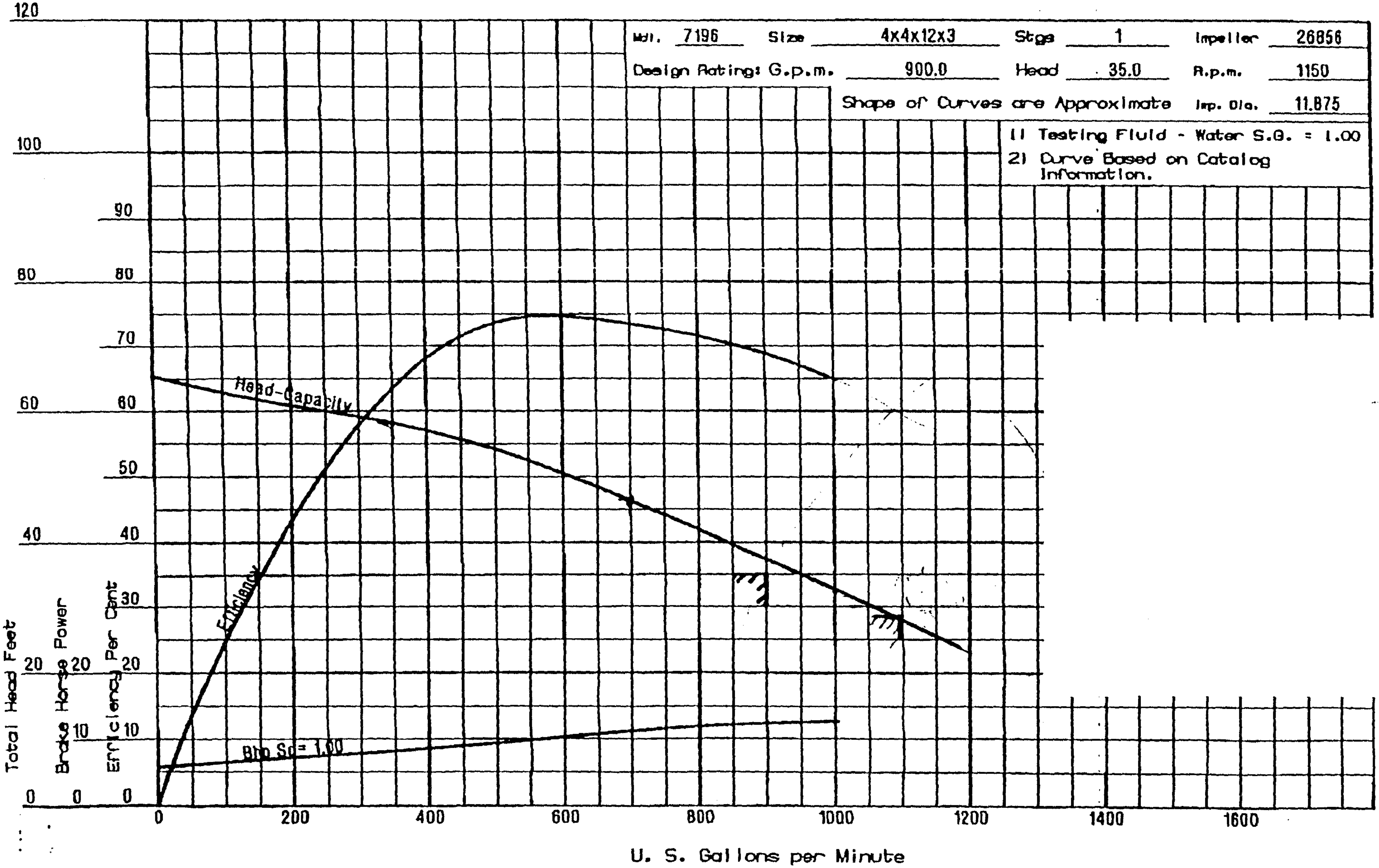
attachments

/lc

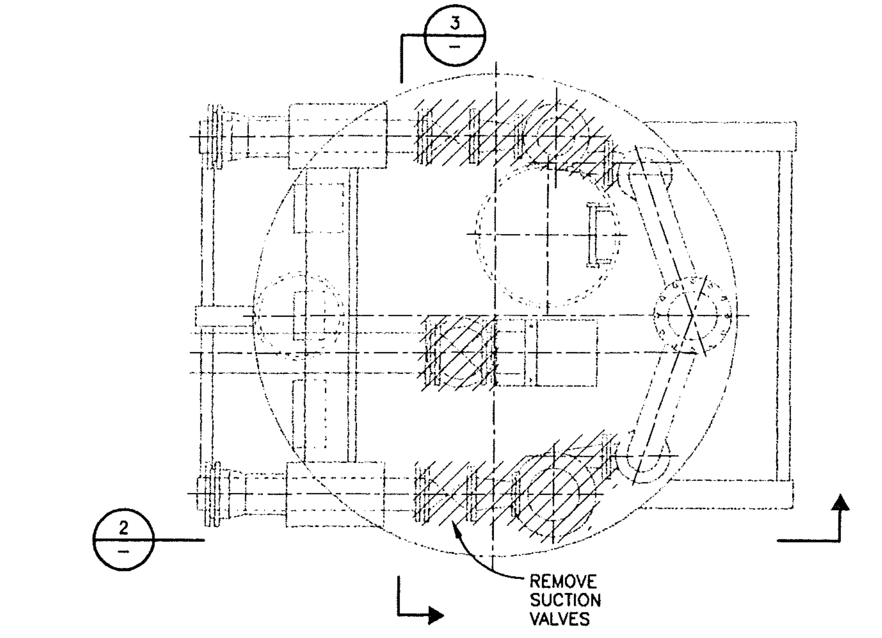
14940 S.E. 82nd Drive / PO Box 950
Clackamas, Oregon 97015
(503) 656-1473
FAX (503) 656-2037

269 S.W. 41st Street
Renton, Washington 98055
(425) 251-9666
FAX (425) 251-9667

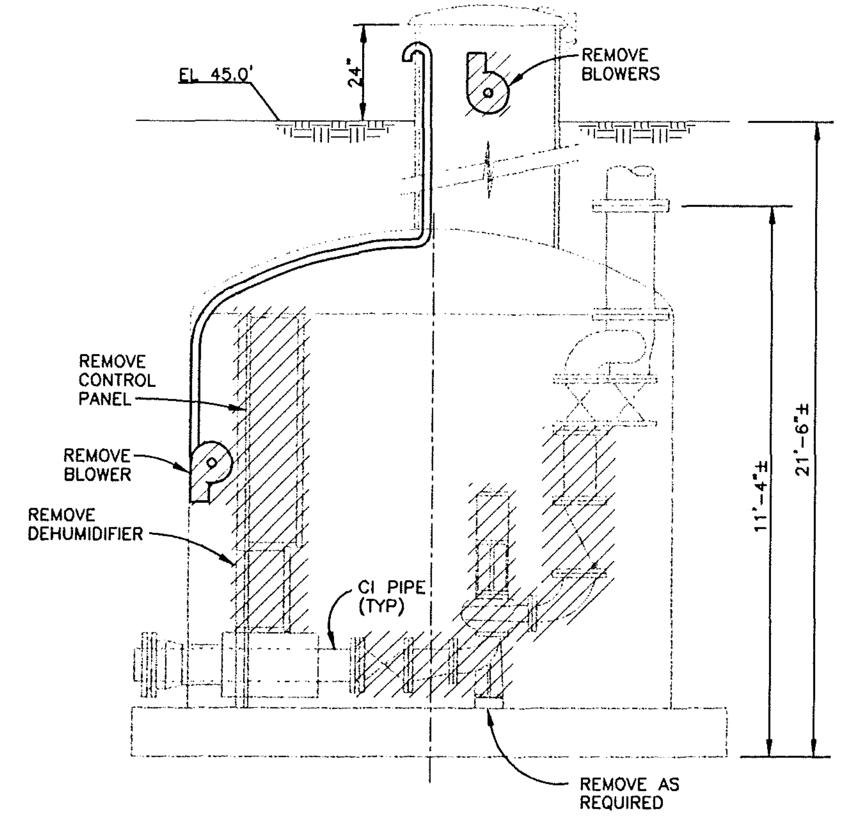
Eng: KCM	Proj: SMITH RD PUMP STA	No:	CRANE DEMING PUMP DIV.
Contr: EMERALD CONST.	Tag:	S.O.: ***	
Owner: CITY OF SCAPPOOSE	Rep.: TRIANGLE PUMP	P.O.: 19396	Salem, Ohio, U.S.A.



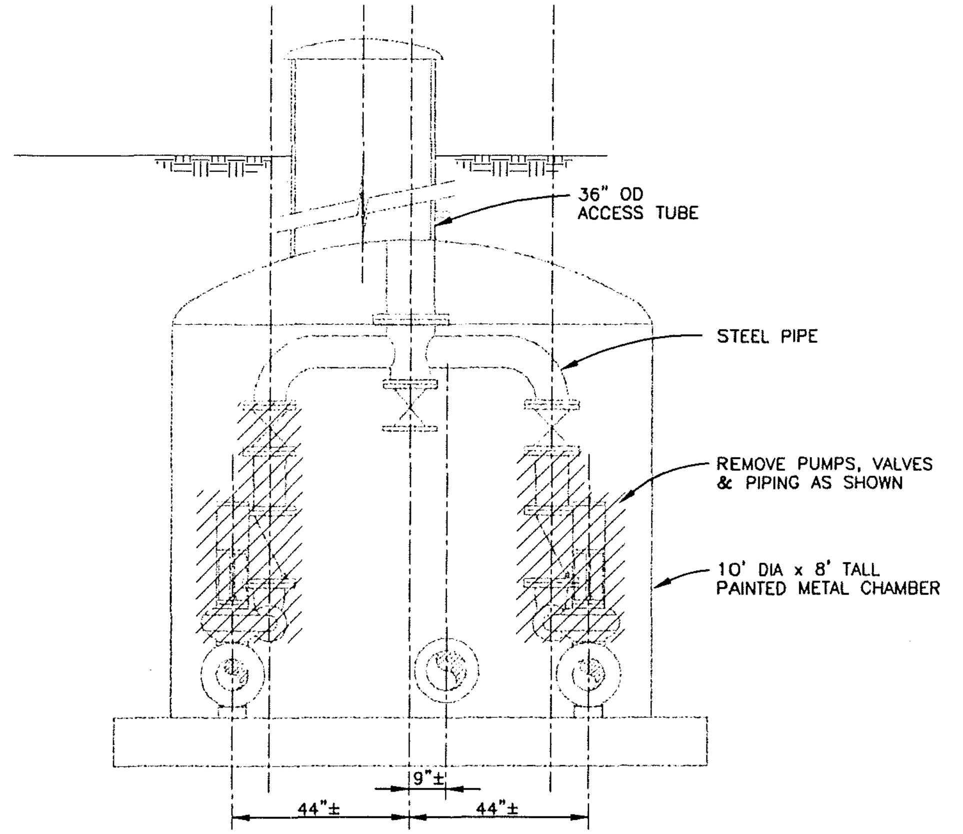
Submitted By:	Date:	Submittal ! **	Date: 07/02/99



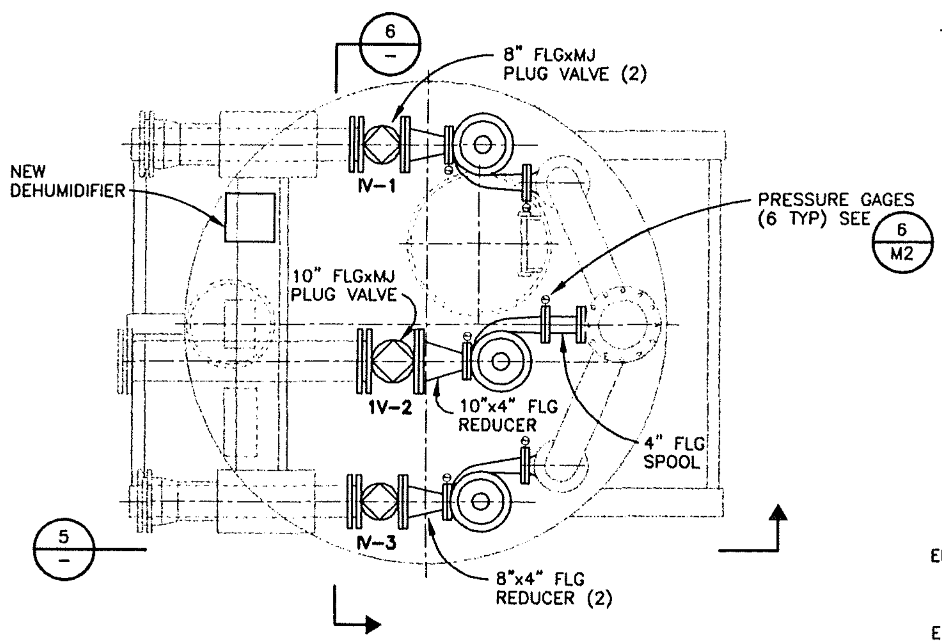
EXISTING PUMP STATION LAYOUT
1/2"=1'-0"
1 —



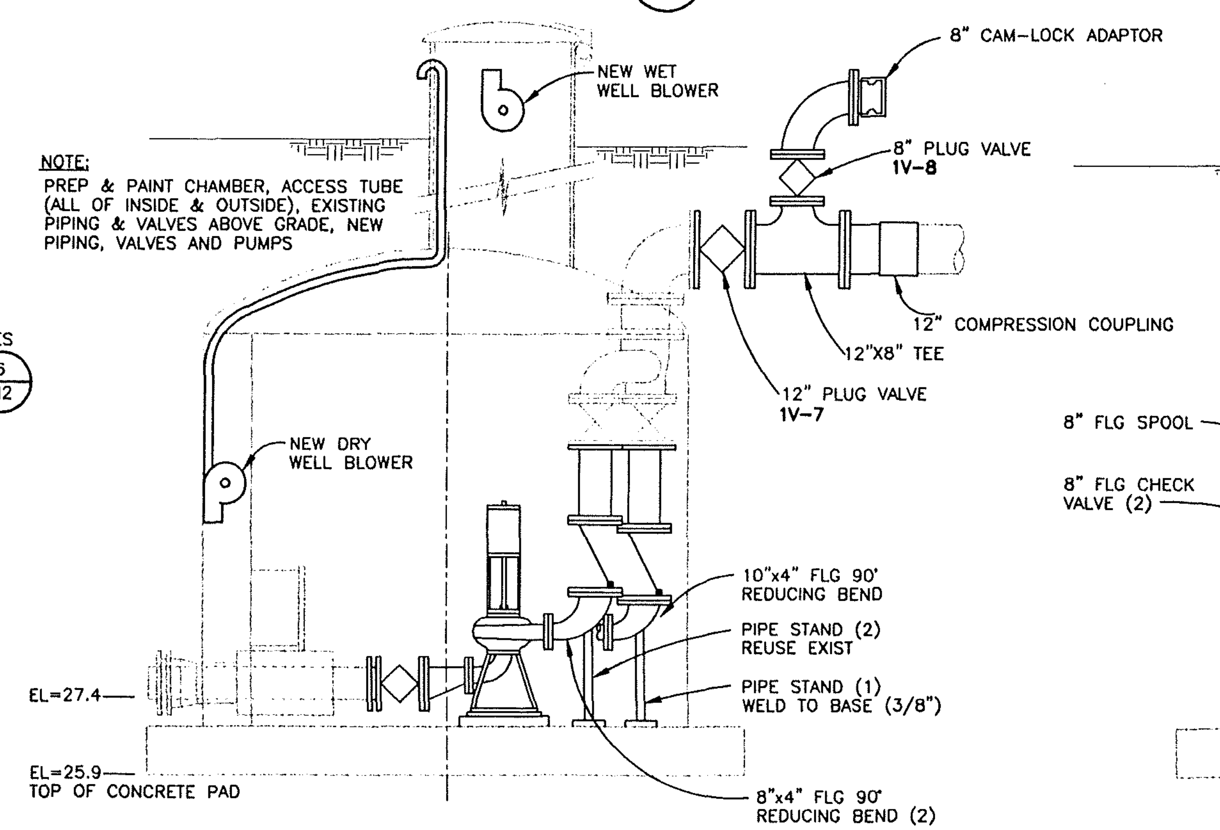
EXISTING PUMP STATION ELEVATION
1/2"=1'-0"
2 —



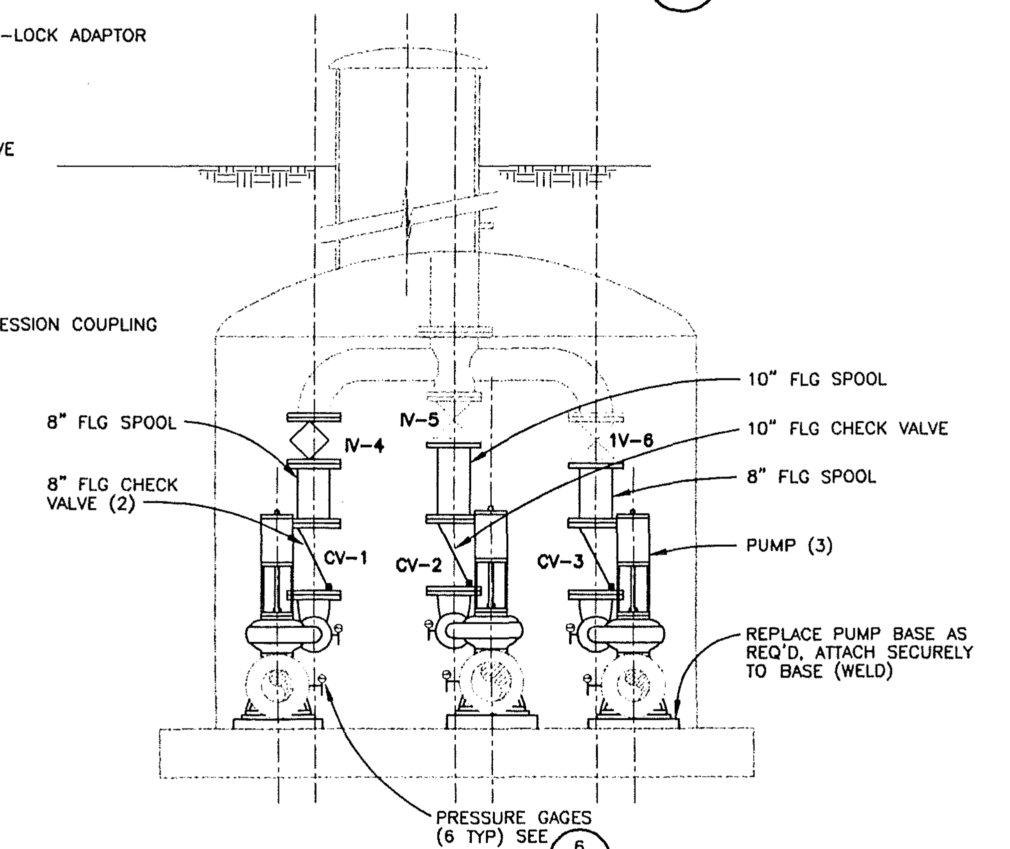
EXISTING PUMP STATION SECTION
1/2"=1'-0"
3 —



PROPOSED PUMP STATION LAYOUT PLAN
1/2"=1'-0"
4 —



PROPOSED PUMP STATION ELEVATION
1/2"=1'-0"
5 —



PROPOSED PUMP STATION SECTION
1/2"=1'-0"
6 —

2-20/CAD/DESIGN/M1.dwg @1=24 04/22/02

This drawing is full size when 22"x 34" or is reduced to half size when 11"x17"

KCM

KCM, Inc.
7080 SW Fir Loop
Portland, Oregon 97223

date	designed by
MAY 1999	drawn by
scale	checked by
AS NOTED	approved by

RECORD DRAWING
ORIGINAL DRAWING REVISED BY KCM BASED ON INFORMATION PROVIDED BY EMERALD CONSTRUCTION. KCM CANNOT VERIFY THE ACCURACY OR COMPLETENESS OF THIS INFORMATION AND SHALL NOT BE RESPONSIBLE FOR ANY ERRORS OR OMISSIONS INCORPORATED HEREIN AS A RESULT

revisions
KCM NO. 1882-020

City of Scappoose, Oregon
SMITH ROAD
PUMP STATION

MECHANICAL
EXISTING DRY WELL PIPING MODIFICATIONS

drawing number M1
sheet number 9 of 14

Springlake Pump Station

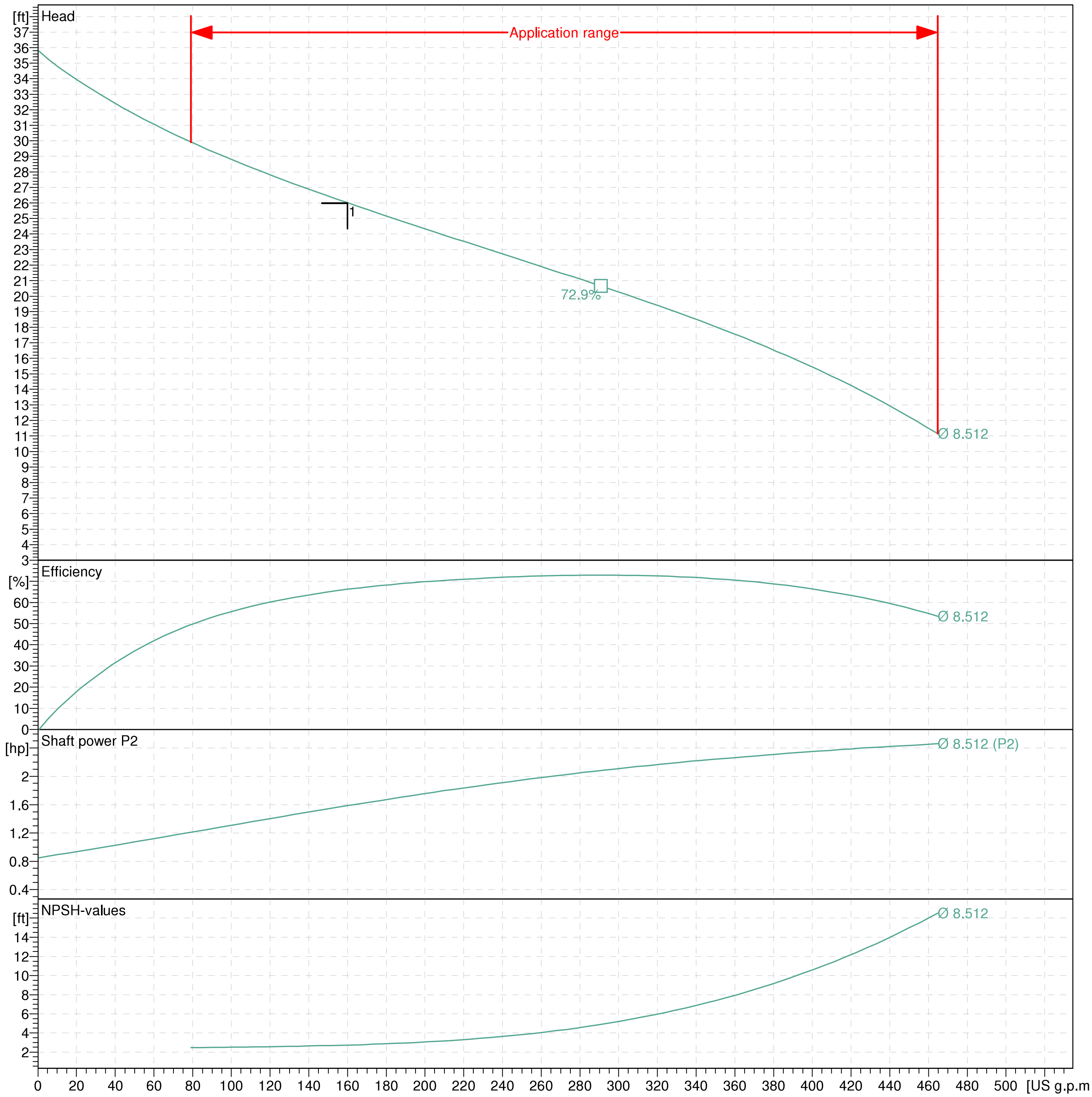
Project:	Spring Lake Lift Station	Created on:	2015-01-14
Project number:	PS Retrofit	Created by:	Tim Owens

Performance curves — with motor

Submersible sewage pump FA 10.33E — FK 17.1-6/8KEx

Power data referred to: Water, pure [100%] ; 68℉; 62.315lb/ft³; 1.0768E-5ft²/s

Tolerance as per ISO 9906 / Annex A.2



Pump			Duty point data		
Impeller Ø designed	$8^1/_2$	inch	Volume flow	160	US g.p.m.
Nominal speed	1140	rpm	Head	26	ft
Frequency	60	Hz	Shaft power P_2	1.59	hp
Impeller type	Single-channel		Pump efficiency	66.2	%
Motor			Power input P_1	2.6	hp
Rated power	2.85	hp	Required pump NPSH	2.7	ft

Keys Landing Pump Station

HYDRONIX Inc. 2425 S. E. OCHOCO STREET • PORTLAND, OREGON 97202 • 503-659-6230

PUMP STATION DATA SHEET

LOCATION KEYS LANDING SERIAL NO. ______

OWNER SCAPOOSE, OR ENGINEER DAVE WINSHIP

CONTRACTOR MERRILL STROBEL CONST DISTRIBUTOR HYDRONIX

STATION TYPE 183 Wet Well 6' Dia. X 13' Deep ~~Wet Well Cover~~ ______

______ DATE INSTALLED ______

PUMP STATION

PIPING: Suction 4, Disch. 4; Suction 4, Disch. 4.

CONDITIONS OF SERVICE

Design Duty: 120 GPM, 46 T.D.H., 13' Suction Lift; Liquid RAW

Solids 3", N.P.S.H. (AVL.) ______, (REQ.) ______.

PUMP DATA

Pump Model: 40MPV Imp. Dia. 9 5/32 Priming: (X) Self, ~~( ) Vacuum,~~ ~~( ) Flooded~~. Stuffing Box Type MECH., Lubrication OIL.

Rotation of Pump #1 CW, #2 CW, #3 ______.

MOTOR DATA

Brand CHOICE, Enclosure ODP, Horsepower 5,

RPM 1750, Phase 3, Cycle 60, Volt 230, Starting Code ______,

Modification ______ Frame ______.

ELECTRICAL DATA

3 Phase, 60 Cycle, 230 Volts, 4 Wire, 120V Control Voltage.

Transformer Required: ( ) YES, (X) NO. Size ______.

HYDRONIX Inc.

RECEIVED
– 5 1992

QUOTATION # 91172
Date 5-28-92 Page # 1 of 2 pages

2425 SE Ochoco
Portland, OR 97222
503-659-6230 FAX 503-659-8718
1-800-547-9708

Project Name: ~~Keeps~~ Keys Landing
Contact Person: Merrill Strobel
Phone: H-543-2581 FAX:
M-936-4303

TO: Merrill Strobel Construction
54444 Kalberer Rd.
Scappoose, OR 97056

QTY.	DESCRIPTION	[redacted]
1	HYDRONIX Model 183, 4" x 4", prefabricated, hot-dipped, galvanized, surface mounted, self-priming sewage lift station with fiberglass access hoods. Installed, in the chamber, will be pumps, motors, valving, piping, control panel, and appurtenances. The equipment will be factory assembled, tested, and ready for operation, for mounting over a 7'0" diameter x 13'0" deep wet well, by others.	

MAIN CHAMBER SIZE:	78"W x 67"L x 51" high
ENTRANCE:	Fiberglass hinged hoods
PUMPS:	Hydromatic Model 40 MPV
MOTORS:	5 HP, 1750 RPM
V-BELT DRIVE RPM:	1750 / 1370
POWER SERVICE:	3 phase, 60 hertz, 230 volts, 4 wire
PUMP CAPACITY:	120 GPM @ 46' T.D.H.
CONTROLLER:	Nema 1, duplex, alternating
LEVEL SENSOR:	Mercury float switch
ALARM:	Local light

ACCESSORIES

1. Suction pipes
2. 4 circuit lighting panel
3. Duplex GFI receptacle
4. 60 watt drop light
5. 13/15 M watt heaters
6. Spare parts kit
7. O & M manuals
8. T.D. no flow limit switches
9. 156 CFM blower

Estimated shipping weight is 2,500 pounds
Start up included

Total Price [redacted]

Above quoted price good for: 30 days.
Delivery in Approximately 6 WKS • Terms C.O.D. • FOB:Portland, Oregon FFA

THIS QUOTATION AND ANY AGREEMENT TO SELL RESULTING FROM THE QUOTATION IS SUBJECT TO HYDRONIX GENERAL TERMS AND CONDITIONS OF SALE SUBMITTED WITH THIS QUOTE. TERMS AND CONDITIONS ON BACK SIDE.

Co. Name Merril Strobel Construction

Accepted by: Merril Strobel Date 6/1/92
SIGNATURE

Please print name Merril Strobel

Hydronix, Inc.
Proposed by: M. Watterson
SIGNATURE

Michael [illegible]atterson, Sales Engineer

HYDRONIX Inc. 2425 S.E. OCHOCO STREET • PORTLAND, OREGON 97222 • 503-659-6230

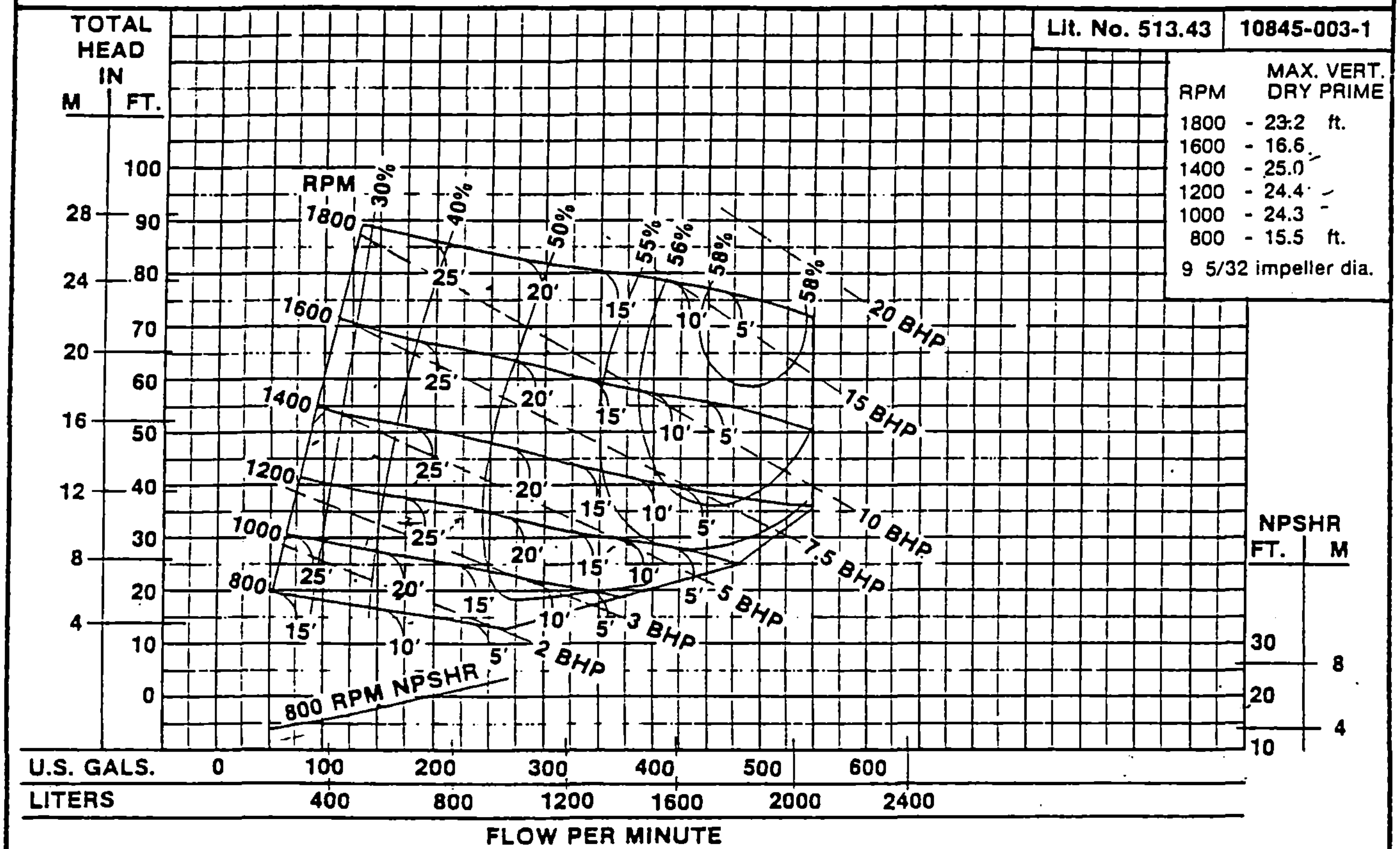
HYDROMATIC PUMPS

HYDROMATIC PUMPS

SECTION 510
PERFORMANCE DATA

MODEL: 40MPV - 40MPSFV SELF PRIMER - MAX. SOLIDS: 3" SPHERE - VAR. RPM

Lit. No. 513.43 | 10845-003-1



RPM	MAX. VERT. DRY PRIME
1800	- 23.2 ft.
1600	- 16.6
1400	- 25.0
1200	- 24.4
1000	- 24.3
800	- 15.5 ft.

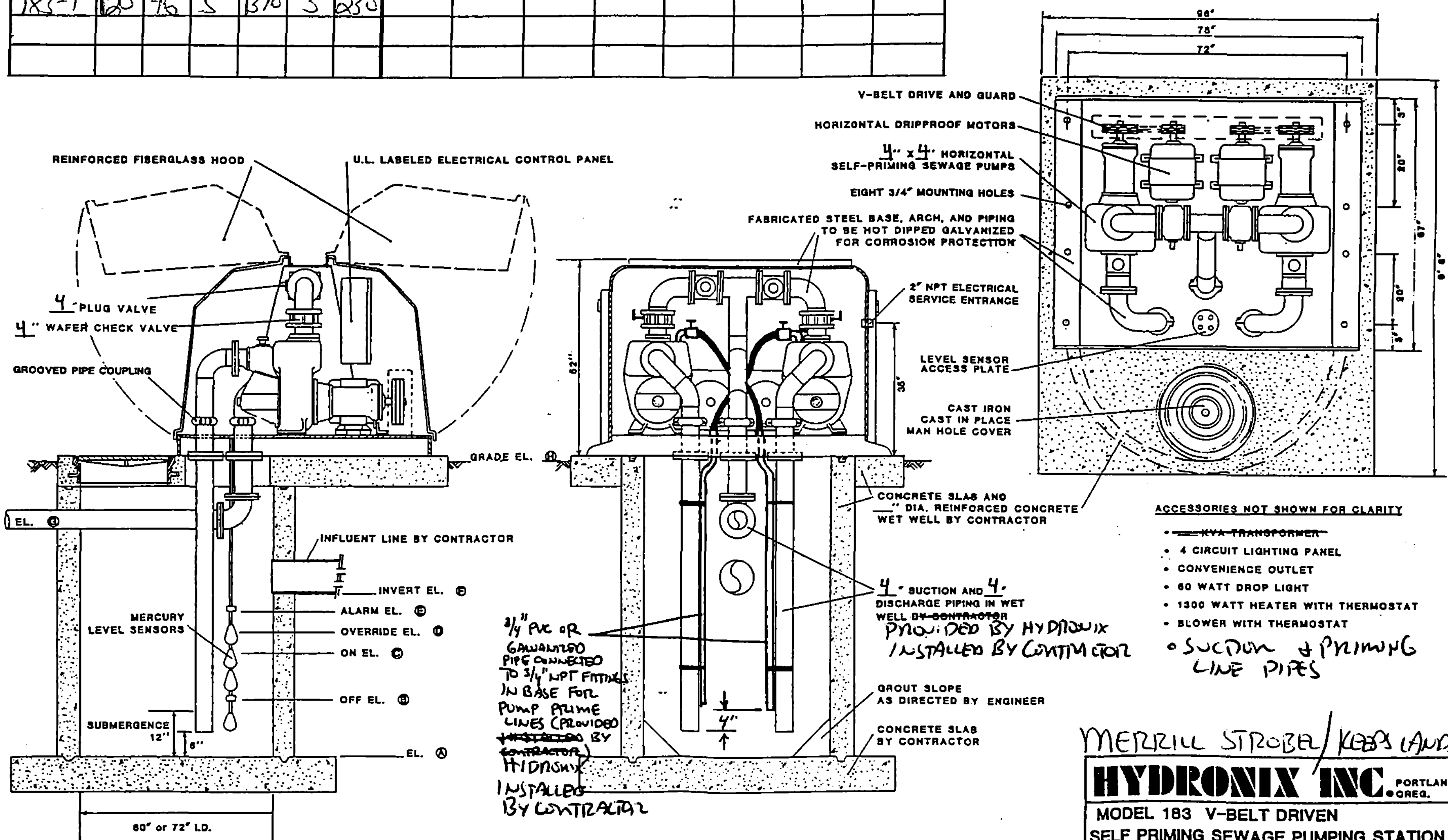
9 5/32 impeller dia.

GPM 120 TDH 46'

EFF. 35 BHP 3.9

NPSHR 10'

STATION	G.P.M.	T.D.H.	H.P.	R.P.M.	PHASE	VOLTS	ELEVATIONS							
							A	B	C	D	E	F	G	H
183-T	120	46	5	1370	3	230								



ACCESSORIES NOT SHOWN FOR CLARITY

- ~~KVA TRANSFORMER~~
- 4 CIRCUIT LIGHTING PANEL
- CONVENIENCE OUTLET
- 60 WATT DROP LIGHT
- 1300 WATT HEATER WITH THERMOSTAT
- BLOWER WITH THERMOSTAT
- SUCTION & PRIMING LINE PIPES

MERRILL STROBEL / KEBBS LANDING

HYDRONIX INC. PORTLAND, OREG.

MODEL 183 V-BELT DRIVEN
SELF PRIMING SEWAGE PUMPING STATION

DATE: 2/83		DWG. BY: JWR
SCALE: NONE	REVISIONS:	DWG# 31-01-3684

Highway 30 Pump Station

Pump Station Data Sheet

Location: Scappoose, Oregon **Serial No.** 48698

Owner: City of Scappoose **Engineer:** ____

Contractor: Clearwater Construction **Distributor:** Hydronix, Inc.

Station Type 183 **Wet Well** 8' **Dia. x** 19' **Deep Wet Well Cover**

Date Installed June, 1996

Pump Station

Piping: Suction 4" **,Disch.** 4" ; **Suction** 4" **,Disch.** 4"

Conditions of Service

Design Duty: 300 **GPM,** 42' **TDH,**__**Suction Lift; Liquid** Sewage

Solids 3" **, NPSH (avl)**____, **(req)**____.

Driven RPM 1400

Sheave 4.75x2 Groove **,Bushing** SH 1-3/8 **,Belt** 3VX475

Pump Data:

Serial No.:____

Pump Model: 40MP **,Imp.Dia.** 9-5/32" **Priming:**(X)**self,**( )**vacuum**

( )**flooded. Stuffing Box Type**____, **Lubrication:** Media

Rotation of Pump #1 CW **,#2** CW **,#3**__.

Motor Data

Brand Baldor **,Enclosure** ODP **,Horsepower** 7.5

RPM 1800 **,Phase** 3 **,Cycle** 60 **,Volt** 230 **,Starting Code**__

Modification__________**,Frame** 213T

Sheave 3V6.0x2 Groove **,Bushing** SH 1-1/2 **,Belt** 3VX475

Electrical Data

Phase 3 **,Cycle** 60 **,Volts** 230 **,Wire** 4 **,Control Voltage** 120

Transformer Required: (X)Yes , () No. Size E180-3PB

Control Panel

Location Inside Station **NEMA Type** 4

Service Entrance Size___Amps	Pump #1	Pump #2	Pump #3
Circuit Breaker-Trip Rating/AMPS	30	30	
Magnetic Starter-NEMA size	1	1	
Overload Heater size	2013B-3	2013B-3	

Alternator Type 67C-1COA **Mfg** Warrick **Coil Voltage** 110

Alarm Functions: Pump 1 & 2 fail, High wet well, Compressor fail

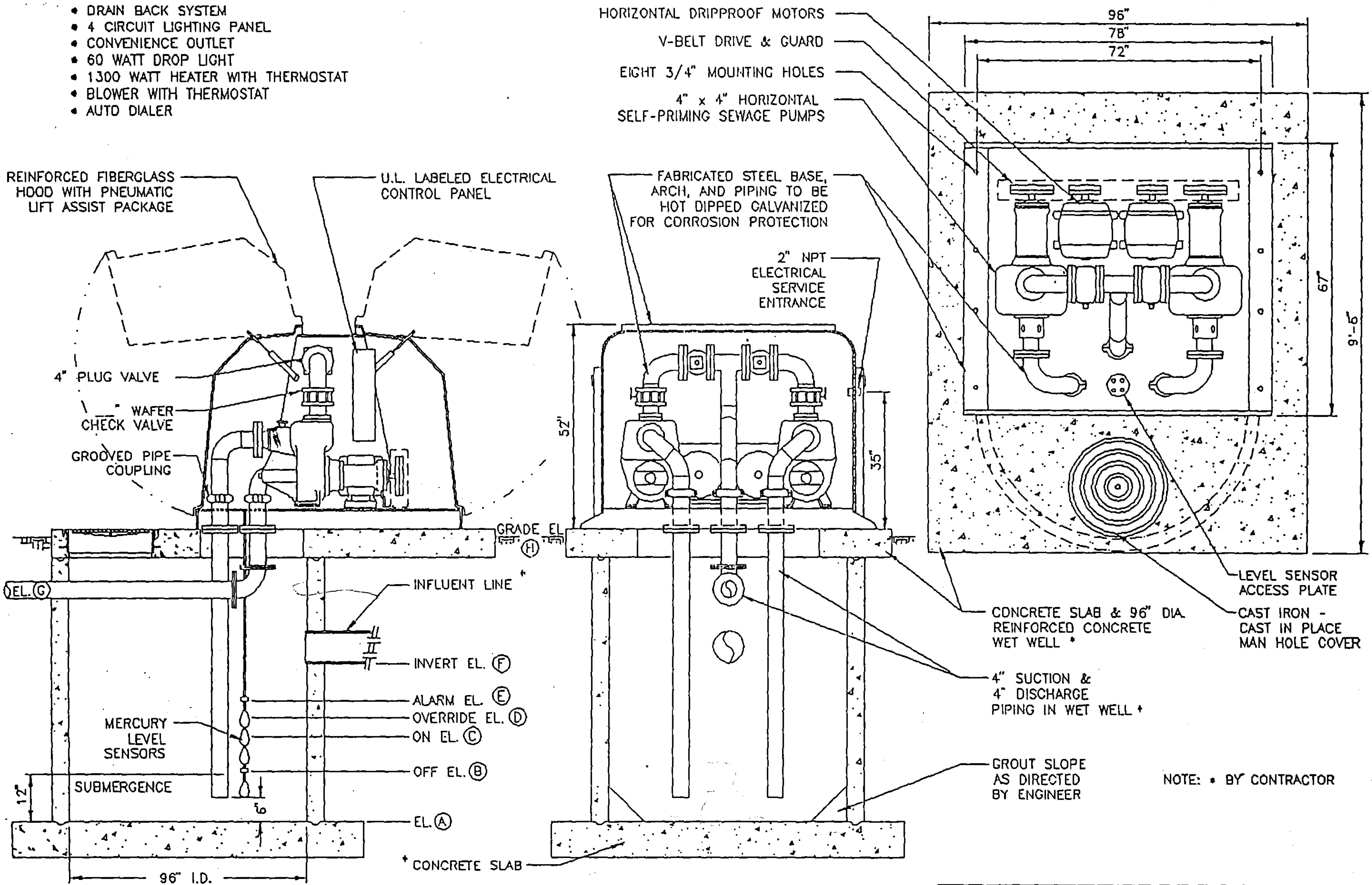
Level Control: Intrinsically Safe Floats

Elevations:

Ground Level	46.6	Low Water	
Station Disch.	42.0	Pump Off	28.5
Station Floor	26.0	Lead Pump On	33.45
WW Invert	34.45	2 Pump Overload	33.95
WW Floor		High Water	34.45

ACCESSORIES NOT SHOWN FOR CLARITY

- DRAIN BACK SYSTEM
- 4 CIRCUIT LIGHTING PANEL
- CONVENIENCE OUTLET
- 60 WATT DROP LIGHT
- 1300 WATT HEATER WITH THERMOSTAT
- BLOWER WITH THERMOSTAT
- AUTO DIALER

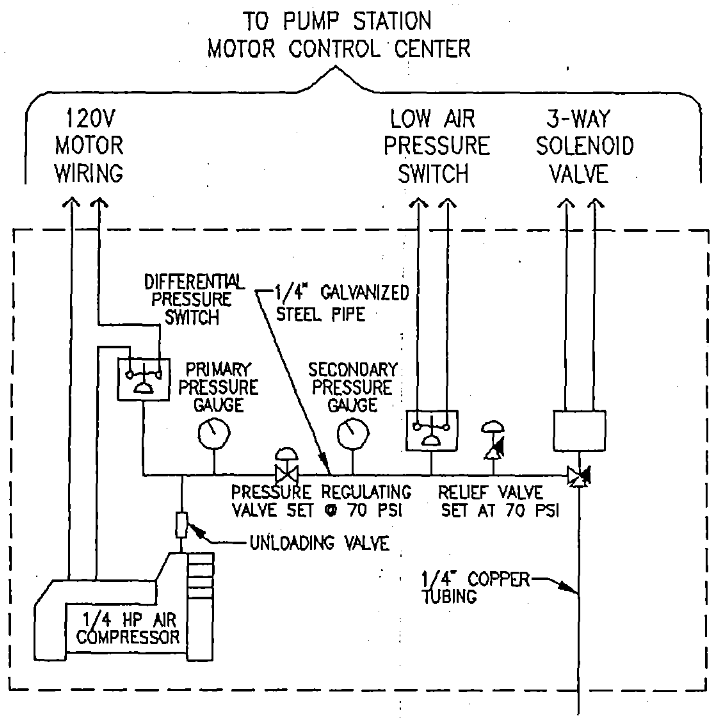


SCALES & DIMENSIONS ARE FOR REFERENCE ONLY, DRAWINGS MUST BE CERTIFIED CORRECT FOR CONSTRUCTION PURPOSES

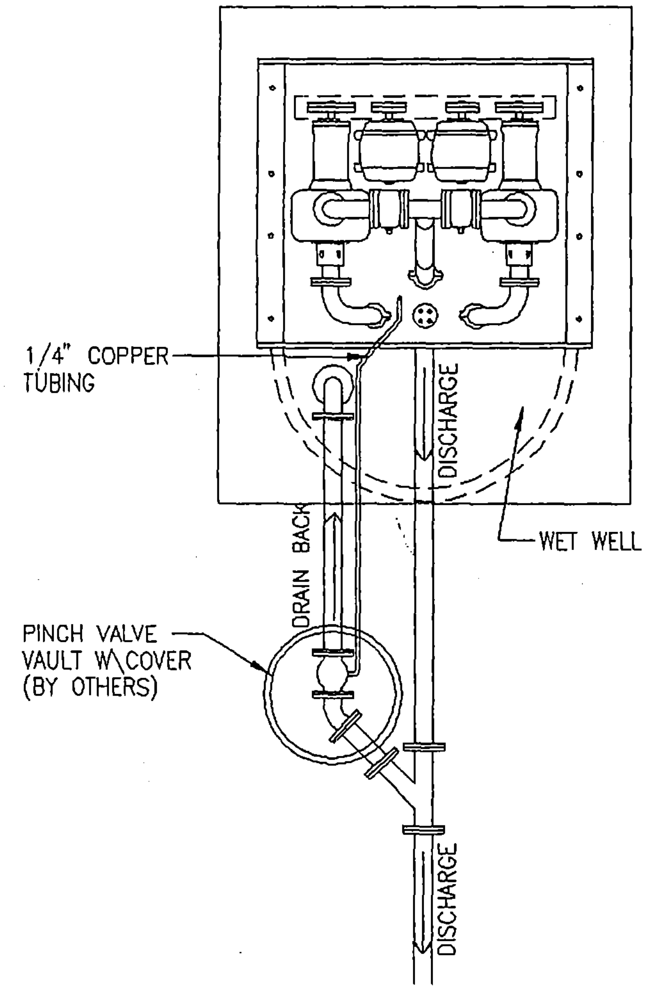
STATION	G.P.M.	T.D.H.	H.P.	R.P.M.	PHASE	VOLTS	ELEVATIONS A	B	C	D	E	F	G	H
183	300	42	7.5	1400	3	230	26.00	28.5	[illegible]3.45	[illegible].95	[illegible]5		4	46.[illegible]

SCAPPOOSE FRED MEYER
SEWAGE PUMP STATION
SCAPPOOSE, OREGON

MODEL # 183-017	Des By	MW	Date	2-5-96
	Drn By	BT		
DWG # 183-017	Chk By	XX	Job #	48698
[illegible]el 1	Rev:	[illegible]v Dat	[illegible]	X



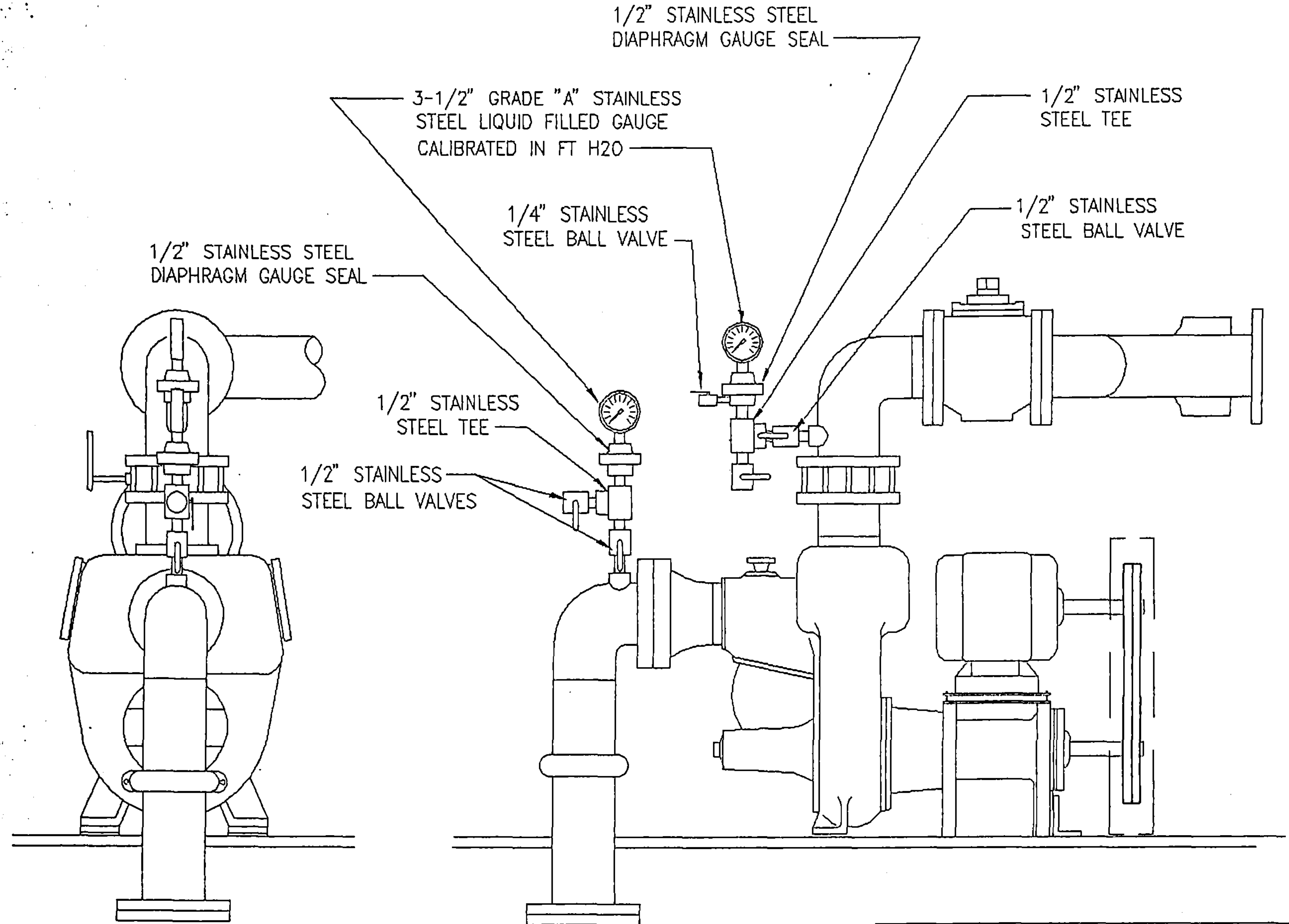
H2S DRAINBACK CONTROL SCHEMATIC



H2S TREATMENT DRAINBACK SYSTEM

JOB #	N/A	DATE	3-10-95	
Des By	MW	Dwg #	DEQ-0002	
Drn By	SM	Sheet	1 of 1	
Chk By	MW	Rev: 1	2-5-96	Chk: MW

HYDRONIX



SUCTION AND DISCHARGE GAUGE KIT

HYDRONIX	JOB # N/A		DATE 9-13-95
	Des By MW	Dwg # DEQ-0007	
	Drn By SM	Sheet 1 of 1	
	Chk By MW	Rev: 1	2-5-96 / Chk: MW

HYDR-O-MATIC PUMPS

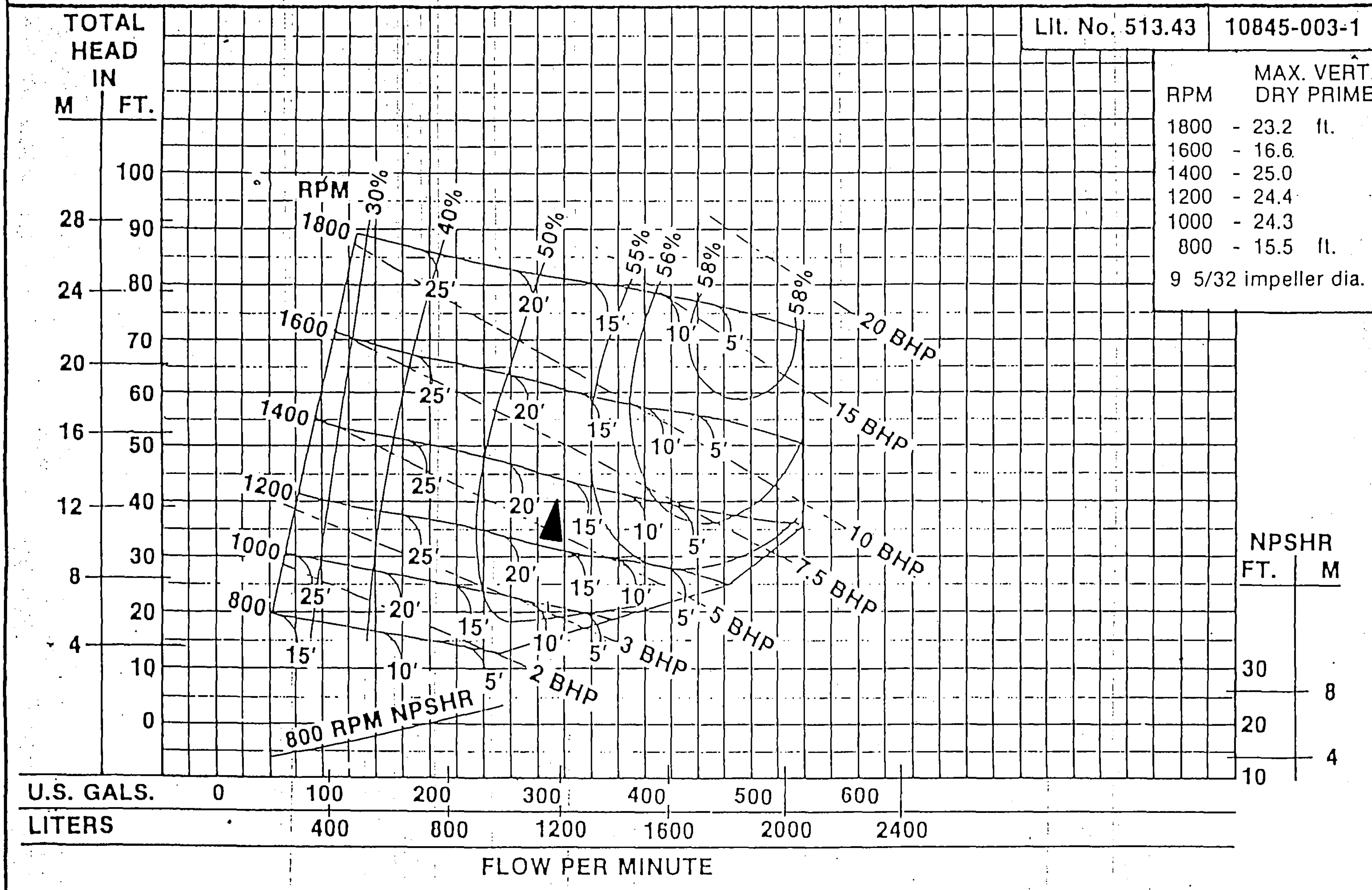
300 G.P.M. @ 42' T.D.H.

MODEL: 40MPV - 40MPSFV SELF PRIMER - MAX. SOLIDS: 3" SPHERE - VAR. RPM

Lit. No. 513.43 | 10845-003-1

RPM	MAX. VERT. DRY PRIME
1800	- 23.2 ft.
1600	- 16.6
1400	- 25.0
1200	- 24.4
1000	- 24.3
800	- 15.5 ft.

9 5/32 impeller dia.



Seven Oaks Pump Station

Pump Station Data Sheet

Location: Scappoose, Oregon ______ Serial No. 48526 ____

Owner: City of Scappoose ____ Engineer: Koss-Brod-Goodrich & Assoc.

Contractor: Bones Construction ______ Distributor: Hydronix ___

Station Type 183 Wet Well 84 Dia. x 16' Deep Wet Well Cover

Date Installed 4/96

Pump Station

Piping: Suction 4",Disch. 4"; Suction 4",Disch. 4"

Conditions of Service

Design Duty: 150GPM, 45 TDH,__Suction Lift; Liquid Sewage

Solids 3", NPSH (avl)______, (req)______.

Driven RPM 1350

Sheave 3V5.3x2 Gr. ,Bushing SH 1-1/2 ,Belt 3VX400

Pump Data:

Serial No.:__________

Pump Model: 40MP ,Imp.Dia. 9 5/32 Priming:(X)self,( )vacuum

( )flooded. Stuffing Box Type_____, Lubrication: Media ___

Rotation of Pump #1 CW ,#2 CW ,#3__.

Motor Data

Brand_Baldor_,Enclosure_ODP_,Horsepower_7.5_

RPM_1750_,Phase_3_,Cycle_60_,Volt_230_,Starting Code__

Modification__________,Frame___

Sheave_3V4.12x2 Gr._,Bushing_SH 1 3/8_,Belt_3VX400_

Electrical Data

Phase_3_,Cycle_60_,Volts_230_,Wire_4_,Control Voltage_120_

Transformer Required: (X)Yes , () No. Size_E180-3PB_

Control Panel

Location_Inside Station_NEMA Type_1_

Service Entrance Size___Amps	Pump #1	Pump #2
Circuit Breaker-Trip Rating/AMPS	50	50
Magnetic Starter-NEMA size	AE16FNSOAC	AE16FNSOAC
Overload Heater size	H2013B-3	H2013B-3

Alternator Type_67C1COA_Mfg_Warrick_Coil Voltage___

Alarm Functions:_Controlled by CB-4 AutoDialer_

Level Control:_Mercury Float Switches_

Elevations:

Ground Level_13.91_	Low Water_________
Station Disch._8.91_	Pump Off_-0.5_
Station Floor_-3.0_	Lead Pump On_3.07_
WW Invert_4.56_	2 Pump Overload_3.57_
WW Floor__________	High Water_4.07_
	OVERFLOW 10.96

Station Options

(X) 1500 Watt Heater,(X)Station Blower,( )Wet Well Blower,()P.P.D. Dehumidifier,(X)Station Light,(X)Trouble Light,( )Vacuum Pumps, (X)Convenience Outlet,( )__KVA Transformer,()Sump Pump, ()Ladder,(X)Elapsed Time Meters,( )__VDC Battery and Charger, (X)Light/Horn/Bell/Dim Glow Alarm,( )Dry Alarm Contacts, ( )Telemetry Included/By Others,(X)Air Compressor, (X)Pinch Valve, (X) 4 O&M Manual, (X)Spare Parts Kit.

Notes: System has DEQ approved 4" Pinch Valve on discharge line

Application Engineering

Prepared By Butch Kline **Date** 4/22/96

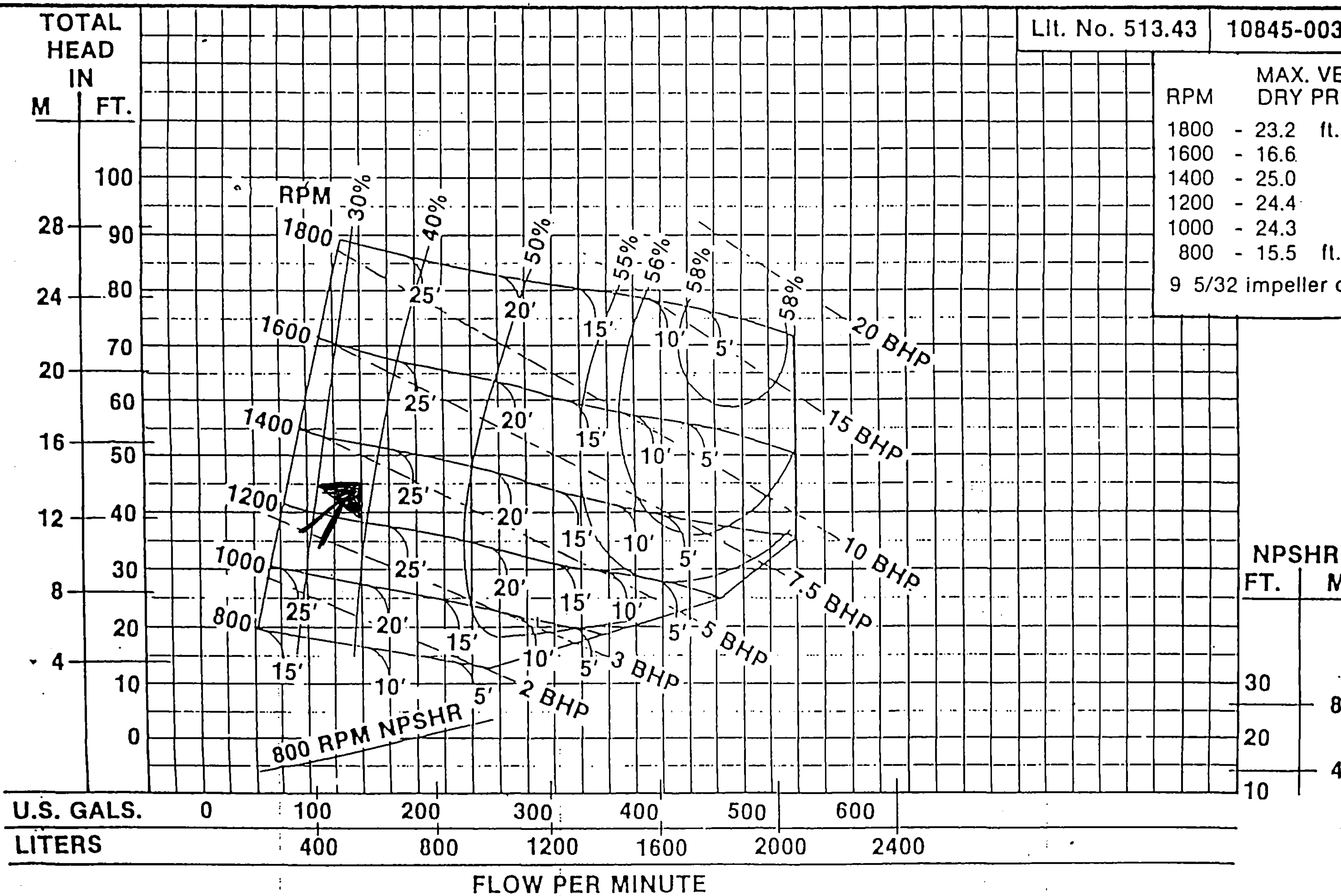
145 G.P.M. @ 45 T.D.H.

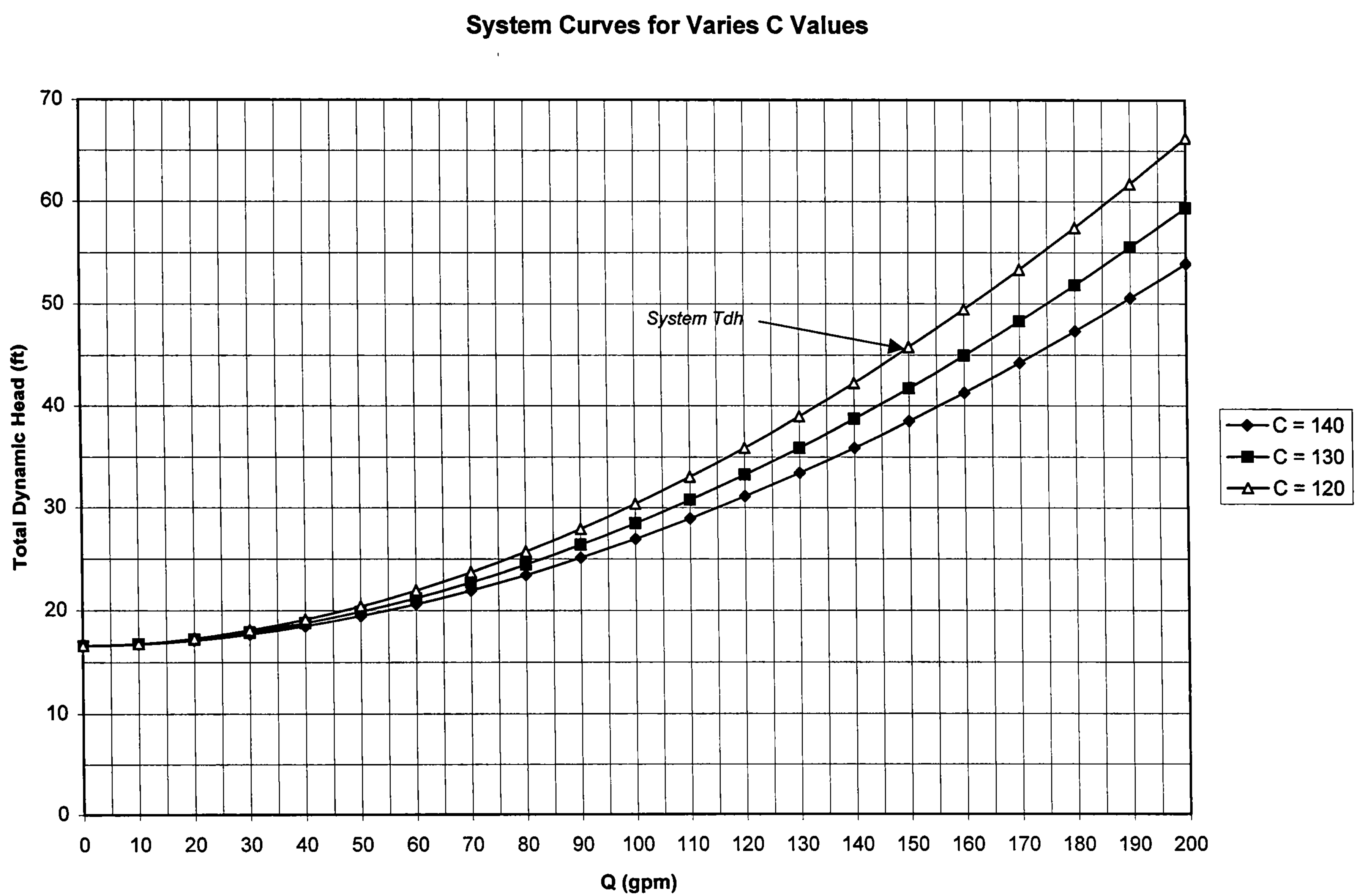
MODEL: 40MPV - ~~40MPSFV~~ SELF PRIMER - MAX. SOLIDS: 3" SPHERE - VAR. RPM

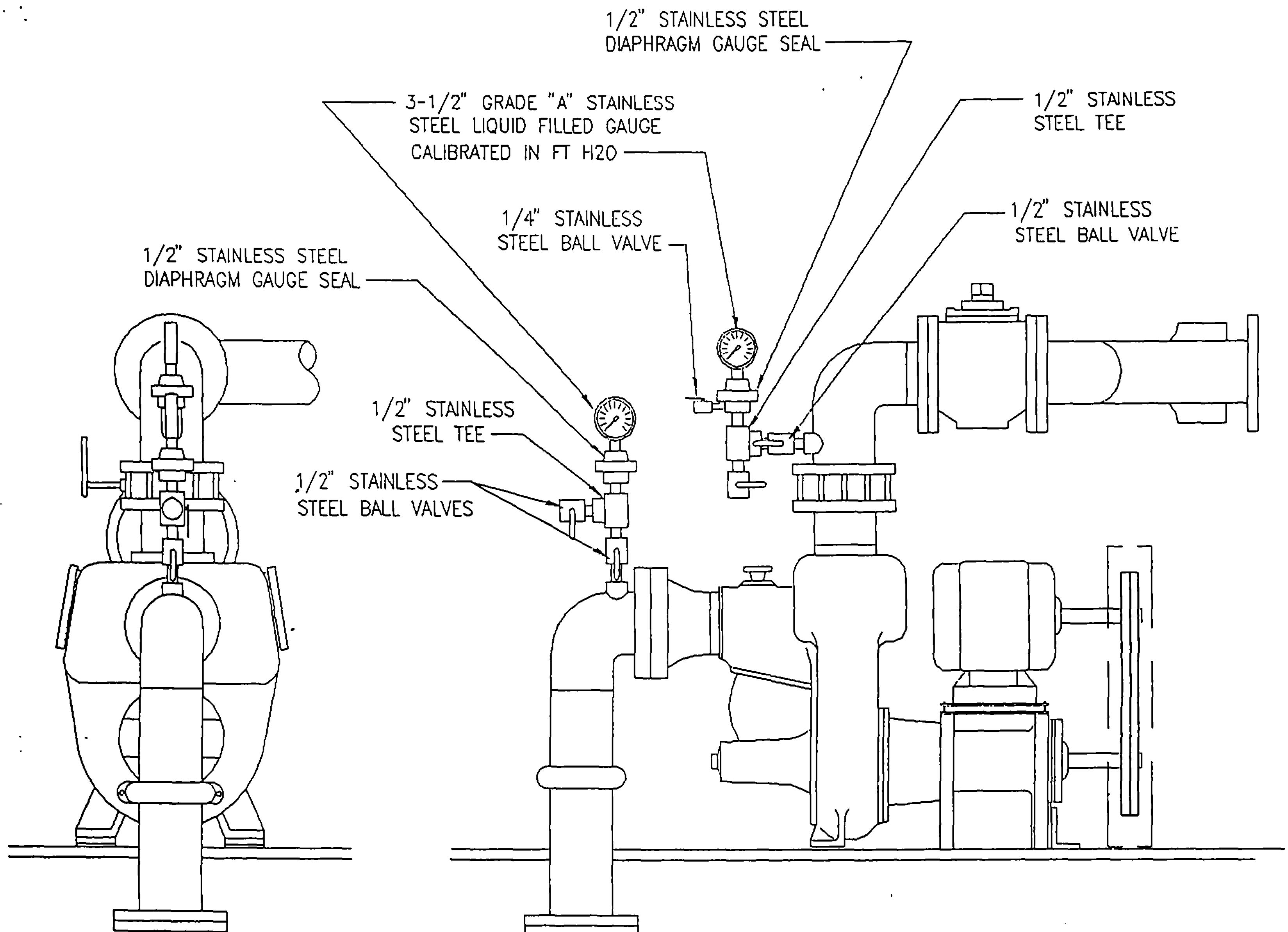
Lit. No. 513.43 | 10845-003-1

RPM	MAX. VERT. DRY PRIME
1800	- 23.2 ft.
1600	- 16.6
1400	- 25.0
1200	- 24.4
1000	- 24.3
800	- 15.5 ft.

9 5/32 impeller dia.




System Curves for Varies C Values
Total Dynamic Head (ft)
Q (gpm)
System Tdh
C = 140
C = 130
C = 120
0
10
20
30
40
50
60
70
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
190
200



SUCTION AND DISCHARGE GAUGE KIT

JOB #	N/A	DATE	9-13-95
Des By	MW	Dwg #	DEQ-[illegible]07
Drn By	SM	Sheet	1
Chk By	MW	Rev: 1	2-5-96 Chk: MW

HYDRONIX

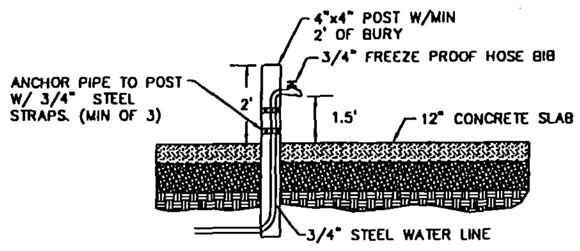
CONTROL PANEL NOTES:

1. ALL ELECTRICAL INSTALLATIONS WILL BE IN CONFORMANCE WITH THE NATIONAL ELECTRICAL CODE AND STATE AND LOCAL REQUIREMENTS.
2. ELECTRIC COMPONENTS SHOULD BE SIZED TO ACCOMMODATE ACTUAL HORSEPOWER REQUIREMENTS.

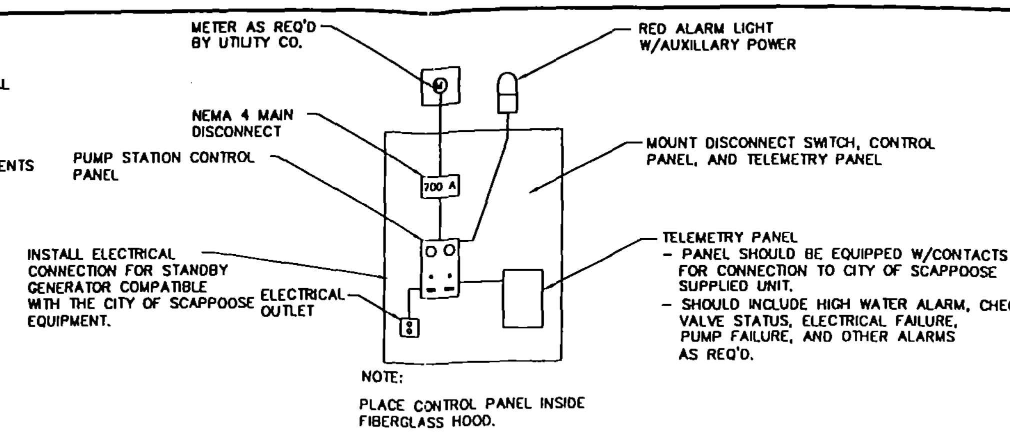
   CLEARLY LABEL ALL CONTACTS AND COMPONENTS.

   THE ELECTRICAL CONTROL PANEL ENCLOSURE SHALL BE NEMA FOUR WITH MATERIAL BEING FIBERGLASS TO PREVENT PREMATURE CORROSION.
5. THE PANEL WILL CONTAIN TWO CIRCUIT BREAKERS (ONE FOR EACH PUMP), ELECTRIC ALTERNATOR, CONTROL POWER TRANSFORMER, TERMINAL STRIP FOR CONNECTING FOUR (4) FLOAT SWITCHES, REMOTE ALARM AND TELEMETERY HOUR METERS FOR EACH PUMP EXTERNAL FLASHING ALARM LIGHT TO BE LOCATED ON OUTSIDE ON ELECTRICAL PANEL.
6. ALARM SYSTEM SHALL INCLUDE A SILENCING RESET ON THE PANEL.
7. THE PANEL SHALL HAVE A LOCKABLE DEAD FRONT DOOR WITH RUN LIGHTS AND H.O.A. SWITCHES INSIDE FOR EASY OPERATION.
8. PROVIDE CONNECTION FOR PORTABLE GENERATOR.
9. PUMP CONTROL SYSTEM SHALL BE FLOATS UNLESS OTHERWISE APPROVED BY CITY OF SCAPPOOSE.

NOTES:
- ALL ELECTRICAL INSTALLATIONS WILL BE IN CONFORMANCE WITH THE NATIONAL ELECTRICAL CODE AND STATE AND LOCAL REQUIRMENTS.
- ELECTRICAL COMPONENTS SHOULD BE SIZED TO ACCOMMODATE ACTUAL HORSEPOWER REQUIREMENTS.
- CLEARLY LABEL ALL CONTACTS AND COMPONENTS



WATER SERVICE
N.T.S.



CONTROL PANEL
N.T.S.

PUMP STATION NOTES

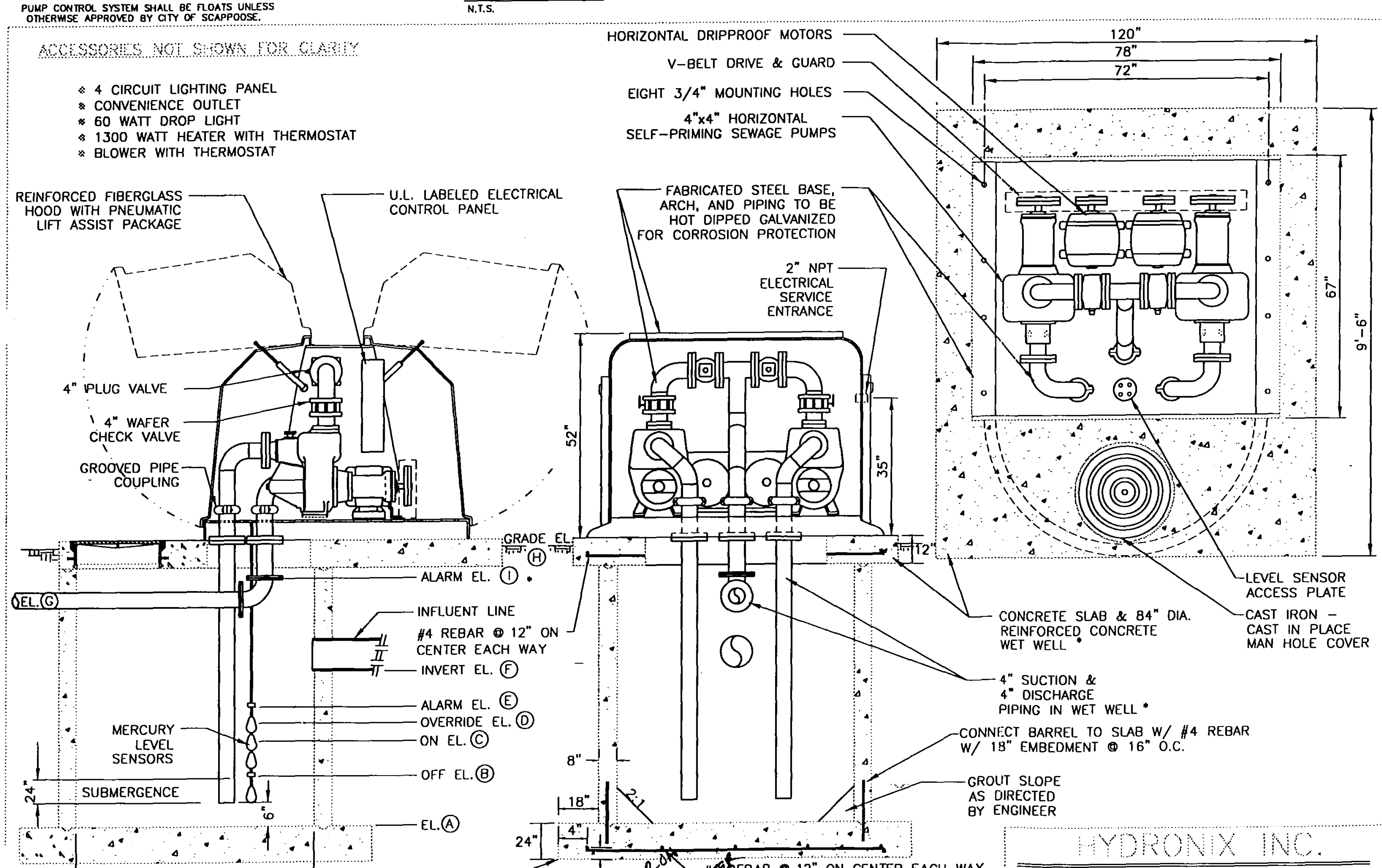
1. THE CONTRACTOR SHALL FURNISH AND INSTALL TWO SUFRACE MOUNTED SELF PRIMING SEWAGE PUMPS AS INDICATED ON THE DRAWINGS AND SPECIFIED HEREIN. PUMP SYSTEM SHALL BE SUPPLIED BY HYDRONIX PUMP SERVICE OR APPROVED EQUAL.
2. PUMP DESIGN: THE PUMPS SHALL BE V-BELT DRIVEN SELF PRIMING SEWAGE PUMPS FOR SURFACE MOUNTED INSTALLATION.
3. THE PUMP MOTOR SHALL BE HOUSED IN AN AIR-FILLED WATER-TIGHT CASING WITH CLASS F INSULATION AND A 1.20 SERVICE FACTOR. BUILT IN MOTOR PROTECTION SHALL CONSIST OF ONE BY METALLIC MICRO SWITCH IN EACH PHASE OF THE WINDING.

   MOTORS SHALL BE NON-OVERLOADING THROUGHOUT THE ENTIRE PUMP OPERATING RANGE. THE MOTOR MUST BE SUITABLE FOR USE IN CLASS 1, DIVISION 1, GROUPS C&D AREAS. OIL FILLED MOTORS SHALL NOT BE CONSIDERED EQUAL OR ACCEPTABLE.
4. ALL CABLE ENTRY JUNCTION BOXES SHALL BE SEPARATED FROM THE MOTOR BY A TERMINAL BOARD AND THE CABLE ENTRY WATER SEAL SHALL NOT REQUIRE EPOXIES, SILICONES, OR OTHER SECONDARY SEALING SYSTEMS.
5. SYSTEM REQUIREMENTS: EACH PUMP SHALL HAVE THE FOLLOWING CHARACTERISTICS:

   CAPACITY 150 (GPM) — TDH ~~38~~ 45 (FT)
6. PUMP WARRANTY: THE PUMPS ARE TO HAVE A ONE-YEAR NON-PRORATED WARRANTY WHICH COVERS DEFECTS IN MATERIALS AND WORKMANSHIP.
7. SEE ATTACHED SPECIFICATION PACKET FOR MORE INFORMATION.
8. PIPING AROUND STRUCTURES AND MACHINERY SHOULD BE D.I. PIPE. PVC IS NOT ACCEPTABLE.
9. A DELAY TIMER WILL BE SET TO OPEN THE PINCH VALVE ON THE DRAIN BACK LINE. THE TIME WILL BE CHANGEABLE BY THE CITY WITH A 30 MINUTE MAXIMUM TIME.
10. THE DISCHARGE MANHOLE WILL BE COATED WITH A LINER TO PROTECT FROM DAMAGE FROM HYDROGEN SULFIDE.
11. A 12' WIDE GRAVEL ROAD ALONG THE FUTURE RIGHT-OF-WAY WILL PROVIDE ALL-WEATHER ACCESS TO THE PUMP STATION UNTIL PHASE II HAS BEEN COMPLETED.
12. PRESSURE GAGES WILL BE PROVIDED ON THE SUCTION AND DISCHARGE SIDE OF THE EACH PUMP WITH THE APPROPRIATE VALVING TO ISOLATE EACH GAGE.
13. THE WETWELL NEEDS TO BE PLACED ON 12" OF 3/4"-0 CRUSHED ROCK COMPACTED TO 95% OF AASHTO T-180. AND THE WETWELL WILL BE BACKFILLED WITH 3/4"-0 CRUSHED ROCK.
14. PROVIDE A POWER METER, MAIN DISCONNECT AND MANUAL TRANSFER SWITCH.
15. EQUIP LIFT STATION WITH A 60W CAGE LIGHT ON BOTH SIDES OF THE CENTRAL SUPPORT, A 1300W HEATER AND A DUAL WEATHER PROOF DUPLEX OUTLET.
16. BASE OF WETWELL WILL BE TIED TO SIDES OF WETWELL WITH #4 REBAR AT 12" ON CENTER. TO KEEP THE BASE FROM SEPERATING FOR THE SIDES.

ACCESSORIES NOT SHOWN FOR CLARITY

- 4 CIRCUIT LIGHTING PANEL
- CONVENIENCE OUTLET
- 60 WATT DROP LIGHT
- 1300 WATT HEATER WITH THERMOSTAT
- BLOWER WITH THERMOSTAT



HYDRONIX INC.

PORTLAND, OREGON

MODEL 183 V-BELT DRIVEN SELF PRIMING SEWAGE PUMPING STATION

SCALE: N.T.S. DRAWING NUMBER: 183V01.DWG

SCALES & DIMENSIONS ARE FOR REFERENCE ONLY. DRAWINGS MUST BE CERTIFIED CORRECT FOR CONSTRUCTION PURPOSES

STATION	G.P.M.	T.D.H.	H.P.	R.P.M.	PHASE	VOLTS	ELEVATIONS A	B	C	D (LAG PUMP ON)	E (HIGH WATER)	F	G	H	I (OVERFLOW)
7 OAKS	150	45	7.5	1300	3ø	120-240	-3.00	-0.50	3.07	3.57	4.07	4.56	8.91	13.91	10.96

MNWR|P
PLANNERS
ENGINEERS
LANDSCAPE ARCHITECTS

233 SW FRONT
PORTLAND, OR
97204
☎ 503|225|0822
FAX: 503|273|8353

REGISTERED PROFESSIONAL ENGINEER 15,190 — OREGON — OCT 2, 1990 — DARREN MARK WELBORN

SEVEN OAKS SUBDIVISION PUMP STATION DETAILS

KOSS-BROD-GOODRICH AND ASSOCIATES
22595 DAY RD. WEST LINN, OREGON 97068

REV.	DATE	BY
1	11/1/95	SR

PROJECT NO. KBG001

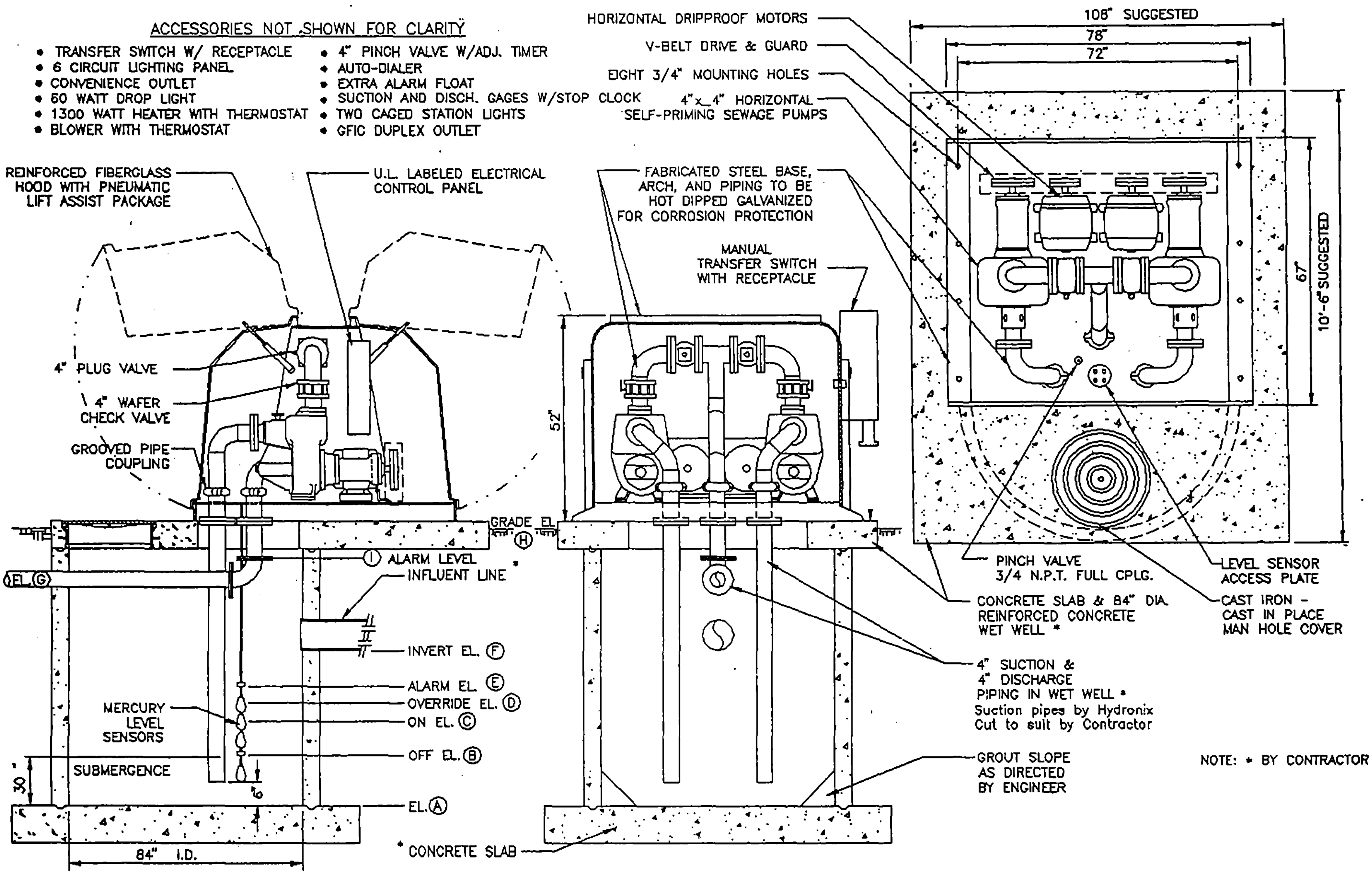
DATE 10/19/95
DESIGNED K. ACKERMAN
ENGINEER D. WELBORN
CHECKED J. REIMANN

SHEET TITLE DETAILS

SHEET NUMBER C13A

ACCESSORIES NOT SHOWN FOR CLARITY

- TRANSFER SWITCH W/ RECEPTACLE
- 6 CIRCUIT LIGHTING PANEL
- CONVENIENCE OUTLET
- 60 WATT DROP LIGHT
- 1300 WATT HEATER WITH THERMOSTAT
- BLOWER WITH THERMOSTAT
- 4" PINCH VALVE W/ADJ. TIMER
- AUTO-DIALER
- EXTRA ALARM FLOAT
- SUCTION AND DISCH. GAGES W/STOP CLOCK
- TWO CAGED STATION LIGHTS
- GFIC DUPLEX OUTLET

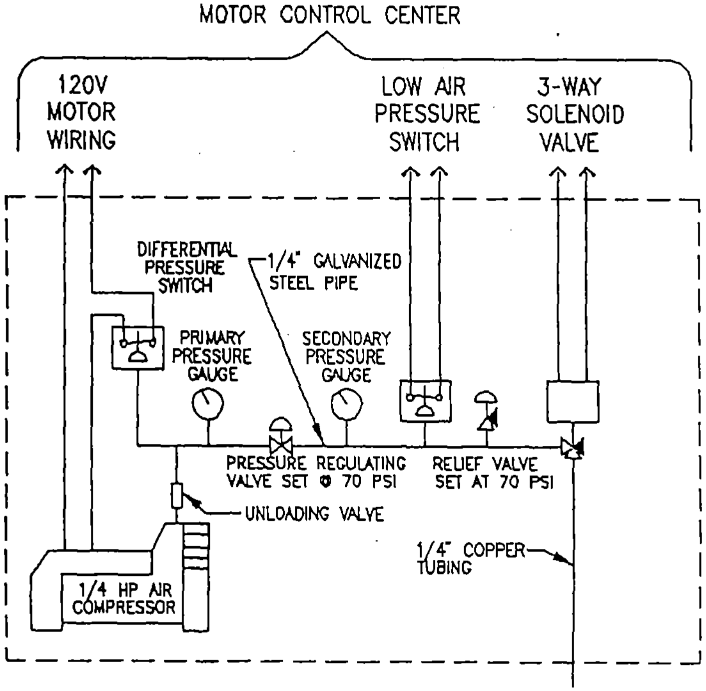


SEVEN OAKS PUMP STATION
SCAPPOOSE, OREGON

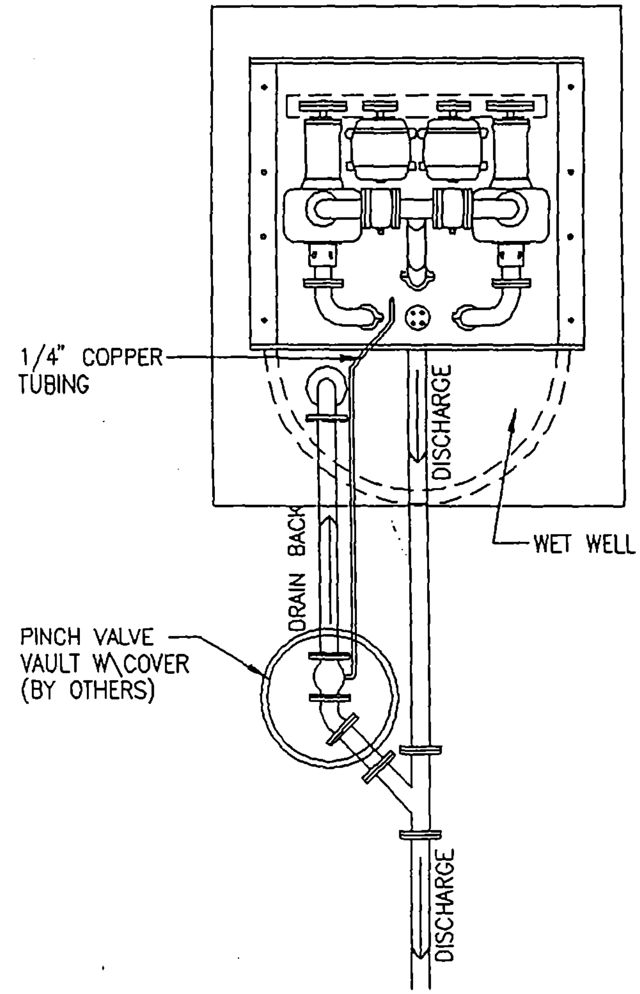
MODEL #	183-010	JOB # 4B526		
		Des By	JH	D· 2-6-95
DWG #	183-010	Drn By	BT	
		Chk By	JH	Sheu. 1 of 1

SCALES & ʼNSIONS ARE FOR REFERENCE ONLY, DRAWINGS MUST BE CERTIFIED CORRECT FOI ʼTRUCTION PURPOSES

STATION		T.D.H.	H.P.	R.P.M.	PHASE	VOLTS	ELEVATIONS A	B	C	D	E		G	H	I
7 OAKS	150	45	7.5	1750	3	230	-3.0	-0.5	+3.07	+3.57	+4.07	+4.56	+8.91	+13.91	+10.91



H2S DRAINBACK CONTROL SCHEMATIC



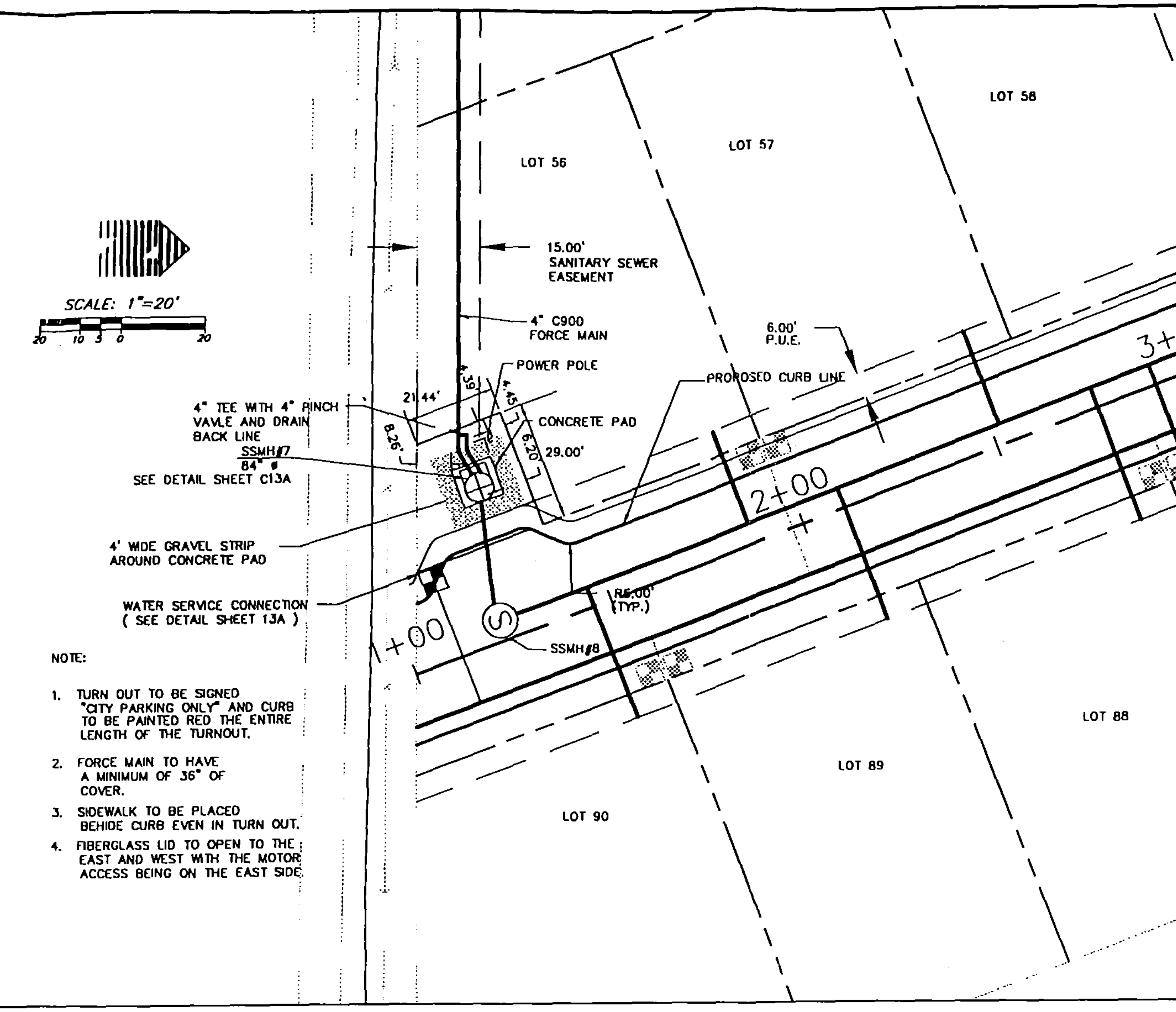
H2S TREATMENT DRAINBACK SYSTEM

JOB #	N/A	DATE	3-10
Des By	MW	Dwg #	DEQ-0
Drn By	SM	Sheet	1 of

SEWAGE PUMP STATION DESIGN DATA

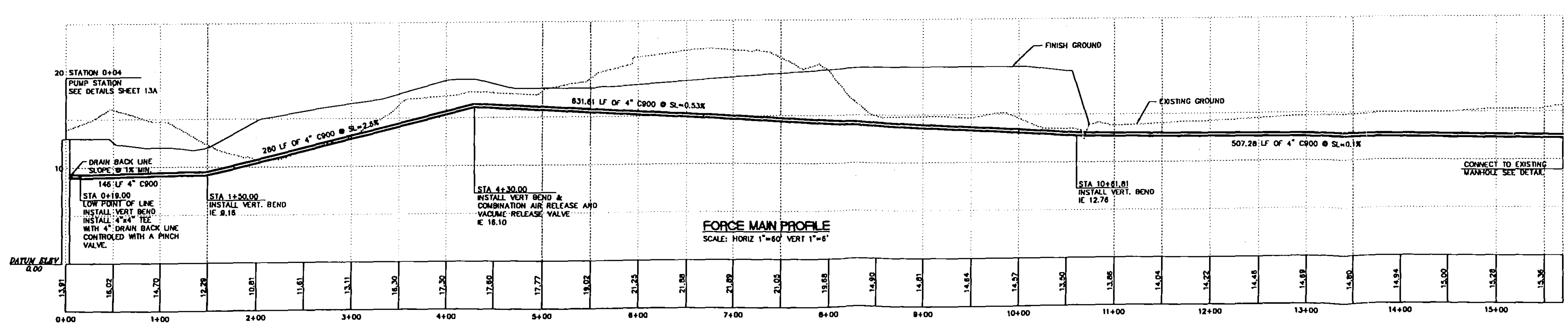
PUMP STATION	**LOCATED • SOUTH END OF 9TH STREET**
TYPE	SURFACE MOUNTED SELF PRIMING
PUMP TYPE	CONSTANT-SPEED NON-CLOG
CAPACITY	150 GPM @ 45FT TDH
PUMP HP	7.5 HP
LEVEL CONTROL	FLOATS
OVERFLOW POINT	SSMH#9 ELEV=10.96 (INT. OF SEVEN OAKS DR. & 9TH STREET)
OVERFLOW DISCHARGE	STORM SYSTEM ON SITE
AVG. TIME TO OVERFLOW	15.75 HRS
AUXILIARY POWER TYPE	3ø GENERATOR
LOCATION	CITY SHOPS
OUTPUT	N/A
FUEL CAPACITY	N/A
TRANSFER SWITCH	MANUAL
ALARM TELEMETRY TYPE	AUTODIALER
EPA RELIABILITY CLASS	II
FORCE MAIN	
LENGTH, TYPE	1,565LF OF C900
PROFILE	ASCENDING TO STA. 4+30 THEN CONTINUOUS DECENDING
DISCHARGE MANHOLE	SIXTH STREET
VACUUM RELEASE VALVE	ONE AT HIGH POINT (STA 4+30)
AVERAGE DETENTION	85 MIN
SULFIDE CONTROL SYSTEM	BACKDRAIN
BACKDRAIN SYSTEM	
CONTROL VALVE TYPE	PNUMATIC PINCH
VALVE SIZE	4"

NOTE:
BEFORE INSTALLATION, THE SIZE AND MATERIAL OF THE PINCH VALVE VAULT AND COVER NEEDS TO BE REVIEWED BY THE CITY OF SCAPPOOSE.



NOTE:

1. TURN OUT TO BE SIGNED "CITY PARKING ONLY" AND CURB TO BE PAINTED RED THE ENTIRE LENGTH OF THE TURNOUT.
2. FORCE MAIN TO HAVE A MINIMUM OF 36" OF COVER.
3. SIDEWALK TO BE PLACED BEHIDE CURB EVEN IN TURN OUT.
4. FIBERGLASS LID TO OPEN TO THE EAST AND WEST WITH THE MOTOR ACCESS BEING ON THE EAST SIDE.



FORCE MAIN PROFILE
SCALE: HORIZ 1"=60' VERT 1"=6'

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233 SW FRONT
PORTLAND, OR
97204
☎ 503|225|0822
FAX: 503|273|8353

REGISTERED PROFESSIONAL ENGINEER 15,190
OREGON
OCT 2, 1990
DARREN MARK WELBORN
EXP 6/30/95

SEVEN OAKS SUBDIVISION
FORCE MAIN PROFILE \ PUMP STATION PLAN

KOSS-BROD-GOODRICH AND ASSOCIATES
22595 DAY RD. WEST LINN, OREGON 97068

REV.	DATE	BY

PROJECT NO.
KBG001

DATE	10/26/95
DESIGNED	K. ACKERMAN
ENGINEER	D. WELBORN
CHECKED	J. REIMANN

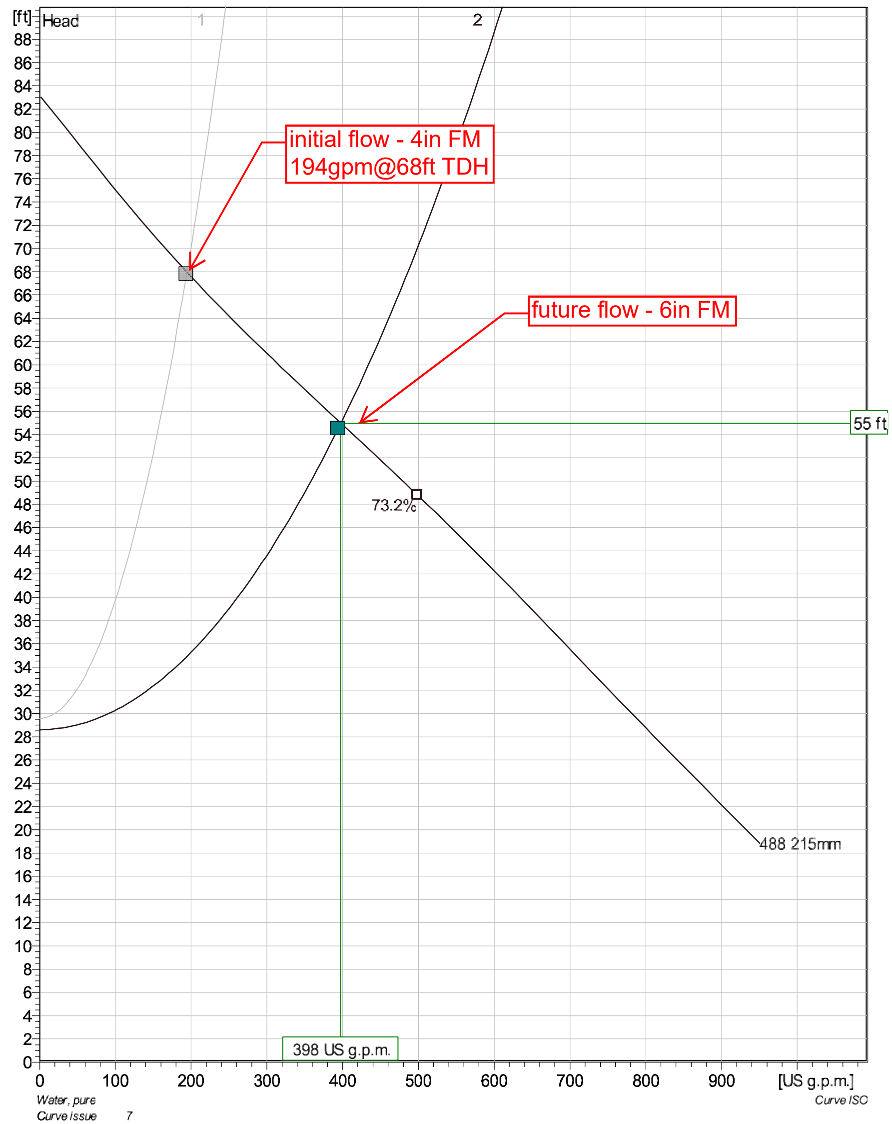
SHEET TITLE
PROFILE
SHEET NUMBER
C13

Charles T Parker (CTP) Pump Station

xylem

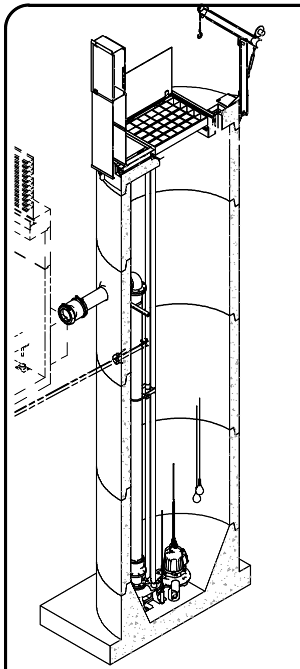
NP 3127 HT 3~ Adaptive 488

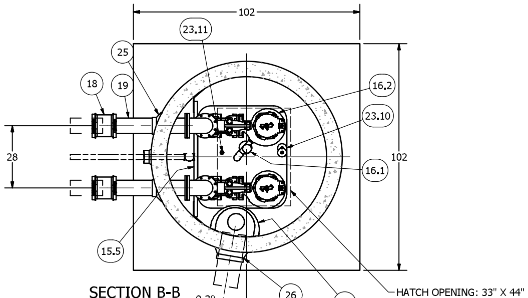
Duty Analysis



Pumps running /System	Individual pump Flow	Head	Shaft power	Total Flow	Head	Shaft power	Pump eff.	Specific energy	NPSHre
2	398 US g.p.m.	55 ft	7.75 hp	398 US g.p.m.	55 ft	7.75 hp	71.3 %	290 kWh/US MG	12.7 ft
1	194 US g.p.m.	68 ft	6.39 hp	194 US g.p.m.	68 ft	6.39 hp	52.3 %	488 kWh/US MG	14.2 ft

Project	Project ID	Created by	Created on	Last update
			4/25/2018	

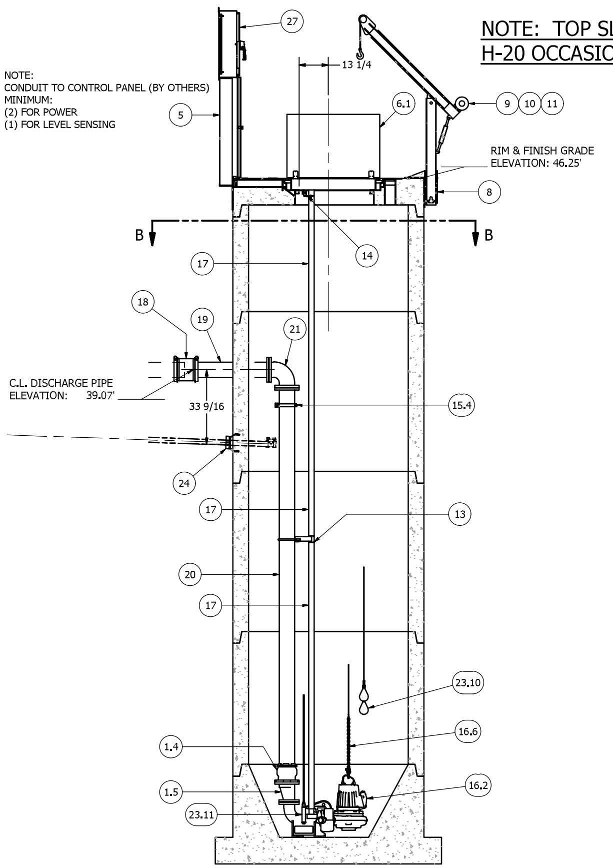




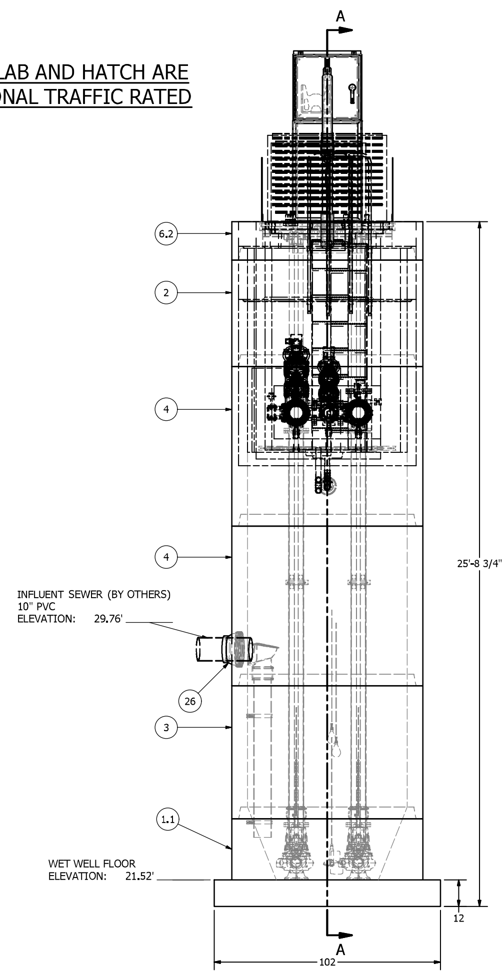
SECTION B-B
SCALE 1/28

SENSOR AND ELEVATION TABLE		
LEVEL ELEVATION	DISTANCE BETWEEN POINTS	SET POINT DESCRIPTION
29.76		INVERT IN
28.65		BACK UP PUMPS START
		SENSOR SPACING
N/A		BACK UP PUMPS STOP
		SENSOR SPACING
27.65		BACK UP HL ALARM
27.15		HIGH LEVEL ALARM
	0.50	SENSOR SPACING
26.65		LAG PUMP START
	1.00	SENSOR SPACING
25.65		LEAD PUMP START
	1.40	SENSOR SPACING
24.25		PUMP STOP
	2.73	DISTANCE TO FLOOR
21.52		FLOOR ELEVATION

NOTE: TOP SLAB AND HATCH ARE H-20 OCCASIONAL TRAFFIC RATED



SECTION A-A
SCALE 1/28



PARTS LIST			
ITEM	QTY	STOCK NUMBER	DESCRIPTION
1	1	10-CB000000	BASE SLAB ASSEMBLY
1.1	1	10-CB068HSQ	BASE - WW - 6ft DIA - RU DESIGN - SQUARE
1.2	2	31-EL0400FL	DISCHARGE ELBOW - 4in - FLYGT
1.3	2	31-HW00AKS6	ANCHOR KIT - 316SS - DISCHARGE ELBOW
1.4	2	44-AD06RMAL	FLANGE ADAPTER - 6in - ALPHA
1.5	2	48-RD0604DE	REDUCER - DI - 6in x 4in - ECCENTRIC
1.6	2	49-GS040000	GASKET - FLANGE - 4in
2	1	12-CR064800	BARREL - 6ft DIA x 4ft H
3	1	12-CR066000	BARREL - 6ft DIA x 5ft H
4	2	12-CR067200	BARREL - 6ft DIA x 6ft H
5	1	13-DS3030SS	DISCONNECT STAND - SS - 30in x 30in x 8in
6	1	14-CT000000	TOP SLAB ASSEMBLY
6.1	1	13-HH06HDCV	HATCH - 6ft - H20 - W/ CABLE TRAY & VENT
6.2	1	14-CT06HD00	TOP SLAB - 6ft DIA - H20
7	1	15-DB999999	DROP BOWL ASSEMBLY
7.1	2	15-BR08SS35	BRACKET - PIPE - 8in - SS35 - SDR35
7.2	1	15-CP080000	COUPLING - FERNCO - 8in
7.3	1	15-DB810868	DROP BOWL - 8in thru 10in INLET x 8in OUTLET - 6ft - 8ft WET WELL
7.4	6.0 ft	70-PP0800DR	PIPE - PVC SDR35 - 8in DIA
8	1	16-BB2PC0BW	CRANE BASE - SIDE MOUNT - 6ft RU DESIGN
9	1	16-CC2000PC	CRANE - 2000lb - POWDERCOAT
10	1	16-WN0000E2	WINCH - ELECTRIC - 6ft PENDANT - ENAMEL
11	1	16-WR1Q45E0	WIRE ROPE - SS - 0.25in x 45ft
12	2	17-AC38000B	BOLT KIT - UPPER GUIDE BAR BRACKET
13	2	17-IG26S4FL	BRACKET - 304SS - INTERMEDIATE GUIDE BAR
14	2	17-UG0200FL	BRACKET - 316SS - UPPER GUIDE BAR - 2in
15	1	18-BR000000	BRACKET ASSEMBLY - 316SS - DISCHARGE SUPPORT
15.1	2	18-AC00000B	BOLT KIT - 316SS - WALL BRACKET
15.2	2	18-AC00001B	WALL BRACKET - DISCHARGE SUPPORT
15.3	2	18-AC010HSB	BOLT KIT - DISCHARGE CLAMP - BOLT, WASHER, LOCK NUT
15.4	2	18-AC06CLS6	DISCHARGE CLAMP - 316SS - 6in - STRUTMOUNT
15.5	4.3 ft	50-US0000S6	UNISTRUT - 316SS - SLOTTED
16	1	30-PU000000	PUMP SHIPPING CRATE
16.1	1	30-MFVFLYGT	MIX FLUSH VALVE - FLYGT
16.2	2	30-PU0000FL	PUMP - FLYGT NP3127HT
16.3	2	32-BS0H00SS	BOW SHACKLE - 316SS - 1-2in
16.4	2	32-BS3800SS	BOW SHACKLE - 316SS - 3-8in
16.5	2	32-CGA000SS	CORD GRIP - .750in - .990 - SS
16.6	4.0 ft	32-PL9320S6	CHAIN - 316SS - 9-32in S5
16.7	1	32-PLGE0000	GRIP EYE UNIT
16.8	2	32-PLLSANYL	LIFTING SLING ASSEMBLY - COATED CABLE x 27ft TOTAL LENGTH
17	92.0 ft	40-PP0200S4	PIPE - 304SS SCH40 - 2in DIA (4 @ 10ft & 4 @ 13ft)
18	2	44-CP060AD0	COUPLING - 6in - ALPHA
19	2	45-FP060360	SPOOL - DI - 6in DIA x 36in - FLGxPE
20	2	45-FP061800	SPOOL - DI - 6in DIA x 180in - FLGxPE
21	2	46-EL0690DI	ELBOW - DI - 6in x 90deg - FLGxFLG
22	4	49-GS060000	GASKET - FLANGE - 6in
23	1	50-AC000000	WELL SHIPPING CRATE
23.1	5	12-GS000001	BARREL - GASKET
23.2	1	13-KY000000	HATCH KEY
23.3	3	18-AC00CH00	CABLE HANGER ASSEMBLY
23.4	4	18-HD040000	LIFTING CLUTCH - 4 TON
23.5	1	51-AC00NSTB	NEVER SIEZE - TUBE
23.6	115	51-BT060000	JOINT WRAP - 6in - BOA TAPE
23.7	145	51-SE0101SL	JOINT SEALANT - 1in - CONSEAL CS-202
23.8	1	80-BR00PT00	BRACKET - PRESSURE TRANSDUCER
23.9	1	80-FI00PT00	DESSICANT FILTER - PRESSURE TRANSDUCER
23.10	2	80-FS20MSNL	FLOAT - 20m - MS1 - NOLTA
23.11	1	80-PT1500EH	PRESSURE TRANSDUCER - 0-15PSI - 60ft CABLE - E & H
24	1	59-KB080400	KOR-N-SEAL - 8in CORE - 4in thru 1.5in PIPE
25	2	59-KB1206DI	KOR-N-SEAL - 12in CORE x 6in DIPS PIPE
26	1	59-KB161000	KOR-N-SEAL - 16in CORE x 10in PIPE
27	1	61-EP3000DC	DISCONNECT PANEL - 15-30FLA

FOR CONSTRUCTION

6' DIAMETER WET WELL
6" DISCHARGE PIPING
FLYGT NP 3127 PUMPS
6" - 687 VALVE VAULT

ALL MATERIALS SHOWN ON THIS SHEET WILL BE SUPPLIED BY ROMTEC UTILITIES AND DELIVERED TO THE SITE AFTER THE HOLE HAS BEEN EXCAVATED AND SHORED. THE CONTRACTOR SHALL SUPPLY A CRANE OF SUFFICIENT SIZE TO LOWER ALL THE CONCRETE PIECES INTO THE HOLE SAFELY. THE THE CONTRACTOR SHALL INSTALL THE WET WELL (AND VALVE VAULT AND METERING VAULT IF APPLICABLE). ROMTEC UTILITIES WILL PROVIDE A REPRESENTATIVE FOR TECHNICAL ASSISTANCE ON THE DAY OF INSTALLATION TO ANSWER ANY QUESTIONS THAT MAY ARISE. THE CONTRACTOR IS RESPONSIBLE FOR ALL PLUMBING AND ELECTRICAL CONNECTIONS AND INSTALLATION. ITEMS NOTED AS "BY OTHERS" WILL BE PROVIDED AND INSTALLED BY THE CONTRACTOR. ROMTEC UTILITIES WILL NOT INSTALL ANY OF THE COMPONENTS SHOWN ON THIS PAGE.

NOTE: CONTRACTOR TO SEAL ALL CONCRETE JOINTS AND PIPE PENETRATIONS WITH NON-SHRINK GROUT

NOTE: ALL DIMENSIONS AND ELEVATIONS SHOWN ARE NOMINAL DIMENSIONS. IT IS THE RESPONSIBILITY OF THE ON-SITE CONTRACTOR OR ROMTEC UTILITIES CUSTOMER (NOT ROMTEC UTILITIES) TO VERIFY THE ACCURACY OF ANY CRITICAL DIMENSIONS OR ELEVATIONS PRIOR TO SETTING OR INSTALLING ANY EQUIPMENT.

REV	DATE	DESCRIPTION	BY
2	12/7/2018	REVISED ELEVATIONS PER COMMENTS	AD
1	11/20/2018	UPDATED FOR PRODUCTION LAUNCH	AD
1	8-20-18	REVISED PER COMMENTS	AD

REVISION HISTORY

VERIFY SCALE
DRAWING HAS BEEN FORMATTED FOR 34 x 22 SHEET. BAR EQUALS ONE INCH
0 — 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

DSN: AD
DRN: AD
CKD: AD
DATE: 4-26-18

ROMTEC UTILITIES
18240 NORTH BANK ROAD
ROSEBURG, OREGON 97470
PHONE: (541) 496-9678
WWW.ROMTECUTILITIES.COM

CHARLES T PARKER WAY
SCAPPOOSE, OR
6ft WET WELL & 6in PIPING

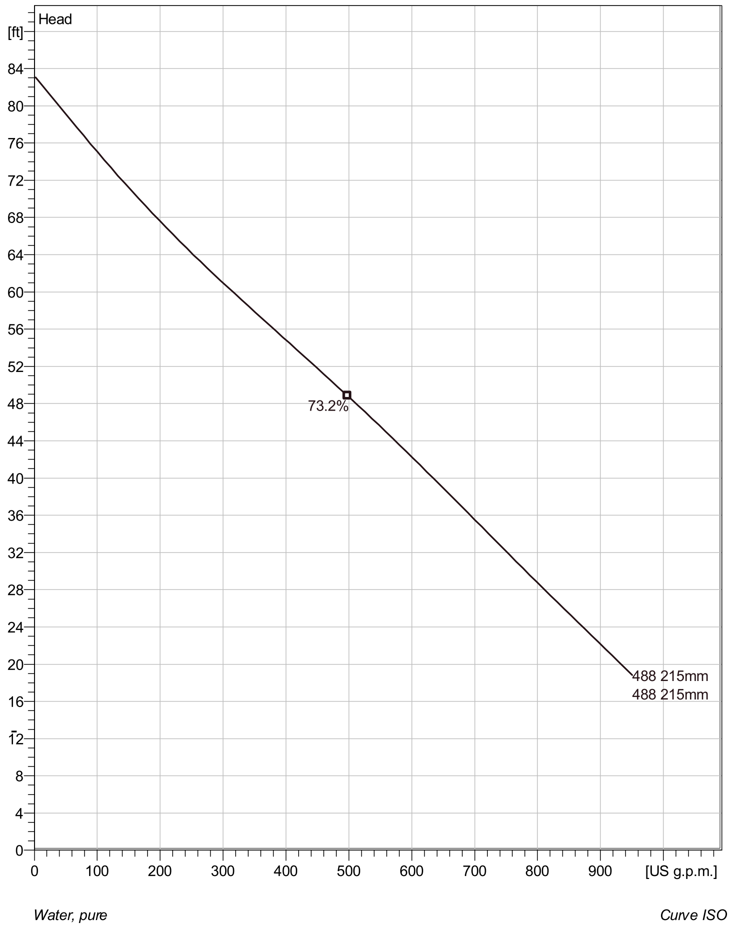
East Airport Pump Station

INITIAL PUMPS SUPPLIED BY ROMTEC UTILITIES

xylem

NP 3127 HT 3~ Adaptive 488

Technical specification



Note: Picture might not correspond to the current configuration.

General

Patented self cleaning semi-open channel impeller, ideal for pumping in waste water applications. Possible to be upgraded with Guide-pin® for even better clogging resistance. Modular based design with high adaptation grade.

Impeller

Impeller material	Hard-Iron ™
Discharge Flange Diameter	3 15/16 inch
Suction Flange Diameter	3 15/16 inch
Impeller diameter	215 mm
Number of blades	2

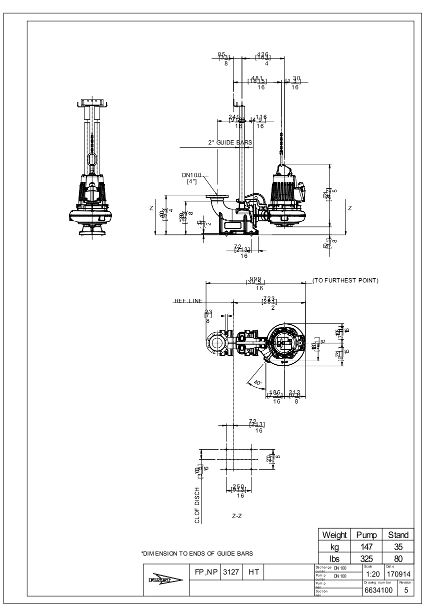
Motor

Motor #	N3127.070 21-12-4AL-W 10hp FM
Stator variant	12
Frequency	60 Hz
Rated voltage	460 V
Number of poles	4
Phases	3~
Rated power	10 hp
Rated current	13 A
Starting current	68 A
Rated speed	1720 rpm
Power factor	
1/1 Load	0.85
3/4 Load	0.83
1/2 Load	0.75
Motor efficiency	
1/1 Load	82.1 %
3/4 Load	83.6 %
1/2 Load	83.1 %

Configuration

50' pump power cables

Installation: P - Semi permanent, Wet



Weight	Pump	Stand
kg	147	35
lbs	325	80

Project	Project ID	Created by	Created on	Last update
			4/25/2018	

xylem

NP 3127 HT 3~ Adaptive 488

Performance curve

FLYGT

Pump

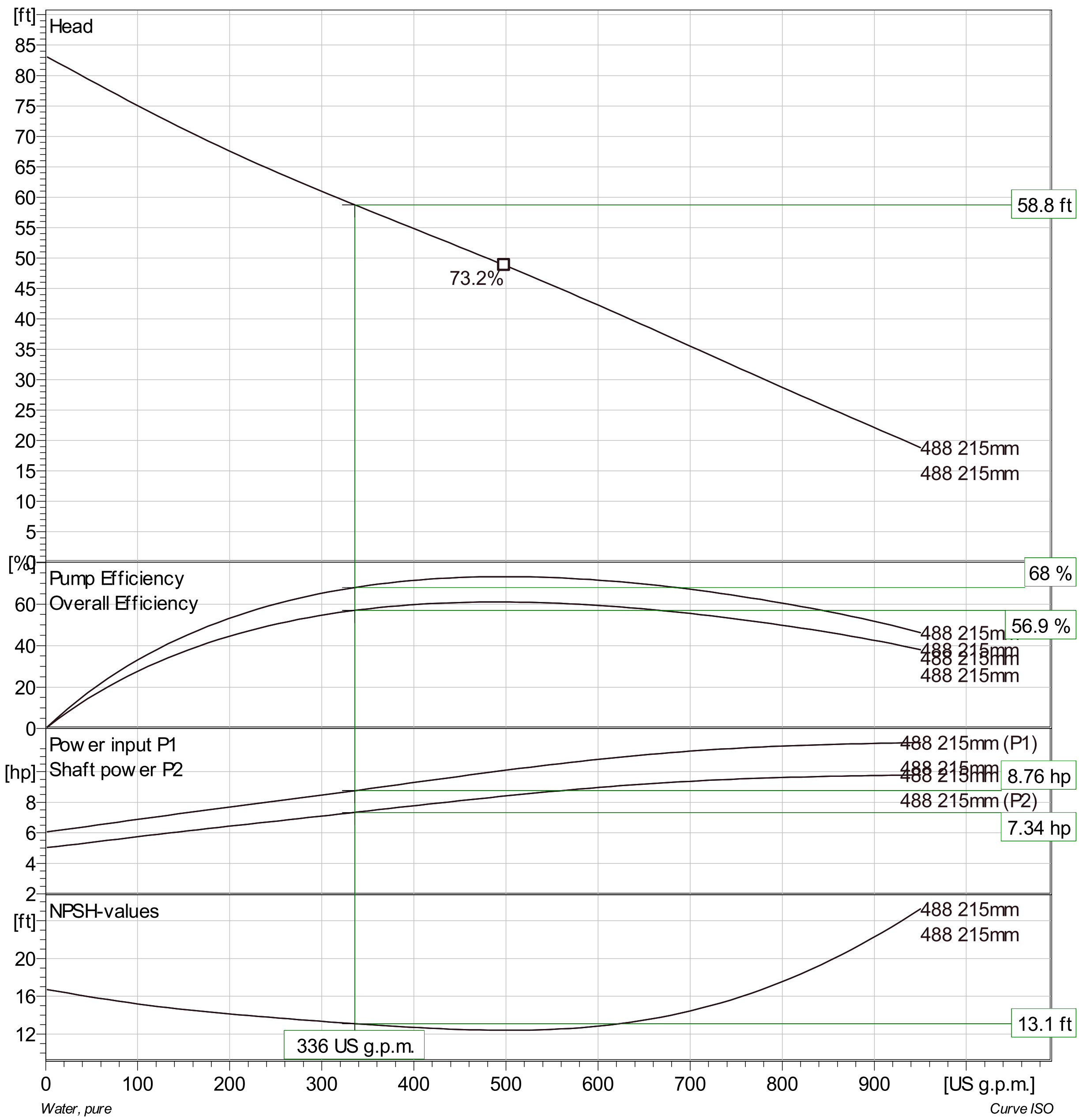
Discharge Flange Diameter	3 15/16 inch
Suction Flange Diameter	100 mm
Impeller diameter	8 7/16"
Number of blades	2

Motor

Motor #	N3127.070 21-12-4AL-W 10hp
Stator variant	12
Frequency	60 Hz
Rated voltage	460 V
Number of poles	4
Phases	3~
Rated power	10 hp
Rated current	13 A
Starting current	68 A
Rated speed	1720 rpm

Power factor	
1/1 Load	0.85
3/4 Load	0.83
1/2 Load	0.75

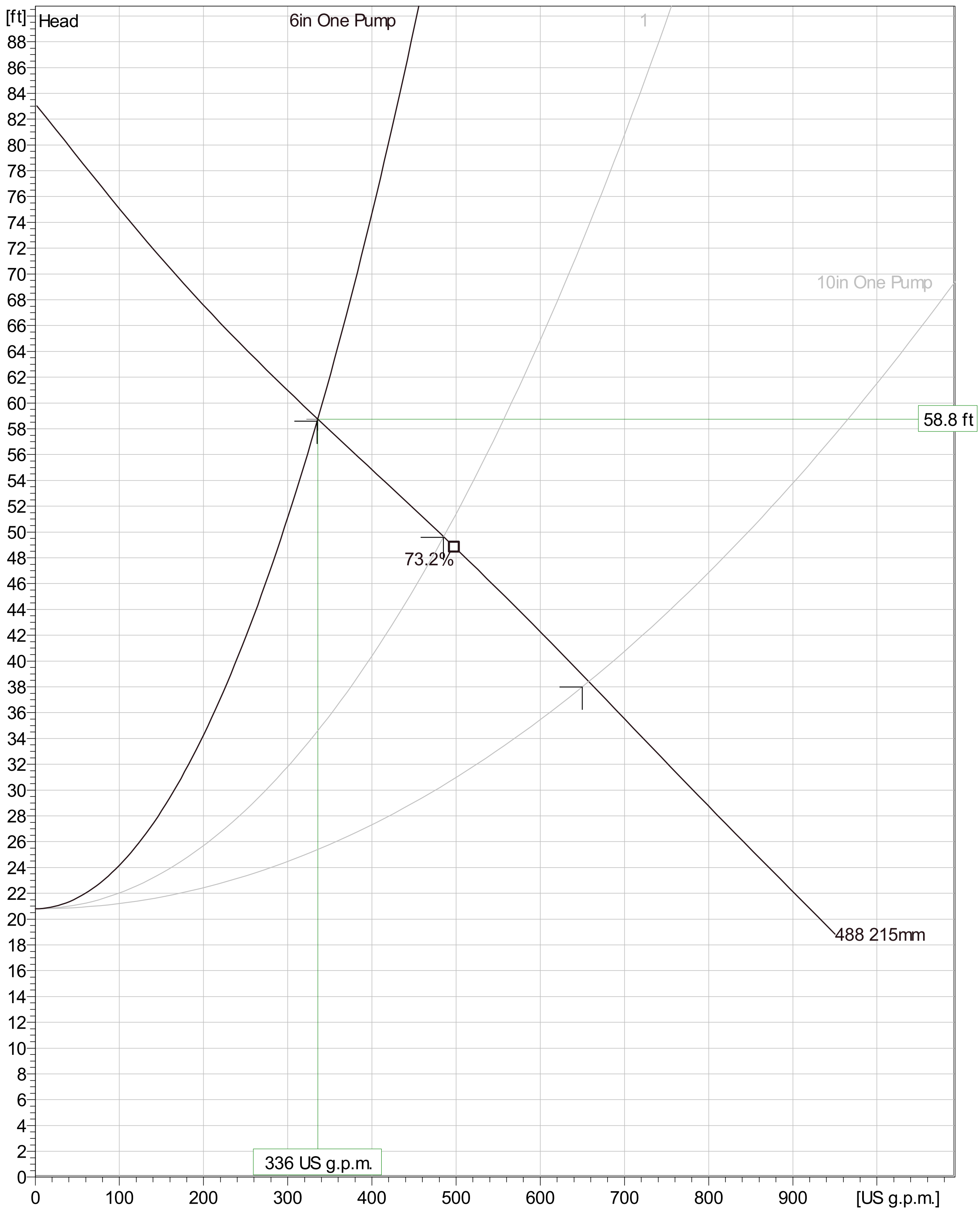
Motor efficiency	
1/1 Load	82.1 %
3/4 Load	83.6 %
1/2 Load	83.1 %



Project	Project ID	Created by	Created on	Last update
			4/25/2018	

NP 3127 HT 3~ Adaptive 488

Duty Analysis



Water, pure *Curve ISO*

Curve issue 7

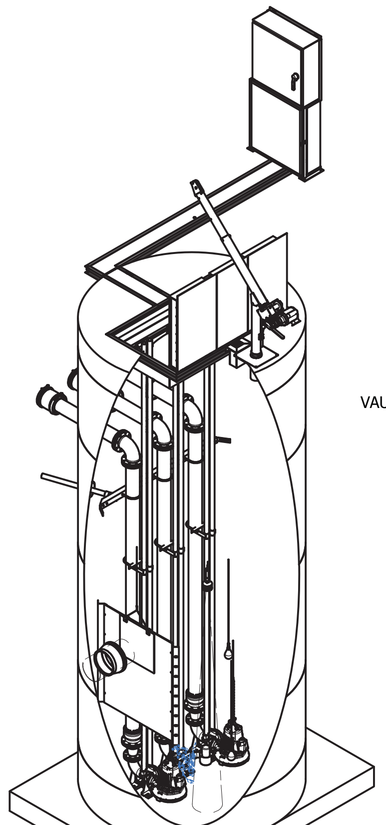
Pumps running /System	Individual pump Flow	Head	Shaft power	Total Flow	Head	Shaft power	Pump eff.	Specific energy	NPSHre
6in One Pump	336 US g.p.m.	58.8 ft	7.34 hp	336 US g.p.m.	58.8 ft	7.34 hp	68 %	324 kWh/US MG	13.1 ft
10in One Pump	658 US g.p.m.	38.4 ft	9.22 hp	658 US g.p.m.	38.4 ft	9.22 hp	69.3 %	211 kWh/US MG	13.6 ft
1	485 US g.p.m.	49.6 ft	8.32 hp	485 US g.p.m.	49.6 ft	8.32 hp	73.2 %	256 kWh/US MG	12.4 ft

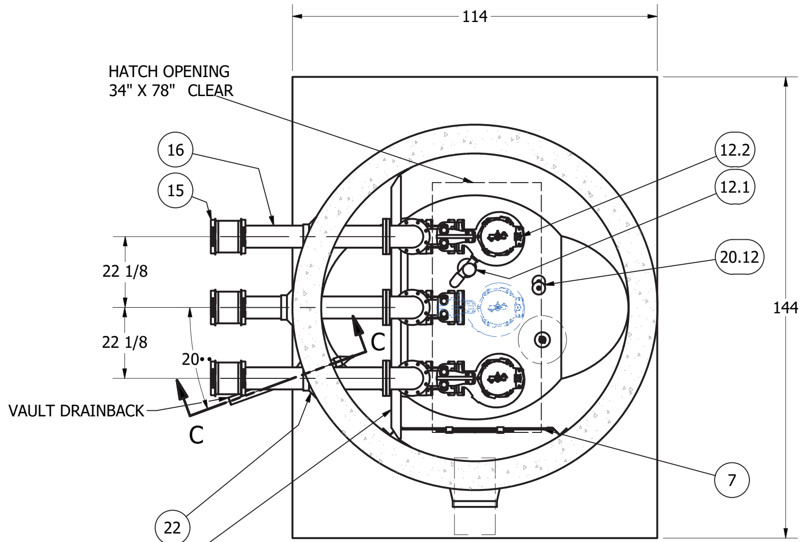
Project	Project ID	Created by	Created on	Last update
			4/25/2018	

1.02 DESIGN CRITERIA

Romtec Utilities has created this SSDS based solely on the design criteria listed below that the customer and/or customer's representative has provided. It is the responsibility of the customer as well as any other reviewing entities, to verify that the stated design criteria is accurate. Romtec Utilities has not verified the design criteria and does not have responsibility for confirming its accuracy.

Project Name:	Scappoose Industrial
Information here in provided by:	Otak
CAD site plan available at this time?	**Yes**
Final Project Owner and/or Operator:	City of Scappoose
Governing Sewer or Water Authority:	City of Scappoose
Does this project require "Buy America" materials?	**No**
Source of Water:	Commercial Development
Water Type:	Wastewater
Influent sewer elevation:	2.99 ft.
Finish grade elevation at wet well:	18.5 ft.
Force Main is:	**New**
Force main length:	3955 ft.
Force main discharge elevation:	18 ft.
Force main diameter:	6 & 10 in. inside diameter
Force main material (PVC, DI, etc.):	PVC C900 DR18
Peak design inflow (max flow to lift station):	336 g.p.m. at initial phases
	916 g.p.m. at full build-out
System Total Dynamic Head (TDH)	53 ft.
Pumping Rate:	336 g.p.m. (1 pump in 10")
Pumping rate as compared to peak inflow is:	**Equal**
Power Supply Voltage:	**480V**
Power Supply Phase:	**Three-Phase**
Is the lift station a classified space thus requiring the pumps to be explosion proof?	**Yes**





SECTION B-B
SCALE 1 / 30

NOTE: TOP SLAB AND HATCH ARE H-20 OCCASIONAL TRAFFIC RATED

MISC. ELEVATION TABLE	
DESCRIPTION	ELEVATION
FLOAT - HIGH LEVEL	2.25'
FLOAT - LOW LEVEL	-3.00'

10" FORCE MAIN OPERATION

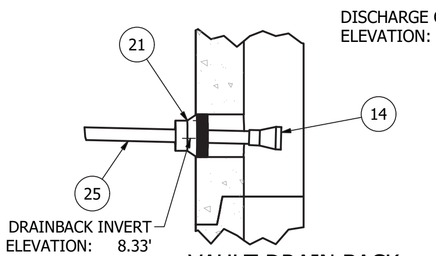
PRIMARY SENSOR ELEVATION TABLE		
DESCRIPTION	ELEVATION	..
INFLUENT INVERT	2.99	
HIGH LEVEL ALARM	0.00	0.25'
LAG PUMP START	-0.25'	0.50'
LEAD PUMP START	-0.75	2.00'
PUMP STOP	-2.75'	2.25'
WELL FLOOR	-5.00'	

6" FORCE MAIN OPERATION

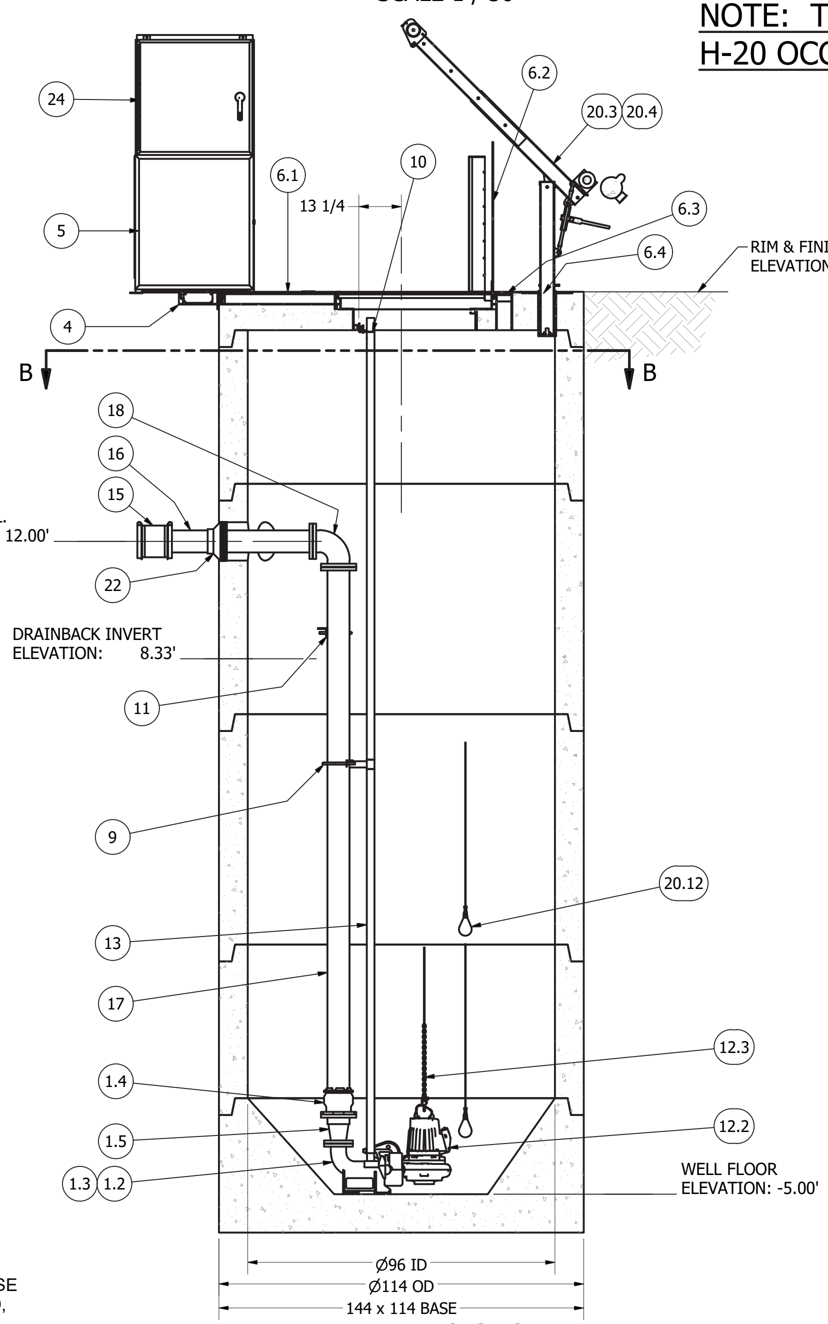
PRIMARY SENSOR ELEVATION TABLE		
DESCRIPTION	ELEVATION	..
INFLUENT INVERT	2.99	
HIGH LEVEL ALARM	-0.50	0.25'
LAG PUMP START	-0.75'	0.50'
LEAD PUMP START	-1.25'	1.50'
PUMP STOP	-2.75'	2.25'
WELL FLOOR	-5.00'	

PARTS LIST			
ITEM	QTY	STOCK NUMBER	DESCRIPTION
1	1	10-CB000000	BASE SLAB ASSEMBLY
1.1	1	10-CB0800RU	BASE - WW - 8ft DIA - RU DESIGN
1.2	3	31-EL0400FL	DISCHARGE ELBOW - 4in - FLYGT
1.3	3	31-HW00AKS6	ANCHOR KIT - 316SS - DISCHARGE ELBOW
1.4	3	44-AD06RMAL	FLANGE ADAPTER - 6in - ALPHA
1.5	3	48-RD0604DC	REDUCER - DI - 6in x 4in - CONCENTRIC
1.6	3	49-GS040000	GASKET - FLANGE - 4in
2	2	12-CR084800	BARREL - 8ft DIA x 4ft H
3	2	12-CR087200	BARREL - 8ft DIA x 6ft H
4	1	13-CARH143	CABLE TRAY EXTENSION - RH - 9in x 143in
5	1	13-DS3636SS	DISCONNECT STAND - SS - 36in X 36in X 12in
6	1	14-CT000000	TOP SLAB ASSEMBLY
6.1	1	13-CA080000	CABLE TRAY - 8ft TRIPLEX TOP SLAB
6.2	1	13-HH08PDTE	HATCH - H20 - 8ft - TRIPLEX
6.3	1	13-VT0000AL	VENT - ALUMINUM - FLUSH
6.4	1	14-CT08HDT0	TOP SLAB - 8ft DIA - H20 - TRIPLEX
6.6	3.0 ft	50-US0000S6	UNISTRUT - 316SS - SLOTTED
6.9	1	16-BB2PC0BF	CRANE BASE - 5BF20 - 2000lb
7	1	15-DP080500	DEFLECTOR PANEL ASSEMBLY - 8ft DIA x 5ft
7.1	2	15-BR00SSGU	BRACKET - SS GUILLOTINE SET
7.2	1	15-DB00CAGU	GUILLOTINE CABLE ASSEMBLY
7.3	1	50-AC00HDPE	HDPE - 4ft X 8ft X 1-2in - BLACK
7.4	1	50-AC00HDPE	HDPE - 24in X 24in X 1/2in - BLACK
7.5	10 ft	50-AN0808GS6	ANGLE - 316SS - 8ft - 11G FORMED
8	3	17-AC38000B	BOLT KIT - UPPER GUIDE BAR BRACKET
9	3	17-IG26S4FL	BRACKET - 304SS - INTERMEDIATE GUIDE BAR
10	3	17-UG0200FL	BRACKET - 304SS - UPPER GUIDE - 2in
11	1	18-BR999999	DISCHARGE PIPE BRACKET - 8ft WW - 6in DI PIPE
12	1	30-PU000000	PUMP SHIPPING CRATE
12.1	1	30-MFVFLYGT	MIX FLUSH VALVE - FLYGT
12.2	2	30-PU0000FL	PUMP - FLYGT NP3127HT
12.3	2	32-AC0000FL	PUMP LIFTING SLING - 316SS - FLYGT
12.4	2	32-CGSS000D	CABLE SUPPORT GRIP - 304SS - 0.75in-0.99in
12.5	1	32-PLGE0000	GRIP EYE UNIT
13	129.0 ft	40-PP0200S4	PIPE - 304SS SCH40 - 2in DIA
14	1	42-TF020000	CHECK VALVE - TIDEFLEX - 2in
15	3	44-CP060AD0	COUPLING - 6in - ALPHA
16	3	45-FP060480	SPOOL - DI - 6in DIA x 48in - FLGxPE
17	3	45-FP061740	SPOOL - DI - 6in DIA x 174in - FLGxPE
18	3	46-EL0690DI	ELBOW - DI - 6in x 90deg - FLGxFLG
19	6	49-GS060000	GASKET - FLANGE - 6in
20	1	50-AC000000	WELL SHIPPING CRATE
20.1	5	12-GS000001	BARREL - GASKET
20.2	1	13-KY000000	HATCH KEY
20.3	1	16-CC2PC0E2	CRANE - 5PT20-E2 - 2000lb
20.4	1	16-WR1Q45E0	WIRE ROPE - SS - 0.25in x 45ft
20.5	4	18-AC00CH00	CABLE HANGER ASSEMBLY - 316SS
20.6	4	18-HD040000	LIFTING CLUTCH - 4 TON
20.7	4	18-HD080000	LIFTING CLUTCH - 8 TON
20.8	1	51-AC00NSTB	NEVER SIEZE - TUBE
20.9	150 ft	51-BT060000	JOINT WRAP - 6in - BOA TAPE
20.10	174 ft	51-SE0101SL	JOINT SEALANT - 1in x 1in - CS-202
20.11	1	80-BR00UT00	BRACKET - ULTRASONIC TRANSDUCER
20.12	2	80-FS20MSNL	FLOAT - 20m - MS1 - NOLTA
20.13	1	80-UT0015XP	ULTRASONIC TRANSDUCER - XPS-15
21	1	59-KB080400	KOR-N-SEAL - 8in CORE - 4in thru 1.5in PIPE
22	3	59-KB1206DI	KOR-N-SEAL - 12in CORE x 6in DIPS PIPE
23	1	59-KB1612P0	KOR-N-SEAL - 16in CORE x 12in DIPS PIPE
24	1	61-EP5036DC	PNL DISCONNECT 31-50FLA (36x36)
25	3.0 ft	70-PP0200P4	PIPE - PVC SCH40 - 2in DIA

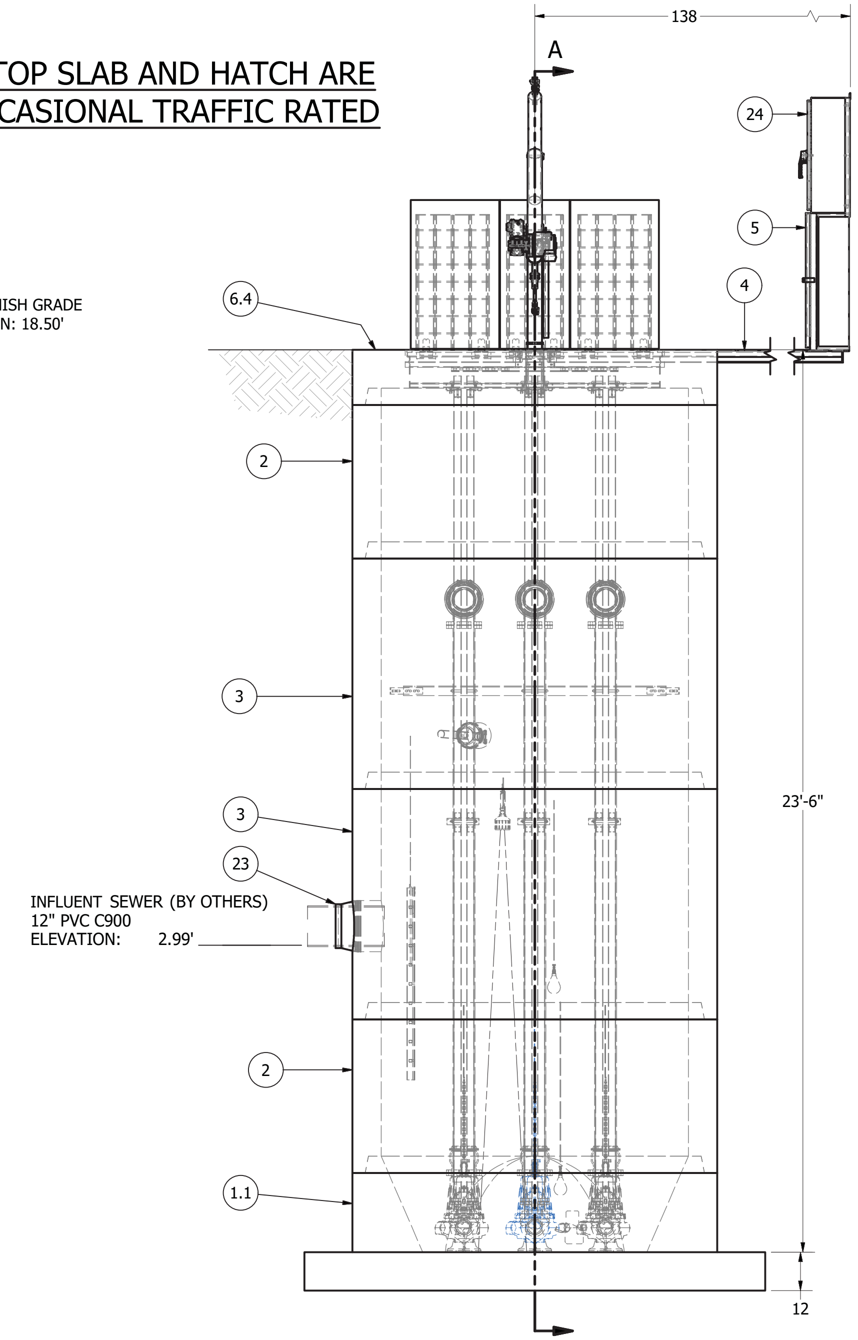
8' DIAMETER WET WELL
6" DISCHARGE PIPING
NP3127 FLYGT PUMPS
6" - 8' X 16' VALVE VAULT



VAULT DRAIN BACK DETAIL
SCALE 1 / 18



SECTION A-A
SCALE 1 / 30



FRONT VIEW
SCALE 1 / 30

NOTE:
CONDUIT TO CONTROL PANEL (BY OTHERS)
MINIMUM:
(3) FOR POWER
(1) FOR LEVEL SENSING

ALL MATERIALS SHOWN ON THIS SHEET WILL BE SUPPLIED BY ROMTEC UTILITIES AND DELIVERED TO THE SITE AFTER THE HOLE HAS BEEN EXCAVATED AND SHORED. THE CONTRACTOR SHALL SUPPLY A CRANE OF SUFFICIENT SIZE TO LOWER ALL THE CONCRETE PIECES INTO THE HOLE SAFELY. THE THE CONTRACTOR SHALL INSTALL THE WET WELL (AND VALVE VAULT AND METERING VAULT IF APPLICABLE). ROMTEC UTILITIES WILL PROVIDE A REPRESENTATIVE FOR TECHNICAL ASSISTANCE ON THE DAY OF INSTALLATION TO ANSWER ANY QUESTIONS THAT MAY ARISE. THE CONTRACTOR IS RESPONSIBLE FOR ALL PLUMBING AND ELECTRICAL CONNECTIONS AND INSTALLATION. ITEMS NOTED AS "BY OTHERS" WILL BE PROVIDED AND INSTALLED BY THE CONTRACTOR. ROMTEC UTILITIES WILL NOT INSTALL ANY OF THE COMPONENTS SHOWN ON THIS PAGE.

SPECIAL NOTE: THE LIFT STATION IS BEING PROVIDED WITH DUPLEX PUMPS FOR PHASES 1 & 2. A THIRD PUMP (SHOWN IN BLUE) IS TO BE ADDED FOR PHASE 3 FOR TRIPLEX CONFIGURATION. THE WET WELL, VALVE VAULT, AND CONTROL PANEL HAVE ALL BEEN SIZED TO ACCOMMODATE THE TRIPLEX PUMP CONFIGURATION.

NOTE: CONTRACTOR TO SEAL ALL CONCRETE JOINTS AND PIPE PENETRATIONS WITH NON-SHRINK GROUT

NOTE: ALL DIMENSIONS AND ELEVATIONS SHOWN ARE NOMINAL DIMENSIONS. IT IS THE RESPONSIBILITY OF THE ON-SITE CONTRACTOR OR ROMTEC UTILITIES CUSTOMER (NOT ROMTEC UTILITIES) TO VERIFY THE ACCURACY OF ANY CRITICAL DIMENSIONS OR ELEVATIONS PRIOR TO SETTING OR INSTALLING ANY EQUIPMENT.

FOR DESIGN REVIEW

REV	DATE	DESCRIPTION	BY
5	8/12/2019	REVISED HOIST MAKE AND MODEL PER COMMENTS	AD
4	7/9/2019	MINOR REVISION PER NEW SITE PLAN	AD
4	6/7/2019	ADDED VAULT DRAIN DETAIL & CABLE TRAY EXT	KB
3	3/21/2019	REVISED PER 1-29-19 COMMENTS	AD
2	8/24/2018	REVISED PER 8-9-18 COMMENTS	AD
1	4-25-18	ADJUSTED DEPTH, CHANGED PUMPS	KB

REVISION HISTORY

VERIFY SCALE
0 — 1"

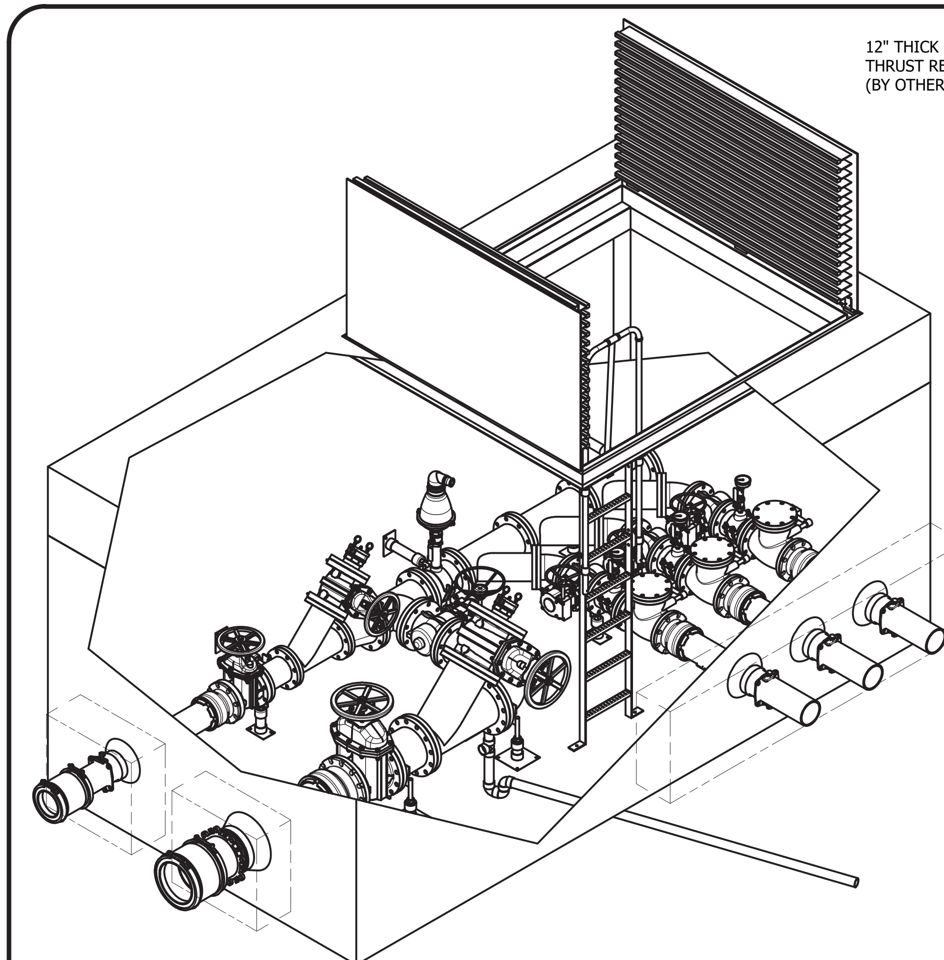
DSN: AD
DRN: AD
CKD: KB
DATE: 3-28-18

ROMTEC UTILITIES
18240 NORTH BANK ROAD
ROSEBURG, OREGON 97470
PHONE: (541) 496-9678
WWW.ROMTECUTILITIES.COM

SCAPPOOSE INDUSTRIAL
SCAPPOOSE, OR

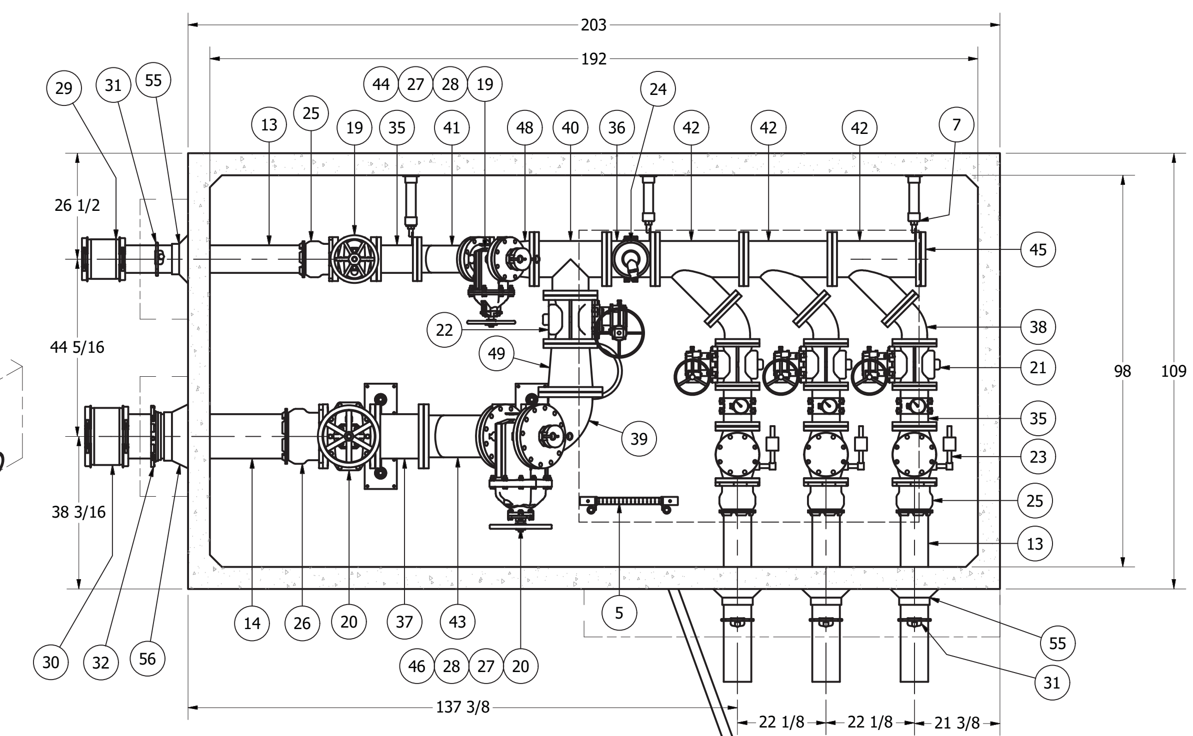
WET WELL ASSEMBLY
COMPONENT DRAWING

MECHANICAL SHEET
4 OF 6



FORCE MAIN (BY OTHERS)
SIZE: 6" & 10"
TYPE: PVC C900 DR18

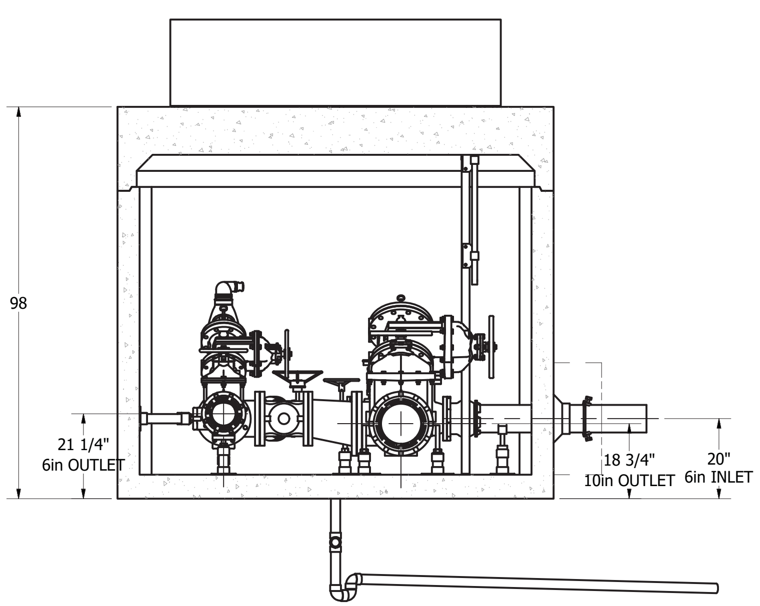
ISO VIEW
SCALE 1/24



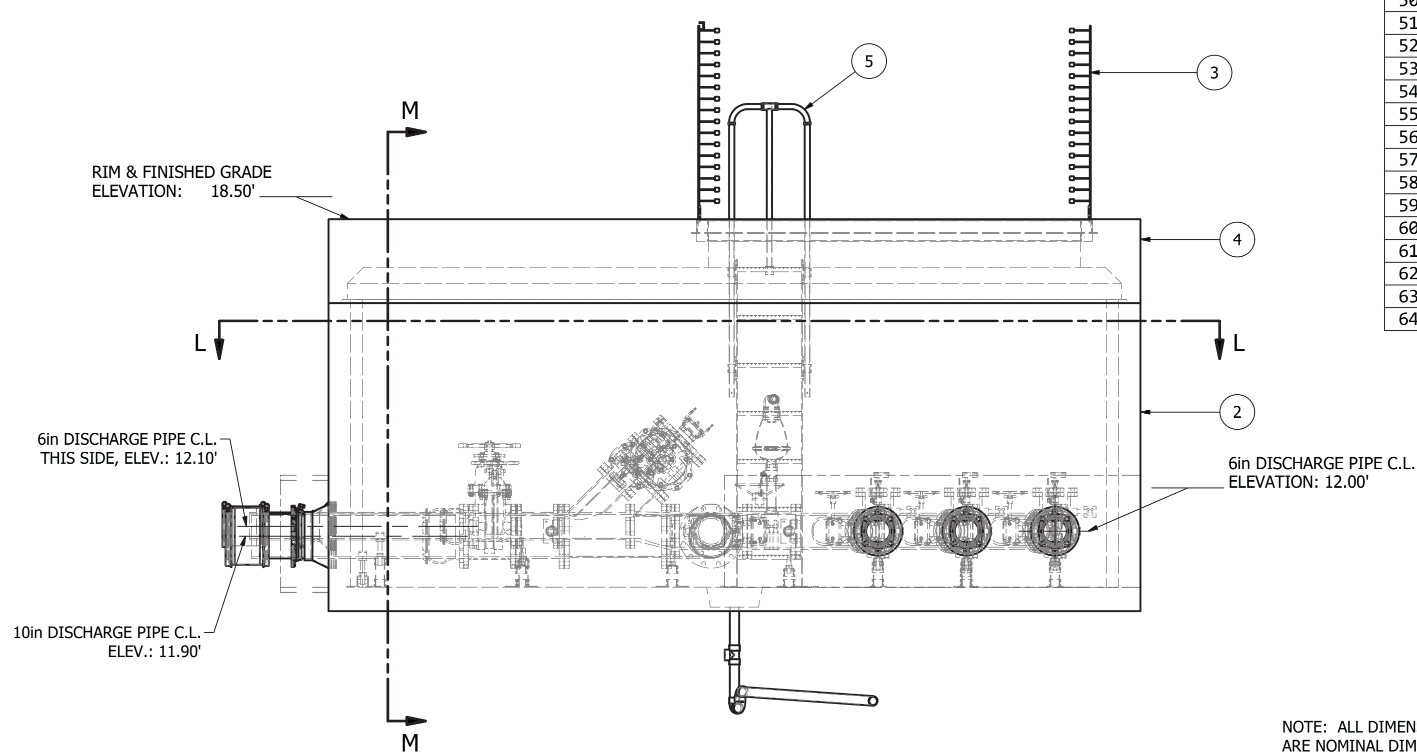
SECTION L-L
SCALE 1/24

NOTE: TOP SLAB AND HATCH ARE H-20 OCCASIONAL TRAFFIC RATED

816 VALVE VAULT
6" & 10" PIPING AND VALVES WITH PUMPING PORT & ARV



SECTION M-M
SCALE 1/24



PARTS LIST			
ITEM	QTY	STOCK NUMBER	DESCRIPTION
2	1	20-CB816000	BASE - VV - 816
3	1	23-HH8100HE	HATCH - VV - 810 - H20
4	1	24-CT816HD0	TOP SLAB - VV - 816 - H20
5	1	25-LD061000	LADDER - 6ft-10in
6	5	25-PS00BASE	PIPE STAND - BASE
7	9	25-PS06S89F	PIPE STAND - FLANGE - 6in
8	4	25-PS06S92S	PIPE STAND - 304SS - 6in SADDLE
9	13	25-PS0BBASE	PIPE STAND BASE - 304SS - 2in - 2 BOLT
10	4	25-PS10S89F	PIPE STAND - 10in FLANGE
11	1	25-PS10S92S	PIPE STAND - SAD S92 - 10in - NO BASE
12	9.4 ft	40-PP0200S4	PIPE - 304SS SCH40 - 2in DIA
13	16.5	40-PP0600D0	PIPE - DI - 6in DIA - CL52 - (3 @ 48in, 1 @ 54in)
14	4.3 ft	40-PP1000D0	PIPE - DI - 10in DIA
15	1	40-TT0208S4	NIPPLE - 304SS - 2in DIA x 8in
16	6	40-TT0H02S4	NIPPLE - 304SS - 0.5in DIA x 2in
17	1	41-BV0200S6	BALL VALVE - 316SS - 2in
18	3	41-BV0H00S6	BALL VALVE - 316SS - 0.5in
19	2	41-GV060HD0	GATE VALVE - 6in - HANDWHEEL
20	2	41-GV100HD0	GATE VALVE - 10in - HANDWHEEL
21	3	41-PV060HD0	PLUG VALVE - 6in - GEARED HANDWHEEL
22	1	41-PV080HD0	PLUG VALVE - 8in - GEARED HANDWHEEL
23	3	42-LW0600D0	CHECK VALVE - LEVER & WEIGHT - 6in
24	1	43-AV020ARI	VALVE - AIR VACUUM RELEASE - 2in - ARI
25	4	44-AD06RMAL	FLANGE ADAPTER - 6in - ALPHA
26	1	44-AD10RMAL	FLANGE ADAPTER - 10in - ALPHA
27	2	44-CL04ACAP	CAM LOCK - ALUM - 4in - SOCKET CAP
28	2	44-CL0404DM	CAM LOCK - ALUM - 4in - PLUG x MNPT
29	1	44-CP060AD0	COUPLING - 6in - ALPHA
30	1	44-CP100AD0	COUPLING - 10in - ROMAC ALPHA
31	4	44-RG060STR	RETAINER GLAND - 6in - HEAVY DUTY
32	1	44-RG100STR	HEAVY DUTY RETAINER GLAND - 10in
33	3	44-TS060H00	TAPPING SADDLE - 6in x .5in
34	1	44-TS080200	TAPPING SADDLE - 8in x 2in
35	4	45-FF060120	SPOOL - DI - 6in DIA x 12in - FLGxFLG
36	1	45-FF080120	SPOOL - DI - 8in DIA x 12in - FLGxFLG
37	1	45-FF100120	SPOOL - DI - 10in DIA x 12in - FLGxFLG
38	3	46-EL0645DI	ELBOW - DI - 6in x 45deg - FLGxFLG
39	1	46-EL1090DI	ELBOW - DI -10in x 90deg - FLGxFLG
40	1	46-TE0808DI	TEE - DI - 8in x 8in - FLG x FLG
41	1	46-YL0606DI	WYE - DI - 6in - FLGxFLG
42	3	46-YL0806DI	WYE - DI - 8in x 6in - 45deg - FLGxFLG
43	1	46-YL1010DI	WYE - DI - 10in x 10in - FLG x FLG
44	1	48-FL0604D0	FLANGE - DI - 6in - BLIND - 4" FNPT TAP
45	1	48-FL080BD0	FLANGE - DI - 8in - BLIND
46	1	48-FL1004D0	FLANGE - DI - 10in - BLIND - 4in TAP
47	3	48-PL0Q00HX	PLUG - 304SS - .25in NPT - HEX SOCKET
48	1	48-RD0806DE	REDUCER - DI - ECCENTRIC - 8in X 6in
49	1	48-RD1008DE	REDUCER - DI - 10in x 8in - ECCENTRIC
50	17	49-GS060000	GASKET - FLANGE - 6in
51	8	49-GS080000	GASKET - FLANGE - 8in
52	6	49-GS100000	GASKET - FLANGE - 10in
53	53	51-BT060000	JOINT WRAP - 6in - BOA TAPE
54	58	51-SE0101SL	JOINT SEALANT - 1in - CONSEAL CS-202
55	4	59-KB1206DI	KOR-N-SEAL - 12in CORE x 6in DIPS PIPE
56	1	59-KB161000	KOR-N-SEAL - 16in CORE x 10in PIPE
57	10.0 ft	70-PP0200P4	PIPE - PVC SCH40 - 2in DIA
58	1	76-EL029040	ELBOW - PVC SCH40 - 2in x 90deg - SLIP
59	2	76-EL02904S	ELBOW - PVC SCH40 - 2in x 90deg - SLIP x SPIG
60	1	76-TE020240	TEE - PVC SCH40 - 2in x 2in - SLIP
61	3	81-PG3H00QB	PRESSURE GAUGE - 3.5in DIA x .25in MNPT BACK - xxx#
62	3	83-GI0HF0QF	DIAPHRAGM SEAL - 0.5in FNPT x 0.25in FNPT
63	3	84-PX0000TR	PROXIMITY SWITCH - TURCK
64	3	84-PX00CCTR	PROXIMITY SWITCH - CONNECTING CABLE - TURCK

NOTE: CONTRACTOR TO SEAL ALL CONCRETE JOINTS AND PIPE PENETRATIONS WITH NON-SHRINK GROUT

FOR DESIGN REVIEW

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REVISION HISTORY

REV	DATE	DESCRIPTION	BY
1	8-24-18	REVISED PER 8-9-18 COMMENTS	AD
	3/20/2019	REVISED PER 1-29-19 COMMENTS	AD
	6/7/2019	REMOVED HOIST SOCKET	AD

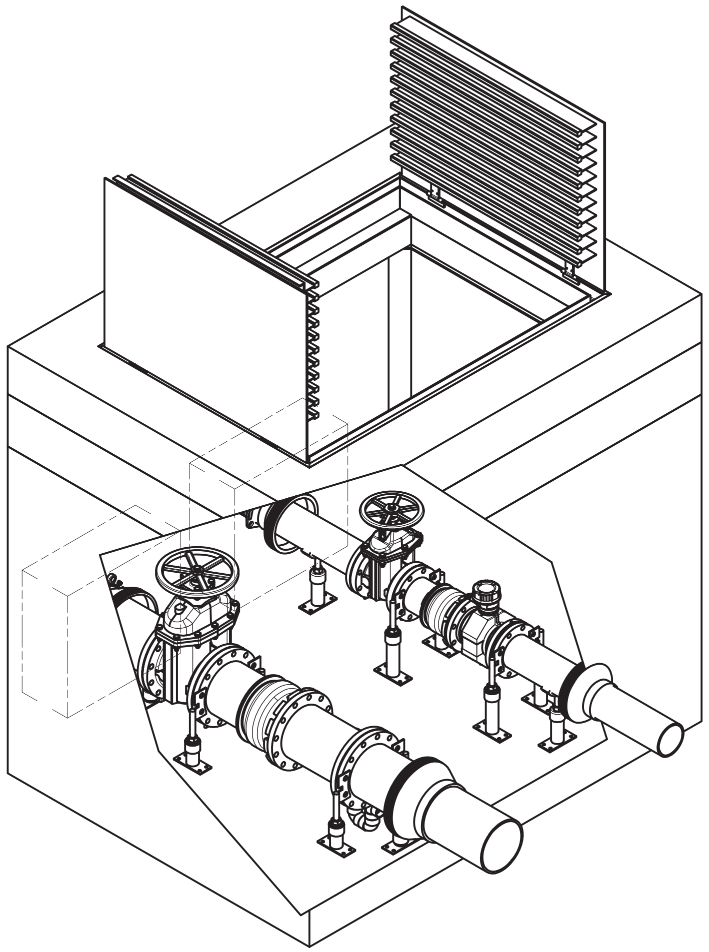
VERIFY SCALE
0 — 1"

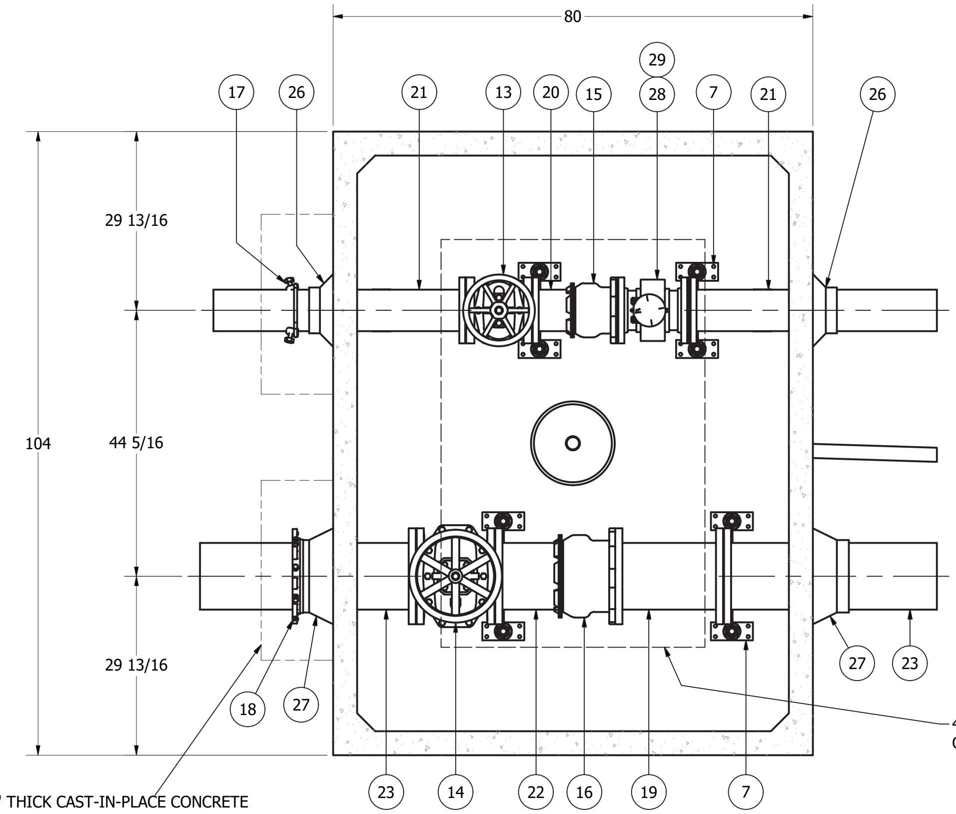
DSN: AD
DRN: AD
CKD: KB
DATE: 3-28-18

ROMTEC UTILITIES
18240 NORTH BANK ROAD
ROSEBURG, OREGON 97470
PHONE: (541) 496-9678
WWW.ROMTECUTILITIES.COM

SCAPPOOSE INDUSTRIAL
SCAPPOOSE, OR
VALVE VAULT ASSEMBLY
COMPONENT DRAWING

MECHANICAL SHEET





12" THICK CAST-IN-PLACE CONCRETE THRUST RESTRAINT COLLAR ON EACH END. (BY OTHERS)

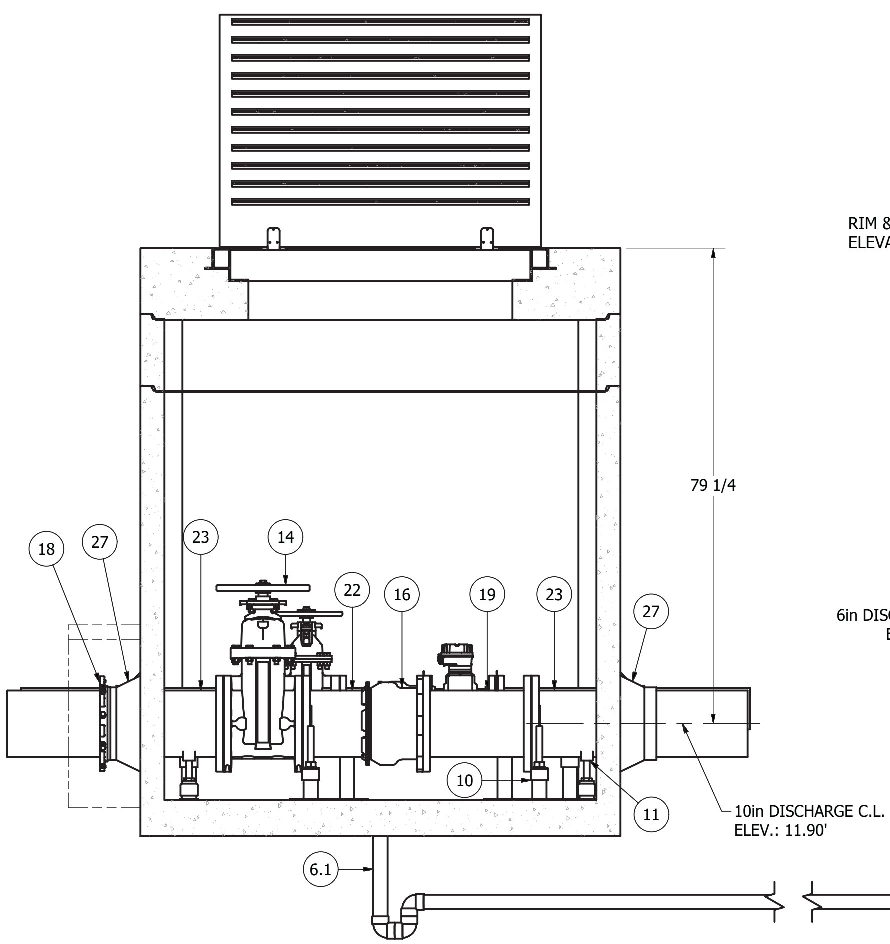
SECTION T-T
SCALE 1 / 16

NOTE: TOP SLAB AND HATCH ARE H-20 OCCASIONAL TRAFFIC RATED

PARTS LIST			
ITEM	QTY	STOCK NUMBER	DESCRIPTION
2	1	20-CB687000	BASE - VV - 687
3	1	22-CB687012	RISER - VV - 687 x 1ft
4	1	23-HH6870HE	HATCH - VV - 687 - H20
5	1	24-CT687HD0	TOP SLAB - VV - 687 - H20
6	1	25-DR999999	DRAIN - VALVE VAULT
6.1	17.8 ft	70-PP0200P4	PIPE - PVC SCH40 - 2in DIA
6.2	3	76-EL029040	ELBOW - PVC SCH40 - 2in x 90deg - SLIP
7	12	25-PS00BAPL	PIPE STAND BASE PLATE - 304SS
8	4	25-PS06S89F	PIPE STAND - FLANGE - 6in
9	2	25-PS06S92S	PIPE STAND - 304SS - 6in SADDLE
10	4	25-PS10S89F	PIPE STAND - 10in FLANGE
11	2	25-PS10S92S	PIPE STAND - SAD S92 - 10in - NO BASE
12	6.5 ft	40-PP0200S4	PIPE - 304SS SCH40 - 2in DIA
13	1	41-GV060HD0	GATE VALVE - 6in - HANDWHEEL
14	1	41-GV100HD0	GATE VALVE - 10in - HANDWHEEL
15	1	44-AD06RMAL	FLANGE ADAPTER - 6in - ALPHA
16	1	44-AD10RMAL	FLANGE ADAPTER - 10in - ALPHA
17	1	44-RG060STR	RETAINER GLAND - 6in - HEAVY DUTY
18	1	44-RG100STR	HEAVY DUTY RETAINER GLAND - 10in
19	1	45-FF100180	SPOOL - DI - 10in DIA x 18in - FLGxFLG
20	1	45-FP060120	SPOOL - DI - 6in DIA x 12in - FLGxPE
21	2	45-FP060420	SPOOL - DI - 6in DIA x 42in - FLGxPE
22	1	45-FP100180	SPOOL - DI - 10in DIA x 18in - FLGxPE
23	2	45-FP100360	SPOOL - DI - 10in DIA x 36in - FLGxPE
24	5	49-GS060000	GASKET - FLANGE - 6in
25	3	49-GS100000	GASKET - FLANGE - 10in
26	2	59-KB1206DI	KOR-N-SEAL - 12in CORE x 6in DIPS PIPE
27	2	59-KB161000	KOR-N-SEAL - 16in CORE x 10in PIPE
28	1	82-FM060LEH	FLOWMETER - 6in - ENDRESS HAUSER - 5L4C1F DN150
29	2	82-GR060000	GROUNDING RING - 6in
30	72.5	51-SE0101SL	JOINT SEALANT - 1in - CONSEAL CS-202
31	62	51-BT060000	JOINT WRAP - 6in - BOA TAPE

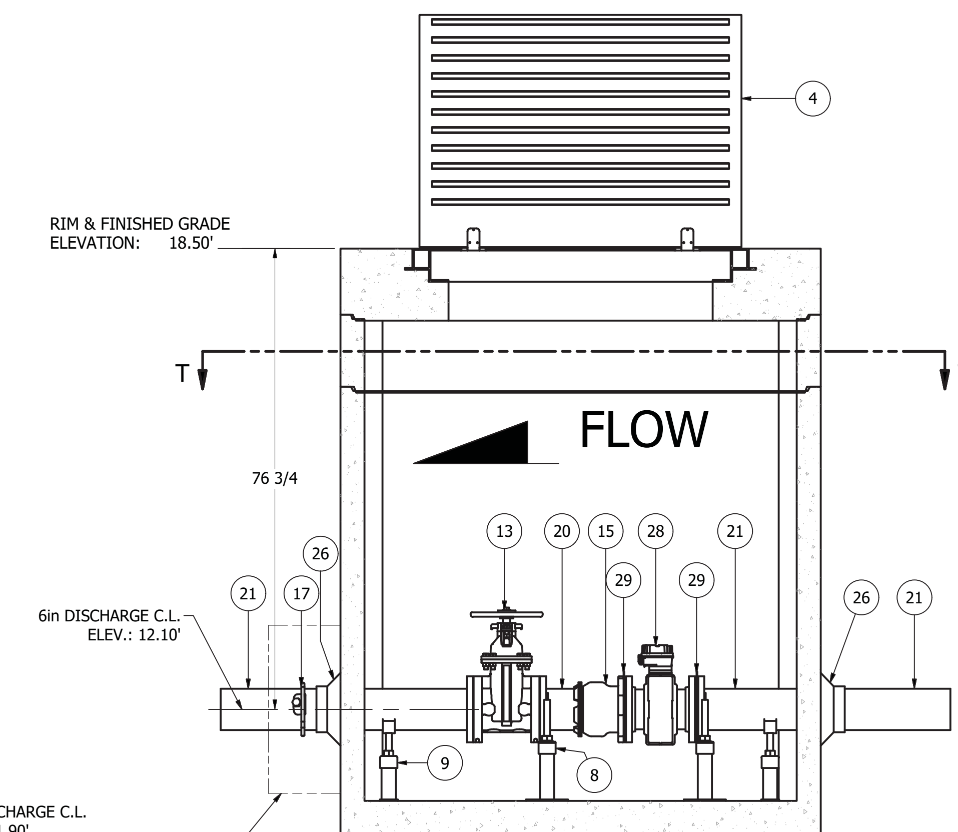
NOTE: CONTRACTOR TO SEAL ALL CONCRETE JOINTS AND PIPE PENETRATIONS WITH NON-SHRINK GROUT

FOR DESIGN REVIEW

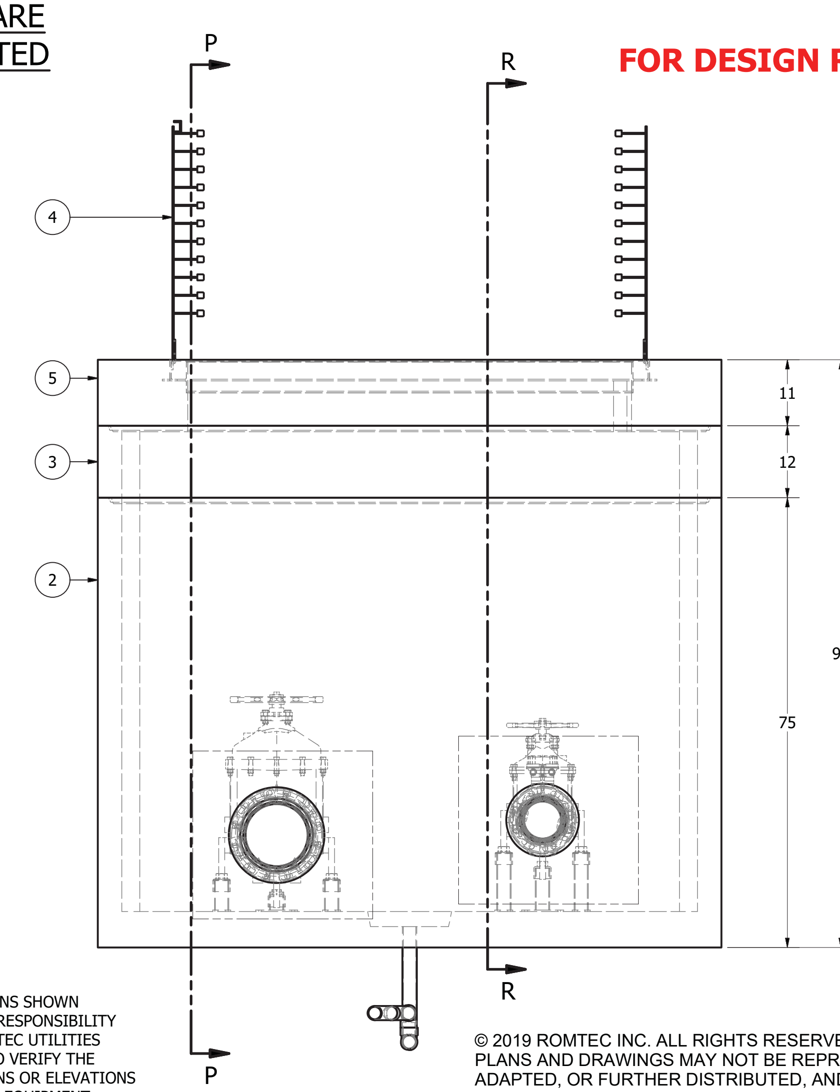


12" THICK CAST-IN-PLACE CONCRETE THRUST RESTRAINT COLLAR ON EACH END. (BY OTHERS)

SECTION P-P
SCALE 1 / 16



SECTION R-R
SCALE 1 / 16



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REV	DATE	DESCRIPTION	BY
1	6/7/2019	REMOVED HOIST SOCKET	AD

REVISION HISTORY

VERIFY SCALE
DRAWING HAS BEEN FORMATTED FOR 34 x 22 SHEET. BAR EQUALS ONE INCH
0 — 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

DSN: AD
DRN: AD
CKD: AD
DATE: 3-21-19

ROMTEC UTILITIES
18240 NORTH BANK ROAD
ROSEBURG, OREGON 97470
PHONE: (541) 496-9678
WWW.ROMTECUTILITIES.COM

SCAPPOOSE INDUSTRIAL
SCAPPOOSE, OR

FLOW METER VAULT
6" METER & SPACE FOR 10"

Appendix C

Smoke Testing

Picture ID	Date	MH Tested	Address	Defect Type	Recommended Action	Photo
1	7/20/2016	0355	32849 NW Bella Vista Dr	open C/O	Notify property owner, seal C/O	Y
2	7/20/2016	0386	53094 NW 11th St	no smoke	Investigate, notify property owner	N
3	7/20/2016	0386	32969 NW Bella Vista Dr	no smoke	Investigate, notify property owner	N
4	7/20/2016	0438	52828 NW Five Peak Ter	open C/O	Notify property owner, seal C/O	Y
5	7/20/2016	0225	52811 NE View Ter	indoor (toilet)	Notify property owner	N
6	7/20/2016	0410	52780 NW Willow Ln	open C/O	Notify property owner, seal C/O	Y
7	7/20/2016	0410	52770 NW Willow Ln	leaking C/O	Notify property owner, seal C/O	Y
8	7/20/2016	0410	52895 NE 7th St	cross connection (downspout)	Notify property owner, remove cross connection	Y
9	7/21/2016	0391	52859 NW 1st St	no smoke	Investigate, notify property owner	N
10	7/21/2016	0391	33349 NW Wickstrom St	indoor (dry P-trap)	Notify property owner	N
11	7/21/2016	0108	52122 Hoag Ter	cross connection (downspout)	Notify property owner, remove cross connection	Y
12	7/21/2016	0109	33114 Felisha Wy	cross connection (driveway drain)	Notify property owner, remove cross connection	Y
13	7/21/2016	0050	Ashley Ct and JP West Rd	open C/O	Under construction, in future check is sealed	Y
14	7/21/2016	0462	32676 JP West Rd	open C/O	Notify property owner, seal C/O	Y
15	7/21/2016	0472	MH 0469	MH	Re-grout or replace MH rim	Y
16	7/21/2016	0472	MH 0479	MH	Re-grout or replace MH rim	N
17	7/26/2016	0632	52239 SW Keys Rd	indoor (dry P-trap)	Notify property owner	N
18	7/26/2016	0346	33343 SW Rogers Rd	cross connection (downspout)	Notify property owner, remove cross connection	Y
19	7/26/2016	0428	52844 NE 2nd St	open C/O	Notify property owner, seal C/O	Y
20	7/26/2016	0425	52657 NE 3rd St	open C/O	Notify property owner, seal C/O	Y
21	7/26/2016	0425	33318 Royal Dr	open C/O	Notify property owner, seal C/O	Y
22	7/26/2016	0607	MH 0614	MH	Re-grout or replace MH rim	Y
23	7/26/2016	0292	33264 Julie Ct	broken C/O	Notify property owner, seal C/O	Y
24	7/26/2016	0594	52313 Columbia River Hwy	indoor (bathroom)	Notify property owner	N
25	7/26/2016	0594	334019 SW Maple St	open C/O (and indoor, washer)	Notify property owner, seal C/O	N
26	7/27/2016	0042	52753 NE Kern Ct	open C/O	Notify property owner, seal C/O	Y
27	7/27/2016	0042	33790 NE Kern Ct	open C/O	Notify property owner, seal C/O	Y
28	7/27/2016	0042	MH 0041	MH	Re-grout or replace MH rim	Y
29	7/27/2016	0174	34371 Egret Ln	open C/O	Notify property owner, seal C/O	Y
30	7/27/2016	0140	51704 SE 4th St	broken C/O	Notify property owner, seal C/O	Y

1. 32849 NW Bella Vista Dr
Open C/O

2. 53094 NW 11th St
No smoke out of vents

No Picture

3. 32969 NW Bella Vista Dr
No smoke out of vents

No Picture

4. 52828 NW Five Peak Ter
Open C/O (around back of house)

5. 52811 NE View Ter
Indoor; toilet smoking from at connection with floor

No Picture

6. 52780 NW Willow Ln
Open C/O

7. 52770 NW Willow Ln
Leaking C/O cap

8. 52895 NE 7th St

Cross connection; downspout on front porch smoking

9. 52859 NW 1st St
No smoke out of vents

No Picture

10. 33349 NW Wickstrom St

Indoor; dry P-trap in bathroom

No Picture

11. 52122 Hoag Ter

Cross connection; downspout, driveway drain smoking

12. 33114 Felisha Way
Cross connection; driveway drain connected to sewer line

13. Ashley Ct and JP West Rd (SE corner house)
Open C/O in front; under construction, will most likely be sealed later on

14. 32676 JP West Rd (SW Taylor St side of house)
Open C/O

15. MH0469
MH rim smoking

16. MH0479
MH rim looks to be smoking; in field

No Picture

17. 52239 SW Keys Rd
Indoor; dry P-trap

No Picture

18. 33343 SW Rogers Rd
Cross connection; downspout over garage smoking

19. 52844 NE 2nd St
Open C/O

20. 52657 NE 3rd St (around back side of house)
Open C/O

21. 33318 Royal Dr
Open C/O

22. MH0614
MH rim smoking

23. 33264 Julie Ct
Broken C/O

24. 52313 Columbia River Hwy (US Bank)
Indoor; light smoke in the bathroom

No Picture

25. 334019 SW Maple St
Open C/O; indoor, washer drain smoking

No Picture

26. 52753 NE Kern Ct
Open C/O (in metal valve can, but uncapped inside can)

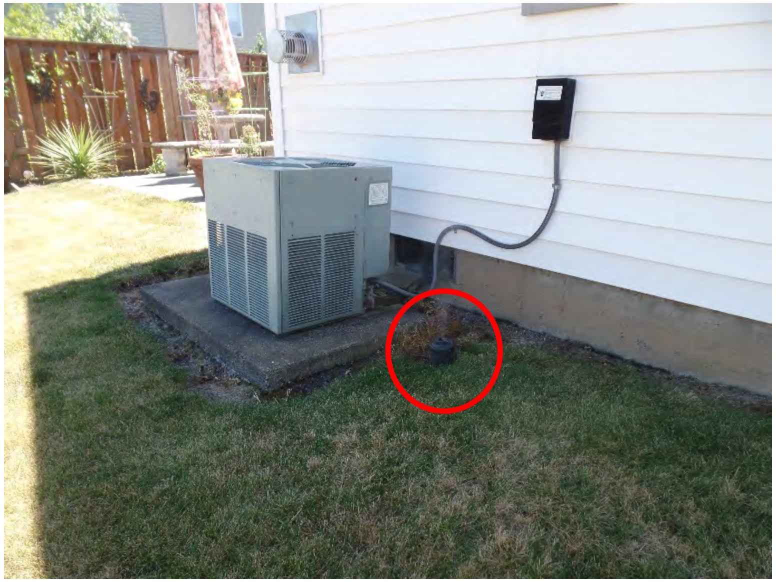
27. 33790 NE Kern Ct
Open C/O

28. MH0041

MH rim smoking (in addition to smoking from holes in lid)

29. 34371 Egret Ln
Open C/O

30. 51704 SE 4th St
Broken C/O



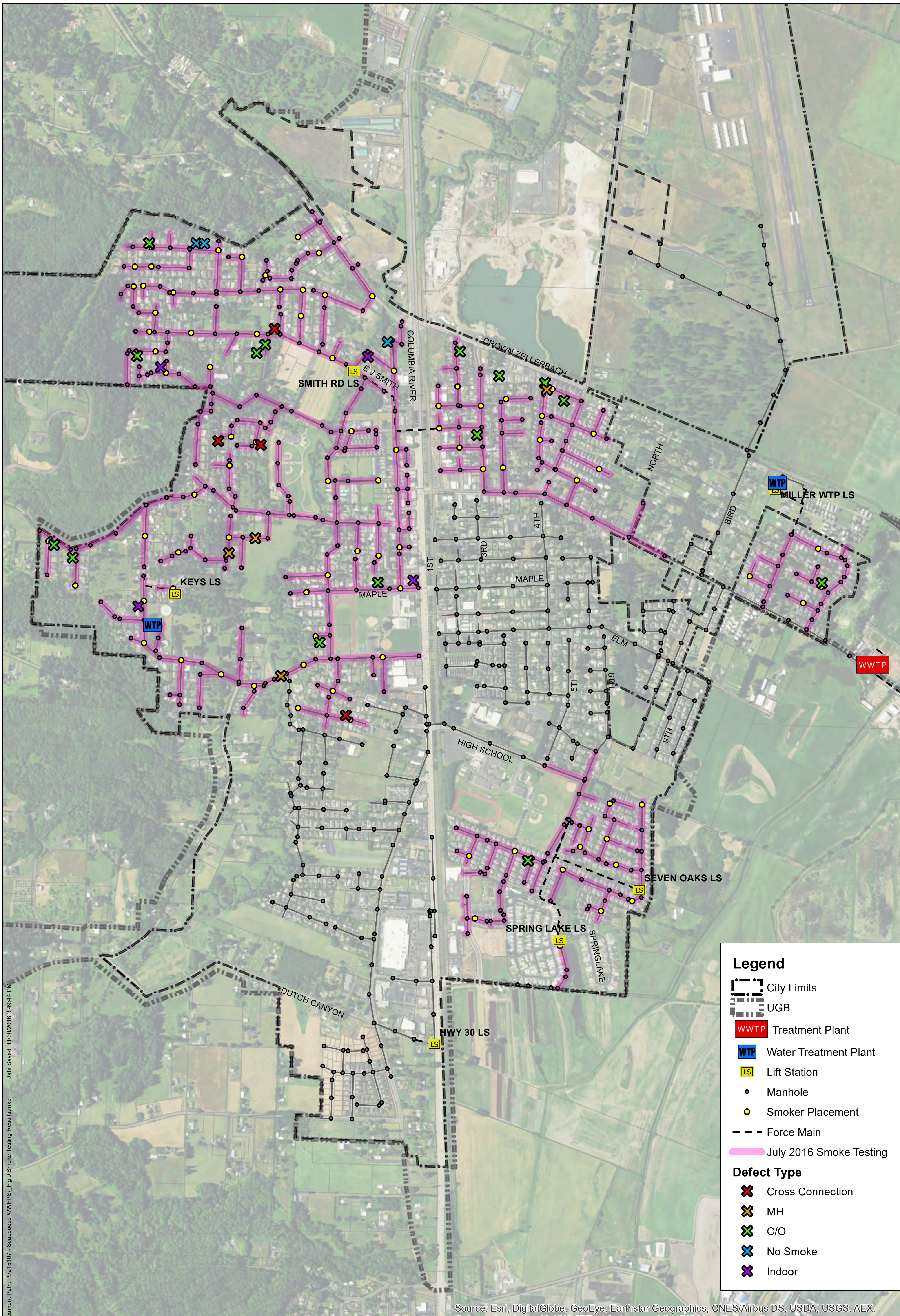


Figure:	Title:	Project:	Prepared for:
X	SMOKE TESTING Completed in 2016	WWFPS	CITY OF SCAPPOOSE, OR

N

KELLER associates

Appendix D

Model Data

Existing (2020) System

Existing (2020) System Manholes: 5-yr, 24-hr Storm Event

Inputs			Outputs					
Manhole ID	Invert Elevation (ft)	Rim Elevation (ft)	Max. Depth (ft)	Max. HGL (ft)	Freeboard (ft)	Max. Inflow (gpm)	Max. Surcharge Height Above Crown (ft)	Total Flood Vol. (MG)
AIRPORTEA_JUNC	12.00	18.50	-	15.9	-	661	3.4	0.0
CHARLES_JUNC	39.07	46.25	-	90.0	-	429	50.5	0.0
MH0018	24.82	30.70	0.3	25.1	5.6	238	0.0	0.0
MH0019	16.11	22.50	0.2	16.3	6.2	232	0.0	0.0
MH0020	17.89	23.70	0.2	18.1	5.6	232	0.0	0.0
MH0021	19.52	25.00	0.2	19.7	5.3	232	0.0	0.0
MH0022	22.11	26.20	0.2	22.3	3.9	232	0.0	0.0
MH0023	23.73	27.90	0.3	24.0	3.9	237	0.0	0.0
MH0024	29.94	36.10	0.1	30.1	6.0	48	0.0	0.0
MH0025	32.48	38.60	0.1	32.6	6.0	45	0.0	0.0
MH0026	35.05	40.22	0.1	35.2	5.1	43	0.0	0.0
MH0027	37.31	42.61	0.1	37.4	5.2	40	0.0	0.0
MH0028	30.24	36.20	0.1	30.4	5.8	83	0.0	0.0
MH0029	36.28	42.30	0.1	36.4	5.9	90	0.0	0.0
MH0030	41.45	47.50	0.2	41.6	5.9	129	0.0	0.0
MH0031	44.88	51.00	0.2	45.1	5.9	192	0.0	0.0
MH0033	45.39	53.00	0.5	45.9	7.1	423	0.0	0.0
MH0048	55.13	62.73	0.7	55.8	6.9	378	0.0	0.0
MH0049	56.35	67.27	0.5	56.8	10.5	375	0.0	0.0
MH0059	6.60	15.34	0.1	6.7	8.7	14	0.0	0.0
MH0061	7.90	15.78	0.1	8.0	7.8	11	0.0	0.0
MH0098	55.11	62.41	0.6	55.7	6.7	380	0.0	0.0
MH0099	53.89	62.35	0.4	54.3	8.0	381	0.0	0.0
MH0125	46.10	52.50	0.1	46.2	6.3	19	0.0	0.0
MH0126	46.77	55.20	0.1	46.9	8.3	16	0.0	0.0
MH0127	47.25	56.50	0.1	47.3	9.2	12	0.0	0.0
MH0128	48.42	55.60	0.1	48.5	7.1	8	0.0	0.0
MH0130	12.35	18.18	0.3	12.7	5.5	78	0.0	0.0
MH0131	12.66	20.62	0.2	12.9	7.8	75	0.0	0.0
MH0132	13.76	21.50	0.1	13.9	7.6	16	0.0	0.0
MH0133	47.73	59.93	0.9	48.6	11.3	399	0.1	0.0
MH0136	13.91	17.27	0.1	14.1	3.2	13	0.0	0.0
MH0137	14.13	17.76	0.1	14.2	3.6	10	0.0	0.0
MH0154	7.24	17.70	0.1	7.4	10.4	41	0.0	0.0
MH0173	1.34	12.70	1.4	2.7	10.0	3070	0.0	0.0
MH0182	35.42	46.90	0.2	35.6	11.3	93	0.0	0.0
MH0184	37.22	47.01	0.2	37.4	9.6	72	0.0	0.0
MH0198	54.48	65.09	0.2	54.7	10.4	77	0.0	0.0
MH0202	54.05	60.80	0.2	54.2	6.6	81	0.0	0.0
MH0203	53.47	59.50	0.2	53.7	5.8	85	0.0	0.0
MH0204	52.93	58.50	0.2	53.1	5.4	93	0.0	0.0

Existing (2020) System Manholes: 5-yr, 24-hr Storm Event

Inputs			Outputs					
Manhole ID	Invert Elevation (ft)	Rim Elevation (ft)	Max. Depth (ft)	Max. HGL (ft)	Freeboard (ft)	Max. Inflow (gpm)	Max. Surcharge Height Above Crown (ft)	Total Flood Vol. (MG)
MH0205	53.21	59.40	0.2	53.4	6.0	87	0.0	0.0
MH0206	52.53	60.07	0.2	52.7	7.3	96	0.0	0.0
MH0207	51.70	59.44	0.3	52.0	7.4	99	0.0	0.0
MH0212	15.29	22.20	0.2	15.5	6.7	238	0.0	0.0
MH0214	36.76	46.96	0.8	37.6	9.4	729	0.0	0.0
MH0215	11.48	16.84	0.3	11.8	5.0	348	0.0	0.0
MH0251	52.36	61.66	1.0	53.4	8.3	385	0.4	0.0
MH0254	49.80	57.40	0.2	50.0	7.4	113	0.0	0.0
MH0255	49.40	58.00	0.2	49.6	8.4	116	0.0	0.0
MH0256	51.14	62.00	0.2	51.3	10.7	106	0.0	0.0
MH0257	51.52	61.40	0.5	52.0	9.4	102	0.0	0.0
MH0262	49.00	61.60	1.2	50.2	11.4	393	0.5	0.0
MH0284	57.40	69.80	0.5	57.9	11.9	372	0.0	0.0
MH0285	58.36	68.49	0.5	58.8	9.7	368	0.0	0.0
MH0286	59.55	64.60	0.5	60.1	4.5	364	0.0	0.0
MH0287	60.55	63.00	0.5	61.0	2.0	358	0.0	0.0
MH0290	10.54	17.30	0.7	11.2	6.1	701	0.0	0.0
MH0291	12.19	16.50	0.5	12.7	3.8	384	0.0	0.0
MH0293	41.23	53.03	0.5	41.7	11.3	535	0.0	0.0
MH0304	45.35	56.93	0.6	45.9	11.0	402	0.0	0.0
MH0305	43.76	58.93	0.4	44.1	14.8	403	0.0	0.0
MH0306	44.24	58.93	0.5	44.8	14.2	400	0.0	0.0
MH0307	46.91	59.81	0.6	47.5	12.3	402	0.0	0.0
MH0308	47.07	59.77	0.6	47.7	12.1	403	0.0	0.0
MH0309	48.77	61.37	0.4	49.2	12.2	396	0.0	0.0
MH0310	50.47	61.37	0.4	50.9	10.5	390	0.0	0.0
MH0311	52.17	61.77	0.5	52.7	9.1	389	0.0	0.0
MH0318	44.20	51.90	0.3	44.5	7.4	161	0.0	0.0
MH0319	44.48	50.40	0.3	44.8	5.6	158	0.0	0.0
MH0320	44.85	53.00	0.3	45.2	7.8	154	0.0	0.0
MH0321	45.16	53.00	0.3	45.5	7.5	151	0.0	0.0
MH0322	45.40	51.30	0.3	45.7	5.6	148	0.0	0.0
MH0323	45.68	57.30	0.3	46.0	11.3	145	0.0	0.0
MH0324	45.80	57.80	0.3	46.1	11.7	142	0.0	0.0
MH0325	46.78	59.20	0.3	47.1	12.1	135	0.0	0.0
MH0326	47.22	58.00	0.3	47.5	10.5	130	0.0	0.0
MH0327	47.39	58.20	0.3	47.7	10.5	126	0.0	0.0
MH0328	47.73	60.90	0.3	48.0	12.9	122	0.0	0.0
MH0329	47.80	61.00	0.3	48.1	12.9	119	0.0	0.0
MH0373	41.05	56.81	0.4	41.5	15.3	418	0.0	0.0
MH0376	45.30	53.72	0.7	46.0	7.7	1648	0.0	0.0

Existing (2020) System Manholes: 5-yr, 24-hr Storm Event

Inputs			Outputs					
Manhole ID	Invert Elevation (ft)	Rim Elevation (ft)	Max. Depth (ft)	Max. HGL (ft)	Freeboard (ft)	Max. Inflow (gpm)	Max. Surcharge Height Above Crown (ft)	Total Flood Vol. (MG)
MH0393	32.07	44.96	0.8	32.9	12.0	1410	0.0	0.0
MH0395	32.47	44.63	0.9	33.3	11.3	804	0.0	0.0
MH0400	38.60	50.54	1.4	40.0	10.6	442	0.7	0.0
MH0401	37.80	48.36	0.8	38.6	9.8	445	0.0	0.0
MH0402MTR2	36.60	49.66	0.3	36.9	12.8	448	0.0	0.0
MH0421	34.22	40.38	0.9	35.1	5.3	787	0.0	0.0
MH0422	33.73	41.96	0.9	34.6	7.4	788	0.0	0.0
MH0423	32.88	39.96	0.8	33.7	6.2	800	0.0	0.0
MH0431	48.61	57.33	2.3	51.0	6.4	1637	1.0	0.0
MH0473	37.47	47.96	0.8	38.3	9.7	728	0.0	0.0
MH0474	38.50	47.96	0.3	38.8	9.2	127	0.0	0.0
MH0483	36.26	46.96	0.8	37.0	9.9	731	0.0	0.0
MH0484MTR1	35.97	42.17	0.8	36.8	5.4	733	0.0	0.0
MH0485	35.25	44.96	0.8	36.0	8.9	736	0.0	0.0
MH0486	34.80	44.96	0.8	35.6	9.4	772	0.0	0.0
MH0487	39.20	49.16	0.7	39.9	9.3	602	0.0	0.0
MH0488	38.56	48.50	0.7	39.2	9.3	604	0.0	0.0
MH0489	38.10	48.50	0.7	38.8	9.7	609	0.0	0.0
MH0506	47.46	57.10	0.7	48.2	8.9	1649	0.0	0.0
MH0507	47.87	57.17	1.4	49.3	7.9	1645	0.2	0.0
MH0510	48.24	56.83	1.9	50.2	6.6	1642	0.7	0.0
MH0513	50.55	57.97	1.1	51.7	6.3	1763	0.0	0.0
MH0514	52.19	61.43	0.8	53.0	8.5	1966	0.0	0.0
MH0525	44.12	53.30	0.7	44.8	8.5	1650	0.0	0.0
MH0526	40.43	50.20	0.5	41.0	9.2	1744	0.0	0.0
MH0530	32.47	46.37	0.7	33.2	13.2	1752	0.0	0.0
MH0533	29.26	40.00	0.6	29.8	10.2	1757	0.0	0.0
MH0534	19.11	32.37	0.6	19.7	12.7	1760	0.0	0.0
MH0536	11.19	20.49	0.6	11.8	8.7	1763	0.0	0.0
MH0537MTR5	2.69	15.50	1.2	3.9	11.6	2122	0.0	0.0
MH0549	30.96	41.05	0.1	31.0	10.0	23	0.0	0.0
MH0561	14.01	22.83	0.1	14.1	8.8	5	0.0	0.0
MH0565	20.91	30.81	0.1	21.0	9.8	30	0.0	0.0
MH0566	18.40	30.50	0.1	18.5	12.0	34	0.0	0.0
MH0567	10.03	19.96	0.1	10.1	9.8	38	0.0	0.0
MH0568	5.24	16.66	0.7	5.9	10.7	722	0.0	0.0
MH0569	5.04	15.78	0.7	5.8	10.0	736	0.0	0.0
MH0570	6.33	16.71	0.8	7.1	9.6	703	0.0	0.0
MH0571	7.16	16.71	0.8	7.9	8.8	708	0.0	0.0
MH0572	4.11	15.92	0.7	4.9	11.1	743	0.0	0.0
MH0573	3.68	13.48	0.7	4.4	9.1	745	0.0	0.0

Existing (2020) System Manholes: 5-yr, 24-hr Storm Event

Inputs			Outputs					
Manhole ID	Invert Elevation (ft)	Rim Elevation (ft)	Max. Depth (ft)	Max. HGL (ft)	Freeboard (ft)	Max. Inflow (gpm)	Max. Surcharge Height Above Crown (ft)	Total Flood Vol. (MG)
MH0574	2.41	14.50	1.3	3.7	10.8	2847	0.0	0.0
MH0575MTR4	4.64	15.60	0.8	5.4	10.2	739	0.0	0.0
MH0576	3.26	11.86	0.8	4.0	7.8	748	0.0	0.0
MH0577	1.89	14.17	1.4	3.3	10.9	3044	0.0	0.0
MH0578	1.05	12.34	1.4	2.4	9.9	3079	0.0	0.0
MH0579	0.77	13.82	1.3	2.0	11.8	3095	0.0	0.0
MH0580	0.19	12.82	1.1	1.3	11.5	3096	0.0	0.0
MH0581	1.58	14.95	1.4	3.0	12.0	3055	0.0	0.0
MH0591	39.31	52.41	0.3	39.6	12.8	425	0.0	0.0
MH0594	46.00	57.96	0.0	46.0	11.9	3	0.0	0.0
MH0595	45.46	58.02	0.1	45.5	12.5	8	0.0	0.0
MH0597	43.86	54.12	0.1	43.9	10.2	12	0.0	0.0
MH0598	39.79	50.94	0.7	40.5	10.5	598	0.0	0.0
MH0603	40.70	52.00	0.7	41.4	10.6	585	0.0	0.0
MH0604	41.61	53.03	0.8	42.4	10.7	532	0.0	0.0
MH0605	42.05	53.03	0.3	42.4	10.7	24	0.0	0.0
MH0606	42.11	52.71	0.8	42.9	9.8	519	0.0	0.0
MH0607	42.57	52.83	0.6	43.2	9.7	516	0.0	0.0
MH0608	43.08	51.78	0.6	43.7	8.1	513	0.0	0.0
MH0609	43.25	53.73	0.1	43.3	10.4	7	0.0	0.0
MH0610	43.61	56.03	0.0	43.7	12.4	3	0.0	0.0
MH0614	43.20	51.20	0.6	43.8	7.4	354	0.0	0.0
MH0615	44.20	52.70	0.3	44.5	8.2	351	0.0	0.0
MH0616	45.12	52.60	0.5	45.6	7.0	349	0.0	0.0
MH0634	26.77	39.43	0.4	27.1	12.3	427	0.0	0.0
MH0635	8.00	15.71	0.7	8.7	7.0	667	0.0	0.0
MH0636	8.85	20.71	0.8	9.6	11.1	667	0.0	0.0
MH0637MTR3	9.45	20.49	0.7	10.2	10.3	680	0.0	0.0
MH0638	10.49	17.78	0.7	11.2	6.6	680	0.0	0.0
MH0639	12.85	21.91	0.1	12.9	9.0	11	0.0	0.0
MH0640	13.11	21.91	0.1	13.2	8.7	9	0.0	0.0
MH0642	16.30	22.79	0.4	16.7	6.1	432	0.0	0.0
MH0643	19.43	30.44	0.4	19.9	10.6	430	0.0	0.0
MH0663	10.88	18.50	0.5	11.4	7.1	360	0.0	0.0
MH0664	12.91	20.20	0.3	13.2	7.0	237	0.0	0.0
MH0665	8.24	19.00	0.2	8.5	10.5	367	0.0	0.0
MH0674	10.58	18.50	0.3	10.9	7.6	364	0.0	0.0
MH1	51.21	57.72	0.1	51.3	6.5	5	0.0	0.0
MH2	50.99	57.12	0.1	51.0	6.1	8	0.0	0.0
MH3	49.44	56.96	0.1	49.5	7.4	16	0.0	0.0
MH4	47.81	56.65	0.1	47.9	8.7	21	0.0	0.0

Existing (2020) System Manholes: 5-yr, 24-hr Storm Event

Inputs			Outputs					
Manhole ID	Invert Elevation (ft)	Rim Elevation (ft)	Max. Depth (ft)	Max. HGL (ft)	Freeboard (ft)	Max. Inflow (gpm)	Max. Surcharge Height Above Crown (ft)	Total Flood Vol. (MG)
MH5	46.33	54.25	0.1	46.4	7.8	27	0.0	0.0
MH6	44.04	52.07	0.1	44.2	7.9	30	0.0	0.0
MH7	42.58	50.51	0.1	42.7	7.8	32	0.0	0.0
MH8	41.12	46.05	0.1	41.3	4.8	35	0.0	0.0
MH9	39.31	43.98	0.1	39.4	4.5	37	0.0	0.0
MILLER_WTP_INFL	6.28	10.40	0.6	6.9	3.5	148	0.0	0.0
MMH0001	4.99	15.00	0.0	5.0	10.0	4	0.0	0.0
MMH0003	54.83	63.00	0.2	55.0	8.0	72	0.0	0.0
MMH0004	48.94	56.60	0.0	49.0	7.6	4	0.0	0.0
NODE451	32.00	45.00	-	187.9	-	2203	154.9	0.0
NODE452	33.93	52.93	-	68.5	-	153	34.1	0.0
NODE455	8.91	13.91	-	83.2	-	153	73.9	0.0
NODE456	8.00	18.40	-	46.5	-	463	38.2	0.0
NODE461	54.33	67.50	0.3	54.6	12.9	329	0.0	0.0
NODE462	54.96	69.50	0.3	55.2	14.3	327	0.0	0.0
NODE463	89.83	105.50	0.2	90.0	15.5	324	0.0	0.0
NODE464	124.48	153.50	0.2	124.7	28.8	320	0.0	0.0
NODE465	153.99	177.50	0.2	154.2	23.3	317	0.0	0.0
NODE466	176.97	184.00	0.2	177.2	6.8	313	0.0	0.0
NODE467	178.05	192.00	0.4	178.4	13.6	305	0.0	0.0
NODE468	179.87	194.00	0.4	180.2	13.8	302	0.0	0.0
NODE469	181.77	192.00	0.3	182.1	9.9	266	0.0	0.0
NODE471	3.74	12.63	0.4	4.2	8.5	208	0.0	0.0
NODE472	4.49	13.51	0.4	4.9	8.6	196	0.0	0.0
NODE473	5.51	13.01	0.4	5.9	7.1	182	0.0	0.0
NODE474	6.21	13.26	0.4	6.6	6.7	166	0.0	0.0

Existing (2020) System Pipes: 5-yr, 24-hr Storm Event

Inputs						Outputs					
Pipe ID	Length (ft)	Manning's N	US Invert (ft)	DS Invert (ft)	Diameter (ft)	Full Flow (gpm)	Slope (%)	Max. Flow (gpm)	Max. Velocity (ft/s)	Max.Flow/Full Flow	Max.Depth/Full Depth
FM_AIRPORTEA	500.0	-	12.00	15.50	0.50	327.0	0.70	2.8	0.06	0.01	0.54
FM_CHARLES	1915.0	-	39.07	47.30	0.50	251.3	0.43	420.6	4.83	1.67	0.96
GM0048	201.2	0.011	6.60	5.80	1.25	2160.6	0.40	13.9	1.17	0.01	0.06
GM0050	292.2	0.011	7.90	6.60	0.83	774.3	0.45	11.0	1.08	0.01	0.09
GM00554	180.5	0.014	37.80	36.70	0.67	393.7	0.61	445.2	3.12	1.13	0.85
GM0057	367.1	0.01	30.24	25.28	0.67	819.6	1.35	75.8	3.27	0.09	0.21
GM0058	449.8	0.013	29.94	25.49	0.83	978.1	0.99	47.9	2.07	0.05	0.15
GM0059	241.0	0.013	32.48	30.09	0.83	979.3	0.99	45.3	2.04	0.05	0.15
GM0060	255.4	0.013	24.82	23.93	1.50	2783.3	0.35	234.0	2.25	0.08	0.19
GM0061	390.0	0.013	23.73	22.36	1.50	2794.4	0.35	229.5	2.24	0.08	0.19
GM0062	331.9	0.011	22.11	19.77	2.50	18269.0	0.71	229.8	2.86	0.01	0.08
GM0063	375.2	0.011	19.52	18.09	2.50	13432.8	0.38	229.3	2.31	0.02	0.09
GM0064	374.5	0.011	17.89	16.16	1.75	5712.6	0.46	229.8	2.59	0.04	0.14
GM0065	235.0	0.013	35.05	32.58	0.83	1008.2	1.05	42.7	2.05	0.04	0.14
GM0066	235.2	0.013	37.31	35.15	0.83	942.4	0.92	40.1	1.91	0.04	0.14
GM0067	379.9	0.01	36.28	30.39	0.67	878.0	1.55	80.2	3.49	0.09	0.20
GM0068	501.2	0.01	41.45	36.48	0.67	702.2	0.99	87.7	3.06	0.13	0.24
GM0069	324.7	0.01	44.88	41.65	0.67	703.2	1.00	126.9	3.41	0.18	0.29
GM0071	258.4	0.01	45.39	45.03	0.67	263.2	0.14	189.0	2.10	0.72	0.58
GM0140	76.0	0.011	48.94	48.62	0.83	753.3	0.42	4.0	0.87	0.01	0.05
GM0141	242.3	0.011	48.42	47.45	0.83	734.6	0.40	8.1	1.05	0.01	0.07
GM0142	65.0	0.011	47.25	46.97	0.83	762.3	0.43	12.3	1.20	0.02	0.09
GM0143	33.1	0.011	46.10	45.97	0.83	727.3	0.39	18.7	1.33	0.03	0.11
GM0144	118.6	0.011	46.77	46.50	0.83	554.0	0.23	15.9	1.10	0.03	0.11
GM0161	23.0	0.011	14.13	14.01	0.83	838.2	0.52	9.5	1.17	0.01	0.07
GM0162	104.0	0.011	13.91	13.86	0.83	254.6	0.05	13.2	0.71	0.05	0.13
GM0163	400.0	0.011	13.76	12.76	0.83	580.5	0.25	15.9	1.04	0.03	0.12
GM0164	79.2	0.011	12.66	12.46	0.83	583.5	0.25	75.8	1.79	0.13	0.24
GM0165	20.0	0.012	12.35	12.30	0.83	532.1	0.25	90.9	1.84	0.17	0.40
GM01_AIRPARK	379.0	0.013	51.21	49.64	0.83	632.9	0.41	5.5	0.87	0.01	0.06
GM0224	362.6	0.011	35.42	33.93	0.83	744.2	0.41	92.1	2.09	0.12	0.24
GM0225	405.3	0.011	37.22	35.62	0.83	729.5	0.40	69.8	1.91	0.10	0.21
GM0237	71.1	0.011	51.70	51.52	1.00	950.9	0.25	99.3	0.69	0.10	0.43
GM0238	290.2	0.011	52.53	51.80	1.00	947.8	0.25	96.4	1.59	0.10	0.23
GM0239	118.2	0.011	52.93	52.63	1.00	952.1	0.25	93.3	1.85	0.10	0.20
GM0241	71.2	0.011	53.21	53.03	1.00	950.1	0.25	87.1	1.83	0.09	0.19
GM0242	62.0	0.011	53.47	53.31	1.00	960.2	0.26	84.6	1.83	0.09	0.19
GM0243	175.4	0.011	54.05	53.57	1.00	988.5	0.27	81.4	1.80	0.08	0.19
GM0244	170.8	0.011	54.48	54.05	1.00	948.3	0.25	76.8	1.59	0.08	0.20
GM0245	126.8	0.011	54.83	54.51	1.00	949.6	0.25	72.0	1.71	0.08	0.18
GM0276	206.3	0.013	36.76	36.36	1.00	704.1	0.19	728.3	2.61	1.03	0.74
GM02_AIRPARK	27.4	0.013	50.99	50.72	0.67	538.4	0.99	7.9	1.24	0.02	0.09
GM0374	120.3	0.011	51.84	51.34	1.00	1218.3	0.42	102.5	2.10	0.08	0.20
GM0375	228.4	0.011	51.14	50.00	1.00	1335.1	0.50	106.4	2.27	0.08	0.19
GM0376	155.3	0.011	49.40	48.75	1.00	1222.7	0.42	116.0	2.19	0.10	0.21
GM0377	49.0	0.011	49.80	49.60	1.00	1207.0	0.41	112.7	2.15	0.09	0.21
GM03_AIRPARK	303.0	0.013	49.44	48.01	0.83	675.6	0.47	16.0	1.22	0.02	0.10

Existing (2020) System Pipes: 5-yr, 24-hr Storm Event

Inputs						Outputs					
Pipe ID	Length (ft)	Manning's N	US Invert (ft)	DS Invert (ft)	Diameter (ft)	Full Flow (gpm)	Slope (%)	Max. Flow (gpm)	Max. Velocity (ft/s)	Max.Flow/Full Flow	Max.Depth/Full Depth
GM0409	250.0	0.011	60.55	59.55	0.67	405.9	0.40	358.6	3.05	0.88	0.76
GM0410	272.7	0.011	59.55	58.53	0.67	392.6	0.37	362.3	3.04	0.92	0.71
GM0411	354.2	0.011	58.36	57.40	0.83	604.4	0.27	367.9	2.62	0.61	0.56
GM0412	358.3	0.011	57.40	56.35	0.83	628.4	0.29	372.0	2.72	0.59	0.55
GM0413	63.8	0.011	55.25	55.20	0.83	325.1	0.08	376.5	2.28	1.16	0.67
GM0414	312.3	0.011	56.35	55.35	0.83	657.0	0.32	374.5	2.71	0.57	0.57
GM0417	329.7	0.011	12.19	11.54	1.00	839.2	0.20	344.6	2.49	0.41	0.42
GM0418	179.1	0.011	11.48	10.54	1.00	1369.3	0.53	343.4	2.35	0.25	0.50
GM0419	21.4	0.013	10.54	10.49	1.00	773.5	0.23	677.2	2.78	0.88	0.67
GM0446	88.8	0.011	44.24	43.86	0.67	419.8	0.43	400.1	3.32	0.95	0.72
GM0447	254.5	0.011	45.35	44.34	0.67	404.4	0.40	397.0	3.14	0.98	0.75
GM0448	362.8	0.011	46.91	45.45	0.67	407.2	0.40	398.9	3.13	0.98	0.76
GM0449	49.7	0.011	47.07	46.93	0.67	340.7	0.28	399.6	2.93	1.17	0.85
GM0450	155.7	0.011	48.77	47.83	0.67	498.7	0.60	396.0	3.33	0.79	0.84
GM0451	203.5	0.011	49.00	48.87	0.67	162.2	0.06	392.9	2.82	2.42	0.83
GM0452	197.3	0.011	50.47	49.00	0.67	554.1	0.75	389.2	2.85	0.70	0.81
GM0453	400.5	0.011	52.17	50.57	0.67	405.7	0.40	384.7	3.11	0.95	0.74
GM0454	162.4	0.011	52.36	52.27	0.67	151.1	0.06	385.3	2.77	2.55	0.83
GM0455	300.0	0.011	55.19	53.99	0.67	405.9	0.40	378.5	3.12	0.93	0.72
GM0456	242.5	0.011	53.89	52.36	0.67	509.8	0.63	381.3	2.76	0.75	0.82
GM0466	96.5	0.013	44.20	43.99	1.00	746.0	0.22	161.1	1.95	0.22	0.28
GM0467	126.2	0.013	44.48	44.20	1.00	753.2	0.22	158.1	1.65	0.21	0.32
GM0468	166.3	0.013	44.85	44.48	1.00	754.4	0.22	154.2	1.67	0.20	0.31
GM0469	136.4	0.013	45.16	44.85	1.00	762.4	0.23	151.3	1.67	0.20	0.30
GM0470	104.0	0.013	45.40	45.16	1.00	768.2	0.23	148.1	1.67	0.19	0.30
GM0471	126.2	0.013	45.68	45.40	1.00	753.2	0.22	145.4	1.65	0.19	0.30
GM0472	53.7	0.013	45.80	45.68	1.00	756.3	0.22	142.4	1.63	0.19	0.30
GM0473	402.8	0.011	46.78	45.90	1.00	883.4	0.22	134.6	1.95	0.15	0.25
GM0474	195.6	0.011	47.22	46.78	1.00	896.3	0.23	129.5	1.72	0.15	0.27
GM0475	84.9	0.011	47.39	47.22	1.00	845.9	0.20	126.2	1.74	0.15	0.26
GM0476	153.1	0.011	47.73	47.39	1.00	890.6	0.22	122.0	1.71	0.14	0.26
GM0477	29.9	0.013	47.80	47.73	1.00	774.1	0.23	118.6	1.67	0.15	0.26
GM04_AIRPARK	284.0	0.013	47.81	46.53	0.83	660.2	0.45	21.3	1.30	0.03	0.12
GM0503	65.8	0.012	0.10	0.00	1.50	2745.6	0.29	3096.0	5.05	1.13	0.72
GM0531	185.0	0.012	43.76	41.12	0.67	702.9	1.43	403.4	4.62	0.57	0.55
GM0553	187.9	0.013	38.60	37.90	0.67	331.1	0.37	442.9	3.02	1.34	1.00
GM0555	100.0	0.015	36.60	32.40	0.83	1745.5	4.20	448.3	4.56	0.26	0.48
GM0556	178.0	0.013	32.47	32.07	1.00	758.0	0.23	804.0	2.50	1.06	0.86
GM0563	225.0	0.013	34.22	33.73	1.00	746.2	0.22	785.6	2.41	1.05	0.87
GM0564	348.0	0.013	33.73	32.96	1.00	752.2	0.22	787.9	2.56	1.05	0.82
GM0565	143.0	0.013	32.88	32.57	1.00	744.5	0.22	799.1	2.63	1.07	0.81
GM05_AIRPARK	464.0	0.013	46.33	44.24	0.83	660.0	0.45	26.5	1.38	0.04	0.13
GM0640	176.4	0.013	38.50	37.80	0.67	341.7	0.40	127.2	2.11	0.37	0.58
GM0646	213.4	0.013	34.80	34.22	1.00	833.6	0.27	771.7	2.51	0.93	0.82
GM0647	158.5	0.013	35.25	34.90	1.00	751.4	0.22	735.6	2.70	0.98	0.72
GM0648	282.0	0.013	35.97	35.35	1.00	749.8	0.22	733.2	2.60	0.98	0.75
GM0649	83.7	0.013	36.26	36.07	1.00	761.8	0.23	730.8	2.64	0.96	0.73

Existing (2020) System Pipes: 5-yr, 24-hr Storm Event

Inputs						Outputs					
Pipe ID	Length (ft)	Manning's N	US Invert (ft)	DS Invert (ft)	Diameter (ft)	Full Flow (gpm)	Slope (%)	Max. Flow (gpm)	Max. Velocity (ft/s)	Max.Flow/Full Flow	Max.Depth/Full Depth
GM0650	303.8	0.013	37.47	36.86	1.00	716.6	0.20	725.9	2.46	1.01	0.78
GM0652	282.4	0.013	38.10	37.47	1.00	755.3	0.22	608.6	2.13	0.81	0.76
GM0653	166.6	0.013	38.56	38.20	1.00	743.3	0.22	604.4	2.57	0.81	0.63
GM0654	251.7	0.013	39.20	38.66	1.00	740.7	0.22	601.4	2.51	0.81	0.64
GM0675	276.2	0.013	50.55	48.71	1.25	2366.6	0.67	1625.2	3.34	0.69	0.94
GM0676	238.9	0.013	52.19	50.55	1.25	2402.4	0.69	1657.6	4.63	0.69	0.74
GM0678	239.9	0.013	48.61	48.24	1.25	1138.6	0.15	1637.6	2.97	1.44	1.00
GM0682	268.3	0.013	48.24	47.87	1.25	1076.7	0.14	1641.3	2.98	1.52	1.00
GM0686	276.3	0.013	47.87	47.46	1.25	1116.9	0.15	1645.9	3.58	1.47	0.78
GM0687	241.6	0.013	47.46	45.30	1.25	2741.8	0.89	1645.4	5.14	0.60	0.56
GM06_AIRPARK	280.0	0.013	44.04	42.78	0.83	659.7	0.45	29.7	1.43	0.05	0.14
GM0708	506.4	0.013	11.19	3.29	1.25	3621.6	1.56	1763.0	6.53	0.49	0.49
GM0709	486.5	0.013	19.11	11.19	1.25	3699.6	1.63	1760.3	6.58	0.48	0.49
GM0710	528.4	0.013	29.26	19.11	1.25	4018.7	1.92	1756.7	6.83	0.44	0.47
GM0711	349.2	0.013	32.47	29.26	1.25	2780.1	0.92	1751.5	5.94	0.63	0.53
GM0712	298.9	0.013	40.43	32.47	1.25	4732.5	2.66	1743.5	6.23	0.37	0.51
GM0713	353.6	0.013	44.12	40.80	1.25	2809.4	0.94	1649.5	5.30	0.59	0.55
GM0714	140.8	0.013	45.30	44.12	1.25	2654.8	0.84	1647.4	5.18	0.62	0.56
GM0724	494.5	0.013	30.96	20.91	0.83	1400.6	2.03	23.0	1.92	0.02	0.10
GM0725	149.8	0.013	20.91	18.40	0.83	1271.7	1.68	29.6	2.11	0.02	0.11
GM0726	452.8	0.013	18.40	10.03	0.83	1335.7	1.85	33.5	1.97	0.03	0.12
GM0727	320.1	0.013	10.03	7.30	0.83	907.3	0.85	37.5	1.83	0.04	0.14
GM0728	130.7	0.013	7.24	5.65	0.83	1083.4	1.22	40.6	2.08	0.04	0.22
GM0729	66.1	0.013	5.24	5.14	1.25	1127.7	0.15	721.6	2.44	0.64	0.53
GM0730	280.4	0.013	4.64	4.22	1.25	1122.1	0.15	736.4	2.35	0.66	0.56
GM0731	222.6	0.013	4.11	3.78	1.25	1116.4	0.15	742.1	2.37	0.67	0.56
GM0732	277.7	0.013	3.68	3.26	1.25	1127.6	0.15	743.4	2.17	0.66	0.60
GM0733	285.5	0.013	3.26	2.83	1.25	1125.2	0.15	744.5	2.02	0.66	0.66
GM0734	536.5	0.013	2.41	1.99	2.50	5151.1	0.08	2841.3	2.44	0.55	0.52
GM0735	299.7	0.013	2.69	2.51	2.50	4511.6	0.06	2125.3	2.06	0.47	0.49
GM0747	380.5	0.013	7.16	6.33	1.00	746.9	0.22	699.3	2.39	0.94	0.79
GM0748	382.4	0.013	6.33	5.49	1.00	749.4	0.22	688.1	2.73	0.92	0.67
GM0752	268.4	0.013	5.04	4.64	1.25	1119.2	0.15	735.4	2.15	0.66	0.60
GM0757	350.0	0.013	1.05	0.87	2.50	4174.9	0.05	3078.5	2.70	0.74	0.51
GM0758	261.6	0.013	1.34	1.15	2.50	4961.0	0.07	3068.5	2.58	0.62	0.53
GM0759	248.7	0.013	1.58	1.44	2.50	4368.4	0.06	3053.4	2.60	0.70	0.53
GM0760	349.9	0.013	1.89	1.68	2.50	4510.2	0.06	3042.5	2.55	0.68	0.53
GM0761	268.0	0.013	0.77	0.61	2.50	4498.2	0.06	3093.3	3.43	0.69	0.43
GM0778	180.5	0.013	42.11	42.05	1.00	291.6	0.03	518.8	2.18	1.78	0.64
GM0779	85.7	0.013	42.05	41.81	0.83	519.9	0.28	16.9	0.85	0.03	0.53
GM0782	119.5	0.013	43.61	43.25	0.83	539.2	0.30	3.0	0.61	0.01	0.08
GM0783	426.7	0.013	43.25	42.15	0.83	498.8	0.26	9.2	0.79	0.02	0.18
GM0785	129.7	0.013	41.23	40.70	1.00	1022.1	0.41	534.9	2.48	0.52	0.59
GM0786	283.9	0.013	41.61	41.23	1.00	585.1	0.13	531.9	2.24	0.91	0.64
GM0787	413.8	0.013	40.70	39.79	1.00	749.9	0.22	584.4	2.31	0.78	0.67
GM0792	186.2	0.013	39.79	39.38	1.00	750.5	0.22	597.6	2.69	0.80	0.60
GM0793	126.8	0.013	41.05	39.80	0.67	539.2	0.99	417.5	3.80	0.77	0.66

Existing (2020) System Pipes: 5-yr, 24-hr Storm Event

Inputs						Outputs					
Pipe ID	Length (ft)	Manning's N	US Invert (ft)	DS Invert (ft)	Diameter (ft)	Full Flow (gpm)	Slope (%)	Max. Flow (gpm)	Max. Velocity (ft/s)	Max.Flow/Full Flow	Max.Depth/Full Depth
GM0798	131.8	0.013	46.00	45.46	0.83	628.7	0.41	3.4	0.67	0.01	0.07
GM0799	402.4	0.013	45.46	43.86	0.83	619.4	0.40	7.5	0.87	0.01	0.08
GM07_AIRPARK	280.0	0.013	42.58	41.32	0.83	659.7	0.45	32.3	1.47	0.05	0.15
GM0800	341.4	0.013	43.86	40.11	0.83	1030.7	1.10	12.0	1.29	0.01	0.25
GM0805	113.7	0.013	45.12	44.60	0.67	367.3	0.46	348.5	2.95	0.95	0.71
GM0806	91.5	0.015	44.20	43.20	1.00	1448.9	1.09	351.1	2.26	0.24	0.45
GM0807	80.0	0.013	43.20	43.08	1.00	619.4	0.15	353.6	1.65	0.57	0.59
GM0808	229.8	0.013	43.08	42.57	1.00	753.3	0.22	513.2	2.29	0.68	0.61
GM0809	160.4	0.013	42.57	42.21	1.00	757.7	0.23	515.5	2.06	0.68	0.67
GM0823	438.8	0.013	26.77	19.58	0.67	695.3	1.64	427.0	4.66	0.61	0.57
GM0824	277.6	0.013	19.43	16.65	0.67	543.5	1.00	429.2	3.84	0.79	0.67
GM0825	512.2	0.013	16.30	10.54	0.67	575.9	1.13	431.8	3.36	0.75	0.82
GM0829	232.8	0.013	14.01	13.11	0.83	610.8	0.39	5.5	0.65	0.01	0.08
GM0830	63.9	0.013	13.11	12.85	0.83	626.7	0.41	8.6	0.95	0.01	0.08
GM0831	240.5	0.013	12.85	10.28	0.83	1015.5	1.07	11.3	1.38	0.01	0.07
GM0832	359.7	0.013	10.49	9.45	1.00	859.8	0.29	666.7	2.57	0.78	0.70
GM0833	230.1	0.013	9.45	8.95	1.00	745.4	0.22	663.9	2.55	0.89	0.70
GM0836	335.2	0.013	8.85	8.10	1.00	756.4	0.22	664.8	2.61	0.88	0.69
GM0837	381.1	0.013	8.00	7.16	1.00	750.7	0.22	662.0	2.40	0.88	0.75
GM0838	475.2	0.013	39.31	26.93	0.67	876.7	2.61	424.5	5.54	0.48	0.49
GM0848	69.2	0.011	16.11	15.64	1.75	6928.7	0.68	232.3	2.97	0.03	0.13
GM0849	236.1	0.011	47.73	47.17	0.67	312.6	0.24	399.8	2.83	1.28	0.87
GM0878	111.2	0.011	4.99	4.40	1.00	1376.8	0.53	3.6	0.90	0.00	0.25
GM0880	483.8	0.011	15.29	13.06	1.75	5706.5	0.46	234.7	2.60	0.04	0.14
GM0881	526.8	0.011	12.91	10.88	1.75	5217.6	0.39	236.4	1.50	0.05	0.21
GM0882	53.8	0.011	8.24	7.86	2.50	18287.1	0.71	366.5	3.31	0.02	0.10
GM0883	265.8	0.011	10.88	10.68	1.75	2305.4	0.08	358.8	1.93	0.16	0.23
GM0893	502.7	0.011	10.58	8.44	2.50	14195.7	0.43	363.9	2.74	0.03	0.11
GM08_AIRPARK	358.0	0.013	41.12	39.51	0.83	659.5	0.45	34.9	1.50	0.05	0.15
GM09_AIRPARK	360.0	0.013	39.31	37.46	0.83	705.0	0.51	37.5	1.58	0.05	0.15
LINK295_SMITHLS	1529.8	-	32.00	52.19	1.00	2773.0	1.32	1961.9	6.40	0.71	0.88
LINK298	28.9	0.014	32.07	32.00	1.17	1102.9	0.24	1409.6	4.09	1.28	0.68
LINK300_HWY30_F	256.5	-	33.93	60.55	0.50	755.4	10.43	156.5	2.45	0.21	0.99
LINK303	1563.3	-	8.91	12.50	0.33	62.7	0.23	157.3	4.06	2.51	1.00
LINK306	1726.0	-	8.00	15.50	0.33	88.4	0.44	149.3	3.86	1.69	0.96
LINK307	24.5	0.014	185.00	181.77	0.27	166.2	13.28	263.3	10.18	1.58	1.00
LINK308	142.4	0.014	181.77	179.87	0.67	582.5	1.33	265.8	3.35	0.46	0.50
LINK309	159.1	0.014	179.87	178.05	0.67	539.4	1.14	301.8	3.41	0.56	0.55
LINK310	94.1	0.014	178.05	176.97	0.67	540.4	1.15	304.7	4.59	0.56	0.44
LINK311	264.9	0.014	176.97	154.40	0.67	1474.6	8.55	312.1	7.45	0.21	0.31
LINK312	252.0	0.014	153.99	124.48	0.67	1731.9	11.79	316.7	8.43	0.18	0.29
LINK313	271.7	0.014	124.48	89.83	0.67	1808.4	12.86	319.9	8.79	0.18	0.28
LINK314	233.7	0.014	89.83	56.00	0.67	1929.0	14.63	323.2	9.11	0.17	0.28
LINK315	21.5	0.014	54.96	54.33	0.67	862.6	2.93	326.6	4.99	0.38	0.44
LINK316	323.1	0.014	54.33	45.97	0.67	811.3	2.59	328.8	4.90	0.41	0.44
LINK317	268.8	0.014	6.28	6.21	0.67	81.4	0.03	148.4	1.26	1.82	0.73
LINK318	146.6	0.014	6.21	5.63	0.67	317.2	0.40	165.6	2.23	0.52	0.48

Existing (2020) System Pipes: 5-yr, 24-hr Storm Event

Inputs						Outputs					
Pipe ID	Length (ft)	Manning's N	US Invert (ft)	DS Invert (ft)	Diameter (ft)	Full Flow (gpm)	Slope (%)	Max. Flow (gpm)	Max. Velocity (ft/s)	Max.Flow/Full Flow	Max.Depth/Full Depth
LINK319	264.0	0.014	5.51	4.59	0.67	297.7	0.35	182.2	2.12	0.61	0.55
LINK320	202.0	0.014	4.49	3.84	0.67	286.1	0.32	195.7	2.13	0.68	0.57
LINK321	64.7	0.014	3.74	3.54	0.67	280.3	0.31	208.0	2.33	0.74	0.55

Future (2040) System

Future (2040) System Manholes: 5-yr, 24-hr Storm Event

Inputs			Outputs					
Manhole ID	Invert Elevation (ft)	Rim Elevation (ft)	Max. Depth (ft)	Max. HGL (ft)	Freeboard (ft)	Max. Inflow (gpm)	Max. Surcharge Height Above Crown (ft)	Total Flood Vol. (MG)
AIRPORTEA_JUNC	12.00	18.50	-	56.4	-	661	43.9	0.0
CHARLES_JUNC	39.07	46.25	-	259.9	-	429	220.3	0.0
MH0018	24.82	30.70	0.5	25.4	5.3	736	0.0	0.0
MH0019	16.11	22.50	0.4	16.5	6.0	746	0.0	0.0
MH0020	17.89	23.70	0.4	18.3	5.4	744	0.0	0.0
MH0021	19.52	25.00	0.4	19.9	5.1	742	0.0	0.0
MH0022	22.11	26.20	0.3	22.5	3.7	739	0.0	0.0
MH0023	23.73	27.90	0.5	24.3	3.6	738	0.0	0.0
MH0024	29.94	36.10	0.2	30.2	5.9	173	0.0	0.0
MH0025	32.48	38.60	0.2	32.7	5.9	170	0.0	0.0
MH0026	35.05	40.22	0.2	35.3	4.9	168	0.0	0.0
MH0027	37.31	42.61	0.2	37.5	5.1	99	0.0	0.0
MH0028	30.24	36.20	0.3	30.6	5.6	442	0.0	0.0
MH0029	36.28	42.30	0.3	36.6	5.7	439	0.0	0.0
MH0030	41.45	47.50	0.4	41.8	5.7	436	0.0	0.0
MH0031	44.88	51.00	0.4	45.3	5.7	434	0.0	0.0
MH0033	45.39	53.00	1.1	46.5	6.5	431	0.0	0.0
MH0048	55.13	62.73	0.7	55.8	6.9	378	0.0	0.0
MH0049	56.35	67.27	0.5	56.8	10.5	375	0.0	0.0
MH0059	6.60	15.34	0.1	6.7	8.7	14	0.0	0.0
MH0061	7.90	15.78	0.1	8.0	7.8	11	0.0	0.0
MH0098	55.11	62.41	0.6	55.7	6.7	381	0.0	0.0
MH0099	53.89	62.35	0.4	54.3	8.0	387	0.0	0.0
MH0125	46.10	52.50	0.2	46.3	6.2	64	0.0	0.0
MH0126	46.77	55.20	0.2	47.0	8.2	61	0.0	0.0
MH0127	47.25	56.50	0.2	47.4	9.1	57	0.0	0.0
MH0128	48.42	55.60	0.2	48.6	7.0	53	0.0	0.0
MH0130	12.35	18.18	0.3	12.7	5.5	79	0.0	0.0
MH0131	12.66	20.62	0.2	12.9	7.8	75	0.0	0.0
MH0132	13.76	21.50	0.1	13.9	7.6	16	0.0	0.0
MH0133	47.73	59.93	0.9	48.6	11.3	409	0.1	0.0
MH0136	13.91	17.27	0.1	14.1	3.2	13	0.0	0.0
MH0137	14.13	17.76	0.1	14.2	3.6	10	0.0	0.0
MH0154	7.24	17.70	0.1	7.4	10.3	45	0.0	0.0
MH0173	1.34	12.70	1.7	3.0	9.7	4486	0.0	0.0
MH0182	35.42	46.90	0.2	35.6	11.3	93	0.0	0.0
MH0184	37.22	47.01	0.2	37.4	9.6	72	0.0	0.0
MH0198	54.48	65.09	0.2	54.7	10.4	119	0.0	0.0
MH0202	54.05	60.80	0.2	54.3	6.5	124	0.0	0.0

Future (2040) System Manholes: 5-yr, 24-hr Storm Event

Inputs			Outputs					
Manhole ID	Invert Elevation (ft)	Rim Elevation (ft)	Max. Depth (ft)	Max. HGL (ft)	Freeboard (ft)	Max. Inflow (gpm)	Max. Surcharge Height Above Crown (ft)	Total Flood Vol. (MG)
MH0203	53.47	59.50	0.2	53.7	5.8	127	0.0	0.0
MH0204	52.93	58.50	0.3	53.2	5.3	136	0.0	0.0
MH0205	53.21	59.40	0.2	53.5	5.9	130	0.0	0.0
MH0206	52.53	60.07	0.3	52.8	7.3	139	0.0	0.0
MH0207	51.70	59.44	0.4	52.1	7.4	142	0.0	0.0
MH0212	15.29	22.20	0.6	15.9	6.3	1524	0.0	0.0
MH0214	36.76	46.96	1.2	38.0	9.0	846	0.1	0.0
MH0215	11.48	16.84	0.3	11.8	5.0	353	0.0	0.0
MH0251	52.36	61.66	1.0	53.4	8.3	391	0.4	0.0
MH0254	49.80	57.40	0.2	50.0	7.4	155	0.0	0.0
MH0255	49.40	58.00	0.2	49.6	8.4	159	0.0	0.0
MH0256	51.14	62.00	0.2	51.4	10.6	149	0.0	0.0
MH0257	51.52	61.40	0.6	52.1	9.3	145	0.0	0.0
MH0262	49.00	61.60	1.2	50.2	11.4	403	0.5	0.0
MH0284	57.40	69.80	0.5	57.9	11.9	372	0.0	0.0
MH0285	58.36	68.49	0.5	58.8	9.7	368	0.0	0.0
MH0286	59.55	64.60	0.5	60.1	4.5	363	0.0	0.0
MH0287	60.55	63.00	0.5	61.0	2.0	358	0.0	0.0
MH0290	10.54	17.30	0.7	11.2	6.1	750	0.0	0.0
MH0291	12.19	16.50	0.5	12.7	3.8	385	0.0	0.0
MH0293	41.23	53.03	0.6	41.8	11.2	655	0.0	0.0
MH0304	45.35	56.93	0.6	46.0	11.0	432	0.0	0.0
MH0305	43.76	58.93	0.4	44.1	14.8	438	0.0	0.0
MH0306	44.24	58.93	0.6	44.8	14.1	435	0.0	0.0
MH0307	46.91	59.81	0.6	47.5	12.3	429	0.0	0.0
MH0308	47.07	59.77	0.7	47.7	12.0	426	0.0	0.0
MH0309	48.77	61.37	0.5	49.2	12.1	406	0.0	0.0
MH0310	50.47	61.37	0.4	50.9	10.5	399	0.0	0.0
MH0311	52.17	61.77	0.6	52.7	9.0	395	0.0	0.0
MH0318	44.20	51.90	0.4	44.6	7.3	218	0.0	0.0
MH0319	44.48	50.40	0.4	44.8	5.6	215	0.0	0.0
MH0320	44.85	53.00	0.4	45.2	7.8	211	0.0	0.0
MH0321	45.16	53.00	0.4	45.5	7.5	208	0.0	0.0
MH0322	45.40	51.30	0.4	45.8	5.5	205	0.0	0.0
MH0323	45.68	57.30	0.4	46.0	11.3	202	0.0	0.0
MH0324	45.80	57.80	0.4	46.2	11.6	200	0.0	0.0
MH0325	46.78	59.20	0.3	47.1	12.1	192	0.0	0.0
MH0326	47.22	58.00	0.3	47.5	10.5	187	0.0	0.0
MH0327	47.39	58.20	0.3	47.7	10.5	184	0.0	0.0

Future (2040) System Manholes: 5-yr, 24-hr Storm Event

Inputs			Outputs					
Manhole ID	Invert Elevation (ft)	Rim Elevation (ft)	Max. Depth (ft)	Max. HGL (ft)	Freeboard (ft)	Max. Inflow (gpm)	Max. Surcharge Height Above Crown (ft)	Total Flood Vol. (MG)
MH0328	47.73	60.90	0.3	48.0	12.9	165	0.0	0.0
MH0329	47.80	61.00	0.3	48.1	12.9	161	0.0	0.0
MH0373	41.05	56.81	0.5	41.5	15.3	447	0.0	0.0
MH0376	45.30	53.72	0.8	46.1	7.6	1991	0.0	0.0
MH0393	32.07	44.96	1.0	33.0	11.9	1771	0.0	0.0
MH0395	32.47	44.63	1.1	33.5	11.1	865	0.0	0.0
MH0400	38.60	50.54	6.5	45.1	5.5	739	5.8	0.0
MH0401	37.80	48.36	3.5	41.3	7.1	742	2.7	0.0
MH0402MTR2	36.60	49.66	0.4	37.0	12.7	746	0.0	0.0
MH0418	51.10	60.03	0.1	51.2	8.8	46	0.0	0.0
MH0421	34.22	40.38	1.2	35.4	5.0	846	0.2	0.0
MH0422	33.73	41.96	1.0	34.8	7.2	849	0.0	0.0
MH0423	32.88	39.96	1.0	33.9	6.1	860	0.0	0.0
MH0431	48.61	57.33	4.5	53.1	4.2	2002	3.2	0.0
MH0473	37.47	47.96	1.3	38.8	9.2	847	0.3	0.0
MH0474	38.50	47.96	0.3	38.8	9.1	127	0.0	0.0
MH0483	36.26	46.96	1.2	37.4	9.5	848	0.1	0.0
MH0484MTR1	35.97	42.17	1.2	37.2	5.0	846	0.1	0.0
MH0485	35.25	44.96	1.2	36.4	8.5	845	0.1	0.0
MH0486	34.80	44.96	1.2	36.0	9.0	853	0.1	0.0
MH0487	39.20	49.16	0.8	40.0	9.1	722	0.0	0.0
MH0488	38.56	48.50	1.1	39.6	8.9	727	0.0	0.0
MH0489	38.10	48.50	1.2	39.3	9.2	727	0.1	0.0
MH0506	47.46	57.10	0.8	48.3	8.9	2043	0.0	0.0
MH0507	47.87	57.17	2.3	50.2	7.0	2034	1.1	0.0
MH0510	48.24	56.83	3.6	51.8	5.0	2020	2.3	0.0
MH0513	50.55	57.97	4.0	54.6	3.4	1976	2.8	0.0
MH0514	52.19	61.43	3.6	55.7	5.7	2004	2.3	0.0
MH0525	44.12	53.30	0.8	44.9	8.4	1991	0.0	0.0
MH0526	40.43	50.20	0.6	41.0	9.2	2076	0.0	0.0
MH0530	32.47	46.37	0.8	33.3	13.1	2087	0.0	0.0
MH0533	29.26	40.00	0.6	29.9	10.1	2095	0.0	0.0
MH0534	19.11	32.37	0.7	19.8	12.6	2132	0.0	0.0
MH0536	11.19	20.49	0.7	11.9	8.6	2125	0.0	0.0
MH0537MTR5	2.69	15.50	1.6	4.3	11.2	3527	0.0	0.0
MH0549	30.96	41.05	0.1	31.0	10.0	24	0.0	0.0
MH0561	14.01	22.83	0.1	14.1	8.8	6	0.0	0.0
MH0565	20.91	30.81	0.1	21.0	9.8	31	0.0	0.0
MH0566	18.40	30.50	0.1	18.5	12.0	35	0.0	0.0

Future (2040) System Manholes: 5-yr, 24-hr Storm Event

Inputs			Outputs					
Manhole ID	Invert Elevation (ft)	Rim Elevation (ft)	Max. Depth (ft)	Max. HGL (ft)	Freeboard (ft)	Max. Inflow (gpm)	Max. Surcharge Height Above Crown (ft)	Total Flood Vol. (MG)
MH0567	10.03	19.96	0.1	10.2	9.8	42	0.0	0.0
MH0568	5.24	16.66	0.7	6.0	10.7	798	0.0	0.0
MH0569	5.04	15.78	0.8	5.8	10.0	813	0.0	0.0
MH0570	6.33	16.71	0.9	7.2	9.5	763	0.0	0.0
MH0571	7.16	16.71	0.8	8.0	8.7	770	0.0	0.0
MH0572	4.11	15.92	0.8	4.9	11.0	821	0.0	0.0
MH0573	3.68	13.48	0.9	4.5	8.9	822	0.0	0.0
MH0574	2.41	14.50	1.7	4.1	10.4	4273	0.0	0.0
MH0575MTR4	4.64	15.60	0.8	5.4	10.2	815	0.0	0.0
MH0576	3.26	11.86	1.0	4.3	7.6	826	0.0	0.0
MH0577	1.89	14.17	1.8	3.6	10.5	4465	0.0	0.0
MH0578	1.05	12.34	1.7	2.8	9.6	4494	0.0	0.0
MH0579	0.77	13.82	1.6	2.3	11.5	4509	0.0	0.0
MH0580	0.19	12.82	1.6	1.8	11.0	4509	0.0	0.0
MH0581	1.58	14.95	1.7	3.3	11.6	4474	0.0	0.0
MH0591	39.31	52.41	0.3	39.7	12.8	454	0.0	0.0
MH0594	46.00	57.96	0.0	46.0	11.9	3	0.0	0.0
MH0595	45.46	58.02	0.1	45.5	12.5	8	0.0	0.0
MH0597	43.86	54.12	0.1	43.9	10.2	12	0.0	0.0
MH0598	39.79	50.94	0.8	40.6	10.4	719	0.0	0.0
MH0603	40.70	52.00	0.8	41.5	10.5	705	0.0	0.0
MH0604	41.61	53.03	0.9	42.5	10.5	652	0.0	0.0
MH0605	42.05	53.03	0.4	42.5	10.5	31	0.0	0.0
MH0606	42.11	52.71	0.9	43.0	9.7	639	0.0	0.0
MH0607	42.57	52.83	0.7	43.3	9.5	635	0.0	0.0
MH0608	43.08	51.78	0.7	43.8	8.0	633	0.0	0.0
MH0609	43.25	53.73	0.1	43.3	10.4	7	0.0	0.0
MH0610	43.61	56.03	0.0	43.7	12.4	3	0.0	0.0
MH0614	43.20	51.20	0.7	43.9	7.3	418	0.0	0.0
MH0615	44.20	52.70	0.4	44.6	8.1	416	0.0	0.0
MH0616	45.12	52.60	0.6	45.8	6.8	414	0.0	0.0
MH0634	26.77	39.43	0.4	27.2	12.3	457	0.0	0.0
MH0635	8.00	15.71	0.8	8.8	6.9	730	0.0	0.0
MH0636	8.85	20.71	0.8	9.7	11.1	730	0.0	0.0
MH0637MTR3	9.45	20.49	0.8	10.2	10.3	722	0.0	0.0
MH0638	10.49	17.78	0.7	11.2	6.6	721	0.0	0.0
MH0639	12.85	21.91	0.1	12.9	9.0	12	0.0	0.0
MH0640	13.11	21.91	0.1	13.2	8.7	9	0.0	0.0
MH0642	16.30	22.79	0.5	16.8	6.0	462	0.0	0.0

Future (2040) System Manholes: 5-yr, 24-hr Storm Event

Inputs			Outputs					
Manhole ID	Invert Elevation (ft)	Rim Elevation (ft)	Max. Depth (ft)	Max. HGL (ft)	Freeboard (ft)	Max. Inflow (gpm)	Max. Surcharge Height Above Crown (ft)	Total Flood Vol. (MG)
MH0643	19.43	30.44	0.5	19.9	10.5	459	0.0	0.0
MH0663	10.88	18.50	0.9	11.8	6.7	1558	0.0	0.0
MH0664	12.91	20.20	0.6	13.5	6.7	1466	0.0	0.0
MH0665	8.24	19.00	0.5	8.7	10.3	1436	0.0	0.0
MH0674	10.58	18.50	0.5	11.1	7.4	1456	0.0	0.0
MH1	51.21	57.72	0.2	51.4	6.3	66	0.0	0.0
MH2	50.99	57.12	0.1	51.0	6.1	8	0.0	0.0
MH3	49.44	56.96	0.2	49.6	7.3	75	0.0	0.0
MH4	47.81	56.65	0.2	48.0	8.6	80	0.0	0.0
MH5	46.33	54.25	0.2	46.5	7.7	85	0.0	0.0
MH6	44.04	52.07	0.2	44.3	7.8	88	0.0	0.0
MH7	42.58	50.51	0.2	42.8	7.7	91	0.0	0.0
MH8	41.12	46.05	0.2	41.3	4.7	94	0.0	0.0
MH9	39.31	43.98	0.2	39.5	4.5	96	0.0	0.0
MILLER_WTP_INFL	6.28	10.40	0.6	6.9	3.5	148	0.0	0.0
MMH0001	4.99	15.00	0.0	5.0	10.0	4	0.0	0.0
MMH0003	54.83	63.00	0.2	55.1	7.9	115	0.0	0.0
MMH0004	48.94	56.60	0.1	49.1	7.5	49	0.0	0.0
NODE451	32.00	45.00	-	126.2	-	1999	93.2	0.0
NODE452	33.93	52.93	-	69.5	-	153	35.1	0.0
NODE455	8.91	13.91	-	109.8	-	153	100.5	0.0
NODE456	8.00	18.40	-	44.4	-	463	36.0	0.0
NODE461	54.33	67.50	0.3	54.6	12.9	354	0.0	0.0
NODE462	54.96	69.50	0.3	55.3	14.2	351	0.0	0.0
NODE463	89.83	105.50	0.2	90.0	15.5	348	0.0	0.0
NODE464	124.48	153.50	0.2	124.7	28.8	345	0.0	0.0
NODE465	153.99	177.50	0.2	154.2	23.3	341	0.0	0.0
NODE466	176.97	184.00	0.2	177.2	6.8	313	0.0	0.0
NODE467	178.05	192.00	0.4	178.4	13.6	305	0.0	0.0
NODE468	179.87	194.00	0.4	180.2	13.8	302	0.0	0.0
NODE469	181.77	192.00	0.3	182.1	9.9	266	0.0	0.0
NODE471	3.74	12.63	0.4	4.2	8.5	213	0.0	0.0
NODE472	4.49	13.51	0.4	4.9	8.6	201	0.0	0.0
NODE473	5.51	13.01	0.4	5.9	7.1	182	0.0	0.0
NODE474	6.21	13.26	0.4	6.6	6.7	166	0.0	0.0

Future (2040) System Pipes: 5-yr, 24-hr Storm Event

Inputs						Outputs					
Pipe ID	Length (ft)	Manning's N	US Invert (ft)	DS Invert (ft)	Diameter (ft)	Full Flow (gpm)	Slope (%)	Max. Flow (gpm)	Max. Velocity (ft/s)	Max.Flow/Full Flow	Max.Depth/Full Depth
C-10	792.1	-	51.10	38.60	0.67	681.4	1.58	46.2	0.79	0.07	0.59
FM_AIRPORTEA	500.0	-	12.00	15.50	0.50	327.0	0.70	662.8	7.52	2.03	1.00
FM_CHARLES	1915.0	0.01	39.07	47.30	0.50	251.3	0.43	428.6	4.92	1.71	0.97
GM0048	201.2	0.011	6.60	5.80	1.25	2160.6	0.40	13.9	1.17	0.01	0.06
GM0050	292.2	0.011	7.90	6.60	0.83	774.3	0.45	11.0	1.08	0.01	0.09
GM00554	180.5	0.014	37.80	36.70	0.67	393.7	0.61	743.1	4.84	1.89	0.95
GM0057	367.1	0.01	30.24	25.28	0.67	819.6	1.35	441.6	5.33	0.54	0.52
GM0058	449.8	0.013	29.94	25.49	0.83	978.1	0.99	172.7	3.01	0.18	0.28
GM0059	241.0	0.013	32.48	30.09	0.83	979.3	0.99	170.1	3.00	0.17	0.28
GM0060	255.4	0.013	24.82	23.93	1.50	2783.3	0.35	735.1	3.12	0.26	0.34
GM0061	390.0	0.013	23.73	22.36	1.50	2794.4	0.35	736.8	3.12	0.26	0.34
GM0062	331.9	0.011	22.11	19.77	2.50	18269.0	0.71	739.1	4.06	0.04	0.14
GM0063	375.2	0.011	19.52	18.09	2.50	13432.8	0.38	741.3	3.27	0.06	0.16
GM0064	374.5	0.011	17.89	16.16	1.75	5712.6	0.46	743.6	3.65	0.13	0.24
GM0065	235.0	0.013	35.05	32.58	0.83	1008.2	1.05	167.5	3.05	0.17	0.28
GM0066	235.2	0.013	37.31	35.15	0.83	942.4	0.92	98.8	2.50	0.11	0.22
GM0067	379.9	0.01	36.28	30.39	0.67	878.0	1.55	439.0	5.60	0.50	0.50
GM0068	501.2	0.01	41.45	36.48	0.67	702.2	0.99	436.4	4.72	0.62	0.57
GM0069	324.7	0.01	44.88	41.65	0.67	703.2	1.00	433.8	4.72	0.62	0.57
GM0071	258.4	0.01	45.39	45.03	0.67	263.2	0.14	431.2	3.04	1.64	0.85
GM0140	76.0	0.011	48.94	48.62	0.83	753.3	0.42	49.0	1.77	0.07	0.17
GM0141	242.3	0.011	48.42	47.45	0.83	734.6	0.40	53.1	1.78	0.07	0.18
GM0142	65.0	0.011	47.25	46.97	0.83	762.3	0.43	57.3	1.85	0.08	0.18
GM0143	33.1	0.011	46.10	45.97	0.83	727.3	0.39	63.7	1.87	0.09	0.20
GM0144	118.6	0.011	46.77	46.50	0.83	554.0	0.23	60.9	1.63	0.11	0.21
GM0161	23.0	0.011	14.13	14.01	0.83	838.2	0.52	9.5	1.17	0.01	0.07
GM0162	104.0	0.011	13.91	13.86	0.83	254.6	0.05	13.2	0.71	0.05	0.13
GM0163	400.0	0.011	13.76	12.76	0.83	580.5	0.25	15.9	1.04	0.03	0.12
GM0164	79.2	0.011	12.66	12.46	0.83	583.5	0.25	76.0	1.79	0.13	0.24
GM0165	20.0	0.012	12.35	12.30	0.83	532.1	0.25	91.9	1.84	0.17	0.41
GM01_AIRPARK	379.0	0.013	51.21	49.64	0.83	632.9	0.41	65.6	1.75	0.10	0.21
GM0224	362.6	0.011	35.42	33.93	0.83	744.2	0.41	92.1	2.09	0.12	0.24
GM0225	405.3	0.011	37.22	35.62	0.83	729.5	0.40	69.8	1.91	0.10	0.21
GM0237	71.1	0.011	51.70	51.52	1.00	950.9	0.25	142.0	0.88	0.15	0.47
GM0238	290.2	0.011	52.53	51.80	1.00	947.8	0.25	139.1	1.81	0.15	0.27
GM0239	118.2	0.011	52.93	52.63	1.00	952.1	0.25	136.0	2.07	0.14	0.24
GM0241	71.2	0.011	53.21	53.03	1.00	950.1	0.25	129.8	2.06	0.14	0.24
GM0242	62.0	0.011	53.47	53.31	1.00	960.2	0.26	127.2	2.06	0.13	0.23
GM0243	175.4	0.011	54.05	53.57	1.00	988.5	0.27	124.1	2.03	0.13	0.23
GM0244	170.8	0.011	54.48	54.05	1.00	948.3	0.25	119.5	1.84	0.13	0.24
GM0245	126.8	0.011	54.83	54.51	1.00	949.6	0.25	114.7	1.95	0.12	0.22
GM0276	206.3	0.013	36.76	36.36	1.00	704.1	0.19	842.4	2.63	1.20	1.00
GM02_AIRPARK	27.4	0.013	50.99	50.72	0.67	538.4	0.99	7.9	1.24	0.02	0.09
GM0374	120.3	0.011	51.84	51.34	1.00	1218.3	0.42	145.1	2.33	0.12	0.23
GM0375	228.4	0.011	51.14	50.00	1.00	1335.1	0.50	149.0	2.50	0.11	0.23
GM0376	155.3	0.011	49.40	48.75	1.00	1222.7	0.42	158.7	2.39	0.13	0.24
GM0377	49.0	0.011	49.80	49.60	1.00	1207.0	0.41	155.3	2.36	0.13	0.24

Future (2040) System Pipes: 5-yr, 24-hr Storm Event

Inputs						Outputs					
Pipe ID	Length (ft)	Manning's N	US Invert (ft)	DS Invert (ft)	Diameter (ft)	Full Flow (gpm)	Slope (%)	Max. Flow (gpm)	Max. Velocity (ft/s)	Max.Flow/Full Flow	Max.Depth/Full Depth
GM03_AIRPARK	303.0	0.013	49.44	48.01	0.83	675.6	0.47	75.5	1.89	0.11	0.22
GM0409	250.0	0.011	60.55	59.55	0.67	405.9	0.40	358.0	3.04	0.88	0.76
GM0410	272.7	0.011	59.55	58.53	0.67	392.6	0.37	362.4	3.04	0.92	0.71
GM0411	354.2	0.011	58.36	57.40	0.83	604.4	0.27	368.1	2.61	0.61	0.56
GM0412	358.3	0.011	57.40	56.35	0.83	628.4	0.29	372.1	2.71	0.59	0.55
GM0413	63.8	0.011	55.25	55.20	0.83	325.1	0.08	377.9	2.26	1.16	0.67
GM0414	312.3	0.011	56.35	55.35	0.83	657.0	0.32	374.7	2.70	0.57	0.57
GM0417	329.7	0.011	12.19	11.54	1.00	839.2	0.20	347.6	2.50	0.41	0.42
GM0418	179.1	0.011	11.48	10.54	1.00	1369.3	0.53	350.1	2.29	0.26	0.51
GM0419	21.4	0.013	10.54	10.49	1.00	773.5	0.23	718.6	2.81	0.93	0.70
GM0446	88.8	0.011	44.24	43.86	0.67	419.8	0.43	434.7	3.39	1.04	0.76
GM0447	254.5	0.011	45.35	44.34	0.67	404.4	0.40	431.5	3.16	1.07	0.82
GM0448	362.8	0.011	46.91	45.45	0.67	407.2	0.40	429.0	3.13	1.05	0.85
GM0449	49.7	0.011	47.07	46.93	0.67	340.7	0.28	426.1	2.94	1.25	0.93
GM0450	155.7	0.011	48.77	47.83	0.67	498.7	0.60	406.0	3.32	0.81	0.84
GM0451	203.5	0.011	49.00	48.87	0.67	162.2	0.06	402.9	2.88	2.48	0.84
GM0452	197.3	0.011	50.47	49.00	0.67	554.1	0.75	399.2	2.86	0.72	0.83
GM0453	400.5	0.011	52.17	50.57	0.67	405.7	0.40	394.1	3.11	0.97	0.75
GM0454	162.4	0.011	52.36	52.27	0.67	151.1	0.06	391.3	2.78	2.59	0.85
GM0455	300.0	0.011	55.19	53.99	0.67	405.9	0.40	381.3	3.12	0.94	0.73
GM0456	242.5	0.011	53.89	52.36	0.67	509.8	0.63	387.2	2.80	0.76	0.83
GM0466	96.5	0.013	44.20	43.99	1.00	746.0	0.22	218.1	2.14	0.29	0.33
GM0467	126.2	0.013	44.48	44.20	1.00	753.2	0.22	215.2	1.82	0.29	0.37
GM0468	166.3	0.013	44.85	44.48	1.00	754.4	0.22	211.3	1.82	0.28	0.36
GM0469	136.4	0.013	45.16	44.85	1.00	762.4	0.23	208.4	1.83	0.27	0.36
GM0470	104.0	0.013	45.40	45.16	1.00	768.2	0.23	205.2	1.83	0.27	0.36
GM0471	126.2	0.013	45.68	45.40	1.00	753.2	0.22	202.5	1.82	0.27	0.35
GM0472	53.7	0.013	45.80	45.68	1.00	756.3	0.22	199.5	1.80	0.26	0.35
GM0473	402.8	0.011	46.78	45.90	1.00	883.4	0.22	191.7	2.15	0.22	0.30
GM0474	195.6	0.011	47.22	46.78	1.00	896.3	0.23	186.8	1.93	0.21	0.32
GM0475	84.9	0.011	47.39	47.22	1.00	845.9	0.20	183.5	1.94	0.22	0.31
GM0476	153.1	0.011	47.73	47.39	1.00	890.6	0.22	164.6	1.82	0.19	0.30
GM0477	29.9	0.013	47.80	47.73	1.00	774.1	0.23	161.3	1.83	0.21	0.30
GM04_AIRPARK	284.0	0.013	47.81	46.53	0.83	660.2	0.45	80.4	1.90	0.12	0.23
GM0503	65.8	0.012	0.10	0.00	1.50	2745.6	0.29	4507.1	5.96	1.64	0.91
GM0531	185.0	0.012	43.76	41.12	0.67	702.9	1.43	437.9	4.65	0.62	0.58
GM0553	187.9	0.013	38.60	37.90	0.67	331.1	0.37	739.8	4.72	2.24	1.00
GM0555	100.0	0.015	36.60	32.40	0.83	1745.5	4.20	745.7	5.38	0.43	0.61
GM0556	178.0	0.013	32.47	32.07	1.00	758.0	0.23	864.5	2.46	1.14	0.99
GM0563	225.0	0.013	34.22	33.73	1.00	746.2	0.22	846.0	2.44	1.13	1.00
GM0564	348.0	0.013	33.73	32.96	1.00	752.2	0.22	848.5	2.55	1.13	0.97
GM0565	143.0	0.013	32.88	32.57	1.00	744.5	0.22	859.5	2.54	1.15	0.98
GM05_AIRPARK	464.0	0.013	46.33	44.24	0.83	660.0	0.45	85.3	1.93	0.13	0.24
GM0640	176.4	0.013	38.50	37.80	0.67	341.7	0.40	127.0	1.85	0.37	0.74
GM0646	213.4	0.013	34.80	34.22	1.00	833.6	0.27	846.0	2.58	1.02	1.00
GM0647	158.5	0.013	35.25	34.90	1.00	751.4	0.22	836.2	2.77	1.11	1.00
GM0648	282.0	0.013	35.97	35.35	1.00	749.8	0.22	842.8	2.63	1.12	1.00

Future (2040) System Pipes: 5-yr, 24-hr Storm Event

Inputs						Outputs					
Pipe ID	Length (ft)	Manning's N	US Invert (ft)	DS Invert (ft)	Diameter (ft)	Full Flow (gpm)	Slope (%)	Max. Flow (gpm)	Max. Velocity (ft/s)	Max.Flow/Full Flow	Max.Depth/Full Depth
GM0649	83.7	0.013	36.26	36.07	1.00	761.8	0.23	843.2	2.67	1.11	1.00
GM0650	303.8	0.013	37.47	36.86	1.00	716.6	0.20	842.7	2.50	1.18	1.00
GM0652	282.4	0.013	38.10	37.47	1.00	755.3	0.22	721.5	2.18	0.96	1.00
GM0653	166.6	0.013	38.56	38.20	1.00	743.3	0.22	721.2	2.60	0.97	1.00
GM0654	251.7	0.013	39.20	38.66	1.00	740.7	0.22	723.9	2.56	0.98	0.89
GM0675	276.2	0.013	50.55	48.71	1.25	2366.6	0.67	1988.5	3.61	0.84	1.00
GM0676	238.9	0.013	52.19	50.55	1.25	2402.4	0.69	1872.2	4.68	0.78	1.00
GM0678	239.9	0.013	48.61	48.24	1.25	1138.6	0.15	2015.5	3.66	1.77	1.00
GM0682	268.3	0.013	48.24	47.87	1.25	1076.7	0.14	2030.2	3.69	1.89	1.00
GM0686	276.3	0.013	47.87	47.46	1.25	1116.9	0.15	2039.3	4.30	1.83	0.82
GM0687	241.6	0.013	47.46	45.30	1.25	2741.8	0.89	1987.8	5.37	0.73	0.64
GM06_AIRPARK	280.0	0.013	44.04	42.78	0.83	659.7	0.45	88.4	1.95	0.13	0.24
GM0708	506.4	0.013	11.19	3.29	1.25	3621.6	1.56	2117.4	6.42	0.59	0.68
GM0709	486.5	0.013	19.11	11.19	1.25	3699.6	1.63	2121.9	6.91	0.57	0.55
GM0710	528.4	0.013	29.26	19.11	1.25	4018.7	1.92	2087.1	7.10	0.52	0.53
GM0711	349.2	0.013	32.47	29.26	1.25	2780.1	0.92	2082.8	6.18	0.75	0.59
GM0712	298.9	0.013	40.43	32.47	1.25	4732.5	2.66	2075.4	6.50	0.44	0.56
GM0713	353.6	0.013	44.12	40.80	1.25	2809.4	0.94	1982.4	5.53	0.71	0.62
GM0714	140.8	0.013	45.30	44.12	1.25	2654.8	0.84	1986.9	5.46	0.75	0.63
GM0724	494.5	0.013	30.96	20.91	0.83	1400.6	2.03	24.1	1.95	0.02	0.10
GM0725	149.8	0.013	20.91	18.40	0.83	1271.7	1.68	30.7	2.13	0.02	0.11
GM0726	452.8	0.013	18.40	10.03	0.83	1335.7	1.85	34.7	1.92	0.03	0.13
GM0727	320.1	0.013	10.03	7.30	0.83	907.3	0.85	41.9	1.89	0.05	0.15
GM0728	130.7	0.013	7.24	5.65	0.83	1083.4	1.22	45.0	1.97	0.04	0.26
GM0729	66.1	0.013	5.24	5.14	1.25	1127.7	0.15	796.9	2.47	0.71	0.57
GM0730	280.4	0.013	4.64	4.22	1.25	1122.1	0.15	813.1	2.40	0.73	0.59
GM0731	222.6	0.013	4.11	3.78	1.25	1116.4	0.15	819.2	2.34	0.73	0.62
GM0732	277.7	0.013	3.68	3.26	1.25	1127.6	0.15	820.4	2.05	0.73	0.76
GM0733	285.5	0.013	3.26	2.83	1.25	1125.2	0.15	821.0	1.92	0.73	0.92
GM0734	536.5	0.013	2.41	1.99	2.50	5151.1	0.08	4262.5	2.71	0.83	0.67
GM0735	299.7	0.013	2.69	2.51	2.50	4511.6	0.06	3519.1	2.38	0.78	0.64
GM0747	380.5	0.013	7.16	6.33	1.00	746.9	0.22	759.4	2.42	1.02	0.86
GM0748	382.4	0.013	6.33	5.49	1.00	749.4	0.22	750.4	2.78	1.00	0.72
GM0752	268.4	0.013	5.04	4.64	1.25	1119.2	0.15	811.9	2.21	0.73	0.64
GM0757	350.0	0.013	1.05	0.87	2.50	4174.9	0.05	4492.2	3.03	1.08	0.64
GM0758	261.6	0.013	1.34	1.15	2.50	4961.0	0.07	4482.8	2.88	0.90	0.67
GM0759	248.7	0.013	1.58	1.44	2.50	4368.4	0.06	4469.9	2.88	1.02	0.67
GM0760	349.9	0.013	1.89	1.68	2.50	4510.2	0.06	4461.4	2.82	0.99	0.68
GM0761	268.0	0.013	0.77	0.61	2.50	4498.2	0.06	4506.0	3.78	1.00	0.55
GM0778	180.5	0.013	42.11	42.05	1.00	291.6	0.03	638.4	2.36	2.19	0.72
GM0779	85.7	0.013	42.05	41.81	0.83	519.9	0.28	18.7	0.84	0.04	0.67
GM0782	119.5	0.013	43.61	43.25	0.83	539.2	0.30	3.0	0.61	0.01	0.07
GM0783	426.7	0.013	43.25	42.15	0.83	498.8	0.26	8.6	0.77	0.02	0.24
GM0785	129.7	0.013	41.23	40.70	1.00	1022.1	0.41	654.5	2.58	0.64	0.68
GM0786	283.9	0.013	41.61	41.23	1.00	585.1	0.13	651.5	2.36	1.11	0.73
GM0787	413.8	0.013	40.70	39.79	1.00	749.9	0.22	705.0	2.41	0.94	0.77
GM0792	186.2	0.013	39.79	39.38	1.00	750.5	0.22	718.3	2.74	0.96	0.70

Future (2040) System Pipes: 5-yr, 24-hr Storm Event

Inputs						Outputs					
Pipe ID	Length (ft)	Manning's N	US Invert (ft)	DS Invert (ft)	Diameter (ft)	Full Flow (gpm)	Slope (%)	Max. Flow (gpm)	Max. Velocity (ft/s)	Max.Flow/Full Flow	Max.Depth/Full Depth
GM0793	126.8	0.013	41.05	39.80	0.67	539.2	0.99	446.9	3.84	0.83	0.70
GM0798	131.8	0.013	46.00	45.46	0.83	628.7	0.41	3.4	0.67	0.01	0.07
GM0799	402.4	0.013	45.46	43.86	0.83	619.4	0.40	7.5	0.87	0.01	0.08
GM07_AIRPARK	280.0	0.013	42.58	41.32	0.83	659.7	0.45	91.0	1.97	0.14	0.24
GM0800	341.4	0.013	43.86	40.11	0.83	1030.7	1.10	12.0	1.29	0.01	0.31
GM0805	113.7	0.013	45.12	44.60	0.67	367.3	0.46	413.3	3.01	1.13	0.82
GM0806	91.5	0.015	44.20	43.20	1.00	1448.9	1.09	415.8	2.28	0.29	0.51
GM0807	80.0	0.013	43.20	43.08	1.00	619.4	0.15	418.2	1.64	0.68	0.68
GM0808	229.8	0.013	43.08	42.57	1.00	753.3	0.22	632.5	2.34	0.84	0.72
GM0809	160.4	0.013	42.57	42.21	1.00	757.7	0.23	634.8	2.15	0.84	0.78
GM0823	438.8	0.013	26.77	19.58	0.67	695.3	1.64	456.5	4.73	0.66	0.59
GM0824	277.6	0.013	19.43	16.65	0.67	543.5	1.00	458.8	3.88	0.84	0.71
GM0825	512.2	0.013	16.30	10.54	0.67	575.9	1.13	461.4	3.48	0.80	0.83
GM0829	232.8	0.013	14.01	13.11	0.83	610.8	0.39	6.4	0.70	0.01	0.08
GM0830	63.9	0.013	13.11	12.85	0.83	626.7	0.41	9.5	0.98	0.02	0.08
GM0831	240.5	0.013	12.85	10.28	0.83	1015.5	1.07	12.2	1.41	0.01	0.08
GM0832	359.7	0.013	10.49	9.45	1.00	859.8	0.29	708.7	2.62	0.82	0.74
GM0833	230.1	0.013	9.45	8.95	1.00	745.4	0.22	714.0	2.56	0.96	0.75
GM0836	335.2	0.013	8.85	8.10	1.00	756.4	0.22	726.9	2.64	0.96	0.75
GM0837	381.1	0.013	8.00	7.16	1.00	750.7	0.22	723.7	2.44	0.96	0.81
GM0838	475.2	0.013	39.31	26.93	0.67	876.7	2.61	453.9	5.64	0.52	0.51
GM0848	69.2	0.011	16.11	15.64	1.75	6928.7	0.68	746.2	4.20	0.11	0.22
GM0849	236.1	0.011	47.73	47.17	0.67	312.6	0.24	408.7	2.76	1.31	0.92
GM0878	111.2	0.011	4.99	4.40	1.00	1376.8	0.53	3.6	0.90	0.00	0.27
GM0880	483.8	0.011	15.29	13.06	1.75	5706.5	0.46	1463.0	4.47	0.26	0.35
GM0881	526.8	0.011	12.91	10.88	1.75	5217.6	0.39	1405.1	3.09	0.27	0.44
GM0882	53.8	0.011	8.24	7.86	2.50	18287.1	0.71	1437.6	4.95	0.08	0.19
GM0883	265.8	0.011	10.88	10.68	1.75	2305.4	0.08	1452.0	3.08	0.63	0.45
GM0893	502.7	0.011	10.58	8.44	2.50	14195.7	0.43	1433.5	4.13	0.10	0.22
GM08_AIRPARK	358.0	0.013	41.12	39.51	0.83	659.5	0.45	93.6	1.98	0.14	0.25
GM09_AIRPARK	360.0	0.013	39.31	37.46	0.83	705.0	0.51	96.2	2.06	0.14	0.25
LINK295_SMITHLS	1529.8	-	32.00	52.19	1.00	2773.0	1.32	1999.2	6.41	0.72	1.00
LINK298	28.9	0.014	32.07	32.00	1.17	1102.9	0.24	1770.2	4.47	1.61	0.77
LINK300_HWY30_F	256.5	-	33.93	60.55	0.50	755.4	10.43	157.0	2.50	0.21	0.99
LINK303	1563.3	-	8.91	12.50	0.33	62.7	0.23	163.5	4.18	2.61	1.00
LINK306	1726.0	-	8.00	15.50	0.33	88.4	0.44	149.5	3.86	1.69	0.96
LINK307	24.5	0.014	185.00	181.77	0.27	166.2	13.28	263.3	10.18	1.58	1.00
LINK308	142.4	0.014	181.77	179.87	0.67	582.5	1.33	265.8	3.35	0.46	0.50
LINK309	159.1	0.014	179.87	178.05	0.67	539.4	1.14	301.8	3.41	0.56	0.55
LINK310	94.1	0.014	178.05	176.97	0.67	540.4	1.15	304.7	4.59	0.56	0.44
LINK311	264.9	0.014	176.97	154.40	0.67	1474.6	8.55	312.2	7.45	0.21	0.31
LINK312	252.0	0.014	153.99	124.48	0.67	1731.9	11.79	341.1	8.62	0.20	0.30
LINK313	271.7	0.014	124.48	89.83	0.67	1808.4	12.86	344.2	8.98	0.19	0.29
LINK314	233.7	0.014	89.83	56.00	0.67	1929.0	14.63	347.6	9.30	0.18	0.29
LINK315	21.5	0.014	54.96	54.33	0.67	862.6	2.93	351.0	5.09	0.41	0.45
LINK316	323.1	0.014	54.33	45.97	0.67	811.3	2.59	353.1	4.99	0.44	0.46
LINK317	268.8	0.014	6.28	6.21	0.67	81.4	0.03	148.4	1.26	1.82	0.73

Future (2040) System Pipes: 5-yr, 24-hr Storm Event

Inputs						Outputs					
Pipe ID	Length (ft)	Manning's N	US Invert (ft)	DS Invert (ft)	Diameter (ft)	Full Flow (gpm)	Slope (%)	Max. Flow (gpm)	Max. Velocity (ft/s)	Max.Flow/Full Flow	Max.Depth/Full Depth
LINK318	146.6	0.014	6.21	5.63	0.67	317.2	0.40	165.6	2.23	0.52	0.48
LINK319	264.0	0.014	5.51	4.59	0.67	297.7	0.35	182.2	2.11	0.61	0.55
LINK320	202.0	0.014	4.49	3.84	0.67	286.1	0.32	200.5	2.14	0.70	0.58
LINK321	64.7	0.014	3.74	3.54	0.67	280.3	0.31	212.8	2.35	0.76	0.56

CIP System

CIP System Manholes: 5-yr, 24-hr Storm Event

Inputs			Outputs					
Manhole ID	Invert Elevation (ft)	Rim Elevation (ft)	Max. Depth (ft)	Max. HGL (ft)	Freeboard (ft)	Max. Inflow (gpm)	Max. Surcharge Height Above Crown (ft)	Total Flood Vol. (MG)
AIRPORTEA_JUNC	12.00	18.50	-	48.3	-	661	35.8	0.0
CHARLES_JUNC	39.07	46.25	-	90.6	-	429	51.1	0.0
MH0018	24.82	30.70	0.5	25.4	5.3	735	0.0	0.0
MH0019	16.11	22.50	0.4	16.5	6.0	745	0.0	0.0
MH0020	17.89	23.70	0.4	18.3	5.4	743	0.0	0.0
MH0021	19.52	25.00	0.4	19.9	5.1	741	0.0	0.0
MH0022	22.11	26.20	0.3	22.5	3.7	739	0.0	0.0
MH0023	23.73	27.90	0.5	24.3	3.6	737	0.0	0.0
MH0024	29.94	36.10	0.2	30.2	5.9	173	0.0	0.0
MH0025	32.48	38.60	0.2	32.7	5.9	170	0.0	0.0
MH0026	35.05	40.22	0.2	35.3	4.9	168	0.0	0.0
MH0027	37.31	42.61	0.2	37.5	5.1	99	0.0	0.0
MH0028	30.24	36.20	0.3	30.6	5.6	442	0.0	0.0
MH0029	36.28	42.30	0.3	36.6	5.7	439	0.0	0.0
MH0030	41.45	47.50	0.4	41.8	5.7	436	0.0	0.0
MH0031	44.88	51.00	0.4	45.3	5.7	434	0.0	0.0
MH0033	45.39	53.00	1.1	46.5	6.5	431	0.0	0.0
MH0048	55.13	62.73	0.6	55.8	7.0	386	0.0	0.0
MH0049	56.35	67.27	0.5	56.8	10.5	384	0.0	0.0
MH0059	6.60	15.34	0.1	6.7	8.7	14	0.0	0.0
MH0061	7.90	15.78	0.1	8.0	7.8	11	0.0	0.0
MH0098	55.11	62.41	0.5	55.6	6.8	388	0.0	0.0
MH0099	53.89	62.35	0.4	54.3	8.0	394	0.0	0.0
MH0125	46.10	52.50	0.2	46.3	6.2	64	0.0	0.0
MH0126	46.77	55.20	0.2	47.0	8.2	61	0.0	0.0
MH0127	47.25	56.50	0.2	47.4	9.1	57	0.0	0.0
MH0128	48.42	55.60	0.2	48.6	7.0	53	0.0	0.0
MH0130	12.35	18.18	0.3	12.7	5.5	78	0.0	0.0
MH0131	12.66	20.62	0.2	12.9	7.8	75	0.0	0.0
MH0132	13.76	21.50	0.1	13.9	7.6	16	0.0	0.0
MH0133	47.73	59.93	0.5	48.3	11.7	417	0.0	0.0
MH0136	13.91	17.27	0.1	14.1	3.2	13	0.0	0.0
MH0137	14.13	17.76	0.1	14.2	3.6	10	0.0	0.0
MH0154	7.24	17.70	0.1	7.4	10.3	45	0.0	0.0
MH0173	1.34	12.70	1.6	3.0	9.7	4240	0.0	0.0
MH0182	35.42	46.90	0.2	35.6	11.3	93	0.0	0.0
MH0184	37.22	47.01	0.2	37.4	9.6	72	0.0	0.0
MH0198	54.48	65.09	0.2	54.7	10.4	119	0.0	0.0
MH0202	54.05	60.80	0.2	54.3	6.5	124	0.0	0.0

CIP System Manholes: 5-yr, 24-hr Storm Event

Inputs			Outputs					
Manhole ID	Invert Elevation (ft)	Rim Elevation (ft)	Max. Depth (ft)	Max. HGL (ft)	Freeboard (ft)	Max. Inflow (gpm)	Max. Surcharge Height Above Crown (ft)	Total Flood Vol. (MG)
MH0203	53.47	59.50	0.2	53.7	5.8	127	0.0	0.0
MH0204	52.93	58.50	0.3	53.2	5.3	136	0.0	0.0
MH0205	53.21	59.40	0.2	53.5	5.9	130	0.0	0.0
MH0206	52.53	60.07	0.3	52.8	7.3	139	0.0	0.0
MH0207	51.70	59.44	0.4	52.1	7.4	142	0.0	0.0
MH0212	15.29	22.20	0.6	15.9	6.3	1523	0.0	0.0
MH0214	36.76	46.96	0.7	37.5	9.5	626	0.0	0.0
MH0215	11.48	16.84	0.3	11.8	5.0	353	0.0	0.0
MH0251	52.92	61.66	0.4	53.4	8.3	397	0.0	0.0
MH0254	49.80	57.40	0.2	50.0	7.4	155	0.0	0.0
MH0255	49.40	58.00	0.2	49.6	8.4	159	0.0	0.0
MH0256	51.14	62.00	0.2	51.4	10.6	149	0.0	0.0
MH0257	51.52	61.40	0.6	52.1	9.3	145	0.0	0.0
MH0262	49.68	61.60	0.4	50.1	11.5	410	0.0	0.0
MH0284	57.40	69.80	0.5	57.9	11.9	379	0.0	0.0
MH0285	58.36	68.49	0.5	58.8	9.7	375	0.0	0.0
MH0286	59.55	64.60	0.4	60.0	4.6	372	0.0	0.0
MH0287	60.55	63.00	0.4	61.0	2.0	371	0.0	0.0
MH0290	10.54	17.30	0.6	11.2	6.1	788	0.0	0.0
MH0291	12.19	16.50	0.5	12.7	3.8	387	0.0	0.0
MH0293	41.23	53.03	0.4	41.7	11.4	413	0.0	0.0
MH0304	45.35	56.93	0.5	45.8	11.1	444	0.0	0.0
MH0305	43.76	58.93	0.4	44.1	14.8	453	0.0	0.0
MH0306	44.24	58.93	0.5	44.7	14.2	448	0.0	0.0
MH0307	46.91	59.81	0.5	47.4	12.4	441	0.0	0.0
MH0308	47.07	59.77	0.5	47.5	12.2	438	0.0	0.0
MH0309	48.77	61.37	0.4	49.2	12.2	414	0.0	0.0
MH0310	50.47	61.37	0.4	50.9	10.5	405	0.0	0.0
MH0311	52.17	61.77	0.4	52.6	9.2	401	0.0	0.0
MH0318	44.20	51.90	0.4	44.6	7.3	218	0.0	0.0
MH0319	44.48	50.40	0.4	44.8	5.6	215	0.0	0.0
MH0320	44.85	53.00	0.4	45.2	7.8	211	0.0	0.0
MH0321	45.16	53.00	0.4	45.5	7.5	208	0.0	0.0
MH0322	45.40	51.30	0.4	45.8	5.5	205	0.0	0.0
MH0323	45.68	57.30	0.4	46.0	11.3	202	0.0	0.0
MH0324	45.80	57.80	0.4	46.2	11.6	200	0.0	0.0
MH0325	46.78	59.20	0.3	47.1	12.1	192	0.0	0.0
MH0326	47.22	58.00	0.3	47.5	10.5	187	0.0	0.0
MH0327	47.39	58.20	0.3	47.7	10.5	184	0.0	0.0

CIP System Manholes: 5-yr, 24-hr Storm Event

Inputs			Outputs					
Manhole ID	Invert Elevation (ft)	Rim Elevation (ft)	Max. Depth (ft)	Max. HGL (ft)	Freeboard (ft)	Max. Inflow (gpm)	Max. Surcharge Height Above Crown (ft)	Total Flood Vol. (MG)
MH0328	47.73	60.90	0.3	48.0	12.9	165	0.0	0.0
MH0329	47.80	61.00	0.3	48.1	12.9	161	0.0	0.0
MH0373	41.05	56.81	0.4	41.5	15.4	471	0.0	0.0
MH0376	45.30	53.72	0.7	46.0	7.7	1778	0.0	0.0
MH0393	32.07	44.96	0.9	32.9	12.0	1570	0.0	0.0
MH0395	32.47	44.63	0.6	33.1	11.5	675	0.0	0.0
MH0400	34.90	49.00	0.6	35.5	13.5	739	0.0	0.0
MH0401	34.40	48.20	0.8	35.2	13.0	742	0.0	0.0
MH0402MTR2	33.40	46.20	0.5	33.9	12.3	745	0.0	0.0
MH0418	51.10	60.03	0.1	51.2	8.8	46	0.0	0.0
MH0421	34.22	40.38	0.6	34.8	5.5	654	0.0	0.0
MH0422	33.73	41.96	0.6	34.4	7.6	656	0.0	0.0
MH0423	32.88	39.96	0.6	33.5	6.5	670	0.0	0.0
MH0431	48.61	57.33	1.0	49.6	7.7	1848	0.0	0.0
MH0473	37.47	47.96	0.6	38.1	9.9	623	0.0	0.0
MH0474	38.50	47.96	0.3	38.8	9.2	127	0.0	0.0
MH0483	36.26	46.96	0.7	36.9	10.0	632	0.0	0.0
MH0484MTR1	35.97	42.17	0.7	36.7	5.5	634	0.0	0.0
MH0485	35.25	44.96	0.7	36.0	9.0	637	0.0	0.0
MH0486	34.80	44.96	0.7	35.5	9.5	654	0.0	0.0
MH0487	39.20	49.16	0.6	39.8	9.3	488	0.0	0.0
MH0488	38.56	48.50	0.6	39.2	9.3	491	0.0	0.0
MH0489	38.10	48.50	0.6	38.7	9.8	497	0.0	0.0
MH0506	47.46	57.10	0.7	48.2	8.9	1776	0.0	0.0
MH0507	47.87	57.17	1.0	48.9	8.3	1777	0.0	0.0
MH0510	48.24	56.83	1.0	49.3	7.5	1789	0.0	0.0
MH0513	50.55	57.97	0.7	51.3	6.7	1899	0.0	0.0
MH0514	52.19	61.43	0.8	53.0	8.4	1986	0.0	0.0
MH0525	44.12	53.30	0.7	44.8	8.5	1782	0.0	0.0
MH0526	40.43	50.20	0.5	41.0	9.2	1878	0.0	0.0
MH0530	32.47	46.37	0.8	33.2	13.1	1891	0.0	0.0
MH0533	29.26	40.00	0.6	29.9	10.1	1903	0.0	0.0
MH0534	19.11	32.37	0.6	19.8	12.6	1951	0.0	0.0
MH0536	11.19	20.49	0.7	11.8	8.6	1953	0.0	0.0
MH0537MTR5	2.69	15.50	1.6	4.3	11.2	3395	0.0	0.0
MH0549	30.96	41.05	0.1	31.0	10.0	24	0.0	0.0
MH0561	14.01	22.83	0.1	14.1	8.8	6	0.0	0.0
MH0565	20.91	30.81	0.1	21.0	9.8	31	0.0	0.0
MH0566	18.40	30.50	0.1	18.5	12.0	35	0.0	0.0

CIP System Manholes: 5-yr, 24-hr Storm Event

Inputs			Outputs					
Manhole ID	Invert Elevation (ft)	Rim Elevation (ft)	Max. Depth (ft)	Max. HGL (ft)	Freeboard (ft)	Max. Inflow (gpm)	Max. Surcharge Height Above Crown (ft)	Total Flood Vol. (MG)
MH0567	10.03	19.96	0.1	10.2	9.8	42	0.0	0.0
MH0568	5.24	16.66	0.7	6.0	10.7	826	0.0	0.0
MH0569	5.04	15.78	0.8	5.8	9.9	842	0.0	0.0
MH0570	6.33	16.71	0.7	7.1	9.7	793	0.0	0.0
MH0571	7.16	16.71	0.7	7.8	8.9	802	0.0	0.0
MH0572	4.11	15.92	0.8	4.9	11.0	848	0.0	0.0
MH0573	3.68	13.48	0.7	4.4	9.1	850	0.0	0.0
MH0574	2.41	14.50	1.7	4.1	10.4	4147	0.0	0.0
MH0575MTR4	4.64	15.60	0.8	5.5	10.1	844	0.0	0.0
MH0576	3.26	11.86	0.9	4.1	7.7	853	0.0	0.0
MH0577	1.89	14.17	1.7	3.6	10.6	4215	0.0	0.0
MH0578	1.05	12.34	1.7	2.7	9.6	4249	0.0	0.0
MH0579	0.77	13.82	1.5	2.3	11.6	4265	0.0	0.0
MH0580	0.19	12.82	1.1	1.2	11.6	4265	0.0	0.0
MH0581	1.58	14.95	1.7	3.2	11.7	4225	0.0	0.0
MH0591	39.31	52.41	0.4	39.7	12.7	478	0.0	0.0
MH0594	46.00	57.96	0.0	46.0	11.9	3	0.0	0.0
MH0595	45.46	58.02	0.1	45.5	12.5	8	0.0	0.0
MH0597	43.86	54.12	0.1	43.9	10.2	12	0.0	0.0
MH0598	39.79	50.94	0.6	40.4	10.6	484	0.0	0.0
MH0603	40.70	52.00	0.6	41.3	10.7	469	0.0	0.0
MH0604	41.61	53.03	0.7	42.3	10.8	410	0.0	0.0
MH0605	42.05	53.03	0.2	42.3	10.8	14	0.0	0.0
MH0606	42.11	52.71	0.7	42.8	9.9	397	0.0	0.0
MH0607	42.57	52.83	0.5	43.1	9.7	393	0.0	0.0
MH0608	43.08	51.78	0.5	43.6	8.2	391	0.0	0.0
MH0609	43.25	53.73	0.1	43.3	10.4	7	0.0	0.0
MH0610	43.61	56.03	0.0	43.7	12.4	3	0.0	0.0
MH0614	43.20	51.20	0.5	43.7	7.5	248	0.0	0.0
MH0615	44.20	52.70	0.3	44.5	8.2	245	0.0	0.0
MH0616	45.12	52.60	0.4	45.5	7.1	243	0.0	0.0
MH0634	26.77	39.43	0.4	27.2	12.3	480	0.0	0.0
MH0635	8.00	15.71	0.7	8.7	7.0	767	0.0	0.0
MH0636	8.85	20.71	0.7	9.5	11.2	766	0.0	0.0
MH0637MTR3	9.45	20.49	0.7	10.1	10.4	762	0.0	0.0
MH0638	10.49	17.78	0.6	11.1	6.7	759	0.0	0.0
MH0639	12.85	21.91	0.1	12.9	9.0	12	0.0	0.0
MH0640	13.11	21.91	0.1	13.2	8.7	9	0.0	0.0
MH0642	16.30	22.79	0.4	16.7	6.1	485	0.0	0.0

CIP System Manholes: 5-yr, 24-hr Storm Event

Inputs			Outputs					
Manhole ID	Invert Elevation (ft)	Rim Elevation (ft)	Max. Depth (ft)	Max. HGL (ft)	Freeboard (ft)	Max. Inflow (gpm)	Max. Surcharge Height Above Crown (ft)	Total Flood Vol. (MG)
MH0643	19.43	30.44	0.4	19.8	10.6	482	0.0	0.0
MH0663	10.88	18.50	0.9	11.8	6.7	1561	0.0	0.0
MH0664	12.91	20.20	0.6	13.5	6.7	1467	0.0	0.0
MH0665	8.24	19.00	0.5	8.7	10.3	1438	0.0	0.0
MH0674	10.58	18.50	0.5	11.1	7.4	1459	0.0	0.0
MH1	51.21	57.72	0.2	51.4	6.3	66	0.0	0.0
MH2	50.99	57.12	0.1	51.0	6.1	8	0.0	0.0
MH3	49.44	56.96	0.2	49.6	7.3	75	0.0	0.0
MH4	47.81	56.65	0.2	48.0	8.6	80	0.0	0.0
MH5	46.33	54.25	0.2	46.5	7.7	85	0.0	0.0
MH6	44.04	52.07	0.2	44.3	7.8	88	0.0	0.0
MH7	42.58	50.51	0.2	42.8	7.7	91	0.0	0.0
MH8	41.12	46.05	0.2	41.3	4.7	94	0.0	0.0
MH9	39.31	43.98	0.2	39.5	4.5	96	0.0	0.0
MILLER_WTP_INFL	6.28	10.40	0.5	6.8	3.6	113	0.0	0.0
MMH0001	4.99	15.00	0.0	5.0	10.0	4	0.0	0.0
MMH0003	54.83	63.00	0.2	55.1	7.9	115	0.0	0.0
MMH0004	48.94	56.60	0.1	49.1	7.5	49	0.0	0.0
NODE451	32.00	45.00	-	83.7	-	1983	50.7	0.0
NODE452	33.93	52.93	-	67.4	-	153	33.0	0.0
NODE455	8.91	13.91	-	71.0	-	153	61.8	0.0
NODE456	8.00	18.40	-	41.4	-	463	33.1	0.0
NODE461	54.33	67.50	0.2	54.6	12.9	220	0.0	0.0
NODE462	54.96	69.50	0.2	55.2	14.3	218	0.0	0.0
NODE463	89.83	105.50	0.2	90.0	15.5	216	0.0	0.0
NODE464	124.48	153.50	0.2	124.6	28.9	214	0.0	0.0
NODE465	153.99	177.50	0.2	154.1	23.4	211	0.0	0.0
NODE466	176.97	184.00	0.2	177.1	6.9	200	0.0	0.0
NODE467	178.05	192.00	0.3	178.3	13.7	195	0.0	0.0
NODE468	179.87	194.00	0.3	180.1	13.9	192	0.0	0.0
NODE469	181.77	192.00	0.3	182.0	10.0	178	0.0	0.0
NODE471	3.74	12.63	0.4	4.1	8.5	166	0.0	0.0
NODE472	4.49	13.51	0.4	4.9	8.6	156	0.0	0.0
NODE473	5.51	13.01	0.3	5.9	7.2	141	0.0	0.0
NODE474	6.21	13.26	0.3	6.5	6.7	127	0.0	0.0

CIP System Pipes: 5-yr, 24-hr Storm Event

Inputs						Outputs					
Pipe ID	Length (ft)	Manning's N	US Invert (ft)	DS Invert (ft)	Diameter (ft)	Full Flow (gpm)	Slope (%)	Max. Flow (gpm)	Max. Velocity (ft/s)	Max.Flow/Full Flow	Max.Depth/Full Depth
C-10	792.1	-	51.10	38.60	0.67	681.4	1.58	46.1	2.48	0.07	0.18
FM_AIRPORTEA	500.0	-	12.00	15.50	0.50	327.0	0.70	660.8	7.50	2.02	1.00
FM_CHARLES	1915.0	0.01	39.07	47.30	0.50	251.3	0.43	428.6	4.92	1.71	0.97
GM0048	201.2	0.011	6.60	5.80	1.25	2160.6	0.40	13.9	1.17	0.01	0.06
GM0050	292.2	0.011	7.90	6.60	0.83	774.3	0.45	11.0	1.08	0.01	0.09
GM00554	180.5	0.014	34.40	34.20	1.25	896.2	0.11	741.8	2.52	0.83	0.53
GM0057	367.1	0.01	30.24	25.28	0.67	819.6	1.35	441.6	5.33	0.54	0.52
GM0058	449.8	0.013	29.94	25.49	0.83	978.1	0.99	172.7	3.01	0.18	0.28
GM0059	241.0	0.013	32.48	30.09	0.83	979.3	0.99	170.1	3.00	0.17	0.28
GM0060	255.4	0.013	24.82	23.93	1.50	2783.3	0.35	734.4	3.12	0.26	0.34
GM0061	390.0	0.013	23.73	22.36	1.50	2794.4	0.35	736.1	3.12	0.26	0.34
GM0062	331.9	0.011	22.11	19.77	2.50	18269.0	0.71	738.4	4.06	0.04	0.14
GM0063	375.2	0.011	19.52	18.09	2.50	13432.8	0.38	740.6	3.27	0.06	0.16
GM0064	374.5	0.011	17.89	16.16	1.75	5712.6	0.46	742.9	3.65	0.13	0.24
GM0065	235.0	0.013	35.05	32.58	0.83	1008.2	1.05	167.5	3.05	0.17	0.28
GM0066	235.2	0.013	37.31	35.15	0.83	942.4	0.92	98.8	2.50	0.11	0.22
GM0067	379.9	0.01	36.28	30.39	0.67	878.0	1.55	439.0	5.60	0.50	0.50
GM0068	501.2	0.01	41.45	36.48	0.67	702.2	0.99	436.4	4.72	0.62	0.57
GM0069	324.7	0.01	44.88	41.65	0.67	703.2	1.00	433.8	4.72	0.62	0.57
GM0071	258.4	0.01	45.39	45.03	0.67	263.2	0.14	431.2	3.04	1.64	0.85
GM0140	76.0	0.011	48.94	48.62	0.83	753.3	0.42	49.0	1.77	0.07	0.17
GM0141	242.3	0.011	48.42	47.45	0.83	734.6	0.40	53.1	1.78	0.07	0.18
GM0142	65.0	0.011	47.25	46.97	0.83	762.3	0.43	57.3	1.85	0.08	0.18
GM0143	33.1	0.011	46.10	45.97	0.83	727.3	0.39	63.7	1.87	0.09	0.20
GM0144	118.6	0.011	46.77	46.50	0.83	554.0	0.23	60.9	1.63	0.11	0.21
GM0161	23.0	0.011	14.13	14.01	0.83	838.2	0.52	9.5	1.17	0.01	0.07
GM0162	104.0	0.011	13.91	13.86	0.83	254.6	0.05	13.2	0.71	0.05	0.13
GM0163	400.0	0.011	13.76	12.76	0.83	580.5	0.25	15.9	1.04	0.03	0.12
GM0164	79.2	0.011	12.66	12.46	0.83	583.5	0.25	75.0	1.79	0.13	0.24
GM0165	20.0	0.012	12.35	12.30	0.83	532.1	0.25	90.5	1.84	0.17	0.41
GM01_AIRPARK	379.0	0.013	51.21	49.64	0.83	632.9	0.41	65.6	1.75	0.10	0.21
GM0224	362.6	0.011	35.42	33.93	0.83	744.2	0.41	92.1	2.09	0.12	0.24
GM0225	405.3	0.011	37.22	35.62	0.83	729.5	0.40	69.8	1.91	0.10	0.21
GM0237	71.1	0.011	51.70	51.52	1.00	950.9	0.25	142.0	0.88	0.15	0.47
GM0238	290.2	0.011	52.53	51.80	1.00	947.8	0.25	139.1	1.81	0.15	0.27
GM0239	118.2	0.011	52.93	52.63	1.00	952.1	0.25	136.0	2.07	0.14	0.24
GM0241	71.2	0.011	53.21	53.03	1.00	950.1	0.25	129.8	2.06	0.14	0.24
GM0242	62.0	0.011	53.47	53.31	1.00	960.2	0.26	127.2	2.06	0.13	0.23
GM0243	175.4	0.011	54.05	53.57	1.00	988.5	0.27	124.1	2.03	0.13	0.23
GM0244	170.8	0.011	54.48	54.05	1.00	948.3	0.25	119.5	1.84	0.13	0.24
GM0245	126.8	0.011	54.83	54.51	1.00	949.6	0.25	114.7	1.95	0.12	0.22
GM0276	206.3	0.013	36.76	36.36	1.00	704.1	0.19	626.3	2.55	0.89	0.66
GM02_AIRPARK	27.4	0.013	50.99	50.72	0.67	538.4	0.99	7.9	1.24	0.02	0.09
GM0374	120.3	0.011	51.84	51.34	1.00	1218.3	0.42	145.1	2.33	0.12	0.23
GM0375	228.4	0.011	51.14	50.00	1.00	1335.1	0.50	149.0	2.50	0.11	0.23
GM0376	155.3	0.011	49.40	48.75	1.00	1222.7	0.42	158.7	2.39	0.13	0.24
GM0377	49.0	0.011	49.80	49.60	1.00	1207.0	0.41	155.3	2.36	0.13	0.24

CIP System Pipes: 5-yr, 24-hr Storm Event

Inputs						Outputs					
Pipe ID	Length (ft)	Manning's N	US Invert (ft)	DS Invert (ft)	Diameter (ft)	Full Flow (gpm)	Slope (%)	Max. Flow (gpm)	Max. Velocity (ft/s)	Max.Flow/Full Flow	Max.Depth/Full Depth
GM03_AIRPARK	303.0	0.013	49.44	48.01	0.83	675.6	0.47	75.5	1.89	0.11	0.22
GM0409	250.0	0.011	60.55	59.55	0.83	734.3	0.40	367.2	3.15	0.50	0.51
GM0410	272.7	0.011	59.55	58.53	0.83	710.1	0.37	368.9	3.03	0.52	0.50
GM0411	354.2	0.011	58.36	57.40	0.83	604.4	0.27	375.3	2.65	0.62	0.57
GM0412	358.3	0.011	57.40	56.35	0.83	628.4	0.29	381.5	2.75	0.61	0.56
GM0413	63.8	0.011	55.25	55.20	1.00	529.2	0.08	385.0	2.38	0.73	0.47
GM0414	312.3	0.011	56.35	55.35	0.83	657.0	0.32	382.7	2.92	0.58	0.53
GM0417	329.7	0.011	12.19	11.54	1.00	839.2	0.20	347.9	2.50	0.42	0.42
GM0418	179.1	0.011	11.48	10.54	1.00	1369.3	0.53	350.5	2.50	0.26	0.47
GM0419	21.4	0.013	10.54	10.49	1.25	1402.4	0.23	755.8	2.86	0.54	0.49
GM0446	88.8	0.011	44.24	43.86	0.83	759.4	0.43	448.0	3.32	0.59	0.54
GM0447	254.5	0.011	45.35	44.34	0.83	731.4	0.40	443.5	3.23	0.61	0.55
GM0448	362.8	0.011	46.91	45.45	0.83	736.5	0.40	439.9	3.23	0.60	0.55
GM0449	49.2	0.011	47.07	46.93	1.00	1007.7	0.28	438.1	2.85	0.44	0.45
GM0450	155.7	0.011	48.77	47.83	0.83	902.0	0.60	413.9	3.39	0.46	0.51
GM0451	203.5	0.011	49.68	48.87	0.83	733.4	0.40	408.8	3.17	0.56	0.52
GM0452	197.3	0.011	50.47	49.68	0.83	733.7	0.40	404.9	3.06	0.55	0.53
GM0453	400.5	0.011	52.17	50.57	0.83	733.8	0.40	400.0	3.14	0.55	0.52
GM0454	162.4	0.011	52.92	52.27	0.83	734.5	0.40	397.1	3.15	0.54	0.51
GM0455	300.0	0.011	55.19	53.99	0.83	734.2	0.40	387.9	3.12	0.53	0.51
GM0456	242.5	0.011	53.89	52.92	0.83	734.2	0.40	393.7	3.05	0.54	0.52
GM0466	96.5	0.013	44.20	43.99	1.00	746.0	0.22	218.2	2.14	0.29	0.33
GM0467	126.2	0.013	44.48	44.20	1.00	753.2	0.22	215.2	1.82	0.29	0.37
GM0468	166.3	0.013	44.85	44.48	1.00	754.4	0.22	211.3	1.82	0.28	0.36
GM0469	136.4	0.013	45.16	44.85	1.00	762.4	0.23	208.4	1.83	0.27	0.36
GM0470	104.0	0.013	45.40	45.16	1.00	768.2	0.23	205.2	1.83	0.27	0.36
GM0471	126.2	0.013	45.68	45.40	1.00	753.2	0.22	202.5	1.82	0.27	0.35
GM0472	53.7	0.013	45.80	45.68	1.00	756.3	0.22	199.5	1.80	0.26	0.35
GM0473	402.8	0.011	46.78	45.90	1.00	883.4	0.22	191.7	2.15	0.22	0.30
GM0474	195.6	0.011	47.22	46.78	1.00	896.3	0.23	186.8	1.93	0.21	0.32
GM0475	84.9	0.011	47.39	47.22	1.00	845.9	0.20	183.5	1.94	0.22	0.31
GM0476	153.1	0.011	47.73	47.39	1.00	890.6	0.22	164.6	1.82	0.19	0.30
GM0477	29.9	0.013	47.80	47.73	1.00	774.1	0.23	161.3	1.83	0.21	0.30
GM04_AIRPARK	284.0	0.013	47.81	46.53	0.83	660.2	0.45	80.4	1.90	0.12	0.23
GM0503	65.8	0.012	0.10	0.00	2.50	10721.1	0.29	4265.3	4.90	0.40	0.42
GM0531	185.0	0.012	43.76	41.12	0.67	702.9	1.43	452.6	4.76	0.64	0.58
GM0553	187.9	0.013	34.90	34.40	1.25	1495.8	0.27	739.4	2.28	0.49	0.57
GM0555	100.0	0.015	33.40	32.40	1.00	1385.9	1.00	744.9	4.00	0.54	0.53
GM0556	178.0	0.013	32.47	32.07	1.25	1374.4	0.23	675.3	2.14	0.49	0.60
GM0563	225.0	0.013	34.22	33.73	1.25	1353.0	0.22	653.6	2.39	0.48	0.50
GM0564	348.0	0.013	33.73	32.96	1.25	1363.8	0.22	656.2	2.58	0.48	0.47
GM0565	143.0	0.013	32.88	32.57	1.25	1349.9	0.22	669.7	2.71	0.50	0.46
GM05_AIRPARK	464.0	0.013	46.33	44.24	0.83	660.0	0.45	85.3	1.93	0.13	0.24
GM0640	176.4	0.013	38.50	37.80	0.67	341.7	0.40	127.1	2.15	0.37	0.41
GM0646	213.4	0.013	34.80	34.22	1.00	833.6	0.27	653.7	2.72	0.78	0.64
GM0647	158.5	0.013	35.25	34.90	1.00	751.4	0.22	636.9	2.67	0.85	0.64
GM0648	282.0	0.013	35.97	35.35	1.00	749.8	0.22	634.3	2.55	0.85	0.67

CIP System Pipes: 5-yr, 24-hr Storm Event

Inputs						Outputs					
Pipe ID	Length (ft)	Manning's N	US Invert (ft)	DS Invert (ft)	Diameter (ft)	Full Flow (gpm)	Slope (%)	Max. Flow (gpm)	Max. Velocity (ft/s)	Max.Flow/Full Flow	Max.Depth/Full Depth
GM0649	83.7	0.013	36.26	36.07	1.00	761.8	0.23	631.8	2.60	0.83	0.65
GM0650	303.8	0.013	37.47	36.86	1.25	1299.3	0.20	623.3	2.27	0.48	0.50
GM0652	282.4	0.013	38.10	37.47	1.00	755.3	0.22	496.5	2.25	0.66	0.60
GM0653	166.6	0.013	38.56	38.20	1.00	743.3	0.22	491.2	2.49	0.66	0.55
GM0654	251.7	0.013	39.20	38.66	1.00	740.7	0.22	488.1	2.41	0.66	0.56
GM0675	276.2	0.013	50.55	48.71	1.50	3848.4	0.67	1834.4	4.11	0.48	0.55
GM0676	238.9	0.013	52.19	50.55	1.25	2402.4	0.69	1801.9	5.11	0.75	0.62
GM0678	239.9	0.013	48.61	48.24	1.75	2792.9	0.15	1785.1	2.70	0.64	0.59
GM0682	268.3	0.013	48.24	47.87	1.75	2641.0	0.14	1772.5	2.69	0.67	0.59
GM0686	276.3	0.013	47.87	47.46	1.75	2739.5	0.15	1772.2	3.30	0.65	0.50
GM0687	241.6	0.013	47.46	45.30	1.25	2741.8	0.89	1774.6	5.22	0.65	0.59
GM06_AIRPARK	280.0	0.013	44.04	42.78	0.83	659.7	0.45	88.4	1.95	0.13	0.24
GM0708	506.4	0.013	11.19	3.29	1.25	3621.6	1.56	1952.0	6.46	0.54	0.65
GM0709	486.5	0.013	19.11	11.19	1.25	3699.6	1.63	1950.0	6.75	0.53	0.52
GM0710	528.4	0.013	29.26	19.11	1.25	4018.7	1.92	1902.8	6.91	0.47	0.50
GM0711	349.2	0.013	32.47	29.26	1.25	2780.1	0.92	1890.1	6.04	0.68	0.55
GM0712	298.9	0.013	40.43	32.47	1.25	4732.5	2.66	1877.7	6.33	0.40	0.53
GM0713	353.6	0.013	44.12	40.80	1.25	2809.4	0.94	1781.6	5.40	0.63	0.58
GM0714	140.8	0.013	45.30	44.12	1.25	2654.8	0.84	1777.4	5.27	0.67	0.59
GM0724	494.5	0.013	30.96	20.91	0.83	1400.6	2.03	24.1	1.95	0.02	0.10
GM0725	149.8	0.013	20.91	18.40	0.83	1271.7	1.68	30.7	2.13	0.02	0.11
GM0726	452.8	0.013	18.40	10.03	0.83	1335.7	1.85	34.7	1.92	0.03	0.13
GM0727	320.1	0.013	10.03	7.30	0.83	907.3	0.85	41.9	1.89	0.05	0.15
GM0728	130.7	0.013	7.24	5.65	0.83	1083.4	1.22	45.0	1.99	0.04	0.27
GM0729	66.1	0.013	5.24	5.14	1.25	1127.7	0.15	825.5	2.49	0.73	0.58
GM0730	280.4	0.013	4.64	4.22	1.25	1122.1	0.15	840.4	2.41	0.75	0.61
GM0731	222.6	0.013	4.11	3.78	1.25	1116.4	0.15	846.8	2.61	0.76	0.57
GM0732	277.7	0.013	3.68	3.26	1.50	1833.6	0.15	847.8	2.12	0.46	0.53
GM0733	285.5	0.013	3.26	2.83	1.75	2760.0	0.15	858.0	1.58	0.31	0.60
GM0734	536.5	0.013	2.41	1.99	2.50	5151.1	0.08	4131.8	2.73	0.80	0.65
GM0735	299.7	0.013	2.69	2.51	2.50	4511.6	0.06	3383.7	2.38	0.75	0.63
GM0747	380.5	0.013	7.16	6.33	1.25	1354.1	0.22	789.4	2.51	0.58	0.56
GM0748	382.4	0.013	6.33	5.49	1.25	1358.8	0.22	779.4	2.85	0.57	0.50
GM0752	268.4	0.013	5.04	4.64	1.25	1119.2	0.15	840.1	2.23	0.75	0.65
GM0757	350.0	0.013	1.05	0.87	2.50	4174.9	0.05	4248.3	3.02	1.02	0.61
GM0758	261.6	0.013	1.34	1.15	2.50	4961.0	0.07	4238.3	2.85	0.85	0.64
GM0759	248.7	0.013	1.58	1.44	2.50	4368.4	0.06	4222.8	2.84	0.97	0.64
GM0760	349.9	0.013	1.89	1.68	2.50	4510.2	0.06	4211.9	2.78	0.93	0.65
GM0761	268.0	0.013	0.77	0.61	2.50	4498.2	0.06	4262.7	3.84	0.95	0.50
GM0778	180.5	0.013	42.11	42.05	1.00	291.6	0.03	396.0	1.96	1.36	0.56
GM0779	85.7	0.013	42.05	41.81	0.83	519.9	0.28	21.0	0.80	0.04	0.40
GM0782	119.5	0.013	43.61	43.25	0.83	539.2	0.30	3.0	0.61	0.01	0.07
GM0783	426.7	0.013	43.25	42.15	0.83	498.8	0.26	8.6	0.77	0.02	0.11
GM0785	129.7	0.013	41.23	40.70	1.00	1022.1	0.41	412.9	2.34	0.40	0.51
GM0786	283.9	0.013	41.61	41.23	1.00	585.1	0.13	409.6	2.08	0.70	0.55
GM0787	413.8	0.013	40.70	39.79	1.00	749.9	0.22	468.9	2.19	0.63	0.59
GM0792	186.2	0.013	39.79	39.38	1.00	750.5	0.22	483.4	2.62	0.64	0.52

CIP System Pipes: 5-yr, 24-hr Storm Event

Inputs						Outputs					
Pipe ID	Length (ft)	Manning's N	US Invert (ft)	DS Invert (ft)	Diameter (ft)	Full Flow (gpm)	Slope (%)	Max. Flow (gpm)	Max. Velocity (ft/s)	Max.Flow/Full Flow	Max.Depth/Full Depth
GM0793	126.8	0.013	41.05	39.80	0.83	975.4	0.99	470.7	3.95	0.48	0.49
GM0798	131.8	0.013	46.00	45.46	0.83	628.7	0.41	3.4	0.67	0.01	0.07
GM0799	402.4	0.013	45.46	43.86	0.83	619.4	0.40	7.5	0.87	0.01	0.08
GM07_AIRPARK	280.0	0.013	42.58	41.32	0.83	659.7	0.45	91.0	1.97	0.14	0.24
GM0800	341.4	0.013	43.86	40.11	0.83	1030.7	1.10	12.0	1.28	0.01	0.20
GM0805	113.7	0.013	45.12	44.60	0.67	367.3	0.46	242.9	2.69	0.66	0.56
GM0806	91.5	0.015	44.20	43.20	1.00	1448.9	1.09	245.4	2.12	0.17	0.37
GM0807	80.0	0.013	43.20	43.08	1.00	619.4	0.15	247.6	1.68	0.40	0.49
GM0808	229.8	0.013	43.08	42.57	1.00	753.3	0.22	390.4	2.16	0.52	0.51
GM0809	160.4	0.013	42.57	42.21	1.00	757.7	0.23	392.8	1.91	0.52	0.57
GM0823	438.8	0.013	26.77	19.58	0.67	695.3	1.64	479.7	4.78	0.69	0.61
GM0824	277.6	0.013	19.43	16.65	0.83	983.0	1.00	482.0	4.00	0.49	0.49
GM0825	512.2	0.013	16.30	10.54	0.83	1041.8	1.13	484.5	3.41	0.47	0.61
GM0829	232.8	0.013	14.01	13.11	0.83	610.8	0.39	6.4	0.70	0.01	0.08
GM0830	63.9	0.013	13.11	12.85	0.83	626.7	0.41	9.5	0.98	0.02	0.08
GM0831	240.5	0.013	12.85	10.28	0.83	1015.5	1.07	12.2	1.41	0.01	0.08
GM0832	359.7	0.013	10.49	9.45	1.25	1558.9	0.29	747.9	2.66	0.48	0.51
GM0833	230.1	0.013	9.45	8.95	1.25	1351.5	0.22	753.0	2.69	0.56	0.51
GM0836	335.2	0.013	8.85	8.10	1.25	1371.4	0.22	764.6	2.78	0.56	0.50
GM0837	381.1	0.013	8.00	7.16	1.25	1361.1	0.22	756.3	2.52	0.56	0.54
GM0838	475.2	0.013	39.31	26.93	0.67	876.7	2.61	477.4	5.71	0.55	0.53
GM0848	69.2	0.011	16.11	15.64	1.75	6928.7	0.68	745.5	4.19	0.11	0.22
GM0849	236.1	0.011	47.73	47.17	0.83	565.4	0.24	415.3	2.81	0.73	0.58
GM0878	111.2	0.011	4.99	4.40	1.00	1376.8	0.53	3.6	0.90	0.00	0.28
GM0880	483.8	0.011	15.29	13.06	1.75	5706.5	0.46	1464.8	4.47	0.26	0.35
GM0881	526.8	0.011	12.91	10.88	1.75	5217.6	0.39	1408.0	3.10	0.27	0.44
GM0882	53.8	0.011	8.24	7.86	2.50	18287.1	0.71	1439.3	4.95	0.08	0.19
GM0883	265.8	0.011	10.88	10.68	1.75	2305.4	0.08	1454.1	3.08	0.63	0.45
GM0893	502.7	0.011	10.58	8.44	2.50	14195.7	0.43	1435.2	4.14	0.10	0.22
GM08_AIRPARK	358.0	0.013	41.12	39.51	0.83	659.5	0.45	93.6	1.98	0.14	0.25
GM09_AIRPARK	360.0	0.013	39.31	37.46	0.83	705.0	0.51	96.2	2.06	0.14	0.25
LINK295_SMITHLS	1529.8	-	32.00	52.19	1.00	2773.0	1.32	1982.4	6.40	0.72	0.91
LINK298	28.9	0.014	32.07	32.00	1.25	1325.7	0.24	1569.9	4.16	1.18	0.65
LINK300_HWY30_F	256.5	-	33.93	60.55	0.50	755.4	10.43	156.3	2.51	0.21	0.92
LINK303	1563.3	-	8.91	12.50	0.33	62.7	0.23	157.5	4.06	2.51	0.97
LINK306	1726.0	-	8.00	15.50	0.33	88.4	0.44	149.4	3.86	1.69	0.96
LINK307	24.5	0.014	185.00	181.77	0.27	166.2	13.28	0.0	0.00	0.00	0.47
LINK308	142.4	0.014	181.77	179.87	0.67	582.5	1.33	177.6	3.82	0.31	0.40
LINK309	159.1	0.014	179.87	178.05	0.67	539.4	1.14	192.2	3.11	0.36	0.43
LINK310	94.1	0.014	178.05	176.97	0.67	540.4	1.15	194.8	4.07	0.36	0.35
LINK311	264.9	0.014	176.97	154.40	0.67	1474.6	8.55	198.6	6.55	0.14	0.25
LINK312	252.0	0.014	153.99	124.48	0.67	1731.9	11.79	210.7	7.51	0.12	0.24
LINK313	271.7	0.014	124.48	89.83	0.67	1808.4	12.86	212.7	7.83	0.12	0.23
LINK314	233.7	0.014	89.83	56.00	0.67	1929.0	14.63	214.7	8.10	0.11	0.23
LINK315	21.5	0.014	54.96	54.33	0.67	862.6	2.93	217.7	4.72	0.25	0.35
LINK316	323.1	0.014	54.33	45.97	0.67	811.3	2.59	218.9	4.39	0.27	0.36
LINK317	268.8	0.014	6.28	6.21	0.67	81.4	0.03	112.7	1.17	1.38	0.62

CIP System Pipes: 5-yr, 24-hr Storm Event

Inputs						Outputs					
Pipe ID	Length (ft)	Manning's N	US Invert (ft)	DS Invert (ft)	Diameter (ft)	Full Flow (gpm)	Slope (%)	Max. Flow (gpm)	Max. Velocity (ft/s)	Max.Flow/Full Flow	Max.Depth/Full Depth
LINK318	146.6	0.014	6.21	5.63	0.67	317.2	0.40	126.7	2.07	0.40	0.41
LINK319	264.0	0.014	5.51	4.59	0.67	297.7	0.35	140.6	2.00	0.47	0.46
LINK320	202.0	0.014	4.49	3.84	0.67	286.1	0.32	154.8	2.04	0.54	0.49
LINK321	64.7	0.014	3.74	3.54	0.67	280.3	0.31	166.2	2.18	0.59	0.49

Appendix E

Energy Audit

Energy Smart Industrial
Strategic Energy Management

Energy Model Report
Version 1

Presented to:

Scappoose Wastewater Treatment Plant
34485 E. Columbia Avenue
Scappoose, OR 97056

Sponsored by:

COLUMBIA RIVER PUD
A COMMUNITY-OWNED UTILITY

and

Energy Smart Industrial
BPA ENERGY EFFICIENCY

TrakSmart ID: SEM_000065

September 23, 2019

OFFICIAL USE ONLY

DISCLAIMER

The intent of this Energy Smart Industrial Energy Model Report is to document the energy baseline model used to estimate energy savings during Scappoose Wastewater Treatment Plant's Strategic Energy Management (SEM) engagement, barring any significant changes to the facility or process. This report is believed to be reasonably accurate, but actual results may vary. As a result, Columbia River PUD and the Bonneville Power Administration (BPA) are not liable if estimated savings or economics are not actually achieved during the SEM engagement. The contents of this document are for informational purposes and are not to be construed as a design document or as guarantees.

Scappoose Wastewater Treatment Plant should independently evaluate any advice or direction provided in this report. In no event will Columbia River PUD and/or BPA Energy Smart Industrial be liable for the failure to achieve a specified amount of energy savings and any incidental or consequential damages of any kind in connection with this report or the installation of recommended measures.

CONTACTS AND PREPARATION

Facility Contact:

Kevin Turner
Wastewater Supervisor, Scappoose WWTP
33568 E. Columbia Ave.
Scappoose, OR 97056
Phone: (503) 543-7146 ext. 5
Email: kturner@cityofscappoose.org

Utility Contact:

Tim Lammers
Energy Services Supervisor, Columbia River PUD
PO Box 1193,
Deer Island, OR 97051
Phone: (503) 397-8155
Email: tlammers@crpud.com

Bonneville Power Administration Contact:

Todd Amundson
Energy Management Engineer
P.O. Box 3621
Portland, OR 97208-3621
Phone: (503) 230-5491
Email: tmamundson@bpa.gov

ESI Contact:

Christian Miner
Energy Smart Industrial Partner (ESIP)
123 NE 3rd Ave. Suite 400
Portland, OR 97232
Phone: (971) 230-5857
Email: christian.miner@energysmartindustrial.com

Report Preparation:

This report was prepared by:

James Roe
Energy Performance Tracking Engineer
123 NE 3rd Ave. Suite 400
Portland, OR 97232
Phone: (971) 202-9740
Email: james.roe@energysmartindustrial.com

TABLE OF CONTENTS

1.0 Background

The Scappoose Wastewater Treatment Plant (Scappoose) operates using the aerobic digester tank/activated sludge recycling process, treating between 0.6 and 1.4 million gallons per day (MGD) of wastewater.

This report outlines the development of the baseline energy model and how it will be used to measure energy savings for this multi-year Strategic Energy Management (SEM) engagement at the Scappoose WWTP Wastewater Treatment Plant located in Scappoose, Oregon. SEM was offered by Columbia River PUD as part of the Bonneville Power Administration's (BPA) Energy Smart Industrial (ESI) program. This SEM engagement provides Scappoose WWTP with two annual periods to address operations and maintenance (O&M) opportunities and improve the effectiveness of previously implemented action items.

1.1 Version History

This is the initial version release as part of the SEM process and reflects the energy and production data available up to June 1, 2019.

Table 1. Version History

Version Number	Version Date	Reason for Revision
1	9/23/2019	First version energy model.

1.2 Baseline Period

In June 2017, a step change in electrical energy use occurred, which coincides with the installation of the screw press drying system. Also, in October and November 2017, an upset condition in the treatment process occurred, and additional pumping was required. This event was exacerbated by two concurrent periods of heavy rainfall. The added operations resolved the condition by December 2017.

The selected baseline period was chosen to avoid the June 2017 step change and the upset/rainfall events in the fall of 2017. The most recent full-year period was selected to most accurately reflect current operations.

The baseline for this model is defined as the twelve month period before the Energy Scan that occurred on June 4, 2019.

- Baseline period: **5/24/2018 – 5/23/2019**
- Baseline energy: **1.5 million kWh/yr**

1.3 Operating Hours

The facility operates year-round and the system operates 24 hours a day. Remote logging and reporting allow for reduced staffing in the overnight and weekend periods. Shutdowns are typically not scheduled, and system redundancy is utilized to ensure that no equipment failures create an inoperable condition.

1.4 Process Description

The facility processes all domestic and business wastewater for the Scappoose region. The wastewater treatment process pre-filters non-digestible trash and grit before entering an aeration basin. The sewage is then fed to two primary clarifiers which allow the waste activated sludge

(WAS) to settle. The sludge is then pumped to an aerobic digestion tank to undergo further biologic decomposition. After this, it is pumped into an aerated biosolids storage lagoon for final settling. One additional unaerated lagoon serves to hold water for additional processing. Clarified water outflow is pumped to UV light banks and discharged by pumping into the Columbia River. The digested sludge is dredged from the lagoons and dried in a screw auger press. Dried sludge is spread over city-owned land during the growing season and stored in a covered building (not visible in Figure 1) during the winter .

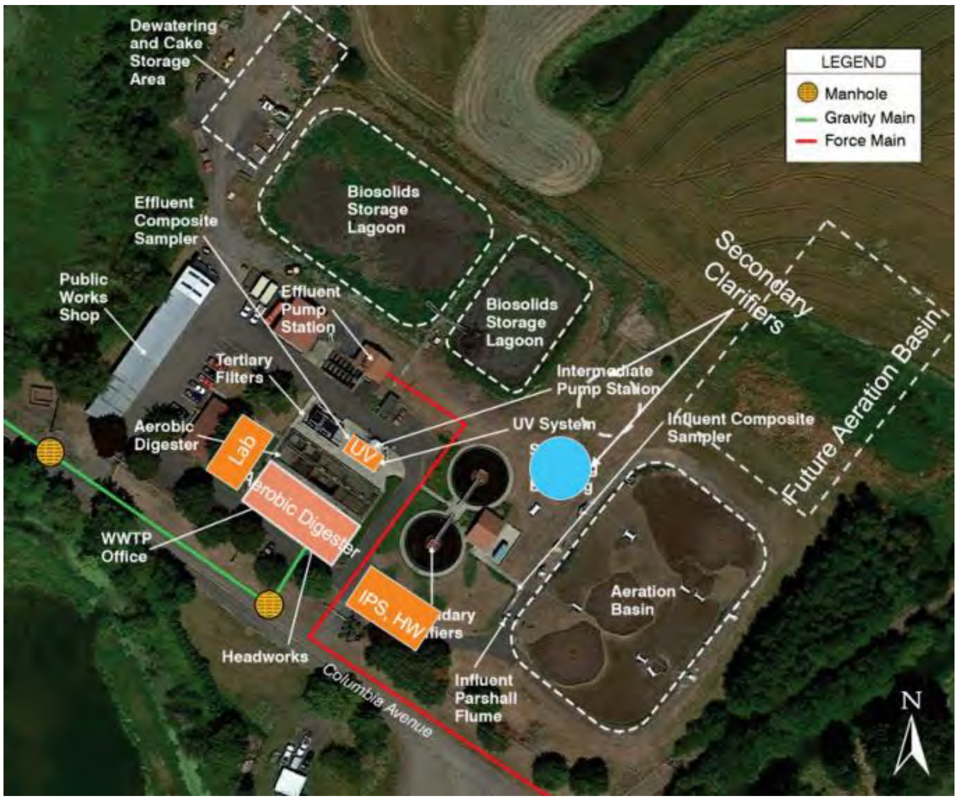


Figure 1. Scappoose WWTP Aerial Photo.

The energy demands from the process are largely from the pumps required at the headworks, circulation and aeration at the digester bins, aeration and circulation at the lagoons, discharge pumps for the effluent, recirculation for activated sludge, and the UV disinfection system. The pumps are installed with VFDs and are installed in sets for redundancy.

Additional energy use is present in facility lighting, HVAC for work areas, driving the clarifiers, and system controls. The primary pumps are detailed in Table 2.

Table 2. Pump Schedule

Function	Qty. × hp
Headworks	4 × 25 hp
Screening and grit	2 × 40 hp 3 × 40 hp 1 × 7 hp
Digester	40 hp Aeration
Sludge Pond	3 × 20 hp Circulation 3 × 4 hp Aeration
Filter Pumps	2 × 25 hp
Screw Press	10 hp
Effluent Discharge	4 × 40 hp

Five additional lift stations are in the collection system but will not be included in the energy model.

1.4.1 Explanation of Process Variables

The facility operates by using the activated sludge recycling process, measuring influent, effluent, total suspended solids (TSS) and biological oxygen demand (BOD) in concentration and total weight. Other measurements track nitrification, dissolved oxygen, pH, and effluent temperature.

The process variables obtained for model evaluation are shown in Table 3.

Table 3. Summary of Process Variables

Meter Description	Date Available	Variable	Interval	Units	Source	Aggregation
Process SCADA	2/1/2016	Influent Flow	Daily	MGD	Site	Sum
		Effluent Flow				Sum
		Influent BOD	3×weekly	mg/l		Average
		Influent TSS		mg/l		Average
		UV Light Intensity	Daily	Relative		Average
Weather	2/1/2106	Site Rainfall	Daily	Inches	Site	Sum
	1/1/2016	Dry Bulb Temperature	Daily	°F	Dark Sky via SENSEI*	Average

* Weather data location is KPDX, 45.5886°N, 122.5975°W

In aggregating the variables for the monthly intervals, some values were totalized (summed) and others required averaging. Influent and Effluent flow were summed to allow comparison to the total energy required. TSS and BOD Density measurements (mg/l) and temperatures were averaged to account for an irregular sampling cycle.

Aggregating according to the semi-regular energy billing cycle allowed better alignment of data than following a calendar month schedule.

1.4.2 Explanation of Weather Variables

Wastewater treatment process efficiency can sometimes be correlated to process or environment temperature and may show a seasonal fluctuation. The weather data for Scappoose WWTP (shown in Table 3) were evaluated for this model. Dry-bulb ambient temperature is collected from SENSEI Dark Sky data, and rainfall is collected as part of the site data and returned within the monthly DMR.

Weather had only a slight effect on the model performance and did not improve the model sufficiently to be included. As the operators continue to improve performance, a model incorporating elements of the environment may better show the dependencies and can be considered as an opportunity for later development. Refer to Appendix A 4.0 for further information on weather in the regression model.

1.5 Metering Boundary

The facility has one single electrical service, and the metering boundary for this facility has been defined as Meter #14147852. Electricity is fed from the Columbia River PUD distribution network.

An additional five lift stations and meters are located around the Scappoose area, but these are outside of the metering boundary for this model. The meter and the total energy use for this model are shown in Table 4.

Table 4. Summary of Electrical Energy Meters

Meter Description	Availability Date	Time Interval	Units	Service Location	Baseline Totals (kWh)	% of Total
14147852	1/22/2016	Monthly	kWh	Facility Entrance	1,529,800	100%

2.0 Development of the Model

2.1 Energy Adjustments During the Baseline Period

Scappoose had no incentivized capital improvements that were incorporated during the baseline period and would need to be included in the model adjustments.

Scappoose has identified that a return activated sludge (RAS) pump upgrade will be completed before 12/31/2019, and the ultraviolet (UV) light system upgrades are being pushed out to 2020. Energy reductions from any future incentivized projects will be documented in annual completion reports. Savings from the incentivized projects will be subtracted from the gross energy savings, and the net result will be used for the O&M based savings.

2.2 Selection of Time Interval

Electrical energy consumption data are available only on a monthly basis and thus this limited the time interval of the model to monthly. Process data are available on a daily basis. Billing months are used to create the model, as correlating the daily process data to the monthly billing cycles provided the best success in correlating the data.

2.3 Missing and Erroneous Data

No missing or erroneous data were identified in the baseline data. All observations were accepted without any modifications or corrections.

2.4 Outliers of Residuals

All model residuals (actual energy use minus predicted energy use) remained within ±4σ. All observations during the baseline period were included in the final model, as shown in Figure 2.

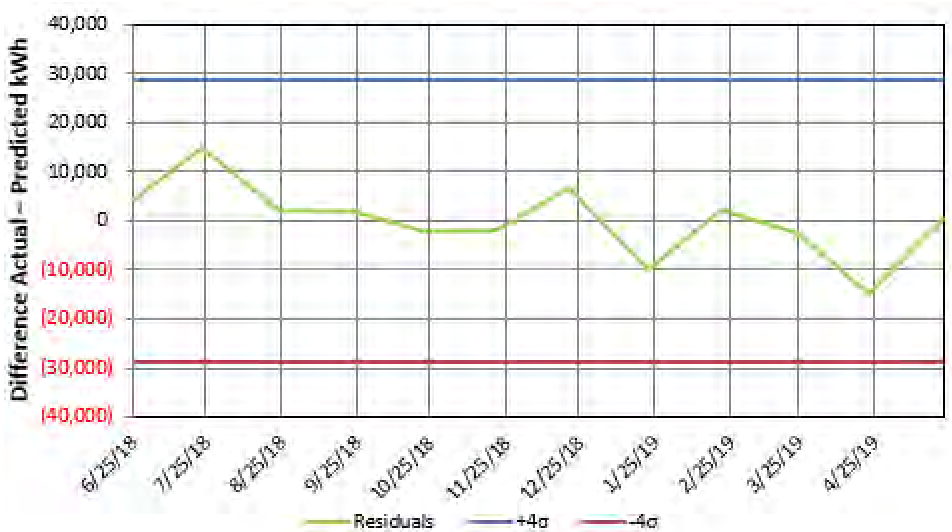


Figure 2. Time series of model residuals.

2.5 Model Selection

Based on the available monthly electrical data, Scappoose's energy consumption is relatively constant. Due to this relatively flat energy profile, no statistically significant correlation was found for common energy drivers including influent flow, BOD, ambient and effluent temperature, and effluent flow.

Since no significant energy drivers could be identified, a mean model is recommended. For mean models, predicted energy use is equal to the average daily energy use during the twelve-month baseline period. Monthly energy use will be predicted by multiplying this average by the number of days in that billing cycle:

$$\boldsymbol{Predicted\ Energy\ Use}\left(\frac{\boldsymbol{kWh}}{\boldsymbol{month}}\right) = \ \boldsymbol{4,191.233}\frac{\boldsymbol{kWh}}{\boldsymbol{day}} \times \boldsymbol{N}\left(\frac{\boldsymbol{days}}{\boldsymbol{month}}\right)$$

Influent flow will be tracked to ensure that operation of the facility does not deviate too far from the baseline conditions. Table 5 shows the valid range for the average daily flows per period. The model will be checked for validity if influent flows fall outside this range. At the end of each year of the performance period, average flows for the whole year will also be compared against the baseline period to ensure that savings calculated by the model are not the result of a significant reduction in flow, for example.

Table 5. Coefficients and Valid Range

Variable Name	Units	Obs Min	Obs Max	Valid Min	Valid Max
Influent Flow	MGD	0.63	1.01	0.59	1.05

Because it is a mean model the coefficient of determination (R^2) is poor. However the ability of the model to identify savings may be sufficient given its low coefficient of variation (CV) and low fractional savings uncertainty (FSU) The statistical fitness of the model is summarized by Table 6.

Table 6. Summary of Model Statistics

Description	Value	Description	Value
R^2 (≥ 0.75)	0.381	CV (≤ 20%)	6.19%
R^2 Adjusted	0.319	Observations (≥ 6 × *n* coef.)	12
Net Det. Bias (< $\pm 5.0\times10^{-5}$)	-3.67×10^{-12}	Autocorrelation	0.045
Est. Project Savings	5%	FSU at 80% Conf. (≤ 50%)	9.8%

3.0 Use of the Model

3.1 Tracking Energy Savings

Energy performance data will be available via an online energy management system called SENSEI. Scappoose's data manager will send daily process data (daily DMRs) to ESI on a monthly basis. ESI will arrange for energy data to be delivered from either the utility or the end user. Daily process and monthly energy data will be loaded to SENSEI, and the Energy Champion at Scappoose will be notified that the data have been updated.

To incorporate incentivized projects and any adjustments required, energy savings for annual completion reports will be calculated using ESI's tracking sheet as the official tool. The tracking sheet is a customized Excel workbook specific to this energy model.

3.2 Energy Performance

A performance plot for this SEM engagement is provided in the tracking sheet. This plot shows *Actual Energy Use* and *Predicted Energy Use* (from the energy model) on the left y-axis and *Gross CUSUM* and *Net CUSUM* on the right y-axis. The CUSUM is the cumulative sum of energy savings. The Gross CUSUM is the energy savings for the entire measurement boundary, including previously incentivized projects, while the Net CUSUM is the energy savings achieved through this engagement. While this engagement is just beginning, the most recent performance plot is shown in Figure 3 below.

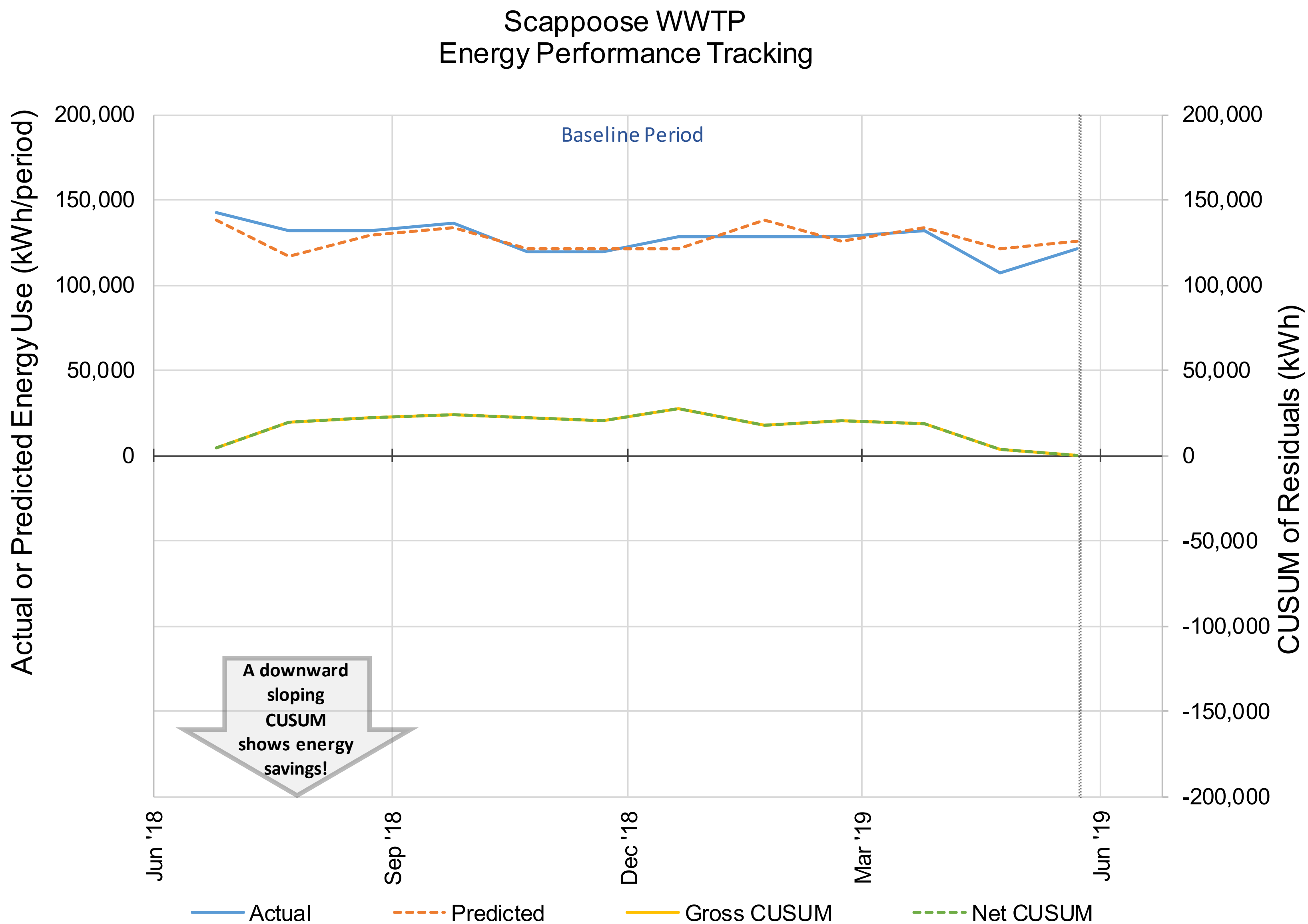


Figure 3. Example of performance plot.

A 1.0 MODEL SUMMARY

In all of the modeling (including evaluation of longer baseline periods not reported here), the relatively flat energy use restricted the ability to correlate process tracking variables with actual energy used. Energy use remained relatively constant, even as influent flows varied between average levels of 0.6 to 1.0 MGD. Several competing models predicted *lower* energy use for *higher* flow rates, which is contrary to the known relationship between flow and energy. Since no other significant energy driver could be identified, a mean model was selected for the final model.

The following comments correspond to each of the competing models summarized in Table 7 below.

1. Influent only model, showing negative correlation to energy consumption. T-stat is also low, indicating that Influent only is not a strong predictor of energy. The negative correlation will increase the predicted energy as the flow decreases.

2. Common influent and temperature model. Ambient temperature has a weak positive correlation to energy, but neither T-statistic shows a strong predictive pattern.

3. Models 3 and 4 included solids to evaluate whether tracking the incoming biological matter can improve the model. TSS tracks the total solids in the Influent and represents the mass of matter to be removed at the clarifier. TSS in this period has a moderate positive statistical presence, but only contributes a small portion of the energy prediction. TSS has not been shown to be a reliable predictor in other system models and use of it would require strong justification.

4. BOD represents the level of carbon-based matter that will require aeration and digestion to decompose and flocculate in the digestion tanks and lagoons. BOD has both a small contribution and weak prediction of energy in this model.

5. Test of Effluent flow, verifying that it is not a predictor of energy. Influent and Effluent flows typically are within 10% of each other at Scappoose WWTP.

6. The SCADA system also tracks the relative intensity of the UV sterilization system which reports back the daily average of the light intensity. Because this metric only reflects the relative process energy for removal of pathogens, it does not reflect overall energy use.

7. **FINAL MODEL**: The mean model indicated statistics are somewhat less than the flow and temperature related models, but this model is preferred to versions with negative coefficients on the flow. The average daily energy is derived from summing the energy used over the 365 days in the baseline period.

Table 7. Competing Model Summary

Trial	Period	R^2	Adj. R^2	CV-RMSE (%)	Auto-correl. coef.	FSU (5.0% savings, 80% CL)	Variables	Coefficients	T-value	% of Baseline kWh	Aggre-gation Type
1	5/24/2018 to 5/23/2019	43.3%	37.7%	5.9%	4.7%	12.2%	Constant	4,721.133	10.38	112.6%	—
							INF Flow, MGD	-705.219	-1.18	-12.6%	Total
2	5/24/2018 to 5/23/2019	44.6%	32.3%	6.1%	7.0%	13.0%	Constant	4,197.218	3.1936	100.1%	—
							Dry Bulb Temperature [°F]	4.954	0.4275	6.5%	Avg
							INF Flow, MGD	-372.601	-0.374	-6.7%	Total
3	5/24/2018 to 5/23/2019	57.6%	41.6%	5.7%	5.2%	11.8%	Constant	2,524.661	1.5729	60.2%	—
							Dry Bulb Temperature [°F]	10.779	0.9526	14.2%	Avg
							INF Flow, MGD	143.276	0.1467	2.6%	Total
							Average TSS, mg/L	3.682	1.5937	23.0%	Avg
4	5/24/2018 to 5/23/2019	46.2%	26.0%	6.4%	11.3%	14.6%	Constant	4,541.992	2.7619	108.4%	—
							Dry Bulb Temperature [°F]	3.217	0.2478	4.2%	Avg
							INF Flow, MGD	-598.279	-0.499	-10.7%	Total
							Average BOD mg/L	-0.265	-0.386	-1.9%	Avg
5	5/24/2018 to 5/23/2019	48.6%	43.5%	5.6%	12.2%	12.9%	Constant	4,859.151	11.216	115.9%	—
							EFF Flow MGD	-895.640	-1.562	-15.9%	Total
6	5/24/2018 to 5/23/2019	51.4%	40.6%	5.7%	6.6%	12.1%	Constant	4,348.072	5.5688	103.7%	—
							EFF Flow MGD	-406.208	-0.478	-7.2%	Total
							UV Intensity	235.791	0.7936	3.5%	Avg
7	5/24/2018 to 5/23/2019	38.1%	31.9%	6.2%	4.5%	9.8%	Constant	0.000	0	0.0%	—
							Mean Model	4,191.233	0.5158	100.0%	Avg

A 2.0 Data Review

A 2.1 Influent Time Series Plot

Using the regression model, the baseline time series plot compares the predicted energy and the Influent Flow. Energy use is relatively flat in this period. (Figure 4). This variable is not used in the model but will be tracked to identify and major deviations from baseline conditions.

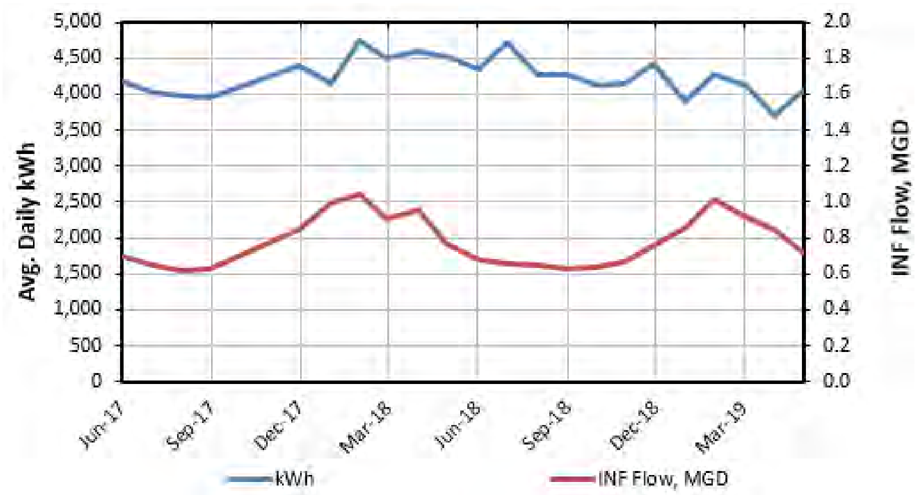


Figure 4. Plot of influent flow and daily kWh.

A 2.2 Variable XY Plots

Figure 5 shows the limited effect of influent flow on energy use, which is relatively flat for a significant range of flow. If included in the model, influent flow would have a negative coefficient. As a result, predicted energy use would decrease for an increase in flow.

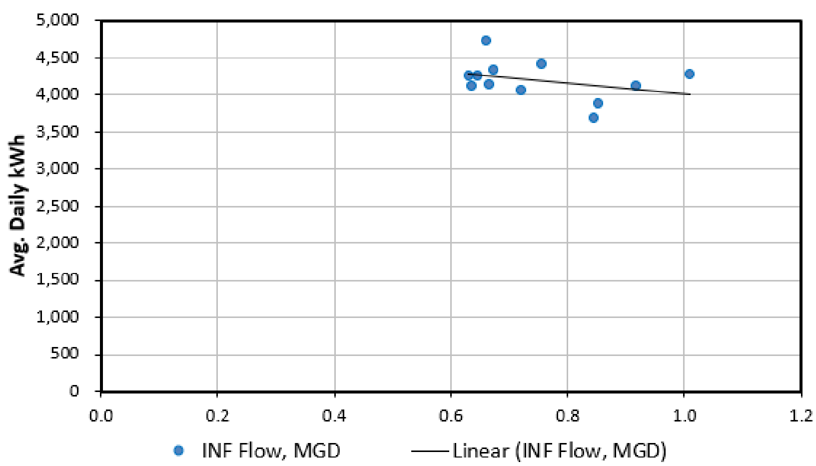


Figure 5. Influent flow vs energy use.

A 3.0 DIAGNOSTIC PLOTS

Mean model residuals fall within +12 and −14%. Figure 6 shows the relatively flat energy use.

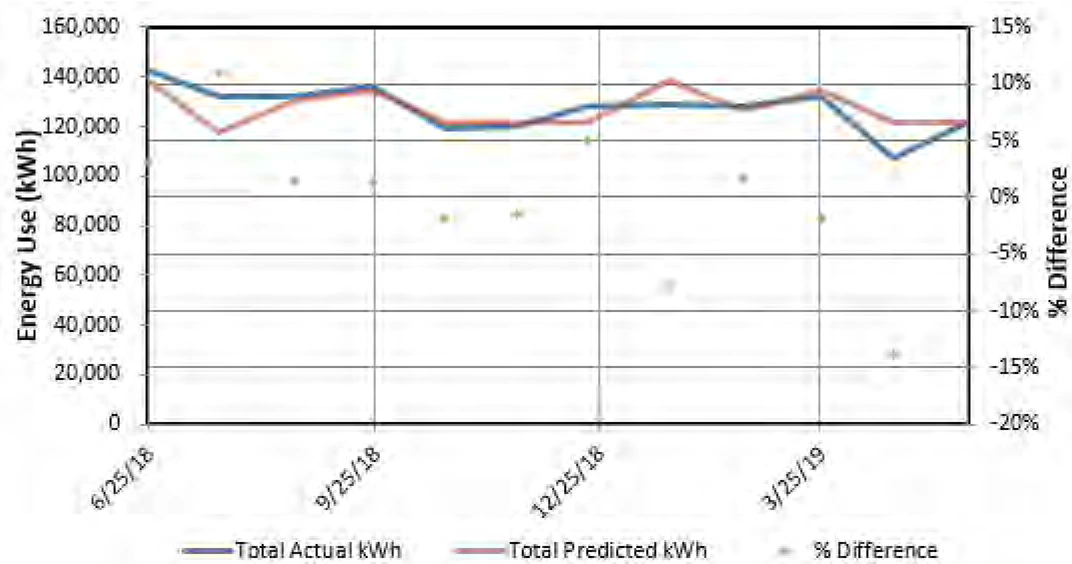


Figure 6. Residuals (actual − predicted energy).

The CUSUM for the baseline period shows no significant inflection points. The maximum value of the CUSUM is 1.6%, as shown in Figure 7.

Figure 7. Predicted and actual energy with CUSUM as percent.

Model residuals are normally distributed with no outliers, as shown in Figure 8.

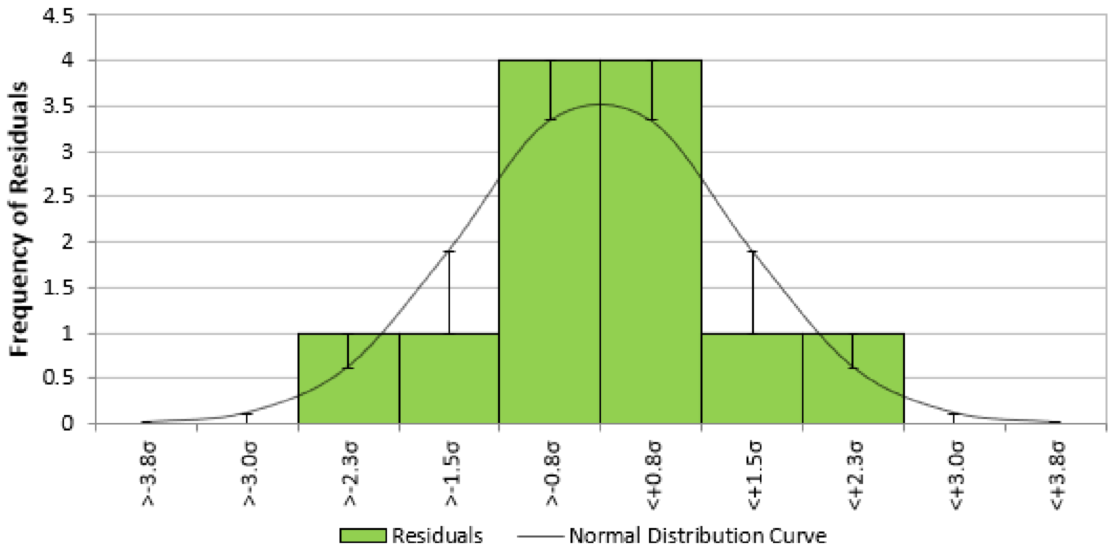


Figure 8. Distribution of Residuals.

The regression model is limited in that a small range of energy is used, resulting in a low R^2. Figure 9 shows the relationship between predicted and actual energy.

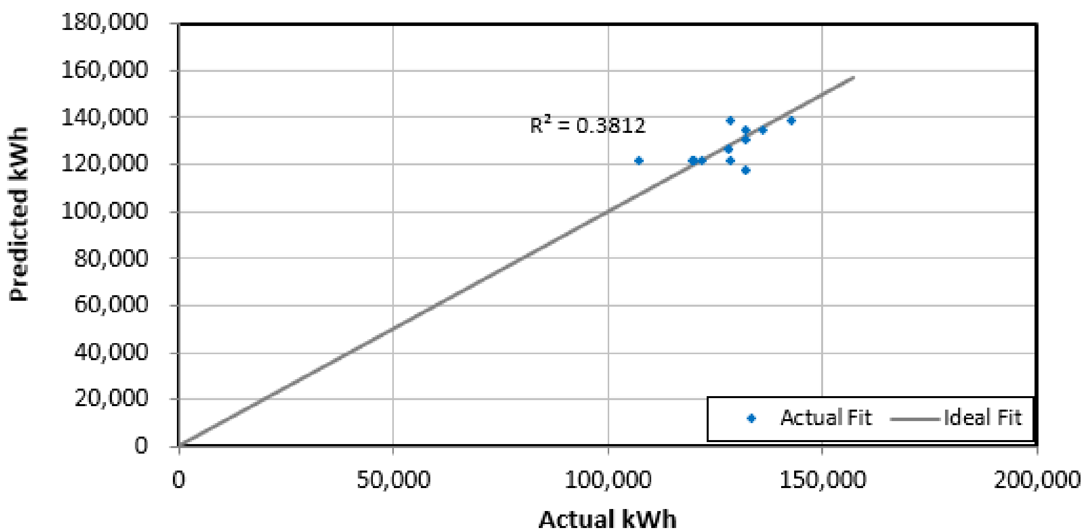


Figure 9. Scatter plot of predicted vs. actual energy.

A 4.0 Review of Weather Data

In creating the model, the full data set was evaluated to discern if any weather trends were present in the energy consumption. The plots below include the time frame from February 2016 until May 2019.As shown in Figure 10, the energy consumption did not vary in a manner that can be predicted by the ambient air temperature.

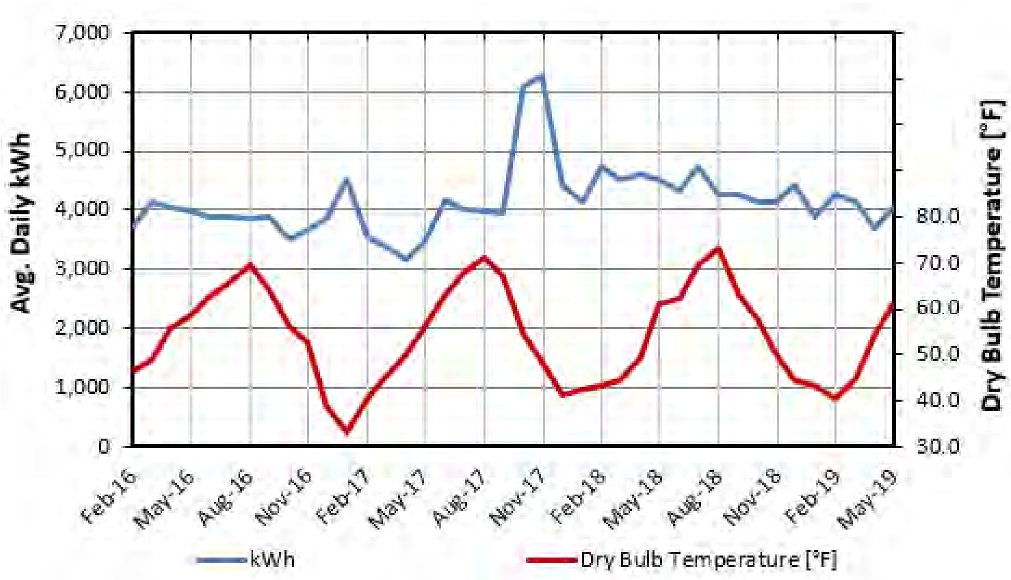


Figure 10. Energy and ambient temperature from 2016–2019.

Total rainfall also followed a seasonal trend but did not translate into an energy pattern. Figure 11 shows the time plot of energy and rainfall (Monthly total converted to a daily mean value).

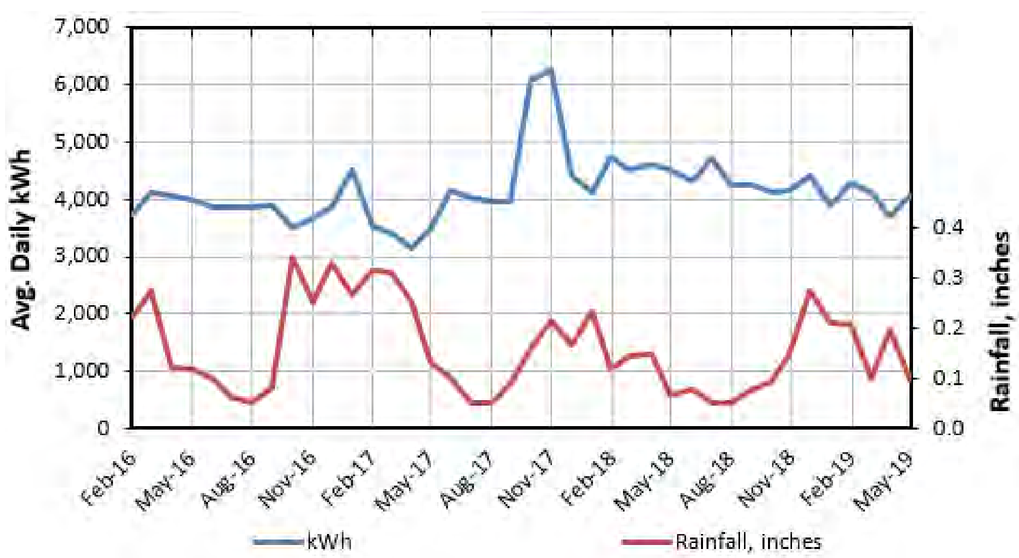


Figure 11. Energy and average daily rainfall from 2016–2019.

A 5.0 Response to Feedback

Negative coefficients for influent and effluent flows is odd. One tends to wonder what flow meter type these are, and how frequently they are calibrated?

Distribution of data and energy use may be creating the impression of negative correlation.
The T stat is very weak in Flow models 2,3,4,5,and 6
Task created to discuss the design and calibration of meters with Scappoose.

Please consider collecting Process SCADA and weather data if it's not inconvenient to do so.

Tracking sheets and completion reports will include daily data. **Figure 12** *shows a sample of the daily tracking.*

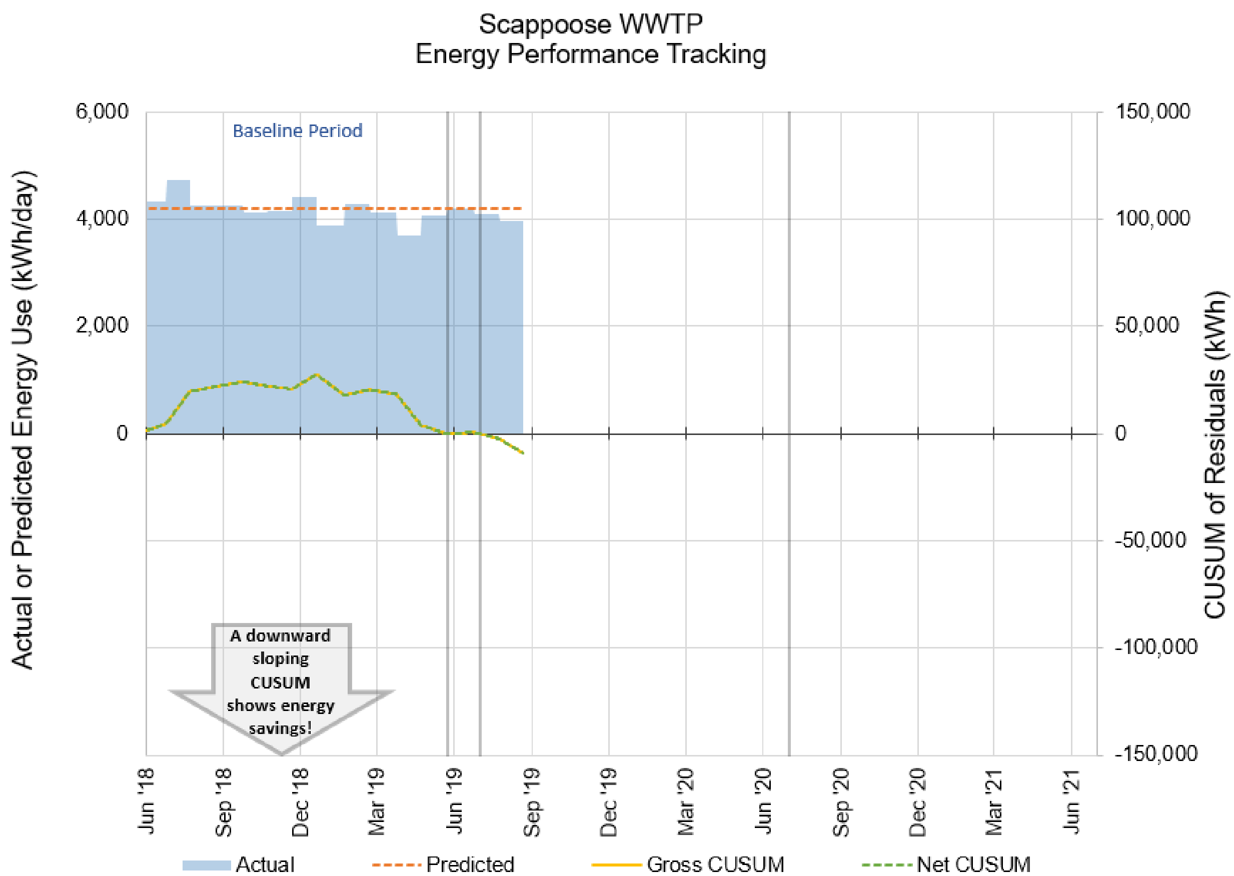


Figure 12. Daily performance tracking

Appendix F

Detailed Opinion of Probable Cost

Alternative 1 - West Line Improvements (with Daytime Keys WTP Flows)				
GENERAL LINE ITEM	**EST. QTY**	**UNIT**	**UNIT PRICE**	**AMOUNT**
Smith Road				
8" PVC Pipe (Gravity) - Excavation, Backfill	750	LF	$ 100	$ 75,000
15" PVC Pipe (Gravity) - Excavation, Backfill	500	LF	$ 140	$ 70,000
Creek Boring	50	LF	$ 900	$ 45,000
Reconnect Services	250	LF	$ 15	$ 3,750
Connect to Pump Station	1	LS	$ 5,000	$ 5,000
Manhole (48")	7	EA	$ 5,000	$ 35,000
Native Surface Repair	750	LF	$ 5	$ 3,750
Full Lane Pavement Repair	500	LF	$ 60	$ 30,000
Abandon Line	1	LS	$ 15,000	$ 15,000
Bypass Pumping	1	LS	$ 15,000	$ 15,000
Traffic Control	1	LS	$ 10,000	$ 10,000
Em Watts, 4th Street to Smith Rd PS				
10" PVC Pipe (Gravity) - Excavation, Backfill	150	LF	$ 110	$ 16,500
15" PVC Pipe (Gravity) - Excavation, Backfill	4,400	LF	$ 140	$ 616,000
18" PVC Pipe (Gravity) - Excavation, Backfill	200	LF	$ 155	$ 31,000
Reconnect Services	3,000	LF	$ 15	$ 45,000
Manhole (48")	25	EA	$ 5,000	$ 125,000
Native Surface Repair	1,600	LF	$ 5	$ 8,000
Half Lane Pavement Repair	3,150	LF	$ 30	$ 94,500
Bypass Pumping	1	LS	$ 25,000	$ 25,000
Traffic Control (without Flagging)	3,500	LF	$ 4	$ 14,000
Creek bank stabilization	1	LS	$ 300,000	$ 300,000
OHP & Mobilization	1	LS	20%	$ 317,000
Contingency and Allowances	1	LS	30%	$ 570,000
Construction Subtotal (rounded)				***$ 2,470,000***
Engineering and CMS	1	LS	30%	$ 741,000
Legal, Admin, and Permitting	1	LS	2%	$ 50,000
Total Project Cost (rounded)				***$ 3,261,000***

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Alternative 2 - West Line Improvements (with Nighttime WTP Flows)				
GENERAL LINE ITEM	**EST. QTY**	**UNIT**	**UNIT PRICE**	**AMOUNT**
WTP Automated Valve, Valve Structure, Controls	1	LS	$ 100,000	$ 100,000
Smith Road				
8" PVC Pipe (Gravity) - Excavation, Backfill	750	LF	$ 100	$ 75,000
15" PVC Pipe (Gravity) - Excavation, Backfill	500	LF	$ 140	$ 70,000
18" PVC Pipe (Gravity) - Excavation, Backfill	200	LF	$ 155	$ 31,000
Creek Boring	50	LF	$ 900	$ 45,000
Reconnect Services	250	LF	$ 15	$ 3,750
Connect to Pump Station	1	LS	$ 5,000	$ 5,000
Manhole (48")	7	EA	$ 5,000	$ 35,000
Native Surface Repair	950	LF	$ 5	$ 4,750
Full Lane Pavement Repair	500	LF	$ 60	$ 30,000
Abandon Line	1	LS	$ 15,000	$ 15,000
Bypass Pumping	1	LS	$ 15,000	$ 15,000
Traffic Control	1	LS	$ 10,000	$ 10,000
OHP & Mobilization	1	LS	20%	$ 88,000
Contingency and Allowances	1	LS	30%	$ 159,000
WTP & Smith Road Construction Subtotal (rounded)				***$ 687,000***
Engineering and CMS	1	LS	30%	$ 207,000
Legal, Admin, and Permitting	1	LS	2%	$ 14,000
WTP & Smith Road Total Project Cost (rounded)				***$ 908,000***

4th Street to Smith Rd PS				
15" PVC Pipe (Gravity) - Excavation, Backfill	2,050	LF	$ 140	$ 287,000
12" Cured-in-place-pipe (CIPP)	900	LF	$ 110	$ 99,000
Reconnect Services	600	LF	$ 15	$ 9,000
Manhole (48")	6	EA	$ 5,000	$ 30,000
Native Surface Repair	1,750	LF	$ 5	$ 8,750
Half Lane Pavement Repair	300	LF	$ 30	$ 9,000
Bypass Pumping	1	LS	$ 20,000	$ 20,000
Traffic Control (without Flagging)	300	LF	$ 4	$ 1,200
OHP & Mobilization	1	LS	20%	$ 93,000
Contingency and Allowances	1	LS	30%	$ 168,000
4th Street to Smith PS Construction Subtotal (rounded)				***$ 725,000***
Engineering and CMS	1	LS	30%	$ 218,000
Legal, Admin, and Permitting	1	LS	2%	$ 15,000
4th Street to Smith PS Total Project Cost (rounded)				***$ 958,000***
Total Project Cost (rounded)				***$ 1,866,000***

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Alternative 3 - New HWY 30 Crossing at Maple Street (with Nighttime WTP Flows)				
GENERAL LINE ITEM	EST. QTY	UNIT	UNIT PRICE	AMOUNT
WTP Automated Valve, Valve Structure, Controls	1	LS	$ 100,000	$ 100,000
Smith Road				
8" PVC Pipe (Gravity) - Excavation, Backfill	750	LF	$ 100	$ 75,000
12" PVC Pipe (Gravity) - Excavation, Backfill	500	LF	$ 120	$ 60,000
Reconnect Services	500	LF	$ 15	$ 7,500
Manhole (48")	5	EA	$ 5,000	$ 25,000
Native Surface Repair	750	LF	$ 5	$ 3,750
Full Lane Pavement Repair	500	LF	$ 60	$ 30,000
Abandon Line	1	LS	$ 15,000	$ 15,000
Bypass Pumping	1	LS	$ 15,000	$ 15,000
Traffic Control	1	LS	$ 10,000	$ 10,000
OHP & Mobilization	1	LS	20%	$ 69,000
Contingency and Allowances	1	LS	30%	$ 124,000
WTP & Smith Road Construction Subtotal (rounded)				***$ 535,000***
Engineering and CMS	1	LS	30%	$ 161,000
Legal, Admin, and Permitting	1	LS	2%	$ 11,000
WTP & Smith Road Total Project Cost (rounded)				***$ 707,000***
Maple Street Crossing				
12" PVC Pipe (Gravity) - Excavation, Backfill	5,000	LF	$ 120	$ 600,000
HWY/RR Crossing	200	LF	$ 900	$ 180,000
Reconnect Services	3,100	LF	$ 15	$ 46,500
Manhole (48")	17	EA	$ 5,000	$ 85,000
Full Lane Pavement Repair	5,000	LF	$ 60	$ 300,000
Bypass Pumping	1	LS	$ 20,000	$ 20,000
Traffic Control	1	LS	$ 30,000	$ 30,000
Easement (non-commercial)	900	LF	$ 30	$ 27,000
OHP & Mobilization	1	LS	20%	$ 258,000
Contingency and Allowances	1	LS	30%	$ 464,000
Maple St Crossing Construction Subtotal (rounded)				***$ 2,011,000***
Engineering and CMS	1	LS	30%	$ 604,000
Legal, Admin, and Permitting	1	LS	2%	$ 41,000
Maple St Crossing Total Project Cost (rounded)				***$ 2,656,000***
12" Cured-in-place-pipe (CIPP)	3,100	LF	$ 110	$ 341,000
OHP & Mobilization	1	LS	20%	$ 69,000
Contingency and Allowances	1	LS	30%	$ 123,000
South Scappoose Creek CIPP Construction Subtotal (rounded)				***$ 533,000***
Engineering and CMS	1	LS	20%	$ 107,000
Legal, Admin, and Permitting	1	LS	2%	$ 11,000
South Scappoose Creek CIPP Total Project Cost (rounded)				***$ 651,000***
Total Project Cost (rounded)				***$ 4,014,000***

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Old Portland Road Improvements				
GENERAL LINE ITEM	EST. QTY	UNIT	UNIT PRICE	AMOUNT
10" PVC Pipe (Gravity) - Excavation, Backfill	2,750	LF	$ 110	$ 302,500
12" PVC Pipe (Gravity) - Excavation, Backfill	150	LF	$ 120	$ 18,000
Reconnect Services	2,900	LF	$ 15	$ 43,500
Manhole (48")	16	EA	$ 5,000	$ 80,000
Native Surface Repair	1,150	LF	$ 5	$ 5,750
Full Lane Pavement Repair	1,250	LF	$ 60	$ 75,000
Highway Repair	500	LF	$ 225	$ 112,500
Bypass Pumping	1	LS	$ 20,000	$ 20,000
Traffic Control	1	LS	$ 20,000	$ 20,000
OHP & Mobilization	1	LS	20%	$ 136,000
Contingency and Allowances	1	LS	30%	$ 244,000
Construction Subtotal (rounded)				***$ 1,058,000***
Engineering and CMS	1	LS	30%	$ 318,000
Legal, Admin, and Permitting	1	LS	2%	$ 22,000
Total Project Cost (rounded)				***$ 1,398,000***

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High School Wy to Elm St Improvements				
GENERAL LINE ITEM	EST. QTY	UNIT	UNIT PRICE	AMOUNT
10" PVC Pipe (Gravity) - Excavation, Backfill	800	LF	$ 110	$ 88,000
15" PVC Pipe (Gravity) - Excavation, Backfill	2,100	LF	$ 140	$ 294,000
Reconnect Services	2,900	LF	$ 15	$ 43,500
Manhole (48")	10	EA	$ 5,000	$ 50,000
Full Lane Pavement Repair	2,900	LF	$ 60	$ 174,000
Bypass Pumping	1	LS	$ 20,000	$ 20,000
Traffic Control	1	LS	$ 15,000	$ 15,000
OHP & Mobilization	1	LS	20%	$ 137,000
Contingency and Allowances	1	LS	30%	$ 247,000
Construction Subtotal (rounded)				***$ 1,069,000***
Engineering and CMS	1	LS	30%	$ 321,000
Legal, Admin, and Permitting	1	LS	2%	$ 22,000
Total Project Cost (rounded)				***$ 1,412,000***

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Dutch Canyon Rd Improvements				
GENERAL LINE ITEM	**EST. QTY**	**UNIT**	**UNIT PRICE**	**AMOUNT**
10" PVC Pipe (Gravity) - Excavation, Backfill	550	LF	$ 110	$ 60,500
Reconnect Services	550	LF	$ 15	$ 8,250
Manhole (48")	3	EA	$ 5,000	$ 15,000
Full Lane Pavement Repair	550	LF	$ 60	$ 33,000
Bypass Pumping	1	LS	$ 10,000	$ 10,000
Traffic Control	1	LS	$ 10,000	$ 10,000
OHP & Mobilization	1	LS	20%	$ 28,000
Contingency and Allowances	1	LS	30%	$ 50,000
Construction Subtotal (rounded)				***$ 215,000***
Engineering and CMS	1	LS	30%	$ 65,000
Legal, Admin, and Permitting	1	LS	2%	$ 5,000
Total Project Cost (rounded)				***$ 285,000***

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Laurel and 3rd Street Improvements				
GENERAL LINE ITEM	**EST. QTY**	**UNIT**	**UNIT PRICE**	**AMOUNT**
18" PVC Pipe (Gravity) - Excavation, Backfill	600	LF	$ 155	$ 93,000
21" PVC Pipe (Gravity) - Excavation, Backfill	250	LF	$ 170	$ 42,500
24" PVC Pipe (Gravity) - Excavation, Backfill	300	LF	$ 185	$ 55,500
Reconnect Services	1,150	LF	$ 15	$ 17,250
Manhole (48")	5	EA	$ 5,000	$ 25,000
Half Lane Pavement Repair	1,150	LF	$ 30	$ 34,500
Bypass Pumping	1	LS	$ 15,000	$ 15,000
Traffic Control (without Flagging)	1,150	LF	$ 4	$ 4,600
OHP & Mobilization	1	LS	20%	$ 58,000
Contingency and Allowances	1	LS	30%	$ 104,000
Construction Subtotal (rounded)				***$ 450,000***
Engineering and CMS	1	LS	30%	$ 135,000
Legal, Admin, and Permitting	1	LS	2%	$ 9,000
Total Project Cost (rounded)				***$ 594,000***

The cost estimate herein is based on our perception of current conditions at the project location. This estimate reflects our professional opinion of accurate costs at this time and is subject to change as the project design matures. Keller Associates has no control over variances in the cost of labor, materials, equipment, services provided by others, contractor's methods of determining prices, competitive bidding or market conditions, practices or bidding strategies. Keller Associates cannot and does not warrant or guarantee that proposals, bids or actual construction costs will not vary from the costs presented herein.

Tyler Street Improvements				
GENERAL LINE ITEM	**EST. QTY**	**UNIT**	**UNIT PRICE**	**AMOUNT**
18" PVC Pipe (Gravity) - Excavation, Backfill	300	LF	$ 155	$ 46,500
21" PVC Pipe (Gravity) - Excavation, Backfill	300	LF	$ 170	$ 51,000
Reconnect Services	600	LF	$ 15	$ 9,000
Manhole (48")	3	EA	$ 5,000	$ 15,000
Half Lane Pavement Repair	600	LF	$ 30	$ 18,000
Bypass Pumping	1	LS	$ 10,000	$ 10,000
Traffic Control (without Flagging)	600	LF	$ 4	$ 2,400
OHP & Mobilization	1	LS	20%	$ 31,000
Contingency and Allowances	1	LS	30%	$ 55,000
Construction Subtotal (rounded)				***$ 238,000***
Engineering and CMS	1	LS	25%	$ 60,000
Legal, Admin, and Permitting	1	LS	2%	$ 5,000
Total Project Cost (rounded)				***$ 303,000***

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Wagner Court Improvements				
GENERAL LINE ITEM	**EST. QTY**	**UNIT**	**UNIT PRICE**	**AMOUNT**
10" PVC Pipe (Gravity) - Excavation, Backfill	300	LF	$ 110	$ 33,000
Reconnect Services	300	LF	$ 15	$ 4,500
Manhole (48")	2	EA	$ 5,000	$ 10,000
Half Lane Pavement Repair	300	LF	$ 30	$ 9,000
Bypass Pumping	1	LS	$ 5,000	$ 5,000
Traffic Control (without Flagging)	300	LF	$ 4	$ 1,200
OHP & Mobilization	1	LS	20%	$ 13,000
Contingency and Allowances	1	LS	30%	$ 23,000
Construction Subtotal (rounded)				***$ 99,000***
Engineering and CMS	1	LS	25%	$ 25,000
Legal, Admin, and Permitting	1	LS	2%	$ 2,000
Total Project Cost (rounded)				***$ 126,000***

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Springlake and HWY 30 PS Improvements				
GENERAL LINE ITEM	**EST. QTY**	**UNIT**	**UNIT PRICE**	**AMOUNT**
Springlake PS				
Test for air lock in force main	1	LS	$ 8,400	$ 8,400
Clean and coat piping in wet well and valves	1	LS	$ 9,500	$ 9,500
Perform engineering review of electrical system	1	LS	$ 3,900	$ 3,900
OHP & Mobilization	1	LS	20%	$ 5,000
Contingency and Allowances	1	LS	30%	$ 9,000
Construction Subtotal (rounded)				***$ 36,000***
Engineering and CMS	1	LS	25%	$ 9,000
Legal, Admin, and Permitting	1	LS	2%	$ 1,000
Springlake Total Project Cost (rounded)				***$ 46,000***
HWY 30 PS				
Install bollards to protect station from traffic	1	LS	$ 3,900	$ 3,900
Clean and coat piping in wet well and valves	1	LS	$ 9,500	$ 9,500
Perform engineering review of electrical system	1	LS	$ 3,900	$ 3,900
OHP & Mobilization	1	LS	20%	$ 4,000
Contingency and Allowances	1	LS	30%	$ 7,000
HWY 30 Construction Subtotal (rounded)				***$ 29,000***
Engineering and CMS	1	LS	25%	$ 8,000
Legal, Admin, and Permitting	1	LS	2%	$ 1,000
Total Project Cost (rounded)				***$ 38,000***
Springlake and HWY 30 Total Project Cost (rounded)				***$ 84,000***

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Smith Road PS Improvements				
GENERAL LINE ITEM	**EST. QTY**	**UNIT**	**UNIT PRICE**	**AMOUNT**
Smith Road PS Improvements				
New wet well	1	LS	$ 100,000	$ 100,000
Replace pumps (includes VFD)	3	EA	$ 65,000	$ 195,000
Electrical/Controls	1	LS	$ 150,000	$ 150,000
OHP & Mobilization	1	LS	20%	$ 89,000
Contingency and Allowances	1	LS	30%	$ 161,000
Construction Subtotal (rounded)				***$ 695,000***
Engineering and CMS	1	LS	25%	$ 174,000
Legal, Admin, and Permitting	1	LS	2%	$ 14,000
Total Project Cost (rounded)				***$ 883,000***

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Keys Landing and Seven Oaks PS Improvements				
GENERAL LINE ITEM	**EST. QTY**	**UNIT**	**UNIT PRICE**	**AMOUNT**
Keys Landing PS				
Address odor control so overflow can be opened	1	LS	$ 8,000	$ 8,000
Clean and coat piping in wet well and valves	1	LS	$ 9,500	$ 9,500
Install standby power from the WTP to the LS	1	LS	$ 26,600	$ 26,600
Repair clamshell door so it remains open without support	1	LS	$ 3,600	$ 3,600
Perform engineering review of electrical system	1	LS	$ 3,900	$ 3,900
OHP & Mobilization	1	LS	20%	$ 11,000
Contingency and Allowances	1	LS	30%	$ 19,000
Construction Subtotal (rounded)				***$ 82,000***
Engineering and CMS	1	LS	25%	$ 21,000
Legal, Admin, and Permitting	1	LS	2%	$ 2,000
Total Project Cost (rounded)				***$ 105,000***
Seven Oaks PS				
Repair bottom clam shell insulation	1	LS	$ 7,600	$ 7,600
Clean and coat piping in wet well and valves	1	LS	$ 9,500	$ 9,500
Perform engineering review of electrical system	1	LS	$ 3,900	$ 3,900
OHP & Mobilization	1	LS	20%	$ 5,000
Contingency and Allowances	1	LS	30%	$ 8,000
Construction Subtotal (rounded)				***$ 34,000***
Engineering and CMS	1	LS	25%	$ 9,000
Legal, Admin, and Permitting	1	LS	2%	$ 1,000
Total Project Cost (rounded)				***$ 44,000***
				$ 149,000

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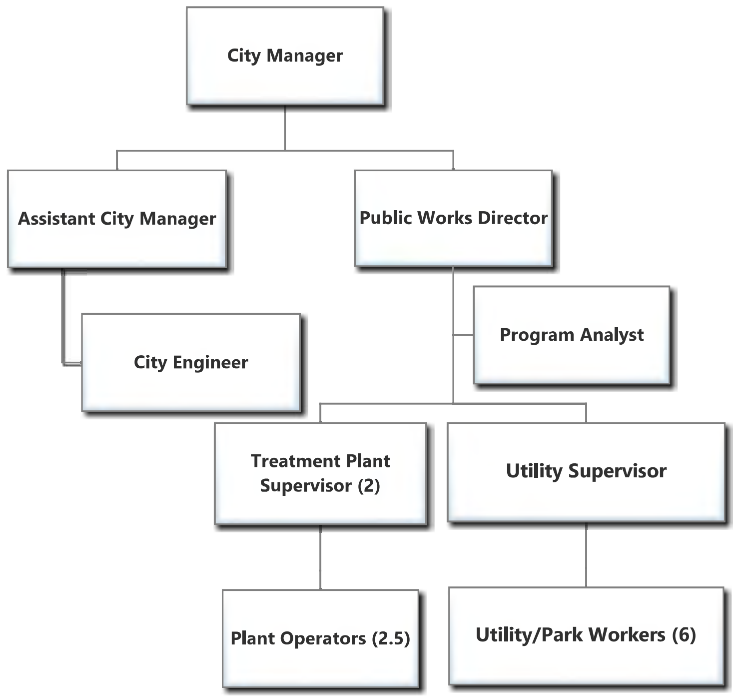
Appendix G

Financial Data

UTILITY WASTEWATER FUND 41



PURPOSE:

The Utility Wastewater Fund is a dedicated "Enterprise" fund. The City of Scappoose operates and maintains a 1.58 M.G.D. activated sludge wastewater treatment plant with tertiary treatment, 36 miles of sewer lines and five pumping stations. The purpose of these facilities is to protect public health and public use of the Columbia River and Multnomah Channel by providing secondary effluent treatment. Treatment plant and staff is responsible for the operation of the wastewater facility to ensure proper treatment of all raw wastewater at all times. The operator is ultimately responsible to ensure all state and federal regulations are met. The City was issued a new permit in March 2009 and will be required to monitor influent, effluent and process control. This monitoring will require the treatment plant operator to sample and test many functions within the treatment plant process as well as sampling of the receiving stream.

VISION FOR THE YEAR:

The Wastewater Fund will focus on long term upgrades as identified in the 2018 Facilities Master Plan. Engineering of Wastewater Master Plan Amendment Phase I upgrades along with a Facility Plan Amendment are priority projects for the year.

COMPLIANCE WITH COUNCIL GOALS:

Address I & I within Collections System
Capacity Upgrades – Wastewater Treatment and Collections
Develop 5-year Capital Improvement Plan
Update Public Works Design Standards
Update SDC's/Fees

Wastewater SDC Fund Objectives	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Complete Collections Master Plan	■	■	■	■	■	■						
Phase I Facility Improvement Design						■	■	■	■	■	■	■
Capacity Upgrades-Treatment & Collections	■	■	■	■	■	■	■	■	■	■	■	■
Update SDC's/Fees								■	■	■	■	■
Develop 5-year Capital Improvement Plan	■	■	■	■	■	■	■	■	■	■	■	■

BUDGET NOTES:

The Wastewater fund will begin the year with a $1,650,005 beginning cash position and anticipates revenue of $3,415,125. Total operating revenue in this fund is projected to be $5,065,130. Expenditures within the department include $1,023,869 for personnel services and $688,153 for materials and services. For capital outlay the projected budget is $1,361,396 for pump replacements, UV upgrades, a vehicle purchase, completion of the Springlake pump station and engineering for Phase I of the Treatment Plant improvements. The fund budgets $119,803 for two principal and interest payments for loan R06809 which matures in 2031 and a US Bank loan which matures in 2021. The fund budgets $173,565 for transfers and has budgeted a contingency of $898,344 and a balance of $800,000 in unappropriated funds.

PERCENTAGE OF TIME ALLOCATION:

Wastewater Fund	17-18	18-19	19-20	20-21	Minimum Salary	Maximum Salary
Public Works Director	30%	35%	35%	35%	37.79	58.61
Utility Supervisor	30%	35%	35%	35%	29.30	45.45
Treatment Plant Supervisor	100%	100%	100%	100%	29.30	45.45
Operator I	0%	50%	50%	50%	23.39	29.85
Operator II	0%	0%	0%	0%	25.77	32.89
Operator III	100%	100%	100%	100%	28.43	36.28
Utility/Parks Worker I	40%	35%	70%	70%	19.64	25.07
Utility/Parks Worker II	60%	60%	35%	35%	23.39	29.85
Utility/Parks Worker III	40%	35%	70%	70%	25.77	32.89
Office Administrator CDC	14%	0%	0%	0%	21.14	26.98
Planning Supervisor	13%	0%	0%	0%	29.30	45.45
Program Analyst				30%	20.44	31.68
City Engineer	34%	30%	30%	30%	32.68	50.70
Engineer Assistant PW	33%	0%	0%	0%	25.27	38.58
City Manager	22%	22%	23%	23%	42.92	66.57
City Recorder	20%	22%	22%	22%	26.31	40.80
Finance Administrator/Office Manager	22%	22%	22%	22%	37.79	58.61
Assistant City Manager	22%	22%	23%	23%	29.30	45.45
Office Administrator Finance	44%	44%	44%	44%	21.14	26.98
TOTAL FTE'S	6.24	6.12	6.59	6.89		

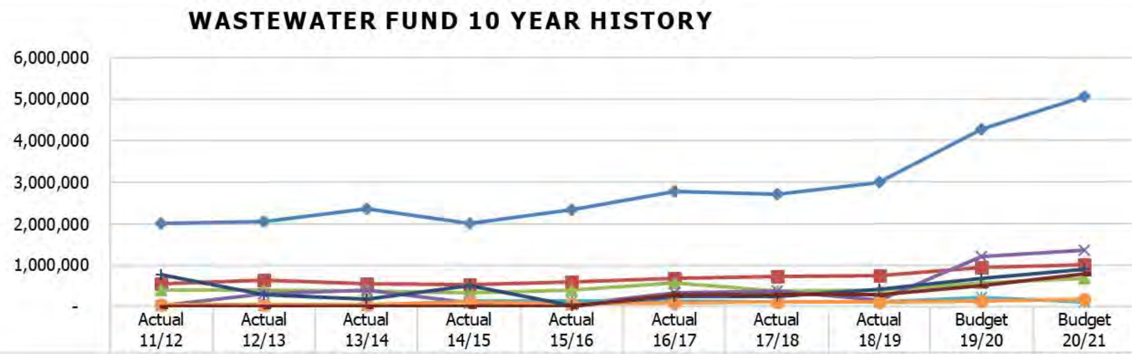
Wastewater Fund 41

Resources		Actual FY 17-18		Actual FY 18-19		Budget FY 19-20		Estimated FY 19-20		Proposed Budget FY 20-21		Approved Budget FY 20-21		Adopted Budget FY 20-21
Working capital carryover	$	971,504	$	990,275	$	1,405,124	$	1,455,694	$	1,650,005	$	1,650,005	$	1,650,005
Current year resources														
Interest	$	14,829	$	31,793	$	30,000	$	36,000	$	44,000	$	44,000	$	44,000
Charges for services		1,730,782		1,990,030		2,054,274		2,109,700		2,171,125		2,171,125		2,171,125
Intergovernmental		10,000		99								1,200,000		1,200,000
Long term debt proceeds						790,000		2,550		1,200,000				
Miscellaneous														
Total current year resources	$	1,755,611	$	2,021,922	$	2,874,274	$	2,148,250	$	3,415,125	$	3,415,125	$	3,415,125
Total resources	$	2,727,115	$	3,012,197	$	4,279,398	$	3,603,944	$	5,065,130	$	5,065,130	$	5,065,130

Expenditures		Actual FY 17-18		Actual FY 18-19		Budget FY 19-20		Estimated FY 19-20		Proposed Budget FY 20-21		Approved Budget FY 20-21		Adopted Budget FY 20-21
Personnel services	$	730,261	$	758,896	$	937,875	$	873,076	$	1,023,869	$	1,023,869	$	1,023,869
Materials & services		377,214		404,590		584,868		469,046		688,153		688,153		688,153
Capital outlay		378,111		157,819		1,220,000		354,985		1,361,396		1,361,396		1,361,396
Debt service														
2009 Principal CWSRF R06809 3/01 & 9/01		17,642		17,642		17,642		17,642		17,642		17,642		17,642
2009 Interest CWSRF R06809 9/01		1,191		1,103		1,014		1,103		926		926		926
2013 Principal USNB 12/01		100,000		100,000		100,000		100,000		100,000		100,000		100,000
2013 Interest USNB 6/01 & 12/01		8,645		6,174		3,705		3,705		1,235		1,235		1,235
2020 Principal R808831 4/01 & 10/01						100,000								
2020 Interest R809831 4/01 & 10/01														
Transfers		123,776		110,279		134,382		134,382		173,565		173,565		173,565
Contingency						679,912				898,344		898,344		898,344
Total expenditures	$	1,736,840	$	1,556,503	$	3,779,398	$	1,953,939	$	4,265,130	$	4,265,130	$	4,265,130
Other requirements														
Unappropriated ending fund balance	$	-	$	-	$	500,000	$	500,000	$	800,000	$	800,000	$	800,000
Ending working capital	**$**	**990,275**	**$**	**1,455,694**	**$**	**-**	**$**	**1,150,005**	**$**	**-**	**$**	**-**	**$**	**-**

Utility Wastewater Fund Line Item Detail		Actual	Actual	Budget	Estimated	Budget
Account	**Description**	**FY 17-18**	**FY 18-19**	**FY 19-20**	**FY 19-20**	**FY 20-21**
41-000-003	Interest Earned	14,829	31,793	30,000	36,000	44,000
41-000-100	Miscellaneous	-	98	-	2,550	-
41-000-150	Intergovernmental Revenue	10,000	-	-	-	-
41-000-151	Long Term Debt Proceeds	-	-	790,000	-	1,200,000
41-000-220	User Fees	1,721,771	1,870,199	2,023,149	2,085,700	2,150,000
41-000-240	Hookup Fees	4,650	1,100	1,125	2,000	1,125
41-000-260	Infrastructure Insp Fees	4,361	118,731	30,000	22,000	20,000
	Total Revenue	**1,755,611**	**2,021,922**	**2,874,274**	**2,148,250**	**3,415,125**
41-410-100	City Manager	31,503	32,258	35,530	35,530	36,803
41-410-102	Public Works Director	28,817	35,861	39,698	39,698	43,321
41-410-104	Planning Supervisor	8,592	-	-	-	-
41-410-106	Finance/Office Manager	22,017	22,377	24,672	24,672	27,429
41-410-107	Assistant to City Manager	13,620	14,596	19,057	19,057	21,133
41-410-108	Office Administrator Finance	19,027	20,949	23,623	23,623	25,539
41-410-109	Program Analyst	-	-	-	-	17,204
41-410-110	City Recorder	15,891	17,833	18,720	18,720	19,457
41-410-113	City Engineer	32,902	30,319	31,838	31,838	33,076
41-410-114	Treatment Plant Supervisor	88,194	90,072	94,827	94,827	98,536
41-410-118	Field Services Supervisor	21,784	27,221	30,150	30,150	32,905
41-410-120	Operators	75,368	85,351	112,556	112,556	120,093
41-410-121	Utility Workers	78,253	95,519	102,780	102,780	112,105
41-410-123	Engineering Assistant PW	6,339	-	-	-	-
41-410-132	Office Administrator CDC	7,371				
41-410-142	Overtime	3,256	2,509	15,347	5,000	16,242
41-410-146	Health Insurance	122,389	122,031	167,685	138,000	177,013
41-410-148	Retirement Benefits	105,735	112,405	155,539	145,000	171,603
41-410-150	Social Security	33,879	35,386	43,904	40,000	48,307
41-410-152	Workers Compensation	15,325	14,209	21,949	11,625	23,103
41-410-155	Taxable Fringe Benefits	-	-	-	-	-
	Total Personnel Services	**730,261**	**758,896**	**937,875**	**873,076**	**1,023,869**
41-410-200	Building/Facilities Maintenance	3,785	1,232	3,500	2,500	15,500
41-410-202	Equipment Maintenance	6,430	25,548	51,000	35,000	32,500
41-410-203	Maintenance Agreements	1,690	1,335	1,860	1,200	1,720
41-410-204	Vehicle Maintenance	16,857	1,512	8,500	7,500	8,500
41-410-205	Small Equipment	8,552	9,096	22,250	15,000	19,550
41-410-206	Fuel/Oil/Lube	7,509	8,887	6,840	9,500	8,153
41-410-216	Office Supplies	9,426	10,574	13,000	9,000	12,000
41-410-218	Operational Supplies	8,662	11,346	19,500	10,000	30,375
41-410-222	Lab Supplies	5,729	5,571	9,358	6,700	8,063
41-410-224	Chemicals	36,404	23,051	34,875	35,000	34,875
41-410-227	Electrical Operations	100,464	99,318	102,000	96,000	99,000
41-410-228	Utilities	6,079	5,832	6,480	5,800	6,360
41-410-229	Electrical Operations Pumps	6,682	5,603	6,600	5,300	7,740
41-410-230	Contractual/Professional	115,206	153,660	234,250	175,000	336,500
41-410-234	Miscellaneous	-	-	-	-	-
41-410-235	Property Tax	1,685	1,370	2,000	1,384	2,000
41-410-238	Insurance	-	-	-	-	-
41-410-240	Travel/Training	3,605	3,687	8,300	4,000	8,500
41-410-242	Dues/Fees/Subscriptions	14,221	18,833	23,580	22,000	23,342
41-410-244	Publications/Notices/Advertise	841	41	3,000	1,000	3,000
41-410-252	Uniforms/Safety	1,078	2,540	3,975	3,975	6,475
41-410-253	Sludge Disposal	4,350	15,237	15,000	14,187	15,000
41-410-254	Equipment Rental	17,960	315	9,000	9,000	9,000
	Total Materials & Services	**377,214**	**404,590**	**584,868**	**469,046**	**688,153**

Account	Description	Actual FY 17-18	Actual FY 18-19	Budget FY 19-20	Estimated FY 19-20	Budget FY 20-21
41-410-300	Equipment	378,111	157,819	140,000	100,000	90,000
41-410-310	Infrastructure Upgrades	-	-	1,040,000	210,000	1,236,396
41-410-311	Equipment Replacement	-	-	40,000	44,985	35,000
	Total Capital Outlay	**378,111**	**157,819**	**1,220,000**	**354,985**	**1,361,396**
41-410-510	Principal USNB	100,000	100,000	100,000	100,000	100,000
41-410-511	Interest USNB	8,645	6,174	3,705	3,705	1,235
41-410-560	Principal CWSRF R80930	17,642	17,642	17,642	17,642	17,642
41-410-561	Interest CWSRF R80930	1,191	1,103	1,014	1,103	926
41-410-562	Principal DEQ Loan	-	-	-	-	-
41-410-564	Interest DEQ Loan	-	-	100,000	-	-
	Total Debt Services	**127,478**	**124,919**	**222,361**	**122,450**	**119,803**
41-410-418	Transfer to Unemployment Fund	-	-	-	-	-
41-410-419	Transfer to General Fund ISF	123,776	110,279	134,382	134,382	173,565
	Total Transfers	**123,776**	**110,279**	**134,382**	**134,382**	**173,565**
41-410-600	Contingency	-	-	679,912	-	898,344
41-410-900	Unappropriated Ending Fund Balance	-	-	500,000	-	800,000
	Total Expenditures	**1,736,840**	**1,556,503**	**4,279,398**	**1,953,939**	**5,065,130**



	Actual 11/12	Actual 12/13	Actual 13/14	Actual 14/15	Actual 15/16	Actual 16/17	Actual 17/18	Actual 18/19	Budget 19/20	Budget 20/21
Resources	2,016,817	2,063,059	2,374,191	2,015,957	2,352,839	2,786,811	2,727,115	3,012,197	4,279,398	5,065,130
Personnel Services	545,760	640,282	561,814	523,217	608,205	687,665	730,261	758,896	937,875	1,023,869
Materials & Services	411,086	395,705	371,284	346,526	403,581	566,801	377,214	404,590	584,868	688,153
Capital Outlay	29,216	324,534	393,121	90,051	42,181	337,206	378,111	157,819	1,220,000	1,361,396
Debt Service	40,219	27,419	34,872	135,152	132,594	130,028	127,478	124,919	222,361	119,803
Transfers	50,430	52,632	56,433	111,229	63,101	93,607	123,776	110,279	134,382	173,565
Contingency	767,612	287,762	186,941	519,757	23,819	245,696	238,727	423,654	679,912	898,344
Unappropriated Ending Fund Balance	-	-	-	-	-	300,000	300,000	300,000	500,000	800,000


CITY OF SCAPPOOSE
WASTEWATER
TREATMENT PLANT


PIPES
FAT, OIL AND
GREASE

WASTEWATER SDC FUND 55

PURPOSE:
The Wastewater System Development Charge fund is a dedicated fund and is the mechanism by which the City of Scappoose collects funds from developers to pay both for previous and new capacity improvements. It makes funds available to pay for future improvement needs generated by development. Wastewater SDC'S are calculated based on the size of the water meter needed for the development. This account includes both the revenue and the capital outlay for those projects.

VISION FOR THE YEAR:
Engineering for Phase I improvements will be the top priority for this fiscal year.

COMPLIANCE WITH COUNCIL GOALS:
Address aging infrastructure
Update SDC's/Fees
Update Public Works Design Standards
Capacity Upgrades- Treatment & Collections
Create a 5-year Capital Improvement Plan

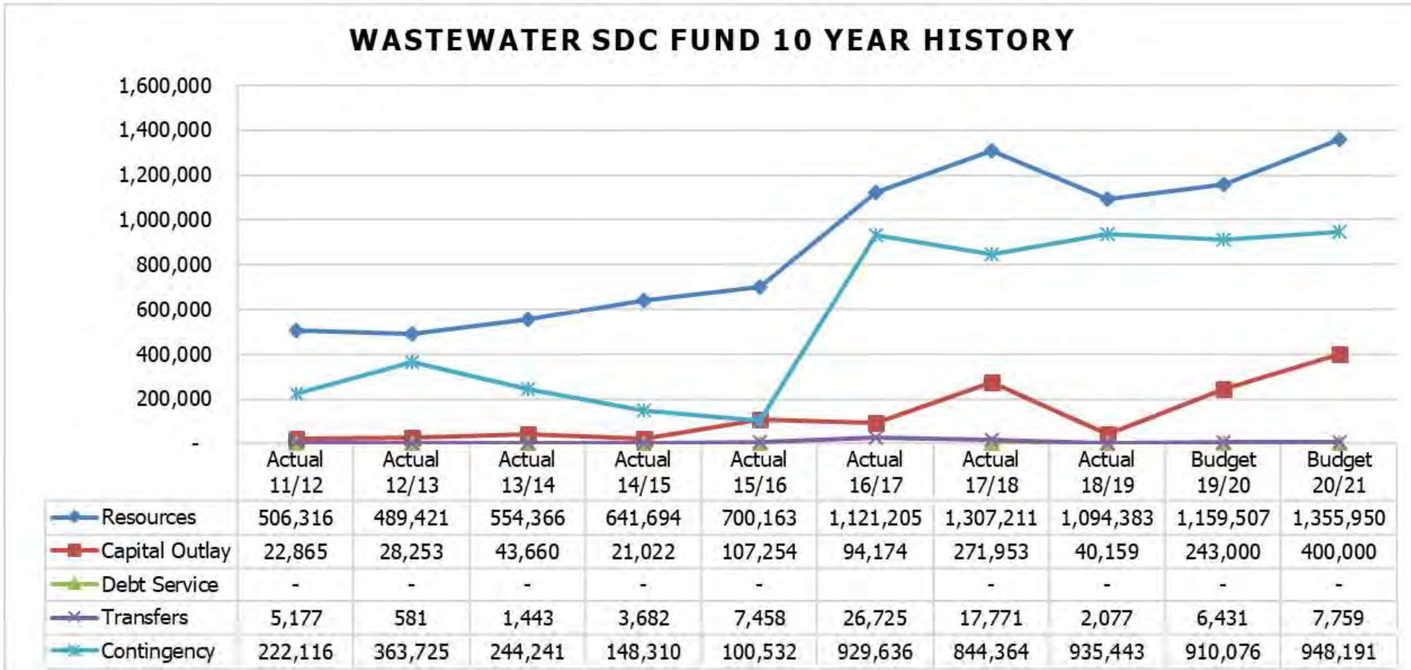
Wastewater SDC Fund Objectives	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Complete Collections Master Plan												
Phase I Facility Improvement Design												
Capacity Upgrades-Treatment & Collections												
Update SDC's/Fees												
Develop 5-year Capital Improvement Plan												

BUDGET NOTES:
The Wastewater SDC fund has a beginning cash position of $1,174,761. The City anticipates receiving $26,000 in interest income and $155,189 in SDC fees. Total resources for the fund are $1,355,950. Projects proposed for FY 20-21 include $400,000 in extra capacity improvements for Phase I Design and Engineering of the Treatment Plant, along with additional Wastewater capacity upgrades. The fund contains a transfer to the General Fund of $7,759 for administrative costs and a contingency of $948,191.

Wastewater SDC 55 Resources	Actual FY 17-18	Actual FY 18-19	Budget FY 19-20	Estimated FY 19-20	Proposed Budget FY 20-21	Approved Budget FY 20-21	Adopted Budget FY 20-21
Working capital carryover	$ 1,000,306	$ 1,017,487	$ 1,003,885	$ 1,052,147	$ 1,174,761	$ 1,174,761	$ 1,174,761
Current year resources							
Interest	$ 16,703	$ 26,119	$ 27,000	$ 25,400	$ 26,000	$ 26,000	$ 26,000
System development charges - reimbursement		10,156	25,724	27,530	31,038	31,038	31,038
System development charges - extra capacity	290,202	40,621	102,898	110,115	124,151	124,151	124,151
Total current year resources	$ 306,905	$ 76,896	$ 155,622	$ 163,045	$ 181,189	$ 181,189	$ 181,189
Total resources	$ 1,307,211	$ 1,094,383	$ 1,159,507	$ 1,215,192	$ 1,355,950	$ 1,355,950	$ 1,355,950

Expenditures	Actual FY 17-18	Actual FY 18-19	Budget FY 19-20	Estimated FY 19-20	Proposed Budget FY 20-21	Approved Budget FY 20-21	Adopted Budget FY 20-21
Capital outlay	$ 271,953	$ 40,159	$ 243,000	$ 34,000	$ 400,000	$ 400,000	$ 400,000
Transfers	17,771	2,077	6,431	6,431	7,759	7,759	7,759
Contingency			910,076		948,191	948,191	948,191
Total expenditures	$ 289,724	$ 42,236	$ 1,159,507	$ 40,431	$ 1,355,950	$ 1,355,950	$ 1,355,950
Ending working capital	**$ 1,017,487**	**$ 1,052,147**	**$ -**	**$ 1,174,761**	**$ -**	**$ -**	**$ -**

Wastewater SDC Fund Line Item Detail		Actual	Actual	Budget	Estimated	Budget
Account	**Description**	**FY 17-18**	**FY 18-19**	**FY 19-20**	**FY 19-20**	**FY 20-21**
55-000-003	Interest Earned	16,703	26,119	27,000	25,400	26,000
55-000-992	Sewer SDC Reimbursements	51,050	10,155	25,724	27,530	31,038
55-000-993	Sewer SDC Extra Capacity Improvements	239,151	40,621	102,898	110,115	124,151
55-000-994	Long Term Debt Proceeds	-	-	-	-	-
	Total Revenue	**306,905**	**76,896**	**155,622**	**163,045**	**181,189**
55-550-314	Wastewater Extra Capacity Improvement	77,003	40,159	243,000	34,000	100,000
55-550-316	Wastewater Reimbursement Improvements	-	-	-	-	-
55-550-326	Council Approved Projects	194,950	-	-	-	300,000
	Total Capital Outlay	**271,953**	**40,159**	**243,000**	**34,000**	**400,000**
55-550-409	Transfer to GF SDC Admin.	17,771	2,077	6,431	6,431	7,759
	Total Transfers	**17,771**	**2,077**	**6,431**	**6,431**	**7,759**
55-550-600	Contingency	-	-	910,076	-	948,191
	Total Expenditures	**289,724**	**42,236**	**1,159,507**	**40,431**	**1,355,950**



City of Scappoose
Schedule of Projected Long-term Debt

	Interest Rates	Date of Issue	Fiscal Year of Maturity	Outstanding July 1, 2020	Issued	Paid	Outstanding June 30, 2021	Due Within One Year
PRINCIPAL TRANSACTIONS								
General Obligations								
Capital Leases	5.20%	2018	2022	$ 34,293	-	$ 16,630	17,663	$ 17,663
Enterprise Obligations								
					-		-	
Dutch Canyon Waterline Loan	3.68%	2010	2031	665,902	-	56,934	608,968	59,029
Water Plant Phase 1 & 2	4.43%	2002	2028	795,070	-	84,278	710,792	89,949
Water Storage Reservoirs	1.00%	2004	2036	2,196,829	-	135,833	2,060,996	137,192
Wastewater DEQ Loan	0.00%	2011	2031	185,231	-	17,642	167,589	17,642
Wastewater US Bank Loan	2.47%	2014	2020	100,000	-	100,000	-	-
Capital Leases	3.65%	2015	2022	256,655	-	45,783	210,872	102,118
Subtotal				$ 4,233,980	$ -	$ 457,100	$ 3,776,880	$ 423,593
	Interest Rates	**Date of Issue**	**Fiscal Year of Maturity**	**Outstanding July 1, 2020**	**Issued**	**Paid**	**Outstanding June 30, 2021**	**Due Within One Year**
INTEREST TRANSASCTIONS								
General Obligations								
Capital Leases	5.20%	2018	2022	3,227	-	2,130	1,097	1,097
Enterprise Obligations								
Dutch Canyon Waterline Loan	3.68%	2010	2031	140,895	-	24,505	116,390	22,410
Water Plant Phase 1 & 2	4.43%	2002	2028	178,588	-	37,724	140,864	33,763
Water Storage Reservoirs	1.00%	2004	2036	180,635	-	21,969	158,666	20,610
Wastewater DEQ Loan	0.00%	2011	2031		-		-	-
Wastewater US Bank Loan	2.47%	2014	2020	1,235	-	1,235	-	-
Capital Leases	3.65%	2017	2021	7,390	-	4,885	2,505	2,505
Subtotal				$ 511,970	$ -	$ 92,448	$ 419,522	$ 80,385
Grand Total				$ 4,745,950	$ -	$ 549,548	$ 4,196,402	$ 503,978

City of Scappoose
Wastewater Facilities Planning Study
User Rate Impacts

Existing Budget is Balanced		
	FY 2020-2021 Revenue	$ 2,171,125

After SDCs, Priority 1 Improvements		
	Priority 1 Improvement Costs	$ 4,961,000
	Less Available SDC Funds / Reserves	$ 1,031,000
	Amount to Finance	$ 3,930,000
	Annual Payment (20yr, 1.6%)	$ 231,169
	Annual O&M Increase	$ -
	Payment % of FY 2020-2021 Revenue	11%
	Additional Monthly Cost Per User (2600 EDUs)	**$ 7.41**

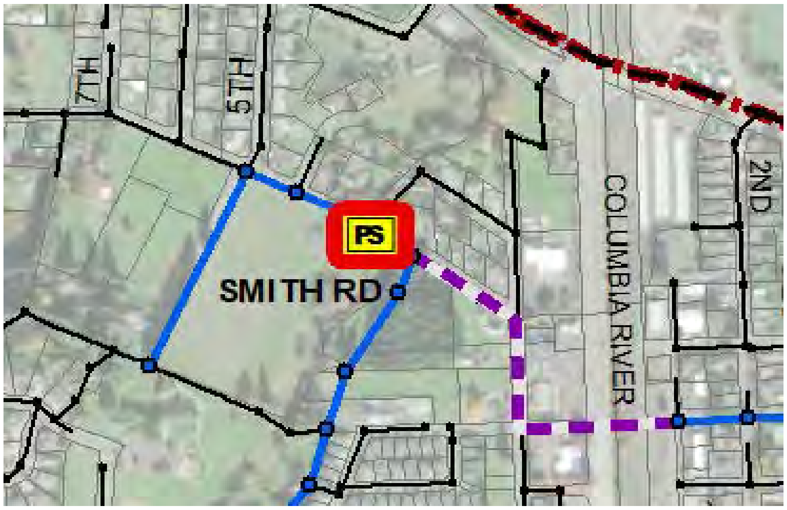
Appendix H

Project Emphasis Sheets

Collection System Project: **Smith Road Pump Station**
Project Identifier: **1.1**

Objective:
Major upgrades to the pump station to address pump station conditions, nearing capacity limitations, and small operating volume. Includes new wet well, pumps with VFD controls, and electrical and controls upgrades.

Project Location: Smith Road Pump Station



Item	Cost (2020)	
New wet well	$	100,000
Replace pumps (includes VFD)	$	195,000
Electrical/Controls	$	150,000
OHP & Mobilization	$	89,000
Contingency and Allowances	$	161,000
Construction Subtotal (rounded)	***$***	***695,000***
Engineering and CMS	$	174,000
Legal, Admin, and Permitting	$	14,000
Total Project Cost (rounded)	***$***	***883,000***

The cost estimate herein is based on our perception of current conditions at the project location. This estimate reflects our professional opinionof accurate costs at this time and is subject to change as the project design matures. Keller Associates has no control over variances in the cost of labor, materials, equipment, services provided by others, contractor's methods of determining prices, competitive bidding or market conditions, practices or bidding strategies. Keller Associates cannot and does not warrant or guarantee that proposals, bids or actual construction costs will not vary from the costs presented herein.

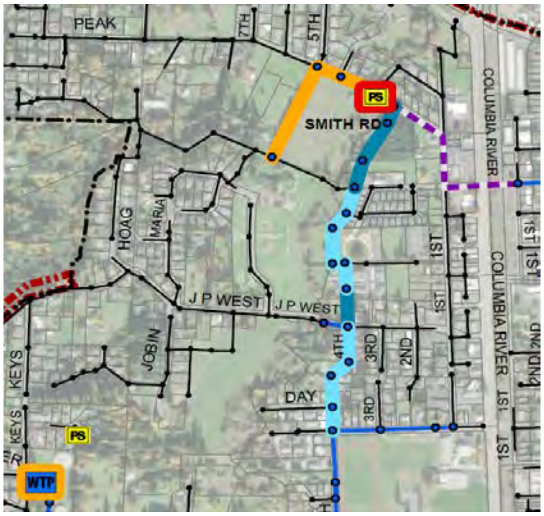
Collection System Project: WTP Improvements and Smith Road

Project Identifier: 1.2

Objective:

Automate Keys WTP backwash operations to operate during night flows. Install new Kucera line to eliminate creek crossing and re-direct flows; upsize existing Smith Road pipeline to alleviate surcharging.

Project Location: Keys WTP, Smith Road and North of Veterans Park (orange highlights below)



Item	Cost (2020)
WTP Automated Valve, Valve Structure, Controls	$ 100,000
Smith Road & Kucera Line	
8" PVC Pipe (Gravity) - Excavation, Backfill	$ 75,000
15" PVC Pipe (Gravity) - Excavation, Backfill	$ 70,000
18" PVC Pipe (Gravity) - Excavation, Backfill	$ 31,000
Creek Boring	$ 45,000
Reconnect Services	$ 3,750
Connect to Pump Station	$ 5,000
Manhole (48")	$ 35,000
Native Surface Repair	$ 4,750
Full Lane Pavement Repair	$ 30,000
Abandon Line	$ 15,000
Bypass Pumping	$ 15,000
Traffic Control	$ 10,000
OHP & Mobilization	$ 88,000
Contingency and Allowances	$ 159,000
Construction Subtotal (rounded)	***$ 687,000***
Engineering and CMS	$ 207,000
Legal, Admin, and Permitting	$ 14,000
Total Project Cost (rounded)	***$ 908,000***

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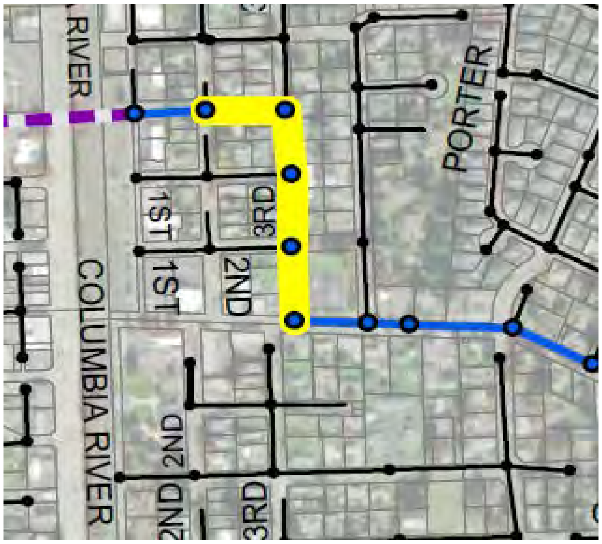
Collection System Project: Laurel and 3rd St
Project Identifier: 1.3

Objective:
Upsize Laurel and 3rd Streets pipeline to alleviate surcharging.

Project Location: Laurel and 3rd St



Item	Cost (2020)
18" PVC Pipe (Gravity) - Excavation, Backfill	$ 93,000
21" PVC Pipe (Gravity) - Excavation, Backfill	$ 42,500
24" PVC Pipe (Gravity) - Excavation, Backfill	$ 55,500
Reconnect Services	$ 17,250
Manhole (48")	$ 25,000
Half Lane Pavement Repair	$ 34,500
Bypass Pumping	$ 15,000
Traffic Control (without Flagging)	$ 4,600
OHP & Mobilization	$ 58,000
Contingency and Allowances	$ 104,000
Construction Subtotal (rounded)	***$ 450,000***
Engineering and CMS	$ 135,000
Legal, Admin, and Permitting	$ 9,000
Total Project Cost (rounded)	***$ 594,000***

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Collection System Project: Old Portland Road
Project Identifier: 1.4

Objective:
Upsize existing Old Portland Road pipeline to alleviate surcharging.

Project Location: Old Portland Road

Item		Cost (2020)
10" PVC Pipe (Gravity) - Excavation, Backfill	$	302,500
12" PVC Pipe (Gravity) - Excavation, Backfill	$	18,000
Reconnect Services	$	43,500
Manhole (48")	$	80,000
Native Surface Repair	$	5,750
Full Lane Pavement Repair	$	75,000
Highway Repair	$	112,500
Bypass Pumping	$	20,000
Traffic Control	$	20,000
OHP & Mobilization	$	136,000
Contingency and Allowances	$	244,000
Construction Subtotal (rounded)	***$***	***1,058,000***
Engineering and CMS	$	318,000
Legal, Admin, and Permitting	$	22,000
Total Project Cost (rounded)	***$***	***1,398,000***

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Collection System Project: High School Way to Elm St
Project Identifier: 1.5

Objective:
Upsize existing High School Way pipeline to Elm Street to alleviate surcharging.

Project Location: High School Way to Elm Street

Item	Cost (2020)	
10" PVC Pipe (Gravity) - Excavation, Backfill	$	88,000
15" PVC Pipe (Gravity) - Excavation, Backfill	$	294,000
Reconnect Services	$	43,500
Manhole (48")	$	50,000
Full Lane Pavement Repair	$	174,000
Bypass Pumping	$	20,000
Traffic Control	$	15,000
OHP & Mobilization	$	137,000
Contingency and Allowances	$	247,000
Construction Subtotal (rounded)	***$***	***1,069,000***
Engineering and CMS	$	321,000
Legal, Admin, and Permitting	$	22,000
Total Project Cost (rounded)	***$***	***1,412,000***

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Collection System Project: Dutch Canyon Road
Project Identifier: 1.6

Objective:
Upsize existing Dutch Canyon Road pipeline to alleviate surcharging.

Project Location: Dutch Canyon Road

Item	Cost (2020)	
10" PVC Pipe (Gravity) - Excavation, Backfill	$	60,500
Reconnect Services	$	8,250
Manhole (48")	$	15,000
Full Lane Pavement Repair	$	33,000
Bypass Pumping	$	10,000
Traffic Control	$	10,000
OHP & Mobilization	$	28,000
Contingency and Allowances	$	50,000
Construction Subtotal (rounded)	***$***	***215,000***
Engineering and CMS	$	65,000
Legal, Admin, and Permitting	$	5,000
Total Project Cost (rounded)	***$***	***285,000***

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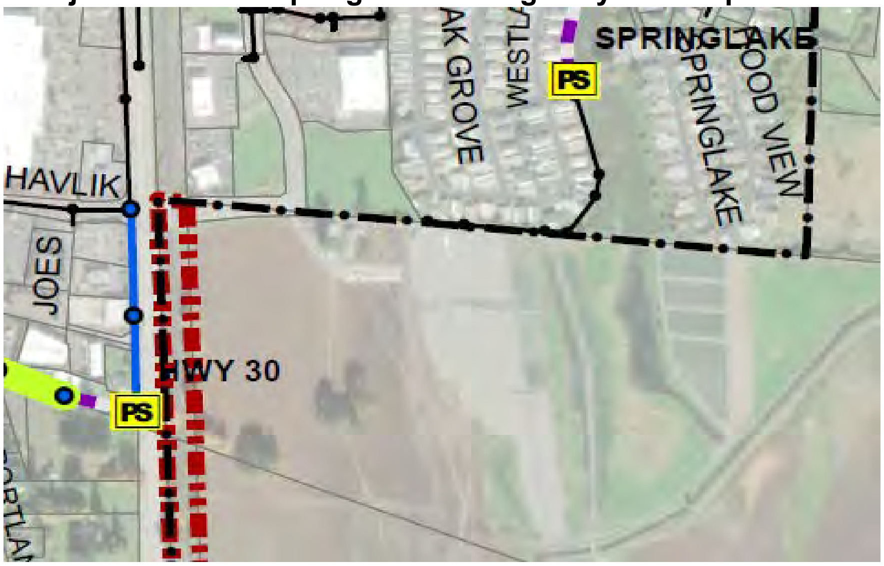
Collection System Project:	**Short-Term Pump Station Improvements**
Project Identifier:	**1.7**

Objective:
Investigate air lock in Springlake force main and perform general pipe and valve maintenance. Install bollards and perform general pipe and valve maintenance at Highway 30 PS.

Project Location: Springlake and Highway 30 Pump Stations



Item		Cost (2020)
Springlake PS		
Test for air lock in force main	$	8,400
Clean and coat piping in wet well and valves	$	9,500
Perform engineering review of electrical system	$	3,900
OHP & Mobilization	$	5,000
Contingency and Allowances	$	9,000
Construction Subtotal (rounded)	***$***	***36,000***
Engineering and CMS	$	9,000
Legal, Admin, and Permitting	$	1,000
Springlake Total Project Cost (rounded)	***$***	***46,000***
HWY 30 PS		
Install bollards to protect station from traffic	$	3,900
Clean and coat piping in wet well and valves	$	9,500
Perform engineering review of electrical system	$	3,900
OHP & Mobilization	$	4,000
Contingency and Allowances	$	7,000
HWY 30 Construction Subtotal (rounded)	***$***	***29,000***
Engineering and CMS	$	8,000
Legal, Admin, and Permitting	$	1,000
Total Project Cost (rounded)	***$***	***38,000***
Springlake and HWY 30 Total Project Cost (rounded)	***$***	***84,000***

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