

Technical Memorandum

Attachment 2

Date: September 6, 2022

Project: Wilsonville Frog Pond East and South Master Plan

To: Andrew Parish – APG/MIG
Joe Dills – APG/MIG

From: Mike Carr, PE – Murraysmith
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Re: Proposed Infrastructure Plans - Water, Wastewater, Stormwater Systems

Introduction

This technical memorandum provides a summary of new water, wastewater, and stormwater infrastructure necessary for the development of Wilsonville Frog Pond East and South areas, to be documented in the area's Master Plan. Analyses were performed to estimate sizes and propose layouts of the proposed systems, using applicable City standards for the systems. The planned infrastructure will also be used for cost estimates and preparation of infrastructure funding strategies.

Background

In 2015, the Frog Pond Area Plan (FPAP) was adopted by the City of Wilsonville. The Frog Pond area consists of three separate neighborhoods: West, East, and South. A master plan for Frog Pond West was developed in 2017 and development in Frog Pond West began soon after. Based on current information from the City, it is estimated that 80% of the parcels in Frog Pond West are currently, or soon to be, under development.

In 2018, the Frog Pond East and South areas were brought into the regional Urban Growth Boundary (UGB). The City initiated master planning in 2020. To date, the master plan process has prepared a draft preferred land use plan. The preferred alternative identifies residential uses of varied housing types, a neighborhood commercial area, streets and trails, and parks and open space. For the purpose of this infrastructure analysis, the plan is assumed to include 1,800 total housing units in the combined East and South neighborhoods. Infrastructure plans were developed for the preferred alternative and are further described in the individual sections below.

The City has also identified a higher-density scenario which calls for 2,384 total units (20 units per net residential acre) in the combined East and South neighborhoods. This scenario represents a very robust buildout of housing, especially middle housing. Infrastructure needs for the higher-

density alternative were estimated to determine the difference in needs between the two alternative plans. These are also described below.

Proposed Water System

The water purveyor for the Frog Pond area is the City of Wilsonville. The City's *Water System Master Plan (WSMP)*, adopted September 6, 2012, is the current basis for domestic water and fire system planning within the Frog Pond East and South. The recommendations provided in the 2015 FPAP for water system improvements still apply for the recommended development concepts for Frog Pond East and South. These areas will be extensions of water pressure Zone B which operates in an elevation range from 100 feet to 285 feet and has a hydraulic grade of 400 feet.

Distribution System

Figure 1 shows the proposed preliminary water system layout for the East and South neighborhoods, including off-site improvements needed to serve the area. The existing 12-inch waterline in Boeckman Road is the primary backbone connection for Frog Pond East and South to the City's water supply and storage system. A looped system consisting of 12-inch and 8-inch distribution mains is proposed for supply of domestic water to Frog Pond East and South. The 12-inch main network provides a redundant capacity of 1,500 gallons per minute (gpm) for fire flow to all areas. In accordance with City Public Works Standards, 12-inch mains are also required for the commercial main street area proposed along Brisband Road in Frog Pond East. For all residential zones, 8-inch mains are required, with all lines interconnected as a network to minimize dead ends.

The plan calls for new 12-inch waterlines extending north in Stafford Road and east in Advance Road to extend the distribution system into Frog Pond East and South, connecting to the existing 12-inch waterlines in Boeckman Road and Advance Road. Additional points of connection will also be made to proposed waterlines planned to be installed in Frog Pond Lane and Brisband Road as part of the Frog Pond West development.

The northernmost neighborhoods in Frog Pond East along SW Kahle Road need to be connected to the City's existing water system with a 12-inch loop that connects to the south side of the BPA easement in two locations, one being a connection at the intersection of Stafford Road and SW Kahle Roads, and the other to the 12-inch waterline in the commercial main street. The loop could be constructed across the BPA easement either in the proposed road extending northeast from Frog Pond Lane, or it could cross the BPA easement further to the east via the proposed pedestrian bridge over the main fork of the Newland Creek. The decision on where to route the loop will depend on what areas are developed first and whether the pedestrian bridge is built. In either scenario the 12-inch mainline along SW Stafford Road and SW Kahle Road will be required.

The WSMP recommended two additional connections to the existing distribution system to reliably serve Frog Pond East and South through buildout. The first is a 12-inch connection to the Canyon Creek Road waterline via a crossing of Boeckman Creek at the west end of Frog Pond Lane, for connection to the Stafford Road waterline in conjunction with development in Frog Pond East.

The second is a crossing of Meridian Creek with a 12-inch main, south of the Meridian Creek Middle School, installed in conjunction with development of Frog Pond South. Both creek crossings are assumed to be below grade directionally drilled pipelines; however, they may be installed on future pedestrian bridges where under consideration by the City.

Storage System

The WSMP identified an overall water storage deficiency in the City which will be further increased by development in Frog Pond East and South. The WSMP proposed a 3.0-million-gallon West Side Tank and 24-inch transmission main project to provide sufficient storage for the City. The City has this project budgeted in the City's current 5-Year Capital Improvement Program, with design expected to begin in FY2022/23. The project is anticipated to be completed in 2025.

The extent of the storage deficiency and its impact on development of Frog Pond East and South is unknown at this time, since the WSMP is 10 years old and significant development has occurred in the City in that period. Additional analysis may be conducted to determine what, if any, impact any development in Frog Pond East and South prior to implementation of the new water tank would have on the existing water system and its customers.

The water system layout and sizing is primarily dependent on the street network to distribute fire flow to the designated land use types. Given the higher-density scenario using the same land use pattern and street plan, it is estimated that waterline sizes and costs would remain the same as with the preferred water system layout.

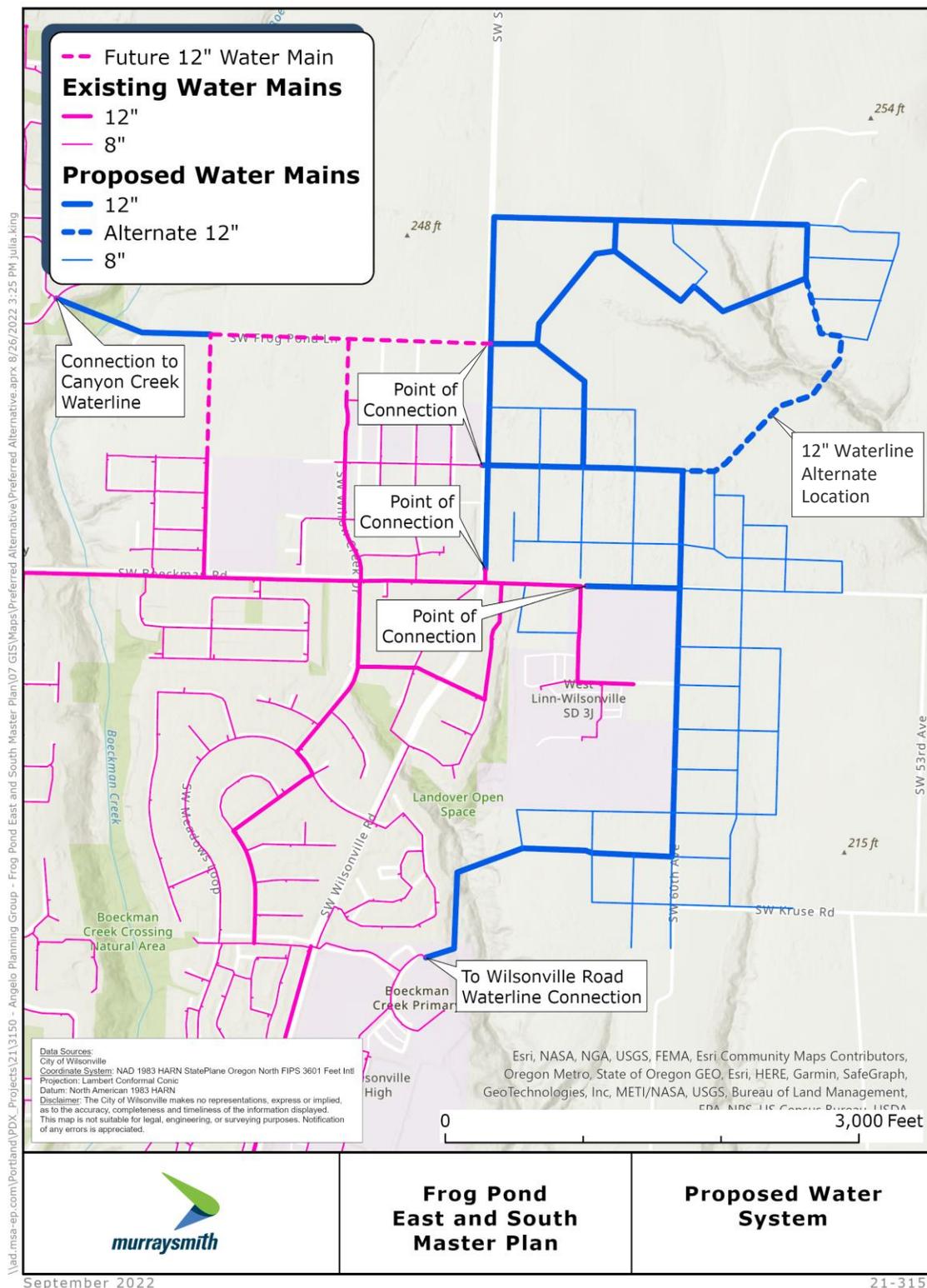
Proposed Wastewater System

The City of Wilsonville will provide sanitary sewer service for the Frog Pond East and South area as an extension of the City's existing collection system. The City's *Wastewater Collection System Master Plan* (WCSMP), adopted in 2014, is the current basis for wastewater system planning within the City. The 2015 FPAP and subsequent studies provide the specific framework for wastewater system planning in the Frog Pond East and South area, along with design criteria from the 2017 Public Works Standards.

Figure 2 shows the proposed preliminary wastewater system layout for the Frog Pond East and South neighborhoods.

The area was divided into five sewer basins, one for each of the four lift stations required and one that flows by gravity out of the Frog Pond area. Basin peak flows were calculated using preliminary land use data provided by MIG and unit flow values determined from the WCSMP. Residences were assumed to have 2.48 people per unit and an average sewer production rate of 67 gallons per person per day. Commercial sectors were assumed to generate 1,000 gallons per acre per day and schools were estimated to generate 25 gallons per day per person. Average dry weather flows were used with a peaking factor of 2 to estimate the peak dry weather flows. Wet weather flows were estimated to have an infiltration and inflow rate of 1,800 gallons per acre per day over the entire basin. Detailed calculations can be found in Appendix A.

Figure 1 – Preliminary Water System Layout



Each basin was analyzed for both the preferred housing scenario of 1,800 total units, and the higher-density scenario of 2,384 total units. The four lift station basins will each require an 8-inch gravity pipe to convey wastewater to the lift station at an assumed slope of 0.5%, and a 4-inch force main discharge to the downstream basin. These requirements are the same for both housing scenarios. **Table 1** shows the peak wet weather flow for each lift station basin and the required pipe sizes.

Table 1 - Lift Station Basins

Basin	Total Peak Flow for 1,800 Units (cfs)	Total Peak Flow for 1,800 Units (gpm)	Total Peak Flow for 2,384 Units (gpm)	Recommended Lift Station Design Capacity (gpm)	Force Main Size (in)	Gravity Sewer Size (in)
LS1	0.130	58	70	135	4	8
LS2	0.159	71	86	135	4	8
LS3	0.123	55	67	135	4	8
LS4	0.489	220	260	260	4	8

Table 1 shows that the recommended capacity for LS1, LS2 and LS3 lift stations is 135 gpm, which is the minimum size required to meet design criteria for 4-inch sewage force mains. This is the same for both housing scenarios. Capacity of LS4 would increase somewhat, from 220 gpm in the preferred scenario, to 260 gpm in the higher-density scenario. This change is estimated to be relatively insignificant in the overall cost of constructing the wastewater facilities for LS4 basin.

The main trunk traveling north to south on SW Stafford Road conveys sewage from both lift station 1 and 2 and a portion of the gravity basin. This pipe has the capacity to carry both housing density scenarios at an 8-inch size; however, this pipe is identified in the WCSMP as a 12-inch line for future extension to the north.

Extension of the Boeckman Road Trunk Sewer east on Advance Road is needed to convey sewage from both Lift Stations 3 and 4 and a portion of the gravity basin. A 10-inch size is required to provide capacity necessary for both housing density scenarios.

All wastewater from Frog Pond East and South is to be conveyed to the wastewater treatment plant through connection to the existing Boeckman Road Trunk Sewer, which flows west to the existing Boeckman Creek Interceptor Sewer and the Memorial Park Pump Station. The Boeckman Road Trunk Sewer is being upsized to 18-inch diameter as part of improvements to Boeckman Road, including Boeckman Dip Bridge, with completion anticipated for 2024.

The Boeckman Creek Interceptor Sewer is a 12-inch to 18-inch diameter pipe extending from Boeckman Road to the Memorial Park Pump Station. Capacity of the Boeckman Interceptor was determined to be sufficient for full buildout of Frog Pond West but will be insufficient to serve full build-out of Frog Pond East and South. The WCSMP recommends the Boeckman Creek Interceptor

Sewer be upsized for buildout of Frog Pond East and South. The City is currently planning to upsize the Boeckman Interceptor in conjunction with a regional trail in the creek corridor. Design of the project will begin in 2022, with construction anticipated to be completed in the fall of 2025.

Though the Boeckman Creek Interceptor will not have sufficient capacity for full buildout of Frog Pond East and South, there will be some capacity available for initial development in the area, depending on how much capacity has been taken up by Frog Pond West. A specific amount has not been calculated. With the Frog Pond West area nearing full development, it is recommended the City reevaluate the remaining capacity in the downstream Boeckman Creek system to estimate how many new dwelling units in Frog Pond East and South can be reliably connected before the planned interceptor improvements are complete.

The WCSMP estimated that the sewer line on SW Kahle Road would need to be a 10-inch pipeline; however based on updated loading conditions, calculations show an 8-inch pipe will be adequate to convey the flow from the areas tributary to the Kahle Road sewer line.

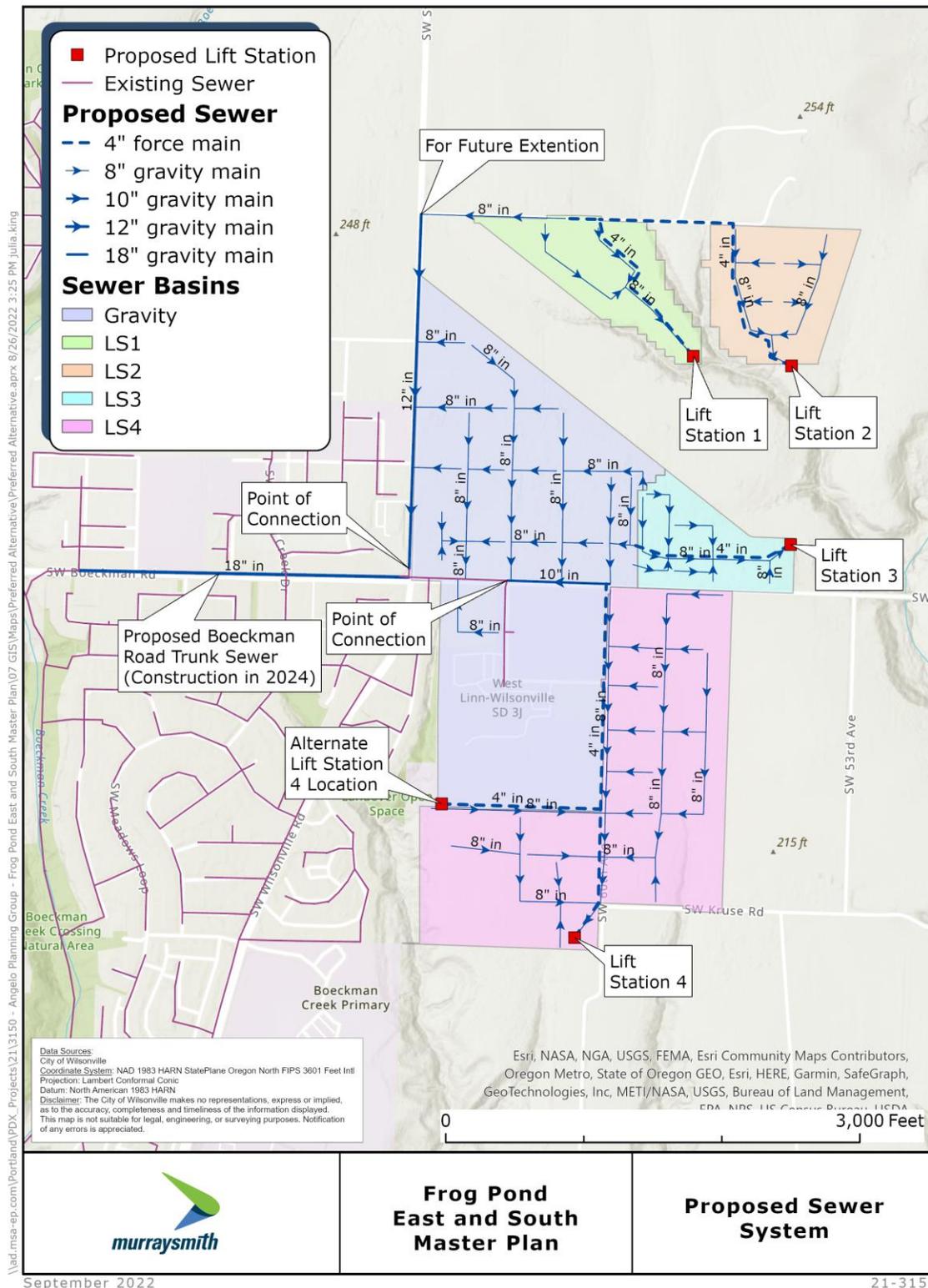
Proposed Stormwater System

<<To Follow - Stormwater Infrastructure Plan is still in development as of September 6, 2022>>

References

- Angelo Planning Group. (2015). *Frog Pond Area Plan*.
- City of Wilsonville. (2017). *Public Works Standards*.
- Keller Associates. (2012). *Water System Master Plan*.
- Murraysmith. (2014). *Wastewater Collection System Master Plan*.
- Murraysmith. (2021). *Findings of HB 2001 Sensitivity Analysis*.
- URS. (2012). *Stormwater Master Plan*.

Figure 2 – Preliminary Wastewater System Layout



Appendix A

Project: 21-3150 Frog Pond Master Plan
 Date: 8/26/2022
 Author: JK
 Description: Frog Pond East and South sewer basin land use and flow calculations for 1,800 total residential units

Assumptions	
Category	Average Sewer GPD
Person	67 gallons/person/day
Commercial	1000 gallons/acre/day
School	25 gallons/person/day
I&I	1800 gallons/acre/day

Gravity Pipe Assumptions	
Slope	0.005
Manning's n	0.013

Diameter	Max Flow in Pipe (cfs)
4	0.135
6	0.398
8	0.857
10	1.553

Basin	Total Area (ac)	MF Units	SFA Units	SFD Units	Total Residential Units	Commercial Area (ac)	School Area (ac)	School Students and Employees	Park/Street Area (ac)	Residential Area (ac)
Gravity	105.0	174	308	274	756	4.9	27.1	1305	27.9	45.0
LS1	18.1	0	63	93	155	0.0	0.0	0	0.4	17.7
LS2	20.7	0	86	111	197	0.0	0.0	0	1.0	19.7
LS3	15.4	0	72	84	156	0.0	0.0	0	1.4	14.0
LS4	76.7	48	212	276	536	0.0	0.0	0	25.1	51.6
Totals	235.9	222	740	837	1,800	4.9	27.1	1305	55.9	148.0

Basin	Average Dry Weather Flow (gpm)	Peak Average Dry Weather Flow (gpm)	Peak I&I Flow (gpm)	Total Peak Flow (gpm)	Total Peak Flow (cfs)	Force Main Size (in)	Force Main Velocity	Does Gravity Flow fit in 8in	Does Gravity Flow fit in 10 in
Gravity	96.6	193.3	131.3	324.5	0.723	N/A	N/A	Yes	Yes
LS1	17.9	35.9	22.6	58.5	0.130	4	1.49	Yes	Yes
LS2	22.7	45.4	25.8	71.2	0.159	4	1.82	Yes	Yes
LS3	18.0	36.0	19.2	55.2	0.123	4	1.41	Yes	Yes
LS4	61.8	123.6	95.9	219.5	0.489	4	5.61	Yes	Yes

Trunk	Total Peak Flow (cfs)	Does Gravity Flow fit in 8in	Does Gravity Flow fit in 10in
SW Stafford Road Trunk (cfs)	0.651	Yes	Yes
Boeckman Trunk Extension (cfs)	0.974	Pipe Overcapacity	Yes

Project: 21-3150 Frog Pond Master Plan

Date: 8/26/2022

Author: JK

Description: Frog Pond East and South sewer basin land use and flow calculations for 2,384 total residential units

Flow Assumptions	
Category	Average Sewer GPD
Person	67 gallons/person/day
Commercial	1000 gallons/acre/day
School	25 gallons/person/day
I&I	1800 gallons/acre/day

Pipe Assumptions	
Slope	0.005
Manning's n	0.013

Diameter	Max Flow in Pipe (cfs)
4	0.135
6	0.398
8	0.857
10	1.553

Basin	Residential Units (32% increase)	Commercial Area	School Students and Employees
Gravity	1,001	4.9	1305
LS1	206	0.0	0
LS2	261	0.0	0
LS3	207	0.0	0
LS4	709	0.0	0
Total	2,384	4.9	1305

Basin	Average Dry Weather Flow (gpm)	Peak Average Dry Weather Flow (gpm)	Peak I&I Flow (gpm)	Total Peak Flow (gpm)	Total Peak Flow (cfs)	Force Main Size (in)	Force Main Velocity	Does Gravity Flow fit in 8in	Does Gravity Flow fit in 10in
Gravity	124.9	249.9	131.3	381.1	0.849	N/A	N/A	Yes	Yes
LS1	23.7	47.5	22.6	70.1	0.156	4	1.79	Yes	Yes
LS2	30.1	60.1	25.8	86.0	0.192	4	2.19	Yes	Yes
LS3	23.8	47.7	19.2	66.9	0.149	4	1.71	Yes	Yes
LS4	81.9	163.7	95.9	259.7	0.579	4	6.63	Yes	Yes

Trunk	Total Peak Flow (cfs)	Does Gravity Flow fit in 8in	Does Gravity Flow fit in 10in
SW Stafford Road Trunk (cfs)	0.772	Yes	Yes
Boeckman Trunk Extension (cfs)	1.152	Pipe Overcapacity	Yes