Capacity Study for Gas, Water and Sewer Utilities – Phase I

For the City of Fairhope

Prepared for:

CITY OF FAIRHOPE
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GMC

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EXECUTIVE SUMMARY

Baldwin County's population is growing faster than any other county in the state of Alabama, with a current population over 200,000. Fairhope is among the cities within the county experiencing significant growth. On December 22, 2016, the Fairhope City Council approved a six-month moratorium on new, large developments and apartment complexes. As one of the objectives, the moratorium served to provide the City additional time to analyze its infrastructure and determine necessary actions to continue providing quality infrastructure services. In addition, the moratorium served to provide much needed time for the planning and zoning officials to complete local ordinances.

Goodwyn, Mills & Cawood (GMC) was contracted to provide a preliminary engineering study of the infrastructure with specific focus on the sewer system. City officials provided GMC with recently upgraded SCADA information, GIS data, and field information to complete the analysis. Further, GMC was directed to focus on five (5) specific sewer basins where the infrastructure is most critical to the service.

The sewer analysis revealed that four (4) of the five (5) major pump stations in the study area, as well as a significant portion of major gravity lines within these systems are at, near or exceed capacity for average diurnal flow events.

The City has taken proper steps to improve the treatment system providing redundancy and tertiary treatment for discharge. The collection system is strained, and the City's operational staff has worked diligently, avoiding SSOs by making adjustments to pump stations to achieve sewer collection objectives. Preliminary engineering results indicate that numerous pump stations are undersized and operating at a rate that can be destructive to the infrastructure. In addition, it is expected that inflow and infiltration (I&I) are significant in the older portions of town.

The majority of the current sewer flows are directed through a major sewage trunk line through the main corridor of downtown Fairhope to the POTW. The trunk line is at capacity and should be upgraded if substantial additional flows are accepted via the existing route. It is critical that the City maintain capacity in its system for I&I, particularly with its historical annual precipitation. Thus, all infrastructure should be sized appropriately.

It is recommended that the City generate a sewer system master plan based upon the growth projections and significant areas of development. A sewer model of the existing system may provide additional information, improve the efficiency of the system, and provide information to aid in the master planning of the sewer system. The City should consider a collection system serving the proposed large growth areas to the east of US Highway 98 with a treatment system designed for incremental growth. A consistent restoration budget including CCTV, CIPP lining and manhole improvements is necessary to maintain an acceptable collection system within the existing service area.

1.0 INTRODUCTION

The City of Fairhope is a unique and treasured municipality located in south Baldwin County, Alabama. The City has been labeled a resort community from the times when visitors from Mobile would cross to vacation. The environment has been cultivated into a community of artistry, leisure, and accenting of natural beauty. The community draws thousands of visitors each year to observe the natural landscape, as well as enjoy its vibrant downtown.

The City's population has grown over 20% in the last decade. As the community has grown, utility (gas, water & sewer) infrastructure necessary to support the growth has been expanded along the way. The state and county roadways that serve the area have been expanded improving accessibility to the area, allowing for development, and extending these utility systems to serve customers.

A moratorium was placed on large development in December of 2016 to provide planning and zoning officials time necessary to develop ordinances and regulations. The moratorium also allowed for a preliminary study into the existing utility infrastructure with specific focus on the sewer infrastructure.

Indicators suggest that the City of Fairhope will continue to grow steadily. With growth on the horizon, it is imperative that the City review the capacity of its utilities and determine the next logical steps to continue providing quality utility service to its service area. The capacity study herein utilizes general engineering concepts and data provided from the City including, but not limited to, GIS data, SCADA information, vendor information, and field information. The study does not utilize complex engineering computations or modeling, but available, Owner-provided information for review.

1.1 Terms, Definitions and Nomenclature

Throughout the report, terms will be used and the definitions are as follows:

07Q10	A discharge of zero flow for the 7-day, 10-year low flow for a stream
ADEM	Alabama Department of Environmental Management
ALDOT	Alabama Department of Transportation
CCTV	Closed Circuit Television
CIPP	Cured-in-place Pipe
EPA	Environmental Protection Agency
GIS	Geographic Information System
GPM	Gallons Per Minute
I&I	Inflow and Infiltration
MG	Million Gallons
MGD	Million Gallons Per Day
NPDES	National Pollutant Discharge Elimination System
POTW	Publicly Owned Treatment Works
SCADA	Supervisory Control And Data Acquisition
SSO	Sanitary Sewer Overflow
WWTP	Wastewater Treatment Plant

2.0 DESCRIPTION OF MAJOR DRAINAGE BASINS

The City of Fairhope, Alabama owns and operates a system of sewer utilities serving the City and local area. This system consists of gravity pipes, force main pipes, pumping stations, and a wastewater treatment plant. GMC was contracted to evaluate the capacity of the sewer system, with particular focus on high demand pumping stations and their specific piping networks. Five (5) basins were determined critical by the City and are the focus of the study. Each of these basins has a critical pumping station that receives wastewater from multiple pumping stations within its basin. As such, each of these pumping stations is solely responsible for providing sewer service to many square miles of residential, industrial, commercial, and rural districts. Certain components of the system are suspected to be operating at or above capacity with the City continuing to grow in both population and development.

In order to perform the analysis required for the capacity study, various components of the City of Fairhope sewer system were analyzed. This memorandum presents the creation and development of the models in the study, as well as the results of the capacity analysis of the sewer system.

2.1 Major Basins of Study

The sewer capacity study was divided into the different sewer drainage basins comprising the system which GMC was charged with reviewing. The selected areas of study are the five (5) following pumping station basins and the single sewer plant basin consisting of the following: Thompson Hall Pumping Station Basin, Doghouse Pumping Station Basin, North Section St. Pumping Station Basin, South Section St. Pumping Station Basin, Mobile St at Fels Ave Pumping Station Basin, and City of Fairhope Wastewater Treatment Plant basin.

Each basin is comprised of multiple smaller pumping stations, force mains, gravity sewer pipes, low pressure systems, and catchment areas. Ultimately, all of the wastewater within these basins discharges to the City Wastewater Treatment Plant. Within the scope of study, the system has over 2,000 manholes, more than 175 total miles of pipe (over 90 linear miles of force main ranging from 2 to 16 inches in diameter; over 85 miles of gravity pipe ranging from 4 to 30 inches in diameter), over 70 pumping stations, and one (1) wastewater treatment plant. All of the basins described should be considered rough basin areas developed by estimating the extent of pump station locations, sewer system connectivity, and water catchment areas. The Environmental Protection Agency's (EPA's) MyWATERS Mapper software was used to define rough catchment areas with the EPA's defined watersheds.

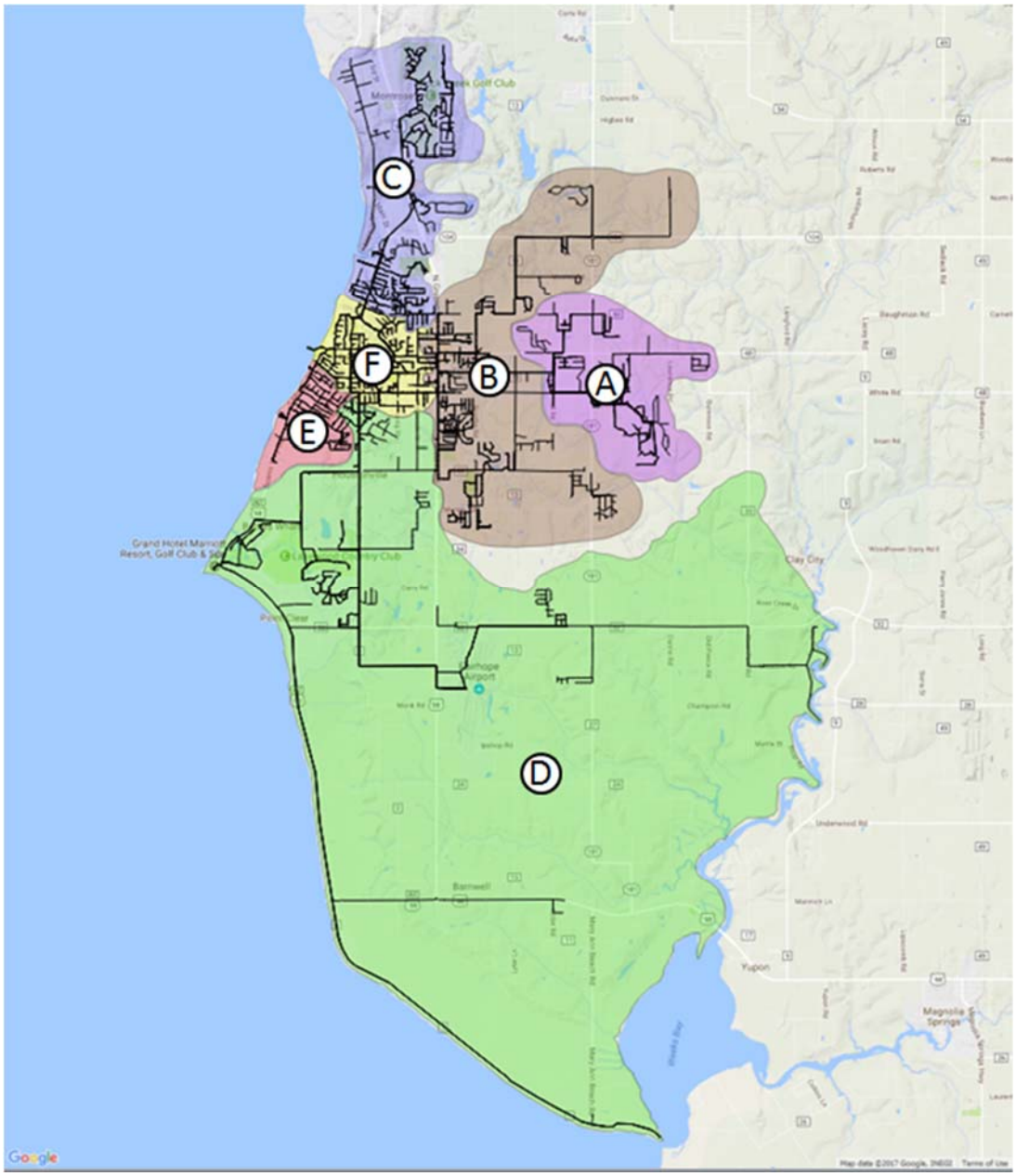

Figure 2.2.1.1-1: Map of the City of Fairhope's five major basins and sewer lines of study.

2.1.1 Thompson Hall Basin (Basin A)

The Thompson Hall basin is the east-most of the main basins in the City of Fairhope sewer system. This basin extends east from The Willows residential neighborhood, stretching east to include a portion of Gunnison Rd. The northern branch of Cowpen Creek flows southeast through the middle of the basin. A few residential ponds exist in the northwest corner of the basin, as well. Basin A contains seven (7) supplemental pumping stations in addition to the larger Thompson Hall pumping station, for a total of eight (8) pumping

stations. All gravity lines and force mains eventually lead all wastewater to the Thompson Hall pumping station. The total estimated area of Basin A is approximately four (4) square miles. Most of the existing supplemental pumping stations serve pre-built or developing residential communities, including Nature's Trail and Quail Creek. The total length of force mains in Thompson Hall basin is 59,167 feet, or 11.2 miles. Roughly eight (8) miles of the linear force main in the basins are of substantial size and not associated with the smaller low pressure systems. The Thompson Hall Basin pumps directly into a gravity trunk line in the Doghouse Basin sewer system.

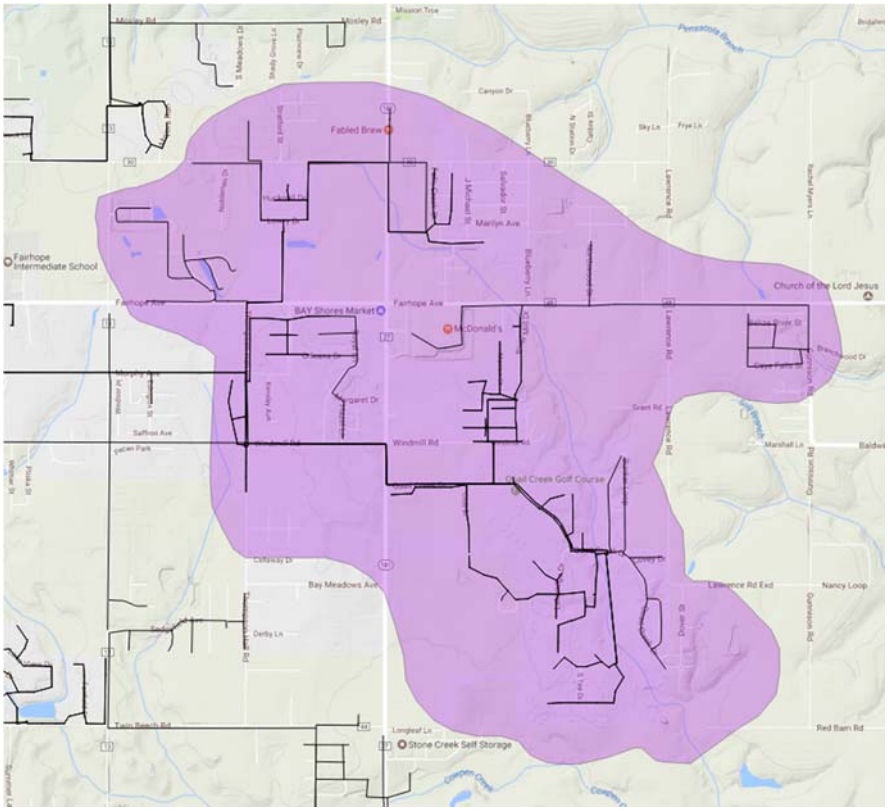

Figure 2.1.1-1.1: Map of Thompson Hall major sewage basin.

2.1.2 Doghouse Basin (Basin B)

The Doghouse basin is located between the eastern Thompson Hall Basin and the western City of Fairhope WWTP Basin. The basin is roughly defined by a catchment area that encompasses the north, west, and southwest sides of the Thompson Hall Basin. Basin B has multiple creeks within its area. These creeks include the northern sections of the Fish River's Pensacola Branch, the southeastern branches of Fly Creek, and the northwestern branches of Cowpen Creek. With an area of approximately 9 square miles, the basin has fifteen (15) pumping stations delivering wastewater into the larger-capacity Doghouse Pumping Station, for a total of sixteen (16) stations. The basin contains 103,018 total feet (19.5

miles) of force mains in addition to its multiple gravity pipe systems. The linear infrastructure length provided through SCADA is misleading as much of this length is due to the twelve (12) low pressure systems and their estimated 14 miles of low pressure piping. These low pressure systems serve private neighborhoods in the more rural areas of the basin. After receiving all of the wastewater from its gravity and force main network, the Doghouse pumping station pumps directly into a gravity trunk line of the City of Fairhope WWTP basin to the west.

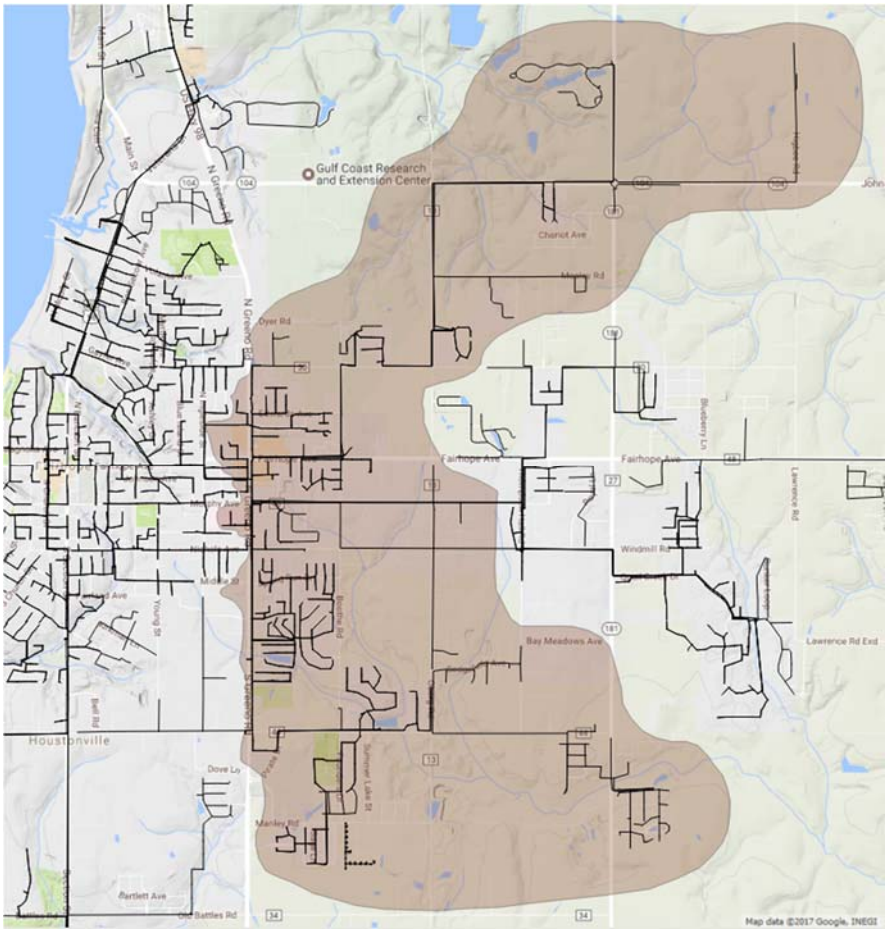

Figure 2.1.2-1.2: Map of Doghouse House major sewage basin.

2.1.3 North Section St. Basin (Basin C)

The North Section Street basin is the northern-most sewer basin serviced by the City of Fairhope sewer system. Stretching to the Mobile Bay coastline, the basin begins just north of the WWTP and follows Highway 98 north toward Montrose, ending near the north side of the Rock Creek Golf Club. The final branches of Rock Creek Fly Creek are contained within the basin area and drain into Mobile Bay. Basin C has an area of approximately 5 square miles, and contains a total of sixteen (16) pumping stations including the final North Section St. pumping station. 10 low pressure systems account for roughly 6.5 miles of low pressure pipe in the basin. Along with the gravity lines, a total of 88,036 linear feet (16.7

miles) of force mains populate the North Section St. basin. All wastewater from this basin is pumped into the City of Fairhope WWTP gravity basin and is conveyed in this manner to the WWTP.

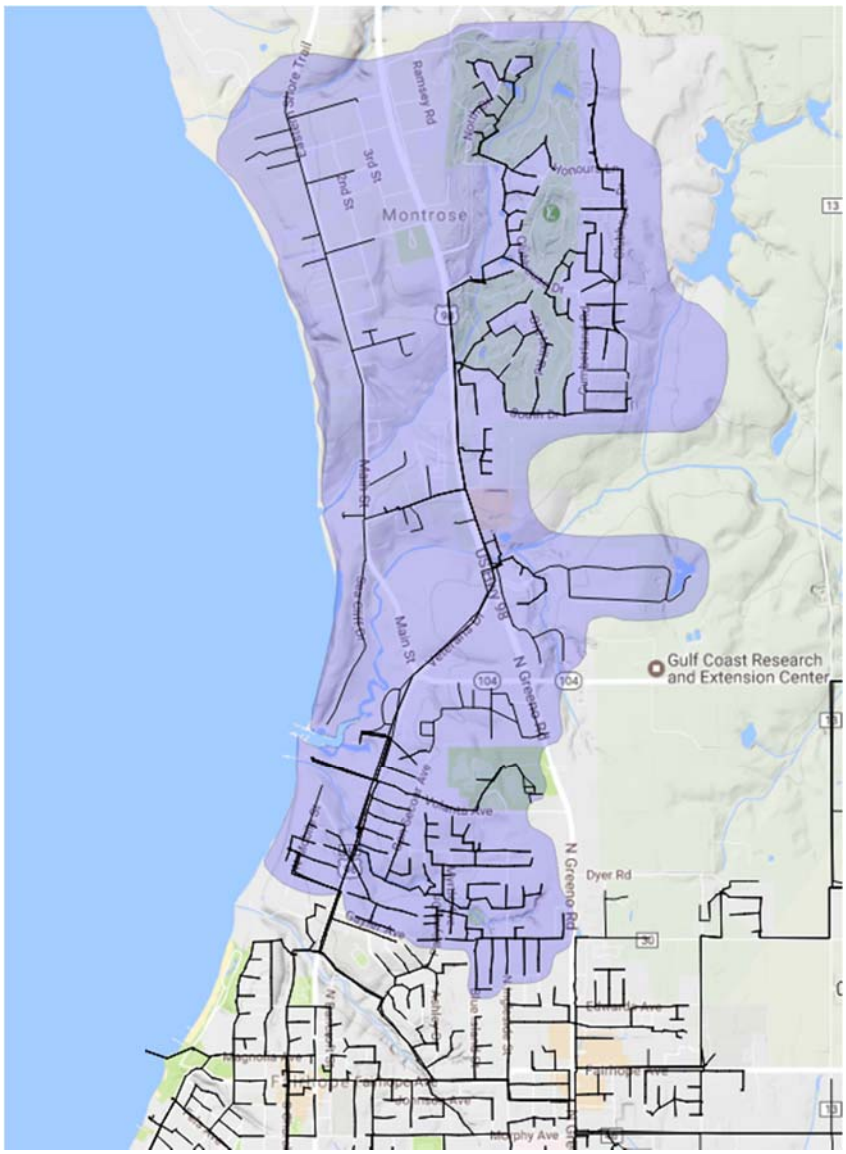

Figure 2.1.3-1.3: Map of North Section Street major sewage basin.

2.1.4 South Section St. Basin (Basin D)

The South Section Street basin is the southern-most and largest-by-area (roughly 41 sq. miles) basin in the City of Fairhope sewer system. It roughly begins just south of Middle St, and extends down the coastline, including the Grand Hotel Marriott Resort, Golf Club & Spa, all the way to Pelican point. Multiple creeks run through this relatively large basin area. The major creeks are Point Clear Creek, Bailey Creek, and the final section of Cowpen

Creek. A number of branches of Fish River also extend into the basin, including the Green Branch, Waterhole Branch, Turkey Branch, and Weeks Branch. Its eastern reach is the Fish River. The majority of the land-area in the South Section St. Basin is undeveloped farmland. The majority of the planned district land is rural district. The remaining districted land is residential and industrial. This basin contains twenty-one (21) pumping stations that pump into the larger South Section Street pumping station, for a total of twenty-two (22) stations. The total length of force mains within the basin is 205,830 feet, or 39.0 miles. Roughly a third of this linear length (~11 miles) can be attributed to the nine (9) low pressure systems serving residential communities. The South Section St. station pumps directly into the City of Fairhope WWTP basin to the north for treatment at the WWTP.

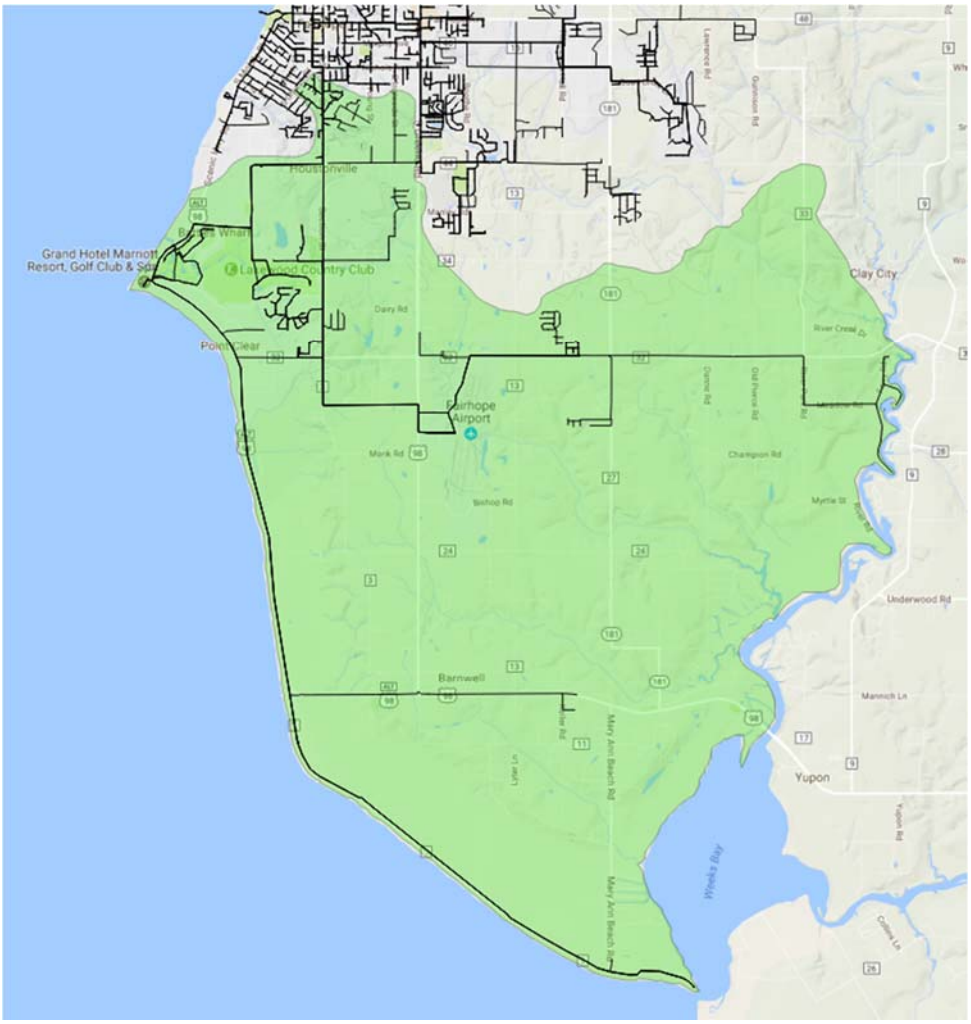

Figure 2.1.4-1.4: Map of South Section Street major sewage basin.

2.1.5 Fels & Mobile Basin (Basin E)

The Fels & Mobile basin also borders the Mobile Bay coastline. Its southern reach begins near the northern edge of the South Section St. basin, while its northern reach ends at the City of Fairhope Wastewater Treatment Plant Basin. It is the smallest basin in the studied portion of the Fairhope sewer system, with an estimated area of 1.5 square miles. No major creeks flow through the basin. Most of the sewers in this basin serve single family homes. Because of this, the majority of the basin's sewer pipes are gravity pipes. Five (5) smaller pumping stations pump wastewater into the larger-capacity Fels & Mobile pumping station, for a total of six (6) stations in the basin. Basin E contains a total of 14,273 feet (2.7 miles) of force mains in addition to its gravity pipes, but only 0.9 miles of low pressure, small diameter piping. The Fels & Mobile pumping station pumps wastewater via a 10 inch force main into a gravity trunk line of the City of Fairhope Wastewater Treatment Plant Basin.

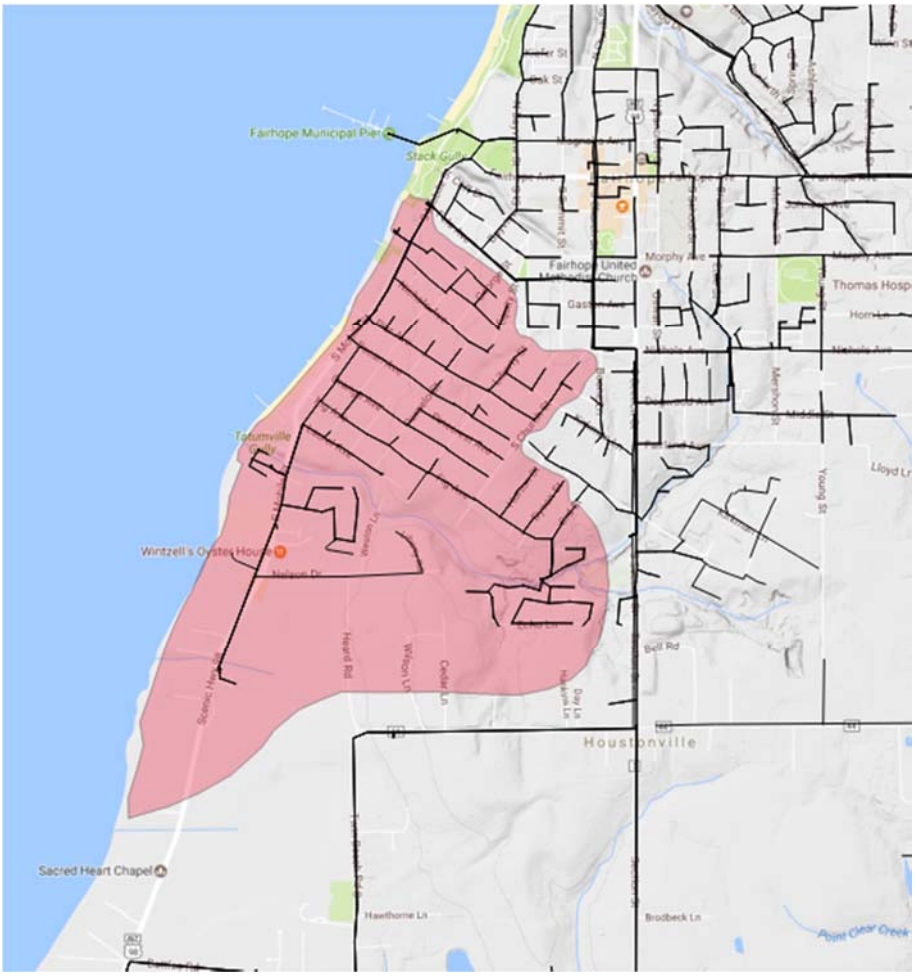

Figure 2.1.5-1.5: Map of Fels & Mobile major sewage basin.

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2.1.6 City of Fairhope Wastewater Treatment Plant Basin (Basin F)

The main wastewater treatment plant (WWTP) serving the City of Fairhope is located just west of Fairhope Elementary School. It has an estimated basin area of roughly 1.6 square miles. The catch basin for the WWTP is primarily comprised of gravity sewer lines. There are no major creeks within the basin area. There are three (3) pumping stations that operate within this basin. Two of these pump stations serve the Fairhope Municipal Pier, while the other serves a small residential neighbor. Neither is considered a major pumping station. The total length of force mains extending from these pump stations is 5,963 feet (1.1 miles), with less than 10% of the total length being small, low pressure pipe specifically serving the Fairhope Municipal Pier. All gravity sewer lines within this catchment eventually converge at the WWTP. The City of Fairhope WWTP basin also receives wastewater from the Doghouse, S. Section Street, N. Section Street, and Fels & Mobile basins.

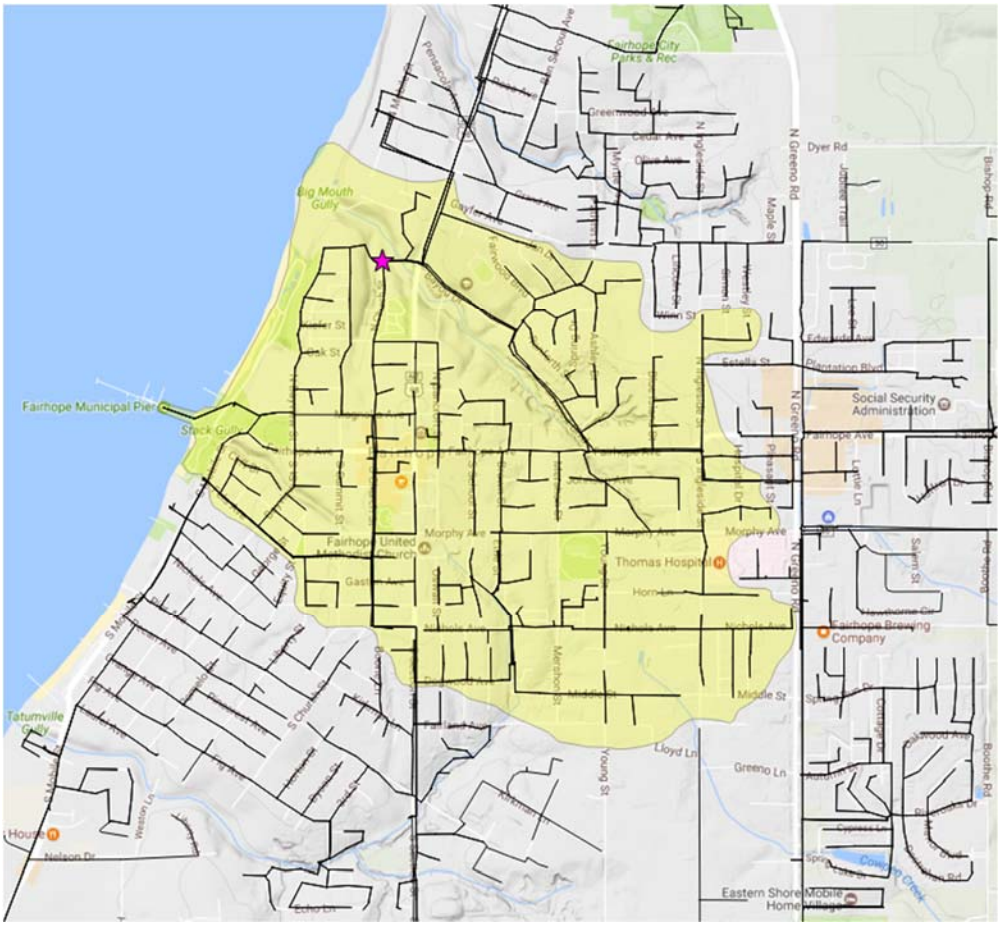


Figure 2.1.6-1.6: Map of City of Fairhope Wastewater Treatment Plant major sewage basin.

3.0 CURRENT CONDITIONS

3.1 Engineering Methods for Collection System Review

GMC reviewed the requested sewer basins utilizing standard engineering methods. Appendix A provides graphs of significant gravity lines and their associated capacities raw and line capacities. The profiles represent an approximate sewer profile based on provided data between manholes and pump stations. Raw capacity is defined as the capacity of each individual pipe between nodes flowing full based upon Manning's Equation. The line capacity is defined as the capacity of the line as a whole, where a downstream pipe with lower capacity (due to pipe diameter or slope) may limit flow upstream.

Pump stations were evaluated using existing pump curves, GIS data and geographical information to determine the probable pumping capacity of each station. In order to evaluate the performance of each station, both the system and the pumps serving the system were analyzed. The system curves indicate the applicable system operating points for each of the five major stations. The downward sloping pump curve on each graph was generated based upon each station's specific pumps that are in service. The system curve was constructed by first checking the design flow of the system using the provided velocity and force main diameter data. The force main pipe fittings were then estimated to calculate an equivalent length of lost head. This calculated head, plus the design flow and elevation, yields the design curve for the system.

Two system curves (low-water level and high-water level curves) were calculated and graphed based upon varying flow rates and the corresponding head losses in the force main. The system curves generated were then overlaid with the associated pump curve. The points on the pump curve that intersect the two crossing system curves are the calculated design points for the system. This flowrate and head loss is compared to the actual design point provided by the station's filed engineering data provided by the owner to evaluate the performance of the infrastructure. The generated pump and system curves for the analyzed pump stations may be found in Appendix B.

3.2 Treatment System

The existing POTW discharging into Mobile Bay is permitted for 4 MGD and lies approximately 3200 L.F. west of the shoreline. The discharge is into waters classified as Shellfish Harvesting /Fish and Wildlife. Mobile Bay is a Tier I stream and is listed as an impaired water body for pathogen impairment (Enterococcus Bacteria). The NPDES permit (AL0020842) for the discharge provides reasonable effluent limitations with the following general Monthly Average requirements: Carbonaceous Biochemical Oxygen Demand (15 mg/L), (Total Suspended Solids (30 mg/L), Ammonia (10 mg/L). Reporting for other pollutants exists, as well as limitations for bacteria and total residual chlorine.

The wastewater treatment facility was renovated to increase its treatment capability in 2015. The facility is now a tertiary treatment facility with improved nutrient removal capabilities. In addition, much needed redundancy was constructed to reduce the probability of process failure and enhance the operator's ability to provide maintenance on the equipment and related infrastructure.

The permit was renewed in 2011 with the expiration date of January 30, 2016. However, this permit remains active as ADEM works to complete the updated NPDES permit for this discharge. A water quality model for the coastal areas of Alabama is currently being developed by regulatory agencies, but is not expected to impact the forthcoming permit. However, it is expected that the limitations for pollutants will be reduced in future permit cycles, in line with water quality efforts.

3.3 Current Pumping Station and Forcemain Conditions

The force mains within the City of Fairhope sewer system range from 3-inch to 16-inch in diameter. Many of the local low-pressure grinder stations are smaller diameter pipes that are not major contributing force mains in the overall sewer system. There are only twelve (12) total force mains of significant size in the sewer system over 8-inch in diameter 0one (1) 16-inch diameter main and ten (10) 10-inch diameter mains). The majority of the mains are in the 4-inch to 8-inch range.

The City of Fairhope's sanitary sewer system is currently strained based upon preliminary engineering analysis. Three (3) of the four (4) main pump stations that serve the City are currently loaded beyond their design capacity. These three (3) stations are the North Section, Thompson Hall and Doghouse Pumping Stations. The South Section Street station is expected to reach design capacity by 2020, if current growth trends continue. In addition to the pumping stations being over capacity, most of the gravity lines that further convey flow from these stations are also beyond their design capacity. The exception is the gravity line into which the North Section Street Pump Station flows. The South Section Street Pumping Station analysis revealed inconclusive results based upon conflicting SCADA information, as-built information, and operational references. It is anticipated that it has indeed exceeded its approximate adf capacity, but additional information is necessary to determine for certain.

When investigating the capacity of a pump station, two (2) parameters were examined, Approximate ADF Capacity and Design Capacity. Design capacity is the ultimate amount that a pump station can pump at any given moment, excluding redundant pumps. The Approximate Average Daily Flow Capacity is considered 50% of this value for the purpose of this study. In the case of pump stations, the infrastructure must be capable of operating at low flows, peak diurnal flows, and during peak rain events. This design consideration allows for the pumps to cycle on and off while reducing the amount of wear and tear. The

current load is the flow at peak daily flow at each station based on current information available through SCADA utilizing pump run times. The table below indicates the capacities of major gravity lines of importance, as well as main pump stations:

Table 3.3-1 Major Pump Station Infrastructure Capacities

MAIN PUMP STATIONS	DESIGN CAPACITY (gpm)	APPROX ADF CAPACITY (gpm)	CURRENT LOAD (gpm)
SOUTH SECTION	650	325	273
NORTH SECTION	500	250	342
THOMPSON HALL	500	250	264
DOGHOUSE	800	400	633

3.4 Collection System Condition Capacity and Reliability

The City of Fairhope lies on the eastern border of the Mobile Bay, and therefore experiences a warm, humid climate. Annual average precipitation is approximately 68 inches. Typically, July has the most precipitation, while October has the least. According to the 2015 revision of the Baldwin County Commission Subdivision Regulations, sewer design shall be based on at least the worst-case scenario of runoff up to and including a 100 year, 24-hour rainfall event. Frequent rain events and the coastal conditions play a significant factor in managing the assets of a sewer system in this area. The coastal conditions often result in shorter life durations for equipment, particularly control panels and pumping equipment. While I&I must be a factor in design with all collection systems, it is critical in a coastal condition where diurnal peak flows and rain events occur concurrently.

Currently the City's collection system is functioning adequately during normal, dry-weather flow patterns conditions. During heavy rain events sewage overflows have been reported at points in the system. As the system continues to be strained these overflows will increase in the number of locations and amount of sewage escaping the system.

Currently, the City of Fairhope has approximately 60 miles of clay pipe that has not been inspected or lined. Clay pipe is commonly known to often have misaligned joints and a propensity to lose its structural integrity over time. This pipe material is associated with

pipe collapse and intrusion of roots, specifically when aged. These factors lead to clay lines being a major source of infiltration and obstruction of gravity sewer lines. Most of the pipe in the older portions of the City utilize clay pipe for sewage collection. It is highly probable that this pipe is allowing ground and stormwater to enter the system, as well as allowing sewage to escape the collection system without proper treatment.

The City has provided funding for CCTV video inspection, lining and repair; however, it is critical that sewer service providers take significant steps to reduce infiltration and the escape of sanitary sewer to protect the environment and perform such services at a rate that positively impacts the customer base. The maintenance of the existing collection system allows for growth in other areas such that the infrastructure does not reach capacity based solely upon I&I.

Design capacity and total capacity were once again reviewed in the analysis of the gravity sewer lines of concern. In the case of a gravity sewer line, total capacity is the amount of flow that can flow by gravity through the pipe when full. The design capacity for the line is indicated as one half of the full pipe flow value. Gravity sewer lines are typically designed to function at half capacity to allow for inflow and infiltration during rain events, specifically as the system ages. This design reduces the probability of SSOs during rain events. The current load for the gravity lines is determined by combining the flows from each station pumping to the line as well as an estimated gravity flow from the surrounding basin. The table below indicates the capacities of major gravity lines of importance, as well as main pump stations:

Table 3.4-1 Major Gravity Infrastructure Capacities

MAIN GRAVITY LINES	TOTAL CAPACITY (gpm)	DESIGN CAPACITY (gpm)	CURRENT LOAD (gpm)
18" GRAVITY LINE FROM DOGHOUSE OUTFALL TO WWTP	2324	915	1650
12" GRAVITY LINE FROM SOUTH SECTION OUTFALL TO WWTP	1072	401	1150
8" GRAVITY LINE BEHIND WINN DIXIE	281	130	560
8" GRAVITY AT DOGHOUSE STATION	384	178	1910

4.0 DEFINED AREAS OF POTENTIAL GROWTH

4.1 Comprehensive Plan

The City of Fairhope is continuing to see rapid growth in all areas less the central core of Old Fairhope which has generally reached its development capacity (build-out). Most of the new growth is occurring to the south in the South Section Street area and east of town along the Alabama Highway 181 corridor. As growth continues, it expected that the area around the intersection of Alabama Highway 181 and Alabama Highway 104 will be become a major hub of development over the next 5 to 10 years. These growth patterns are consistent with what was detailed in the City's Comprehensive Plan completed in 2015.

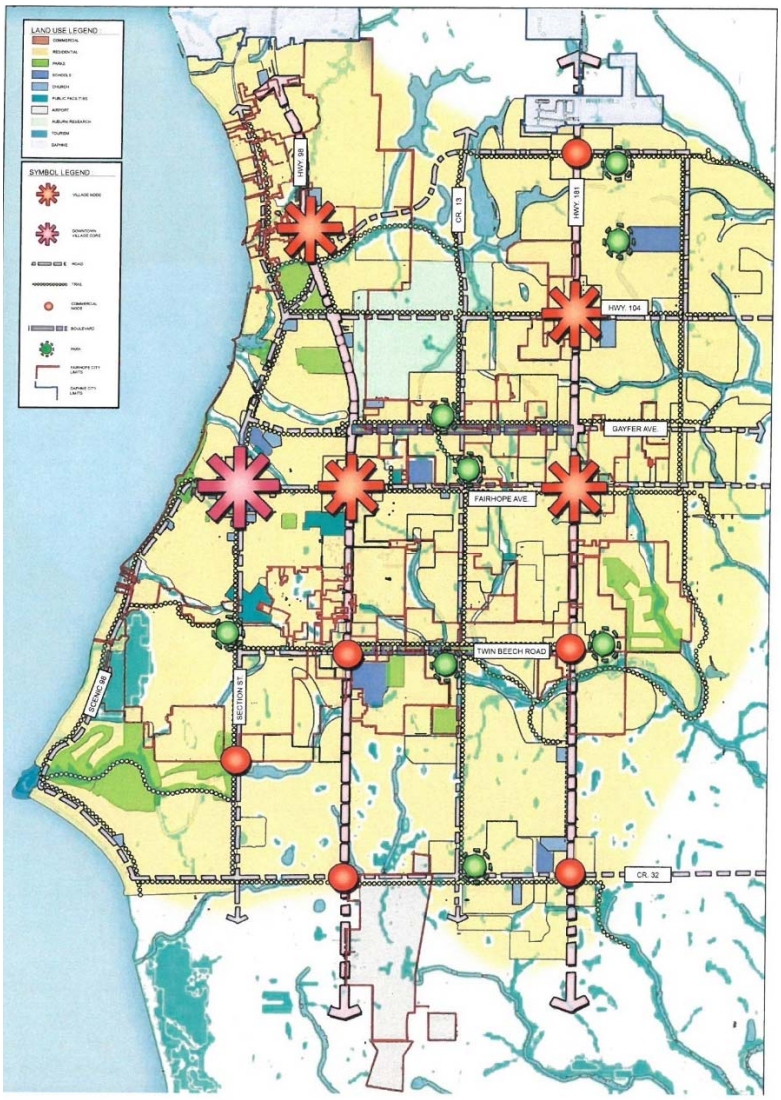


Figure 2.1.6-1 Comprehensive Plan Growth Map

4.2 City Permitting Department Data

Below is 4.2-1 showing the number of single family home building permits issued by the City of Fairhope between 2000 and 2016. The Table provides data that has been projected forward to provide a linear interpolation of single family home construction. The projections are not indicative of statistical population growth patterns, but a more simplistic approach based upon historical permit applications for the area. The interpolation of the data is then used to estimate additional residential (only) sewer flows during the growth periods reviewed.

Table 4.2-1 Historical Construction Permit Issuance

	YEAR	PERMITS ISSUED
	2000	231
	2001	235
	2002	338
	2003	363
	2004	420
	2005	498
	2006	365
	2007	266
	2008	179
*	2009	101
*	2010	138
*	2011	144
*	2012	248
	2013	268
	2014	279
	2015	353
	2016	363
Average		280
Average (Excluding Years of Recession)*		302
Average Since 2013		316

The permitting data indicates that the continued development pattern will require additional infrastructure to serve the developments based upon the known capacities of the sewer system. In addition, such single-family home development will also result in significant commercial and business developments that will require utility service.

4.3 10-Year Growth Projections

Over the next 10 years, it is expected that the City will continue to see a steady inflow of new residents and development. The population growth will result in new single-family homes as expressed by the historical permitting table above. Between 2013 and 2016 the average number of new homes built in Fairhope was 316. For purposes of the preliminary study, this represents an average or "Medium" growth year. In 2013, the fewest number of permits were issued (268). Thus, this value represents a "Low" growth year. The highest number of permits issued was in 2016 (363). For the purpose of the preliminary study, the value is considered a "High" growth year.

Table 4.3-1 10-Yr. Building Permit Projections

PROJECTED BUILDING PERMITS ISSUED			
YEAR	LOW GROWTH	MEDIUM GROWTH	HIGH GROWTH
2018	268	316	363
2019	268	316	363
2020	268	316	363
2021	268	316	363
2022	268	316	363
2023	268	316	363
2024	268	316	363
2025	268	316	363
2026	268	316	363
2027	268	316	363

Currently, the City is experiencing most of its growth along the Alabama Highway 181 corridor south of County Road 48 and along South Section Street. It is expected that this pattern will continue. ALDOT is in the process of improving Alabama Highway 181 from two to four lanes from Daphne to Alabama Highway 104, and possibly extending the four-lane to County Road 32. Once complete, it is anticipated that development along Alabama Highway 181 may accelerate. This acceleration may coincide with a slowdown along US 98 as large tracts of developable land are consumed.

With these factors in mind, a distribution chart of projected growth was developed for new sanitary sewer services added in each major sanitary basin over the next 10 years (Table 4.3-2). The projection is merely an assumption to evaluate the effect of the sewer loadings on existing infrastructure.

Table 4.3-2 Projected Growth Rates for Individual Drainage Basins

	NORTH SECTION	SOUTH SECTION	THOMPSON HALL	INTERMEDIATE SCHOOL
2018	15%	35%	35%	15%
2019	15%	35%	35%	15%
2020	15%	35%	35%	15%
2021	15%	35%	35%	15%
2022	15%	35%	35%	15%
2023	5%	35%	20%	40%
2024	5%	35%	20%	40%
2025	5%	35%	20%	40%
2026	5%	35%	20%	40%
2027	5%	35%	20%	40%

4.4 Estimated Load Projections on Major Pump Stations

The charts below show the projected loading on four (4) major pumping stations. The loadings over the next ten (10) years are based on the interpolated single-family home development (Low, Average and High growth rates) and assumed areas of growth from the table above.

Table 4.4-1 Low, Average & High Growth - Major Infrastructure Capacity Estimates

LOW GROWTH

PUMP STATION	CURRENT DESIGN CAPACITY (gpm)	ADF (gpm)	PDF (gpm)	ADF (gpm) 2022	PDF (gpm) 2022	ADF (gpm) 2027	PDF (gpm) 2027	PEAKING FACTOR (%)
SOUTH SECTION	650	196	273	277	386	358	499	1.39
NORTH SECTION	500	231	342	266	394	276	409	1.48
THOMPSON HALL	500	200	264	280	370	325	429	1.32
DOGHOUSE	800	500	633	615	779	755	956	1.27

AVERAGE GROWTH

PUMP STATION	CURRENT DESIGN CAPACITY (gpm)	ADF (gpm)	PDF (gpm)	ADF (gpm) 2022	PDF (gpm) 2022	ADF (gpm) 2027	PDF (gpm) 2027	PEAKING FACTOR (%)
SOUTH SECTION	650	196	273	292	407	388	540	1.39
NORTH SECTION	500	231	342	272	403	287	425	1.48
THOMPSON HALL	500	200	264	296	391	351	463	1.32
DOGHOUSE	800	500	633	637	806	802	1015	1.27

HIGH GROWTH

PUMP STATION	CURRENT DESIGN CAPACITY (gpm)	ADF (gpm)	PDF (gpm)	ADF (gpm) 2022	PDF (gpm) 2022	ADF (gpm) 2027	PDF (gpm) 2027	PEAKING FACTOR (%)
SOUTH SECTION	650	196	273	306	426	416	579	1.39
NORTH SECTION	500	231	342	278	412	293	434	1.48
THOMPSON HALL	500	200	264	210	277	273	360	1.32
DOGHOUSE	800	500	633	658	833	847	1072	1.27

4.5 Recommended Immediate Wastewater System Improvements

Based on design capacities and existing flow rates, it is recommended that the City immediately replace the four (4) major lift stations studied. These stations are the S. Section St, N. Section St., Thompson Hall and Doghouse lift stations. A complete replacement including a new wet well, pumps, control panel, electrical, and piping at each station is recommended. The existing wet wells are not lined and display signs of concrete degradation. The pumps are undersized in all cases to accommodate the peak flows. The increase in pump size expected will require the electrical components be upgraded.

Along with pump station upgrades, significant improvements are necessary for several of the major gravity outfall lines in the system. The receiving gravity line that is fed by the Doghouse Pumping Station is currently an 18-inch line. This line is currently carrying flows above its design capacity and approaching its total capacity. This line runs down Fairhope Ave to Fernwood, and then to the WWTP. The 12-inch gravity line into which the South Section St Station discharges has two (2) additional pump stations that discharge into the same wetwell. If all three (3) stations are pumping simultaneously, the total capacity of this line is consumed, which may create sewer surcharging in the manholes. Such surcharging creates increased probability of an SSO. The Thompson Hall station currently discharges into an 8-inch gravity main behind Winn Dixie and then combines with a line that The East

of Sun Pumping Station discharges into where it then flows to the Doghouse station. These 8-inch gravity mains both contain segments that have very little slope which results in a lowered capacity. Further, the invert of the gravity line with both stations pumping is above design capacity and on the verge of exceeding its total capacity.

An aggressive sewer collection system CCTV and CIPP repair plan is also strongly recommended to address the aged infrastructure in the older portions of town where clay pipe is prevalent. This repair plan entails videoing, cleaning, and lining approximately six (6) miles of pipe per year for the next 10 years. An aggressive program such as this greatly reduces the amount of infiltration into the system during large rain events. It also can reduce the flows to the wastewater treatment plant during these same events. In addition, flows that may not be reaching the WWTP due to buried pipe failures can be corrected, effectively protecting the environment from unpermitted discharges that are currently undiscovered.

5.0 SEWER SYSTEM EXPANSION ALTERNATIVES

The preliminary engineering study indicates that some existing infrastructure as previously described shall be improved to continue providing adequate service to the existing customer base. The City has three (3) logical alternatives that provide for expansion of its sewer services that were reviewed in this study. Displays of the alternatives are located in Appendix C and Cost Estimates are located in Appendix.

5.1 Alternative 1

Alternate 1 involves upgrading 4 pump stations and related lines and continuing to send all of the sewer to the existing WWTP. The first station to be upgraded South Section Street pumping station, it would be rebuilt to a new design capacity of 1,000 GPM and the force main that currently leaves the South Section St station and empties into a 12" gravity line on Church St. would be extended all the way to the WWTP. The 12" gravity line in Church St. currently is undersized and by running the force main to the WWTP the 12" gravity main will have a substantial amount of flow taken off of it and will be able to handle the remaining flows on the main.

The second station to be upgraded is the Doghouse pumping station, it would be rebuilt to a new design capacity of 1,500 GPM and the force main that currently leaves the station and empties into an 18" gravity line on Fairhope Ave. would be extended to the intersection of Fairhope Ave and Fairwood. The gravity line from this intersection to the WWTP would then be upsized to a 30" gravity main.

The third station to be upgraded Thompson Hall pumping station, it would be rebuilt to a new design capacity of 1000 GPM and the force main that currently leaves the station and

empties into an 8" gravity line behind Winn Dixie would be extended to the force main leaving the Doghouse station. Also as part of this work the force main that leaves the Intermediate School station would be extended to the force main leaving the Doghouse station also. By extending both force mains to a connection point past the Doghouse station you are cutting down on the required capacity of the Doghouse station and also decreases the number of times sewer is being pumped before it reaches the WWTP.

The fourth station to be upgraded is the N. Section St pumping station, it would be rebuilt to a new design capacity of 800 GPM.

5.2 Alternative 2

Alternate 2 involves upgrading 4 pump stations and related lines and continuing to send all of the sewer to the existing WWTP. The major difference in Alternatives 1 and 2 are in the improvements for the S. Section St. pumping station.

The S. Section Street pumping station would still be rebuilt to a new design capacity of 1,000 GPM and the force main that currently leaves the South Section St station and empties into a 12" gravity line on Church St. would remain as is. The 12" gravity line in Church St. which is currently undersized would be upgraded to an 18" gravity main.

The second station to be upgraded is the Doghouse pumping station, it would be rebuilt to a new design capacity of 1,500 GPM and the force main that currently leaves the station and empties into an 18" gravity line on Fairhope Ave. would be extended to the intersection of Fairhope Ave and Fairwood. The gravity line from this intersection to the WWTP would then be upsized to a 30" gravity main.

The third station to be upgraded Thompson Hall pumping station, it would be rebuilt to a new design capacity of 1000 GPM and the force main that currently leaves the station and empties into an 8" gravity line behind Winn Dixie would be extended to the force main leaving the Doghouse station. Also as part of this work the force main that leaves the Intermediate School station would be extended to the force main leaving the Doghouse station also. By extending both force mains to a connection point past the Doghouse station you are cutting down on the required capacity of the Doghouse station and decreases the number of times sewer is being pumped.

The fourth station to be upgraded is the N. Section St pumping station, it would be rebuilt to a new design capacity of 800 GPM.

5.3 Alternative 3

Alternative 3 provides for the most significant increase in sewer capacity. The City may elect to improve the existing infrastructure to meet the service area requirements as

indicated in section 4.5. The expected growth and corresponding sewer system would be collected and directed to a location to be determined on the East side of US Highway 98. A site may be selected for treatment and discharge that meets the approval of ADEM through required NPDES permitting.

Other applicable discharge options for the City of Fairhope are as follows: Fish River, tributaries of Fish River (Cowpen Creek, Waterhole Branch, etc.), and other locations within Mobile Bay. Areas that may trigger stringent limits due to shellfish harvesting should be carefully reviewed based upon the Department of Public Health and Federal Department of Agriculture requirements. Collection of wastewater along the growth corridors of the City must be conveyed to a treatment facility. Conveyance to the existing facility from high growth areas may be cost prohibitive based upon the historical relevance of the area, downtown business utility interruption, and temporary loss of tourism. Onsite treatment solutions may be applicable to specific developments; however, onsite treatment solutions will not provide the necessary long-term treatment and protection of groundwater for the anticipated development area. Numerous treatment locations may become difficult to operate and maintain for a single utility where a conventional sewer collection and treatment system is appropriate.

Treatment technologies are available that can meet the tertiary discharge limitations for most surface waters, even where a 07Q10 may exist. It is recommended that the City consider streams where the 7Q10 is greater than zero if possible. Annual average precipitation data indicates that Fairhope receives nearly 68 inches. The rainfall provides some challenges, as well as some positive planning information for future discharges. Due to the stringent limitations required in tributaries and into Fish River, it is recommended that the City attempt to utilize the treated effluent to the greatest extent possible with a reuse permit or other eco-friendly method. The effluent may be permitted for reuse on agricultural fields where crops are not grown for human consumption, or for use on land such as golf courses and recreational areas. Although reuse infrastructure costs may be significant, the use of treated wastewater for other uses provides relief from constant discharge into impaired streams and is indicative of admirable water stewardship. The City may also elect to review the geology and potential for future aquifer storage in the area that the reclaimed water is to be discharged.

6.0 SEWER RECOMMENDATIONS

The City of Fairhope is facing a significant landmark in the life of its sewer system. The City may allow the system to continue to function with its current intent and convey all of its sewage to trunk lines through the central business district and old Fairhope. These major pump stations and gravity lines have reached the end of their useful life and need

substantial upgrades to continue serving the residents of Fairhope. Alternatives 1 and 2 provide temporary relief from growth, but more significant modifications are anticipated as growth occurs. The flows from the projected growth may also be conveyed through these sensitive areas of town; however, the construction and maintenance of this infrastructure may cause interruptions and not be in the best long-term interest of the City.

The City may also consider methods to mitigate the need for the existing and particularly the future sewer to pass through these areas of town to the existing WWTP. A new transmission system to the WWTP directly from areas of development, a new, smaller WWTP on the east side of town, or a combination of these approaches may be in the best interest of the City.

It is recommended that the City make the critical infrastructure improvements indicated in the report herein to continue providing quality sewer service to its existing customers. Major pump stations and gravity lines are in need of immediate attention. It is also recommended that the City progress with a more aggressive CIPP Repair plan to reduce I&I and protect the aged infrastructure in the system. Investment into the sewer system is vital to extend its life. The City may consider developing its own team of professionals for CCTV, line inspection and point repairs, while only outsourcing the lining of the pipe and manholes.

The recommendations in this report are based upon information provided by the City for evaluation by GMC. The City should further investigate the sewer system reviewed in this report and the additional service area. The over 60 sewage pumping stations in the system create a complex system with a wide range of flows that must be conveyed appropriately to a treatment facility. Flow meters may be installed on gravity and pressure sewer lines and utilized with the existing SCADA system to improve the data for evaluation. Such meters may be purchased and installed by the City or temporarily provided by a flow metering service.

A Sewer Model is suggested where this data, along with rain gauge data, may provide improved insight into the sewer system. Water usage and projected water usage may be utilized within the model to create dynamic and accurate engineering solutions. The sewer model may then be used to create a Sewer Master Plan that meets all of the objectives of the City and provides avenues for growth.

7.0 REFERENCES

Metcalf & Eddy., George Tchobanoglous., Franklin L. Burton, and H. David Stensel. *Wastewater Engineering: Treatment and Reuse*. 4th ed. Boston: McGraw Hill, 2003. Print.

Metcalf & Eddy., George Tchobanoglous. *Wastewater Engineering: Collection and Pumping of Wastewater.* McGraw Hill, 1981. Print.

APPENDIX A

GRAVITY SEWER PROFILES OF CONCERN

APPENDIX B

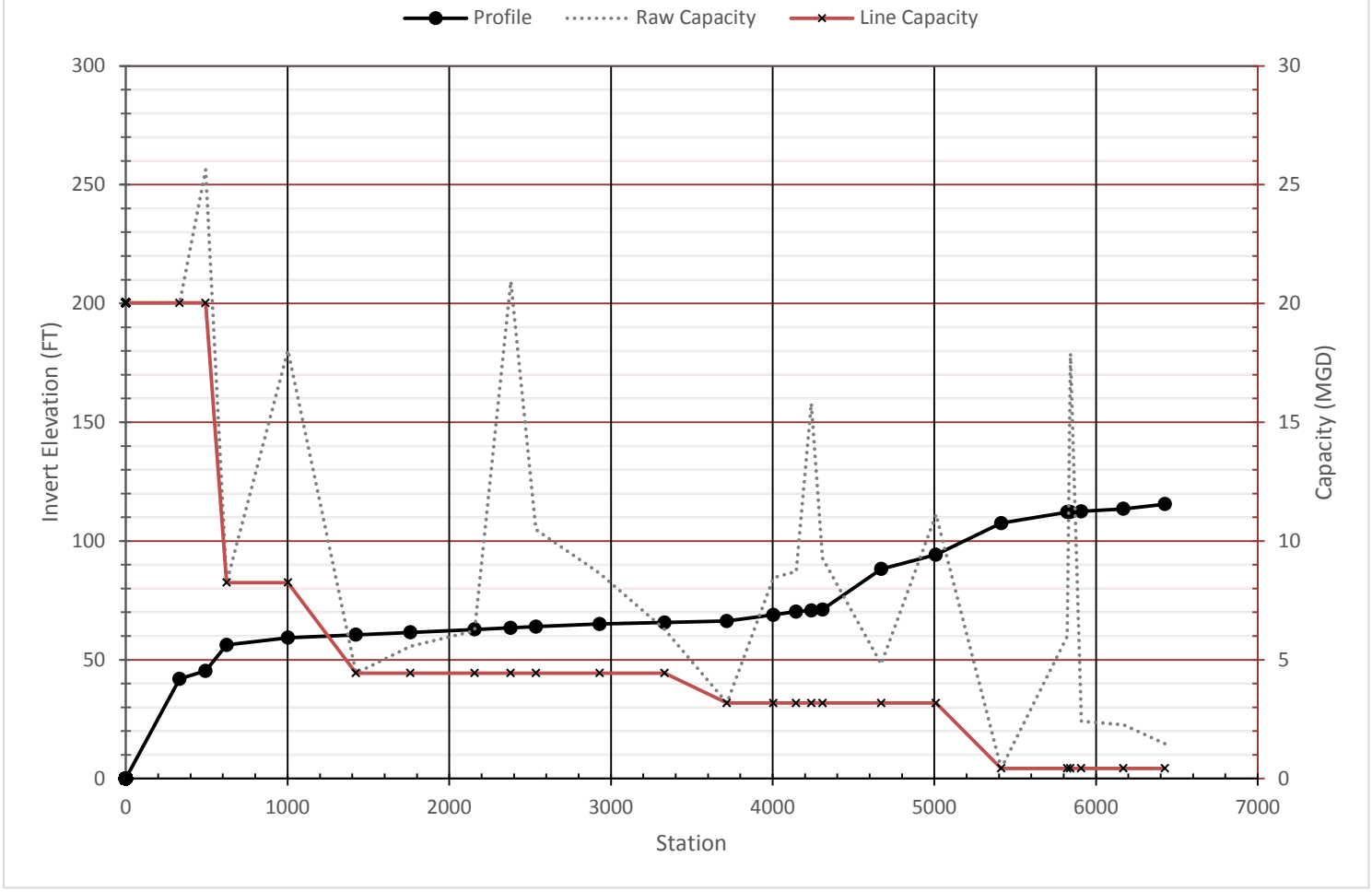
PUMP STATION PUMP AND SYSTEM CURVES

APPENDIX C
ALTERNATIVES

APPENDIX D
OPINIONS OF PROBABLE COST


18" GRAVITY LINE FROM DOGHOUSE TO WWTP
0
600'
1200'
Scale: 1" = 600'
FAIRHOPE ELEMENTARY SCHOOL
MH-59
WASTEWATER TREATMENT PLANT
GRAVITY SEWER (TYP.)
MANHOLE (TYP.)
SP-8-1G5A
N
Image courtesy of USGS Earthstar Geographics SIO © 2017 Microsoft Corporation © 2
Image courtesy of USGS Earthstar Geographics SIO © 2017 Microsoft Corporation © 2
Seminole Ave
Frederick Ave
Leslie Ct
Greenwood Ave
Quail Loop
Cedar Ave
Myrtle Ave
Olive Ave
Holly Dr
Grand Ave
N Section St
Pensacola Ave
Volanta
Davis Ln
Circle Dr
SCENIC
98
ALT
98
Pathym Dr
Yupon Ave
Jasmine Ave
Gayfer Ave
Jan Dr
Marsha Dr
Fairwood Blvd
Bayou Dr
Marca Ct
Lincoln St
Ridgeside St
Winn Ave
Blue Island Ave
Kurlane St
Spring Dr
Ashley Dr
Ronforth St
Greenbrier Ln
Park Dr
Oak St
Pine St
Equality St
Church St N
Bancroft St
Stimpson Ave
Brown St
School St N
Fairhope Ave
48
Call St
De la Mare St
S School St
Johnson Ave
Young St
Bellangee St
Morphy Ave
Burglin St

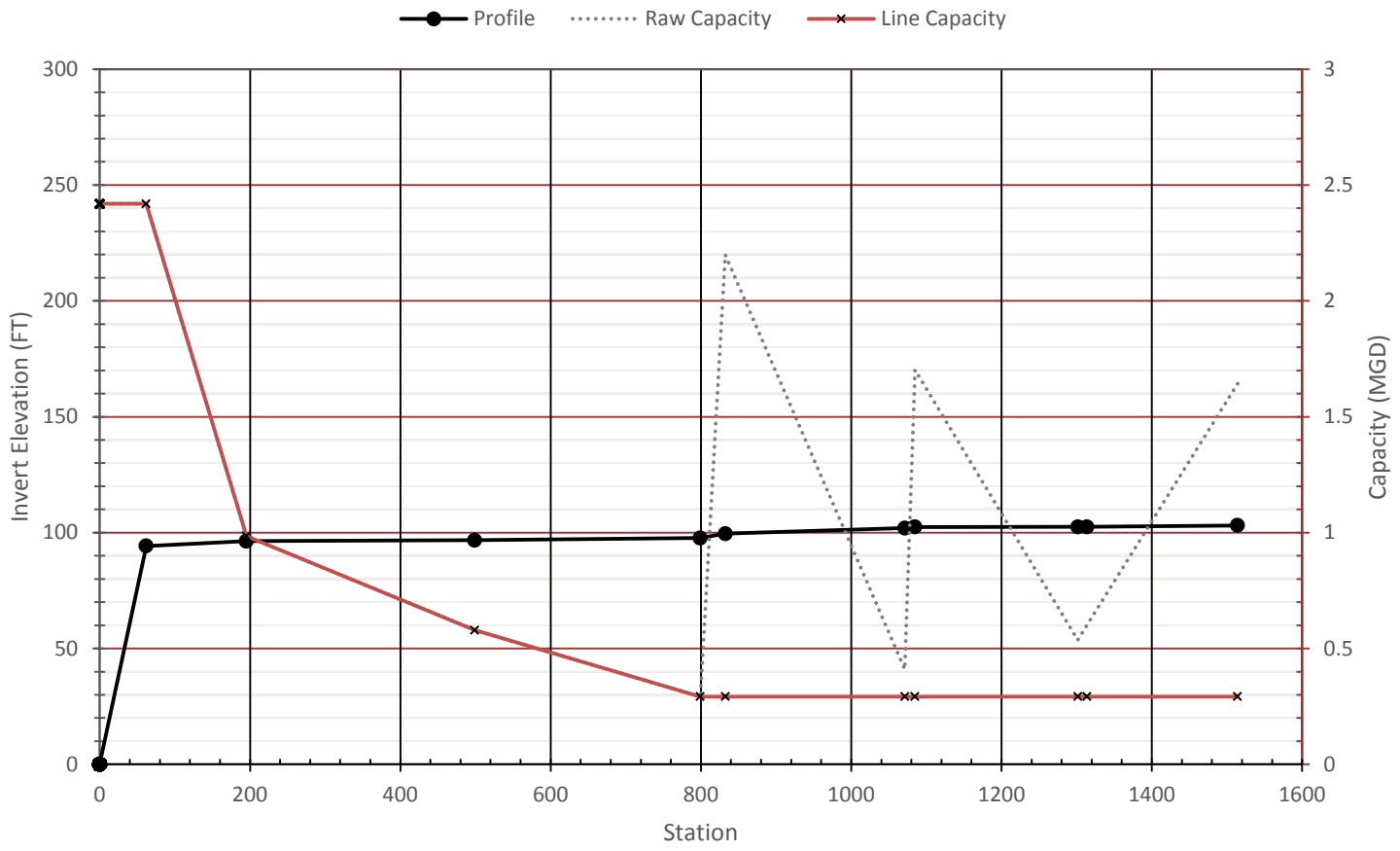
18" Gravity Line from Doghouse to WWTP Capacity (Manholes SP-8-1G5A to MH-59)

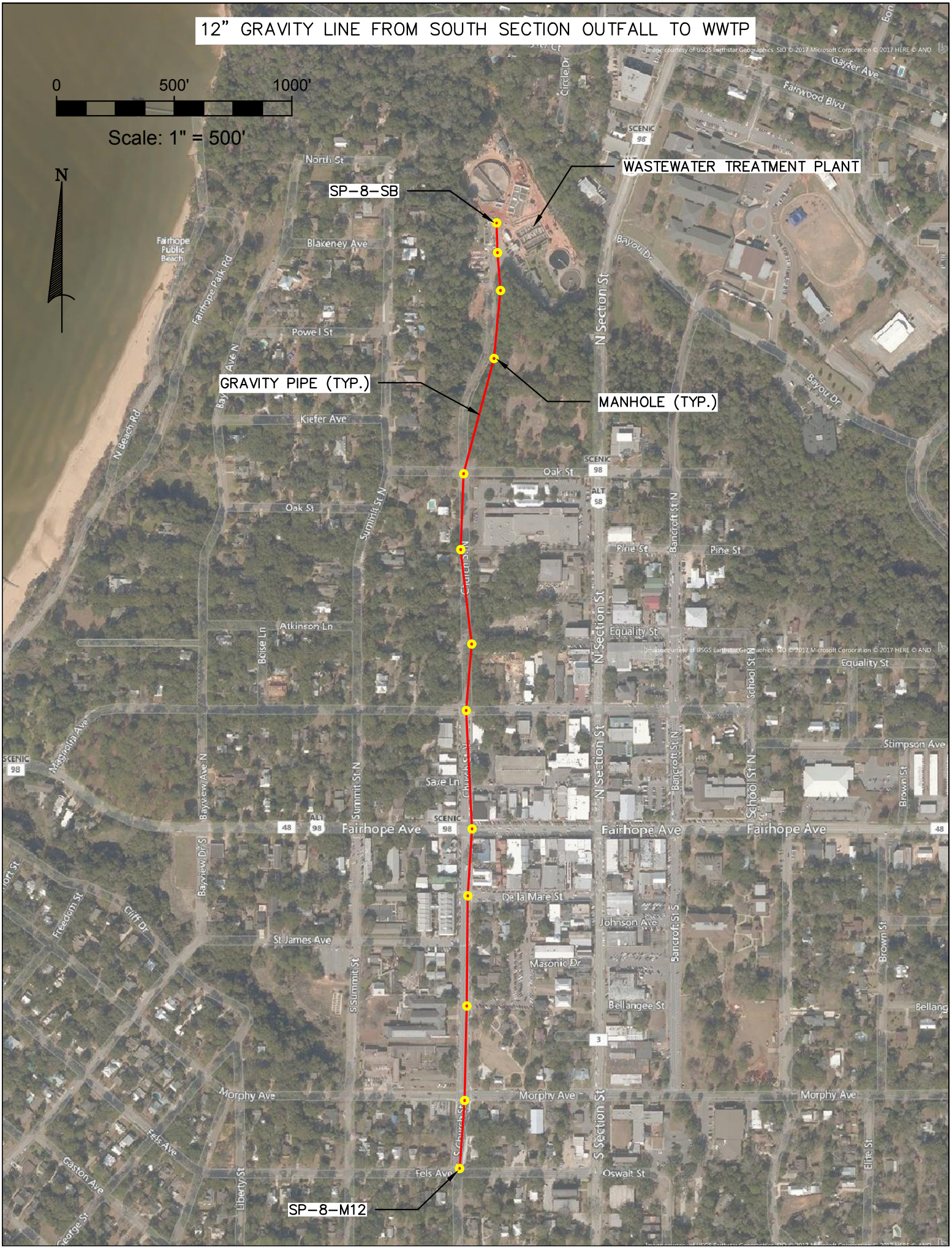



8" GRAVITY LINE BEHIND WINN-DIXIE
Fairhope Ave
Fairhope Ave
0
200'
400'
Scale: 1" = 200'
Pleasant St
S Greeno Rd
Eastern Shore Shopping Center
WINN-DIXIE
N
MH12-2-L6
Morphy Ave
Morphy Ave
GRAVITY SEWER (TYP.)
MANHOLE (TYP.)
Hawthorne Circle
Kensington Ct

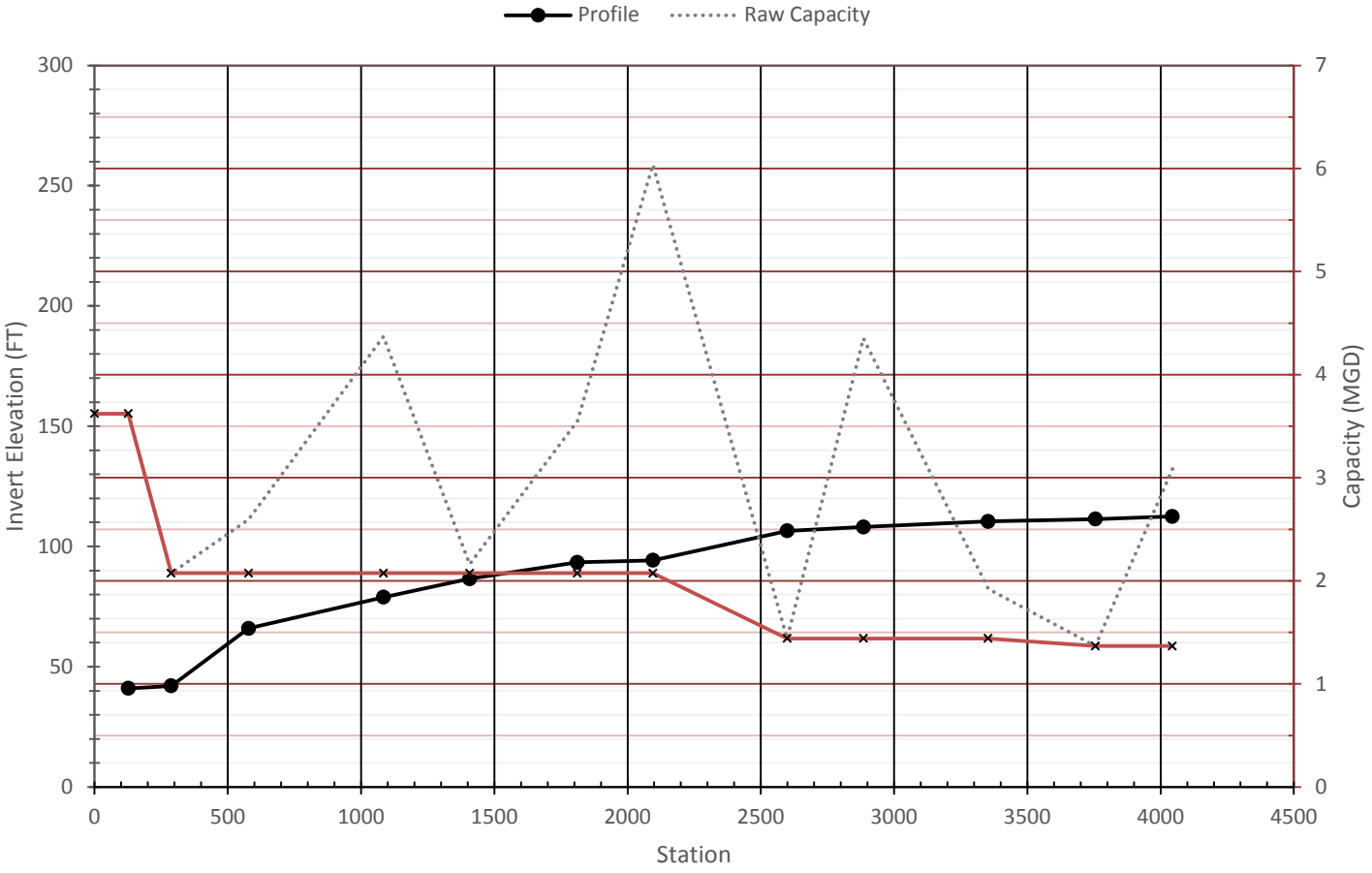

8" GRAVITY LINE FEEDING DOGHOUSE STATION
Fairhope Ave
Fairhope Ave
0
200'
400'
Scale: 1" = 200'
WET WELL
WW12-2
Pleasant St
S Greeno Rd
Eastern Shore Shopping Center
GRAVITY SEWER (TYP.)
WINN-DIXIE
N
Morphy Ave
Morphy Ave
MANHOLE (TYP.)
Hawthorne Circle
Kensington Ct

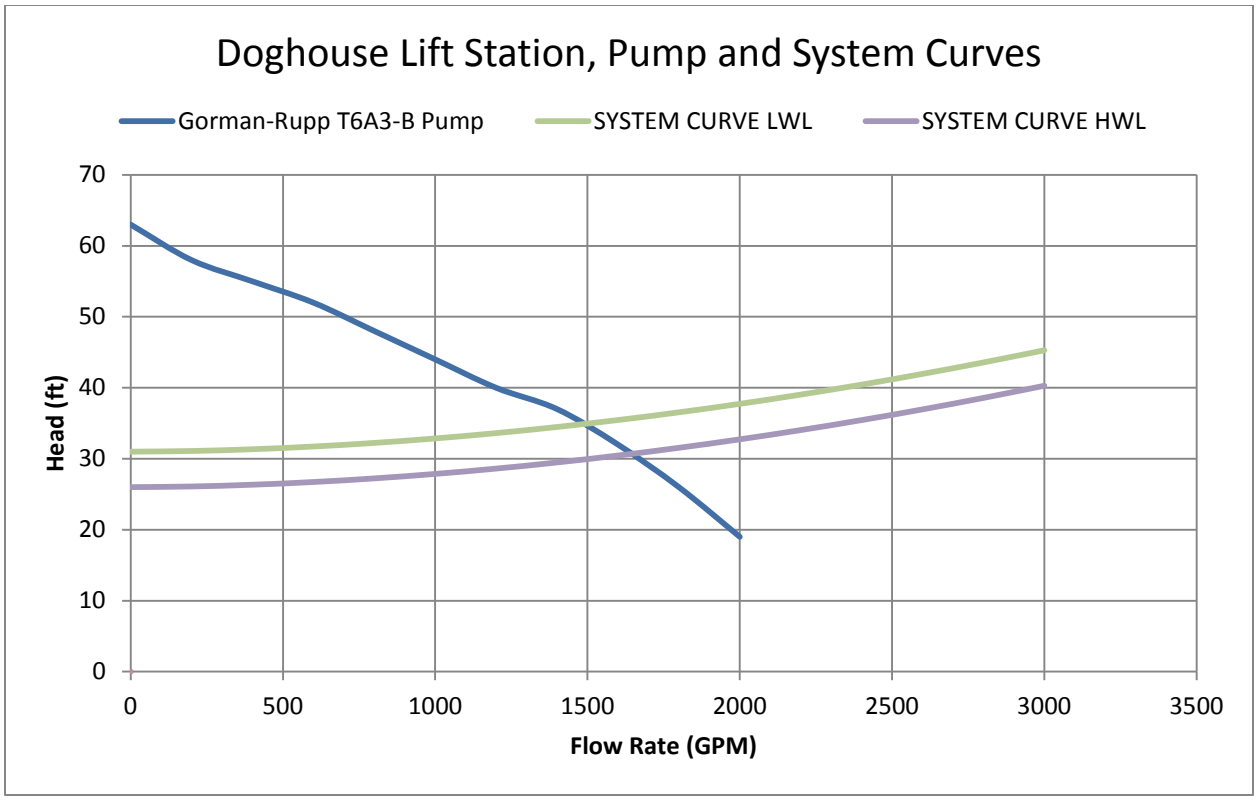
8" Gravity Line Behind Winn-Dixie + 8" Gravity Line Feeding Doghouse Station Capacity (Manholes MH12-2-L6 to WW12-2)

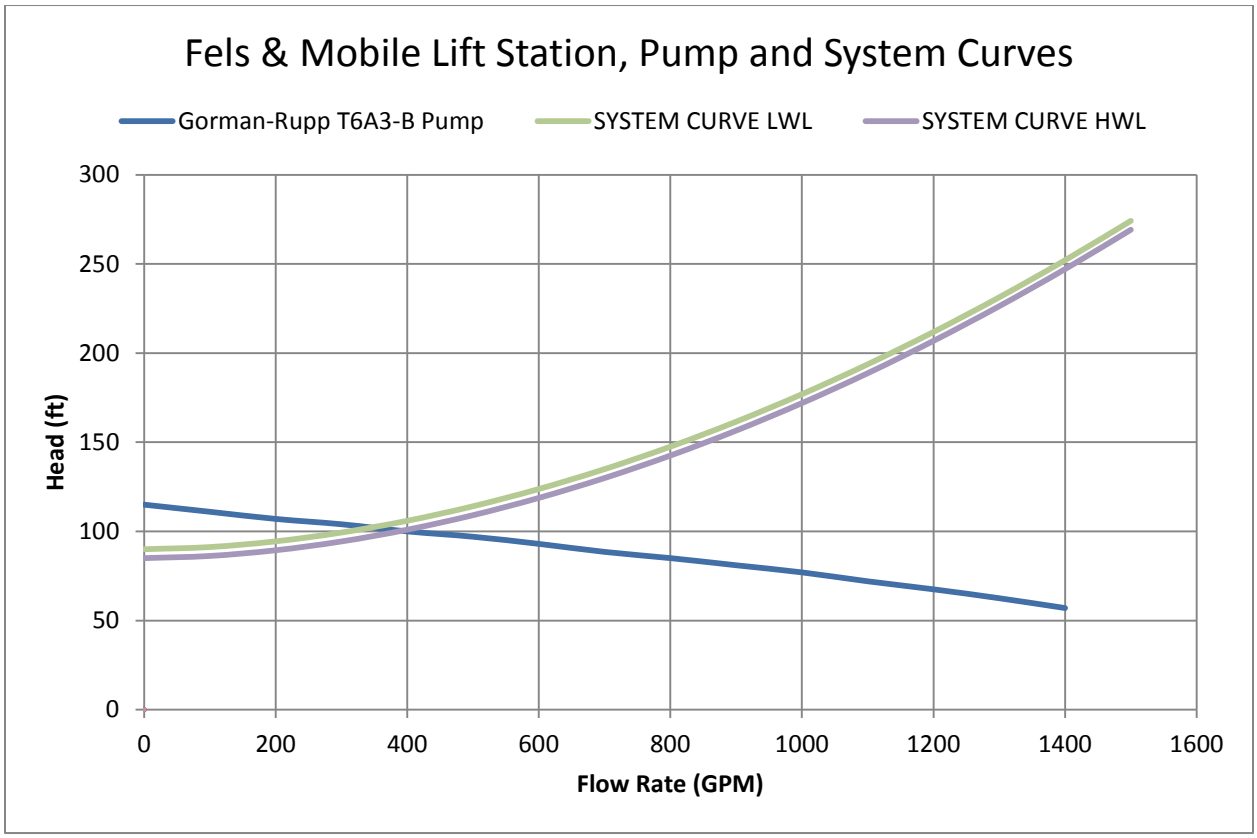


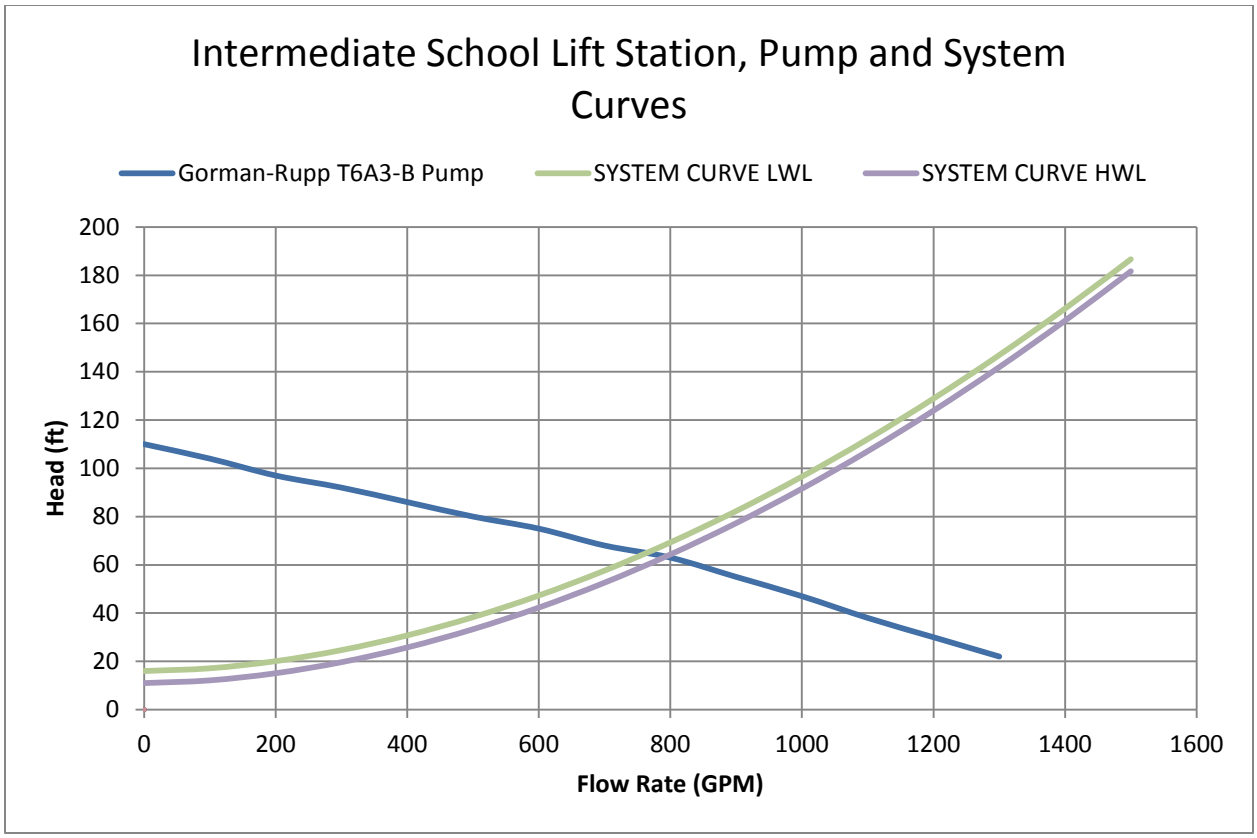

12" GRAVITY LINE FROM SOUTH SECTION OUTFALL TO WWTP
0
500'
1000'
Scale: 1" = 500'
N
WASTEWATER TREATMENT PLANT
SP-8-SB
GRAVITY PIPE (TYP.)
MANHOLE (TYP.)
SP-8-M12
North St
Blakeney Ave
Fairhope Public Beach
Fairhope Park Rd
Powell St
Kiefer Ave
N Beach Rd
Bay Ave N
Oak St
Summit St N
Church St N
Atkinson Ln
Boise Ln
Pine St
Bancroft St N
N Section St
Equality St
School St N
Stimpson Ave
Brown St
Magnolia Ave
Bayview Ave N
Bayview Dr S
Sage Ln
Fairhope Ave
De la Mare St
Johnson Ave
Bancroft St S
St James Ave
Masonic Dr
S Summit St
Bellangee St
Freedom St
Cliff Dr
Morphy Ave
S Church St
S Section St
Fels Ave
Oswalt St
Gaston Ave
Liberty St
George St
Elite St
Fairwood Blvd
Gayfer Ave
Circle Dr
Bayou Dr
SCENIC 98
ALT 98
48
3

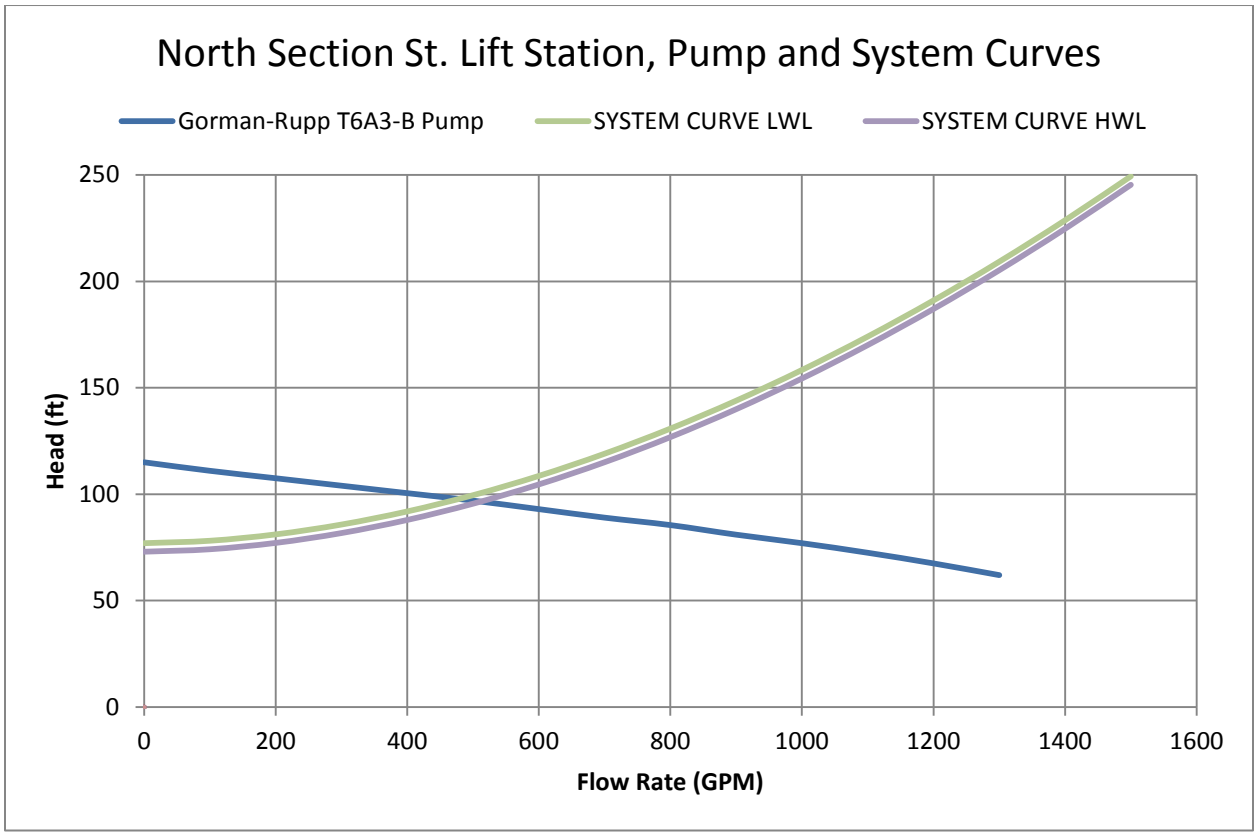
12" Gravity Line from South Section Outfall to WWTP (Manholes SP-8-M12 to SP-8-SB)

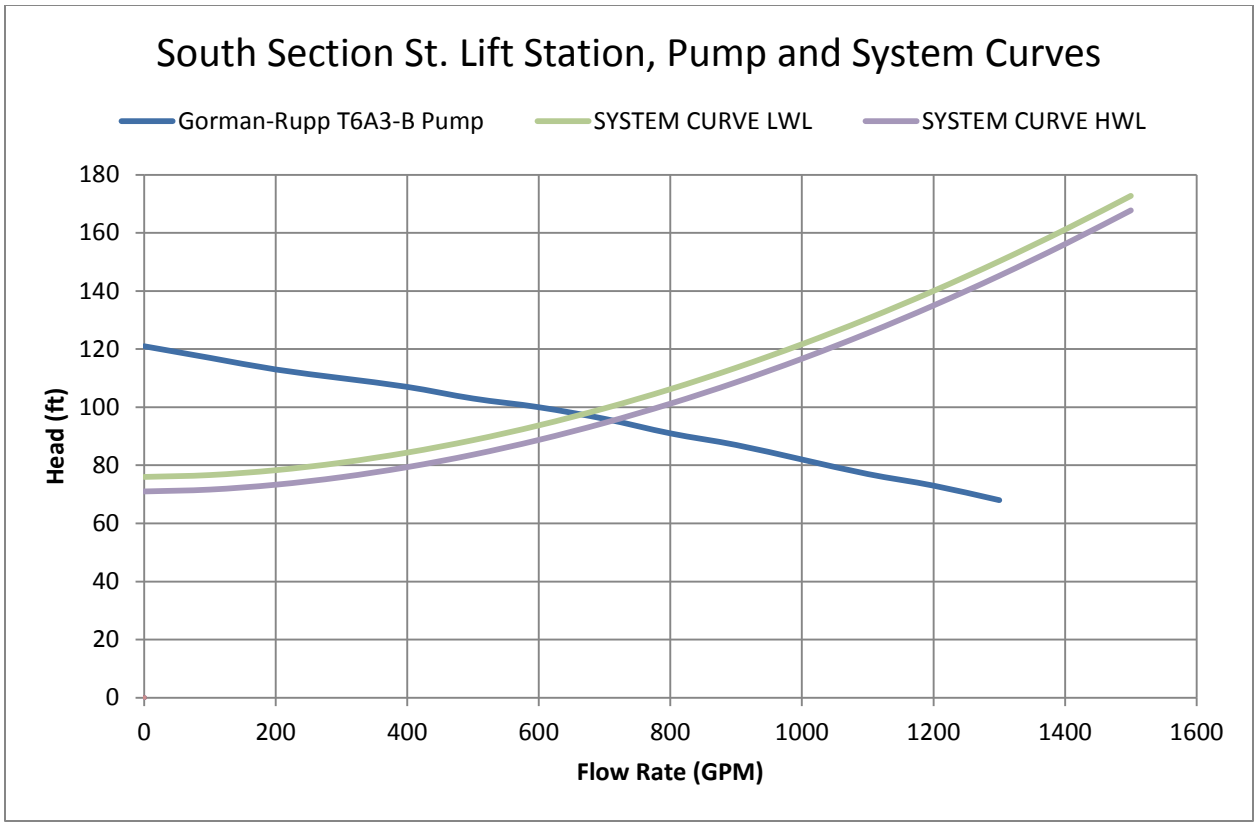


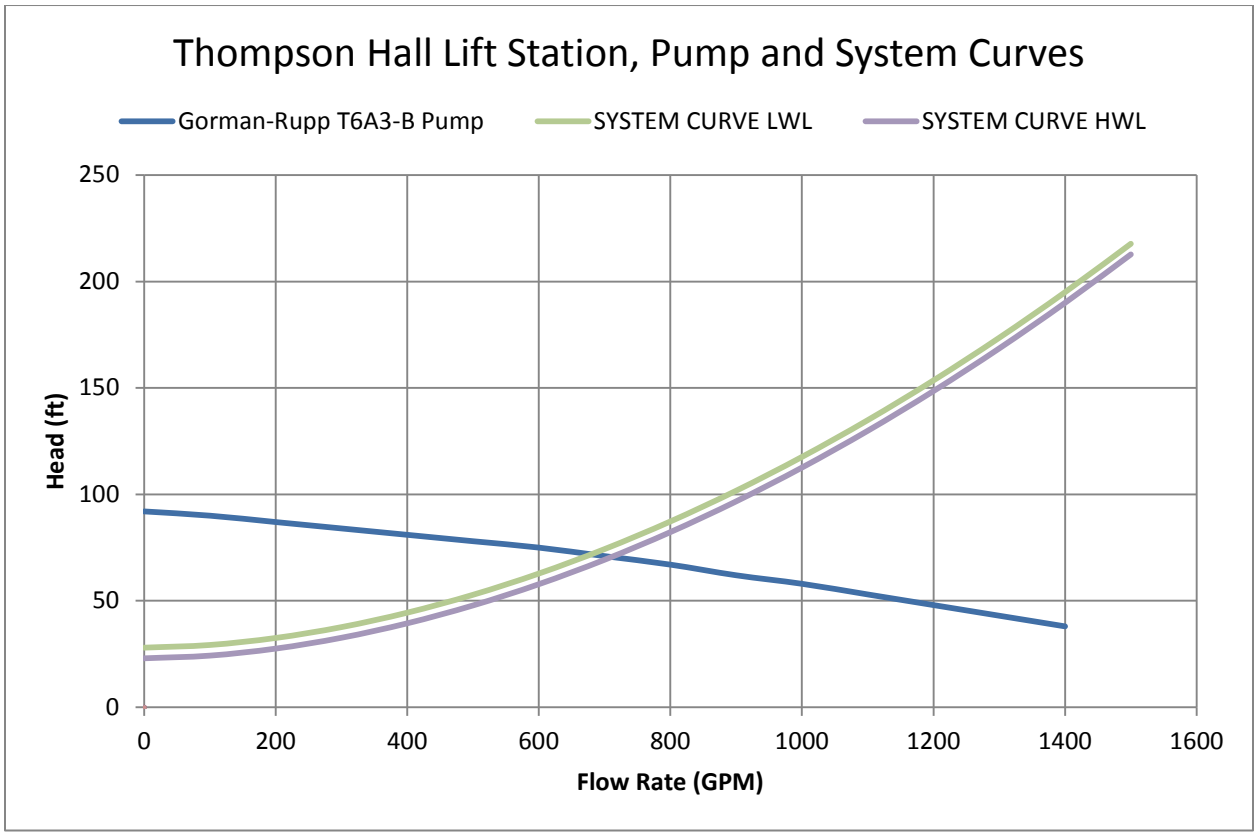

Doghouse Lift Station, Pump and System Curves
Gorman-Rupp T6A3-B Pump
SYSTEM CURVE LWL
SYSTEM CURVE HWL
Head (ft)
70
60
50
40
30
20
10
0
0
500
1000
1500
2000
2500
3000
3500
Flow Rate (GPM)

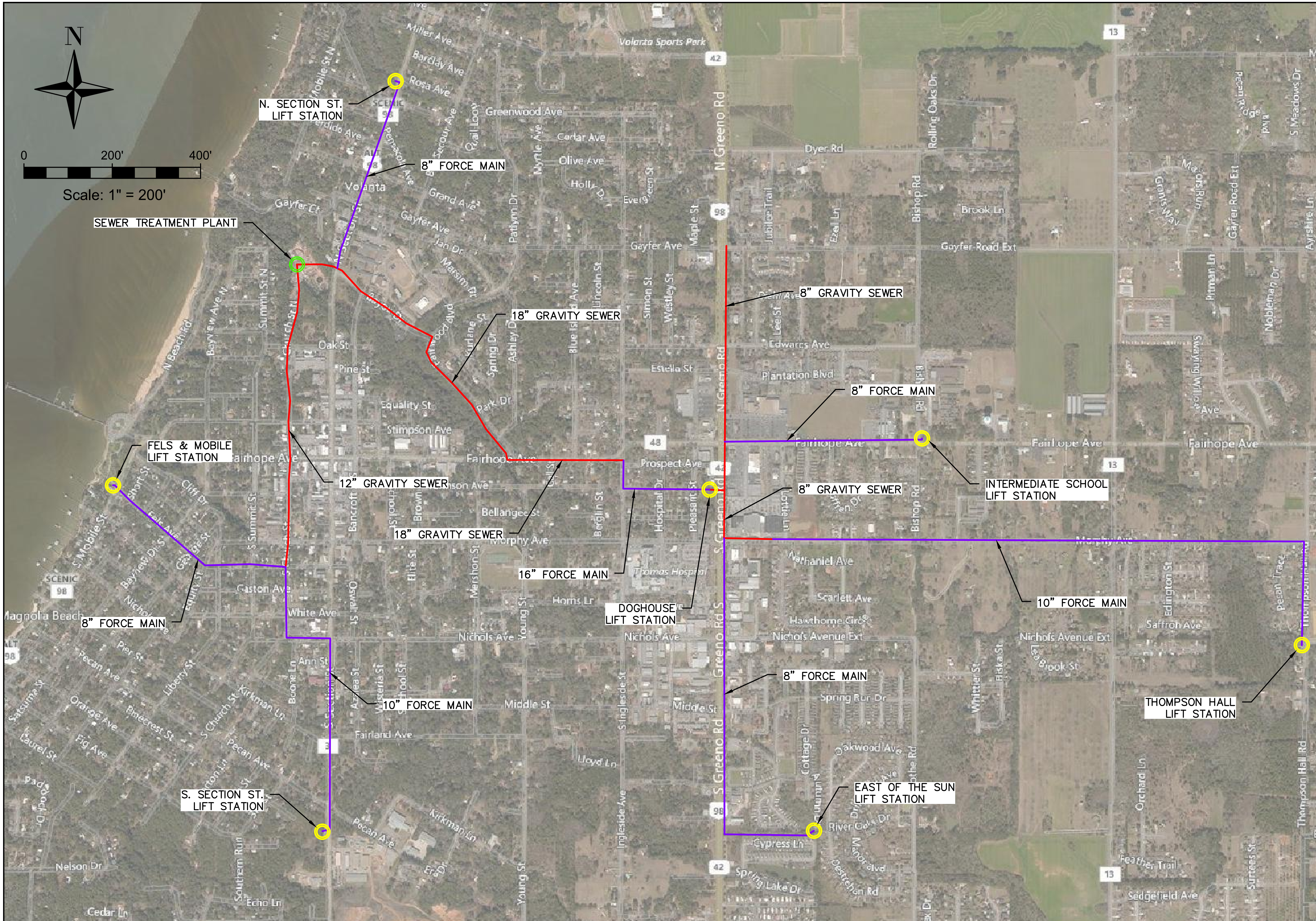

Fels & Mobile Lift Station, Pump and System Curves
Gorman-Rupp T6A3-B Pump
SYSTEM CURVE LWL
SYSTEM CURVE HWL
Head (ft)
300
250
200
150
100
50
0
0
200
400
600
800
1000
1200
1400
1600
Flow Rate (GPM)


Intermediate School Lift Station, Pump and System Curves
Gorman-Rupp T6A3-B Pump
SYSTEM CURVE LWL
SYSTEM CURVE HWL
Head (ft)
0
20
40
60
80
100
120
140
160
180
200
0
200
400
600
800
1000
1200
1400
1600
Flow Rate (GPM)


North Section St. Lift Station, Pump and System Curves
Gorman-Rupp T6A3-B Pump
SYSTEM CURVE LWL
SYSTEM CURVE HWL
Head (ft)
0
50
100
150
200
250
0
200
400
600
800
1000
1200
1400
1600
Flow Rate (GPM)


South Section St. Lift Station, Pump and System Curves
Gorman-Rupp T6A3-B Pump
SYSTEM CURVE LWL
SYSTEM CURVE HWL
Head (ft)
180
160
140
120
100
80
60
40
20
0
0
200
400
600
800
1000
1200
1400
1600
Flow Rate (GPM)


Thompson Hall Lift Station, Pump and System Curves
Gorman-Rupp T6A3-B Pump
SYSTEM CURVE LWL
SYSTEM CURVE HWL
Head (ft)
250
200
150
100
50
0
0
200
400
600
800
1000
1200
1400
1600
Flow Rate (GPM)



GMC

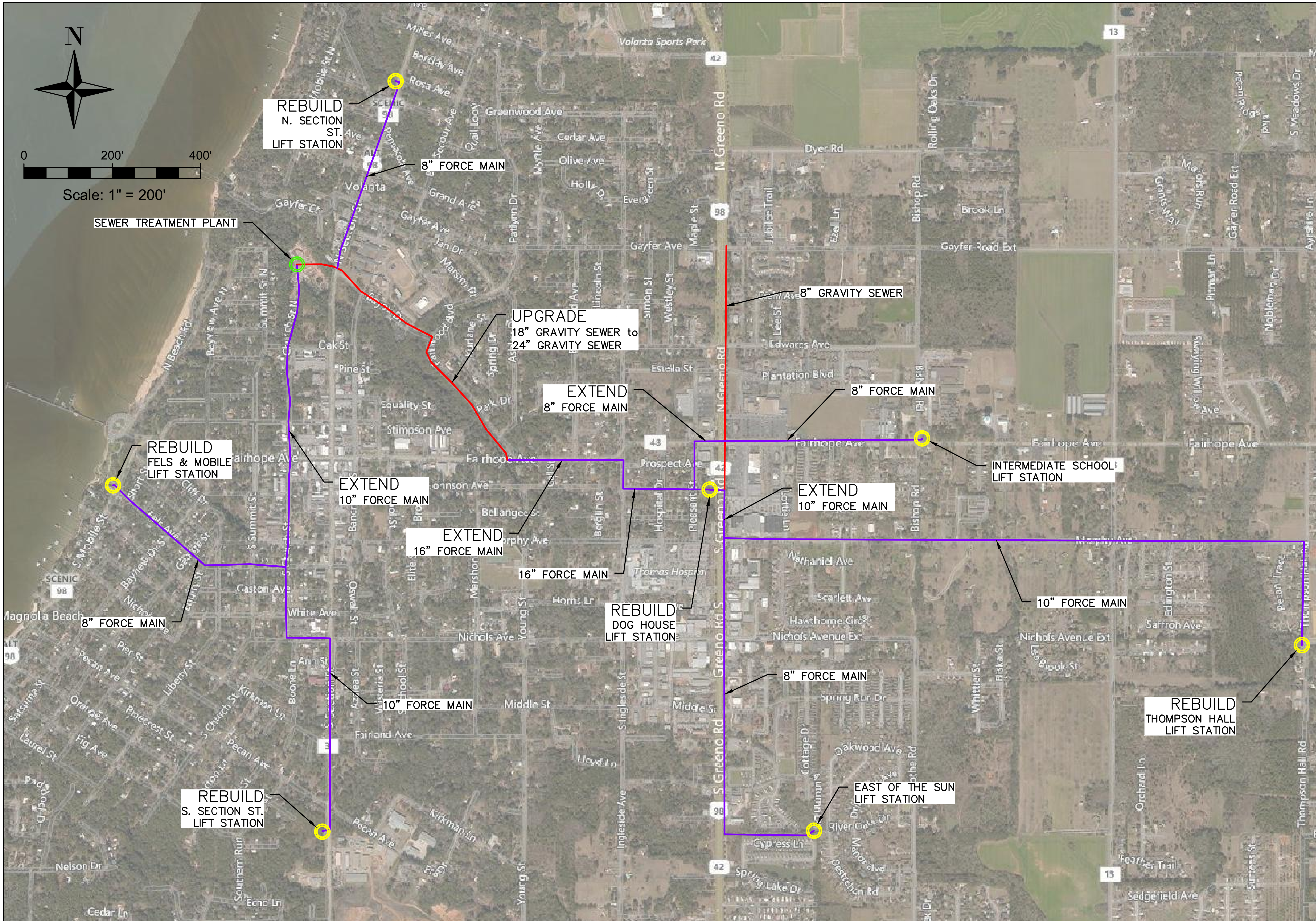
316 Magnolia Avenue
Fairhope, AL 36532
T 251.210.0286
GMCNETWORK.COM

EXISTING

GMC # CMOB-17-0026
08/08/2017
DRAWN BY: THH

Capacity Study for Gas, Water, and Sewer Utilities
City of Fairhope
Fairhope, AL

CONCERNING SEWER STATIONS, EXISTING



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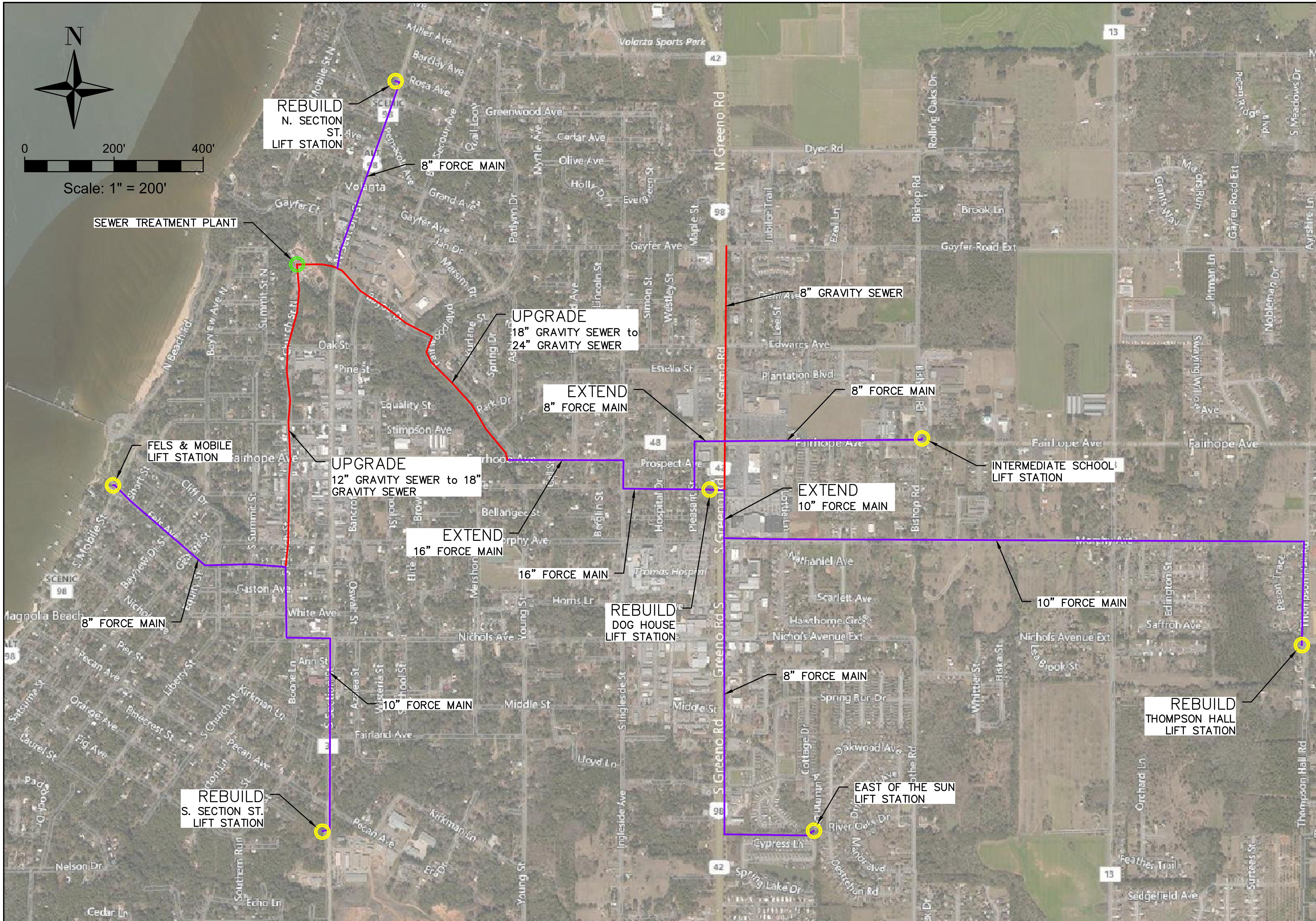
OPTION 1

GMC # CMOB-17-0026
07/05/2017
DRAWN BY: THH

Capacity Study for Gas, Water, and Sewer Utilities
City of Fairhope
Fairhope, AL

CONCERNING SEWER STATIONS, ALTERNATIVE 1



GMC

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OPTION 2

GMC # CMOB-17-0026
07/05/2017
DRAWN BY: THH

Capacity Study for Gas, Water, and Sewer Utilities
City of Fairhope
Fairhope, AL

CONCERNING SEWER STATIONS, ALTERNATIVE 2

N

0 4000' 8000'

Scale: 1" = 4000'

Highway 98

Exisiting Sewer Service Area 1

Proposed Sewer Service Area 2 w/ Additional POTW + discharge

GMC

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OPTION 3

SUPPLEMENTAL DRAWING

GMC # CMOB-17-0026

07/05/2017

DRAWN BY: THH

Capacity Study for Gas, Water, and Sewer Utilities
City of Fairhope
Fairhope, AL

CONCERNING SEWER STATIONS, OPTION 3

CITY OF FAIRHOPE
PHASE I SEWER IMPROVEMENTS
OPTION 1

DOGHOUSE LIFT STATION BASIN		
REBUILD DOG HOUSE LIFT STATION	$	1,000,000.00
UPGRADE 18" GRAVITY SEWER TO 24"	$	900,000.00
EXTEND IMS FORCEMAIN TO 24" GRAVITY LINE	$	250,000.00
EXTEND DOGHOUSE FORCEMAIN TO 24" GRAVITY LINE	$	125,000.00
THOMPSON HALL BASIN		
REBUILD THOMPSON HALL LIFT STATION	$	80,000.00
NORTH SECTION STREET BASIN		
REBUILD N. SECTION STREET PUMP STATION	$	800,000.00
SOUTH SECTION STREET BASIN		
REBUILD SOUTH SECTION STREET STATION	$	800,000.00
EXTEND CHURCH STREET FORCEMAIN FROM FELS AVE TO PLANT	$	500,000.00
UPGRADE FELS AT MOBILE ST. STATION	$	500,000.00
VIDEO AND LINE CHURCH ST 12" GRAVITY LINE	$	250,000.00
TOTAL CONSTRUCTION COST	$	5,205,000.00
CONTINGENCY 10%	$	520,500.00
ENGINEERING AND INSPECTION 10%	$	520,500.00
TOTAL PROJECT COST	**$**	**6,246,000.00**

CITY OF FAIRHOPE
PHASE I SEWER IMPROVEMENTS
OPTION 2

DOGHOUSE LIFT STATION BASIN		
REBUILD DOG HOUSE LIFT STATION	$	1,000,000.00
UPGRADE 18" GRAVITY SEWER TO 24"	$	900,000.00
EXTEND IMS FORCEMAIN TO 24" GRAVITY LINE	$	250,000.00
EXTEND DOGHOUSE FORCEMAIN TO 24" GRAVITY LINE	$	125,000.00
THOMPSON HALL BASIN		
REBUILD THOMPSON HALL LIFT STATION	$	800,000.00
NORTH SECTION STREET BASIN		
REBUILD N. SECTION STREET PUMP STATION	$	800,000.00
SOUTH SECTION STREET BASIN		
REBUILD SOUTH SECTION STREET STATION	$	800,000.00
UPGRADE 12" GRAVITY SEWER TO 18"	$	650,000.00
TOTAL CONSTRUCTION COST	$	5,325,000.00
CONTINGENCY 10%	$	532,500.00
ENGINEERING AND INSPECTION 10%	$	532,500.00
TOTAL PROJECT COST	**$**	**6,390,000.00**

CITY OF FAIRHOPE
CIPP PROGRAM ESTIMATE

PAY ITEM	QUANTITY	UNIT PRICE		COST
8" GRAVITY SEWER CLEANED, INSPECTED, AND LINED	316,800.00	$ 50.00	$	15,840,000.00
TOTAL CONSTRUSCTION COST			$	15,840,000.00
CONTINGENCY 10%			$	1,584,000.00
ENGINEERING AND INSPECTION 10%			$	1,584,000.00
TOTAL PROJECT COST			**$**	**19,008,000.00**