City of St. Marys

Water and Wastewater Master Plan

October 7, 2004

Adopted October 11, 2004

JORDAN
JONES &
GOULDING

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Deborah Hase, *Mayor*

City Council

Jerry Lockhart	L.J. Williams
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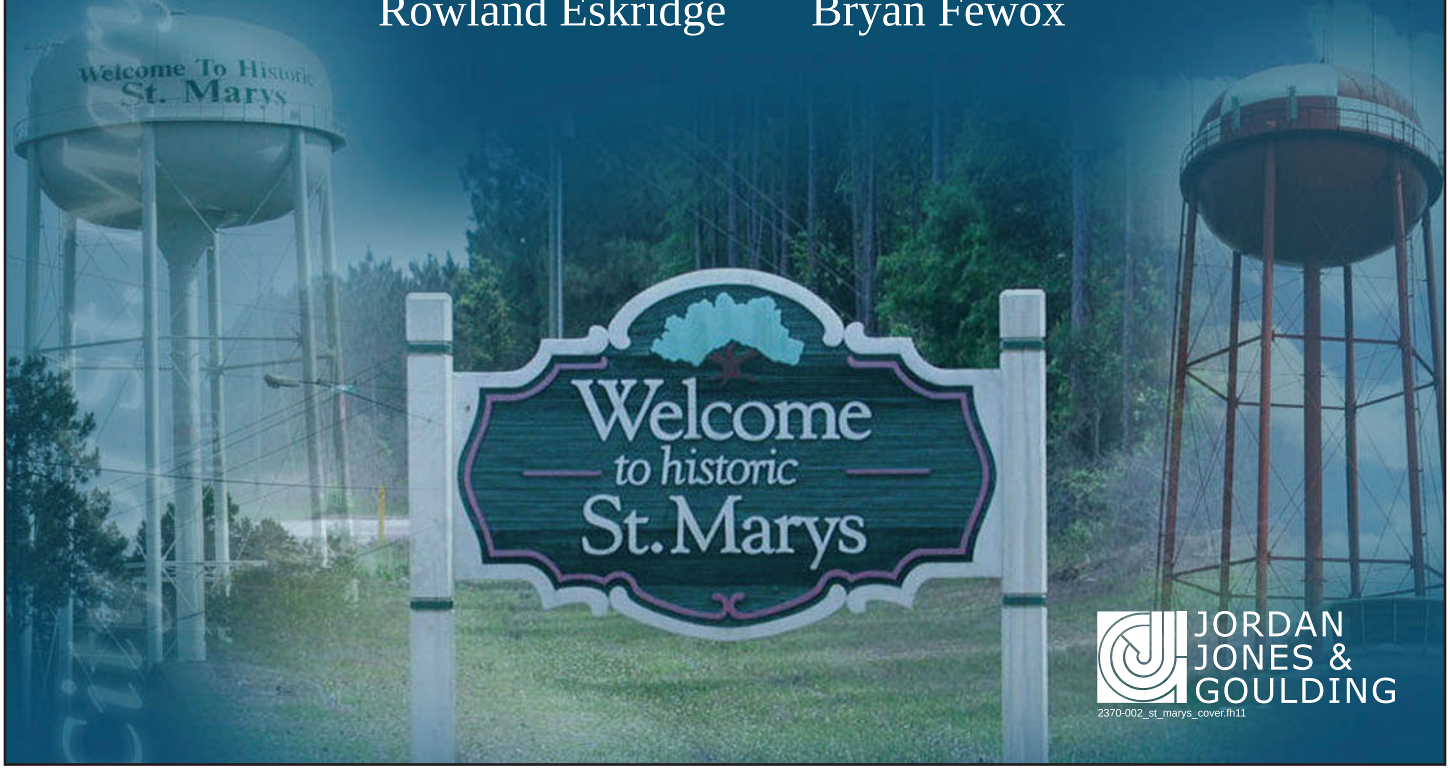

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Water and Wastewater Master Plan

Table of Contents

Executive Summary

Section 1 - Introduction

Section 2 - Water Demand and Wastewater Flow Projections

Section 3 - Water System Evaluation and Modeling Results

Section 4 - Wastewater System Evaluation and Modeling Results

Section 5 - Recommendations

Section 6 – Five-year CIP

Appendix A – Water System Data

Appendix B – Wastewater System Data

List of Tables

List of Figures

Water and Wastewater Master Plan

Executive Summary

The City of St. Marys, Georgia retained Jordan, Jones & Goulding, Inc. (JJG) to evaluate its existing water and wastewater system infrastructure and develop plans to help the City meet its immediate and future infrastructure needs. This Water and Wastewater Master Plan (Master Plan) provides the background information and data, analysis of future demands, and projection of system improvements that the City will need to consider in order to meet these needs. The Master Plan addresses the level of service that will be necessary in the short term planning horizon of one to five years, as well as the long term, 20-year planning horizon (through 2025).

The Master Plan includes the following key elements:

- Analysis of population growth and development affecting infrastructure needs
- Determination of water demand and distribution associated with population growth and development
- Projection of wastewater collection and treatment needs associated with population growth and development
- Development of water distribution and wastewater collection system hydraulic models to be used to simulate existing conditions and improvement/expansion needs
- Identification of specific improvement and expansion projects needed over the course of the 20-year planning horizon, including sequencing and costing of projects
- A 5-year Capital Improvements Program identifying the costs required for near-term upgrades and expansions, including proposed revenue sources.

The City of St. Marys is committed to providing its residents and businesses with the appropriate level of drinking water and wastewater system infrastructure to sustain growth. The Master Plan provides a framework for delivering quality services to the customers of the St. Marys system by identifying projects for implementation that ensure adequate system capacity, reliable system infrastructure and appropriate funding of improvements.

Water and Wastewater System Overview

Water supply for the City is obtained from three groundwater well sites – Old Jefferson, Dandy Street, and Mission Trace. The total permitted monthly average withdrawal is 3.0 million gallons per day (MGD). Water treatment plants (WTPs) are located at each well site and provide aeration, chlorination and fluoridation prior to pumping the water to the distribution system. The water distribution system is composed of two elevated storage tanks and approximately 120 miles of water transmission and distribution mains ranging in size from two inches to 12 inches in diameter.

Wastewater is conveyed to one of two existing treatment facilities, the Weed Street Wastewater Treatment Facility (WWTF) and the Point Peter WWTF, via a sewer network that consists of 110 miles of gravity sewers and force mains and 60 lift stations. The two treatment facilities have a combined effective treatment capacity of 1.25 MGD on a Maximum Month Average Day (MMAD) flow basis. A third wastewater treatment facility, the Scrubby Bluff WWTF, is currently under construction and is scheduled for completion by late Summer 2004. The Scrubby Bluff WWTF has a design capacity of 0.5 MGD, which will provide the City with a total of 1.75 MGD of treatment capacity on a MMADF basis.

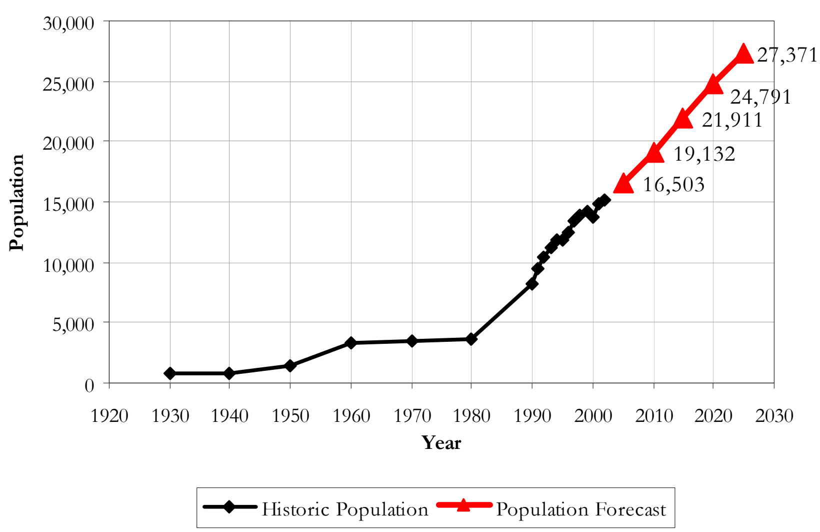
Determination of Future System Needs

Population, water demand, and wastewater flow projections provide the basis of planning for water and sewer infrastructure development. The development of population, water demand, and wastewater flow forecasts is a complex process that requires the collection and evaluation of large quantities of data. The methodologies employed by JJG in development of this Master Plan and the results of the various forecasts are described in the following subsections.

Population Projections

Population projections through 2025 were derived based on historic trends, regional growth patterns, and local conditions. Projections for year 2010 were obtained from the Georgia Office of Planning and Budget. St. Marys' population is projected to grow from 15,103 in 2002 to 27,371 by 2025, which is approximately an 81 percent increase over the planning period. Figure ES.1 presents the historic population figures and estimated population growth during the study planning horizon.

Figure ES.1
Historic and Projected Population of St. Marys



Water Demand

JJG calculated a per capita water use rate that was applied to the projected population growth to estimate the residential and commercial water demands. Demands associated with unaccounted for water, or UFW, and other known developments (most notably, Cumberland Harbour) were also included in the water demand projections. A peaking factor was calculated and used to estimate future peak day demands to ensure that the system could meet both average annual day and peak day demands.

As shown in Figure ES.2, a range of annual average day (AAD) and peak day water demands were developed to account for the variability in UFW, which is water that is pumped to the system but is not billed. Currently, the UFW in the City's system is estimated to be 25 percent of the amount billed, which is within the industry range of 4 to 30 percent. A range of water withdrawals was developed for each planning increment based on the percentage of UFW of total water withdrawn ranging between 15 percent and 25 percent. The peak day water demands are anticipated to increase from 2.55 million gallons per day (MGD) in 2002 to 4.8 MGD by 2025 if UFW remains at the same levels as today. However, if UFW is decreased to 15 percent of the water withdrawn, the 2025 peak day demand would be 4.3 MGD. At current UFW levels, additional water supply will be needed by 2010, when the projected AAD demand will be reaching the permitted AAD withdrawal (W/D).

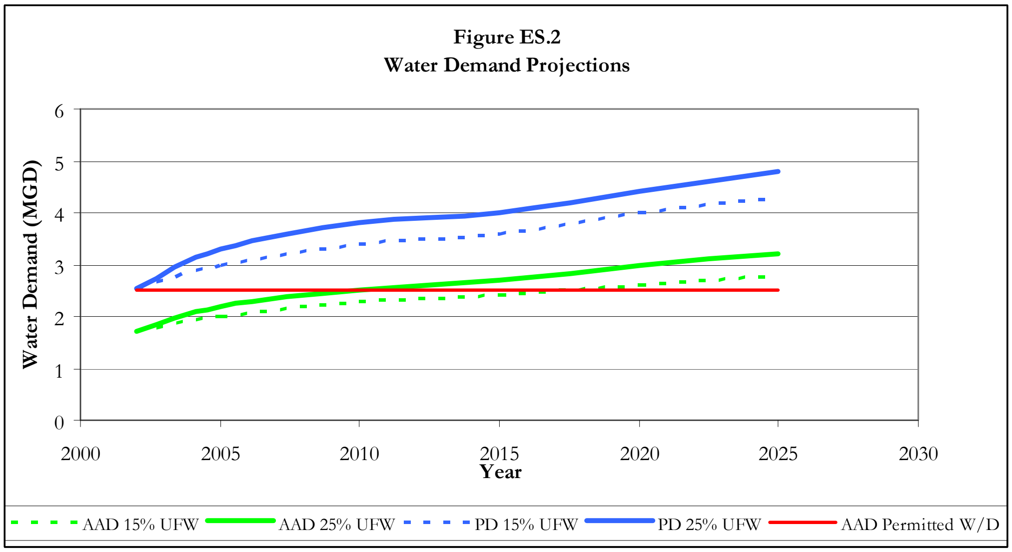


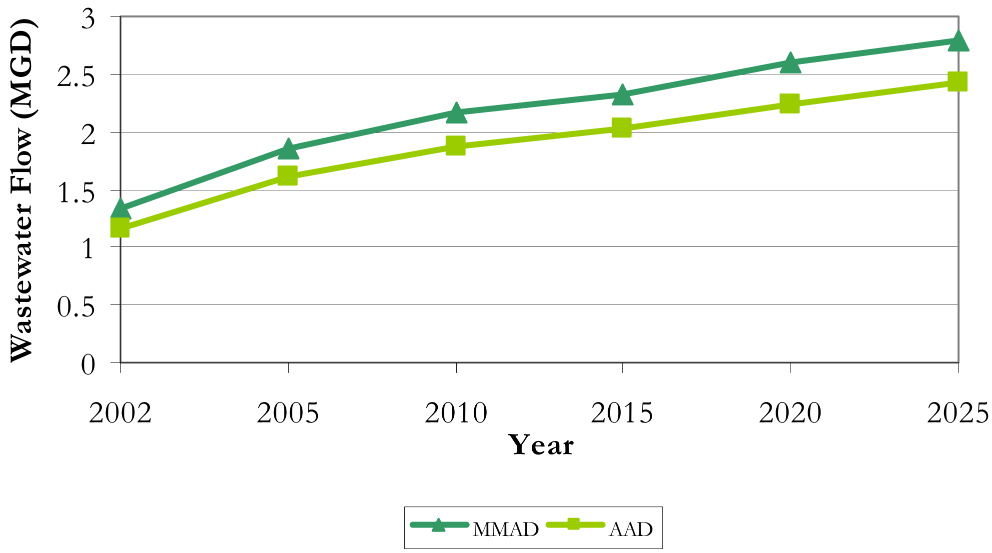
Figure ES.2
Water Demand Projections

Wastewater Flow Projections

Future wastewater flows were forecast based on anticipated population growth; inflow/infiltration (I/I), which refers to extraneous water that enters all collection systems; and known proposed developments. The quantity of I/I in the St. Marys system was estimated based on flows received at the WWTFs; I/I is estimated to be 20 percent of total flow to the WWTFs. This rate of I/I was assumed to remain constant over the planning period and is included in the projected wastewater flows.

Future wastewater flows were projected for the 2005, 2010, 2015, 2020, and 2025 planning horizons. Figure ES.3 presents the wastewater flow projections for the annual average day (AAD) and the maximum month average day (MMAD), which is used to size treatment facilities. The MMAD flow is forecast to increase from 1.33 MGD in 2002 to 2.79 MGD by 2025.

Figure ES.3
Wastewater Flow Projections



Water System Evaluation and Modeling Results

A field evaluation was undertaken by JJG as part of the Master Plan to assess the condition of the existing water system. The groundwater well pumps at the Old Jefferson, Mission Trace, and Dandy Street sites were found to be in good condition and expected to have 10 years of service life if properly maintained. The distribution system pumps, treatment facilities, and elevated storage tanks were also found to be in good condition.

The City water distribution system was evaluated using the H2OMAP Water network analysis computer software developed by MWHSoft, Inc. A computer model of the existing water distribution system was developed that included all water mains as well as all other distribution components, such as pumps and elevated storage tanks. The model was verified using data collected by City and JJG personnel, who conducted fire hydrant flow and pressure tests at 5 key locations in the water distribution system. The model results were reviewed for each parameter, and adjustments were made where needed to accurately simulate system operation.

Existing Distribution System Evaluation Results

The evaluation of the existing system model for both the average and peak day demand model scenarios indicates that the system is operating within normal operating standards. There are no areas in the City system with low velocities that cause concern; however, a regular flushing program should be conducted on all dead end lines to ensure a fresh water supply for the customers connected to these lines.

With the planned addition of an elevated storage tank at the Cumberland Harbor development, the usable storage in the City's distribution system will be 1.25 MG, or nearly 40 percent of the annual 2025 annual average day demand of 3.2 MGD, which exceeds the American Water Works Association (AWWA) recommendation of 20-25 percent of the annual average day system demand. Therefore, no additional storage is needed during the planning period.

The City's water system is committed to providing fire protection to all customers within the City Limits of St. Marys. City Staff indicated that their goal is to provide a minimum of 1,000 gallons per minute (gpm) at all fire hydrants located in residential zones for a two-hour period and 3,000 gpm at hydrants in commercial zones for a three-hour period. With these fire flows input into the model, the water distribution system is predicted to be unable to provide these flows at many residential and commercial locations. Distribution system improvements necessary to achieve the City's fire protection goals are identified.

Future Distribution System Evaluation Results

The 2025 water system was modeled to include all the existing system recommendations with 2025 average and peak day demand conditions. The model indicates that the system is capable of providing adequate flow and pressure. The model predicts that the system will operate within normal operating standards for pressure and velocity.

Several new transmission mains and service lines are recommended to achieve the City's fire protection goals. These improvements are summarized on Figure ES.4. A total of 44 projects has been identified for the fire protection improvements program for a total cost of $3.5 million in 2004 dollars. A phasing plan has been developed for these projects; however, the fire protection projects are not of a type that requires a particular prioritization or sequencing. Water main improvements should be coordinated with roadway improvements to minimize inconvenience and cost of construction.

Water Supply

St. Marys has a water withdrawal permit of 3.0 MGD on a monthly average basis and a yearly average withdrawal of 2.5 MGD. The 2025 projected annual average water demand is 3.2 MGD if UFW remains at the same level as today. An increase in the water supply permit, which could require the development of additional groundwater sources, will need to be obtained by 2010 to meet projected demands. The Georgia Environmental Protection Division (EPD) is currently studying regional capacity, water withdrawal and source water protection issues associated with the Upper Floridan Aquifer as a part of its "Sound Science Study." This study is scheduled to be released in December 2005. Once the study is completed, a water supply study should be undertaken to investigate and confirm water supply sources and yields.

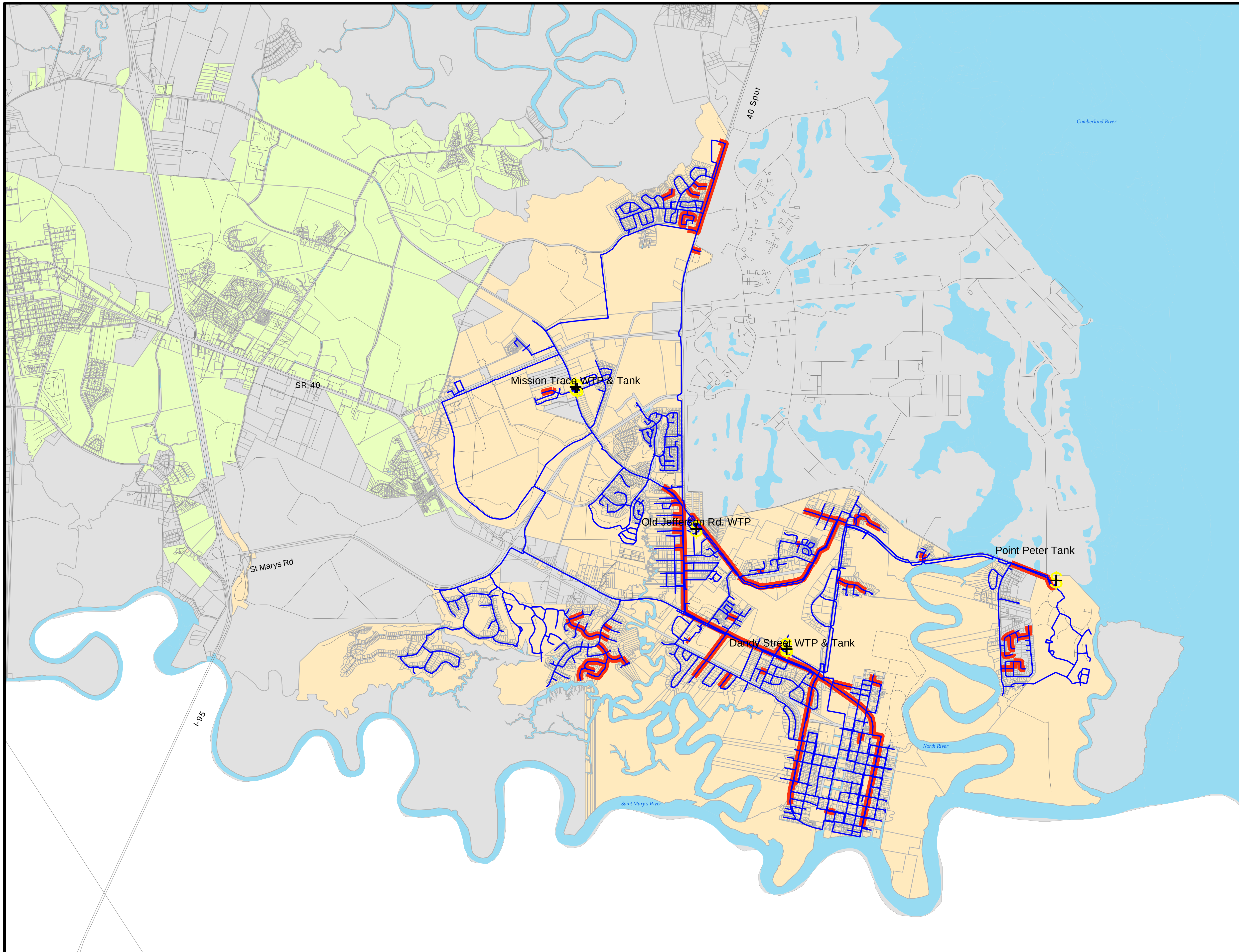


Figure ES.4: St. Marys Water Distribution System Recommended Improvements

Legend

- Wells and Tanks
- Water Junction
- Water Pipe
- Proposed Improvements
- Roads
- County
- Kingsland
- St. Marys
- Water Body

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Wastewater System Evaluation and Modeling Results

The existing St. Marys wastewater treatment and collection system was evaluated and modeled as part of the Master Plan. The sanitary sewer system, which serves the majority of the City, includes a network of approximately 110-miles of force mains and gravity sewers ranging in size from 2-inches to 24-inches in diameter. Due to the relatively flat terrain of the service area, the system currently operates approximately 60 lift stations that transfer flow from one gravity system to another or directly to one of the wastewater treatment facilities.

Collection System Evaluation

On January 20-21, 2004, a field evaluation of the wastewater infrastructure was conducted for the City. The inspection focused on 55 wastewater lift stations (five lift stations have been added since the inspection) and two wastewater treatment facilities. The conditions of wet wells, discharge valves, guide rails, electrical panels, and above ground pumps were evaluated. The majority of the lift stations are in good condition; however, those that need repairs or improvements have been identified in Section 4 of this report.

A steady state wastewater collection model was developed for the City's collection system to identify improvements necessary to reliably convey projected wastewater flows to treatment facilities under peak flow conditions. The modeling software H20Map Sewer, developed by MWHSoft, was used for this evaluation. Projected infrastructure requirements were identified for three planning horizons: 2010, 2015, and 2025.

The existing collection system analysis indicated that many of the gravity sewers that convey discharge flow from lift stations are not adequately sized to transport these flows and as a result experience surcharging and in some cases pressurized flows. In addition, several pumps within the system were found to be undersized due to peak inflows to the lift stations. Eight pumps were found to be much larger than needed based on peak flows. Reducing the capacity of these oversized pumps is recommended, thereby eliminating the need to increase downstream infrastructure. Where necessary, new pump facilities, gravity sewers and force main recommendations were made to eliminate surcharging. The recommended wastewater collection system improvements, shown on Figure ES.5, are detailed in Section 5 and are estimated to cost $8.3 million. The future system analyses indicated that improvements recommended for the existing system would provide adequate capacity for the future flows.

The steady state hydraulic model developed by JJG is a good representation of collection system operations and was based on the best available information. To increase accuracy of the model, an elevation survey of critical collection system components, collection of more detailed pump operation data, and flow monitoring in key locations is recommended. In addition, a dynamic model would provide better insight into the complexities of lift station operations and flow attenuation and is recommended to be developed within the next two years.

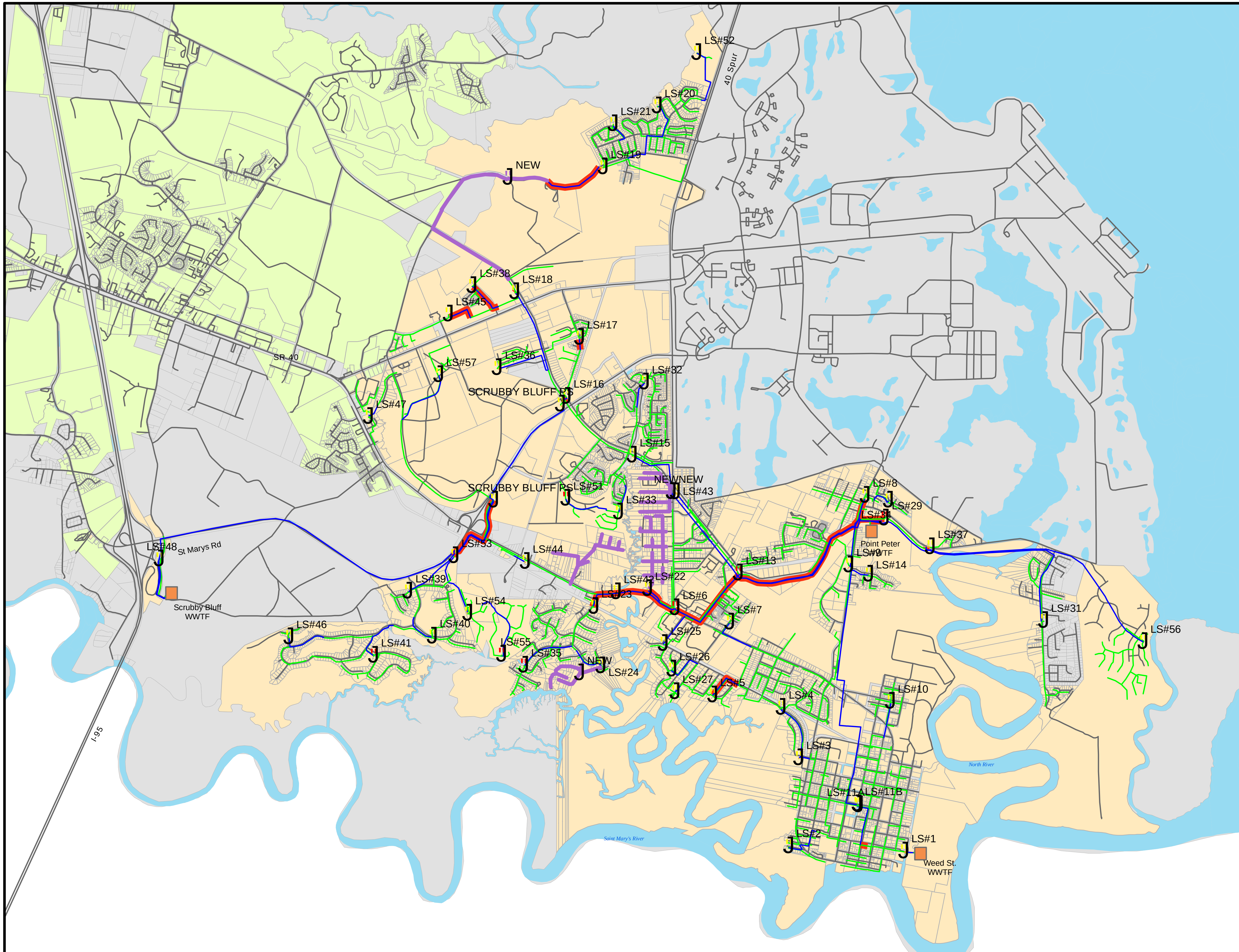

Figure ES.5: St. Marys Wastewater Collection System Recommended Improvements

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Treatment Facilities Evaluation

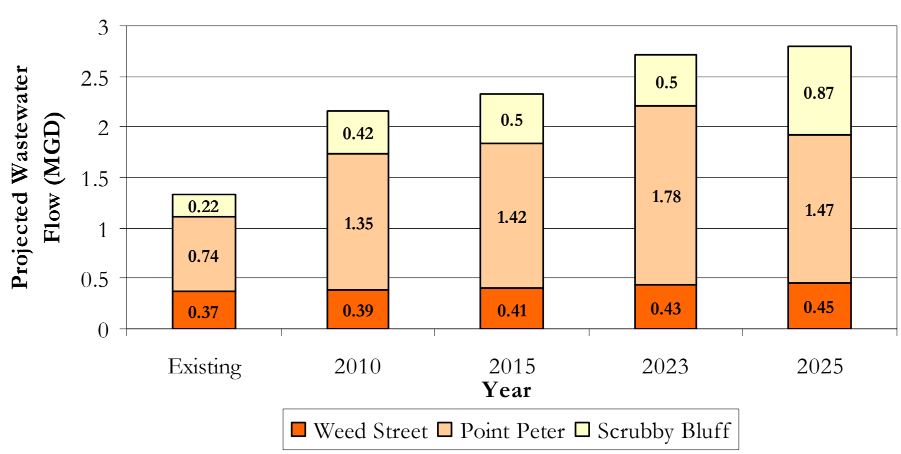
Based on the field evaluations conducted, the facilities at the Point Peter WWTF, which has a design capacity of 0.8 MGD, should have several years of serviceable life left if properly maintained. The package plant tank appears well maintained and is in "good" shape, although some items are in need of repair. The interior structures of the plant are rated in "fair" condition; refurbishment of these structures is recommended.

While the design flow for the Weed Street WWTF is 0.55 MGD, the discharge permit allows for up to 0.7 MGD of effluent flow. According to plant personnel, a temporary permit modification was granted by EPD while the Point Peter WWTF was under construction. This modified permit is still in effect. Plant operators indicate that the facility will not effectively treat the design flow of 0.55 MGD; the maximum effective treatment capacity has since been estimated to be 0.45 MGD. The aeration basin, which was sized based on 1976 standards, is too small to effectively treat the design flow. The package plant tank is of concrete construction and was refurbished in 2003. It appeared to be in "good" condition during our inspection. The interior structures of the treatment tank also receive a "good" rating.

The current combined treatment capacity of Point Peter and Weed Street WWTFs is 1.25 MGD on a MMAD basis. The MMAD flow in 2002 was 1.33 MGD; therefore, additional capacity is needed immediately. Fortunately, the new Scrubby Bluff WWTF is scheduled for completion in late 2004. This facility, which has a design treatment capacity of 0.5 MGD, will provide short-term treatment capacity relief for the system. Flows in the Point Peter and Weed Street service areas are anticipated to increase and additional capacity in these service areas will be needed.

Flow projections indicate that the wastewater treatment capacity needed by 2025 is nearly 2.8 MGD. This can be provided by expanding the Point Peter WWTF from 0.8 to 1.8 MGD by 2008 and by expanding the Scrubby Bluff WWTF from 0.5 to 1.0 MGD by 2023. A portion of the wastewater flow will need to be redirected from the Scrubby Bluff service area to the Point Peter service area to maximize flow to this facility and to prevent upgrading the Scrubby Bluff WWTF earlier in the planning period. Diversion of flow will need to occur around 2015 and continue through 2023 when the expanded Scrubby Bluff WWTF would be completed and would again accept all flow generated in its service area. The Weed Street WWTF would continue to operate without expansion, although a major project to refurbish the old equipment at the plant is anticipated. The Weed Street

Figure ES.6
Projected MMAD Flows to WWTFs



WWTF could continue to operate until it reaches the end of its useful life, at which point flows could be diverted to Point Peter and Scrubby Bluff WWTFs for treatment. The projected MMAD flows to each WWTF are presented in Figure ES.6. Costs associated with treatment facilities expansions and upgrades are estimated to be $10.9 million in 2004 dollars.

Recommendations and Five-Year CIP

Based on the analyses performed for this Master Plan, several improvements in the water and wastewater systems will be needed over the next 20 years. Accordingly, the resulting improvement projects have been proposed in a phased sequence across the duration of the 20 year planning period on a priority basis. Projects related to regulatory requirements and reliability/capacity improvements were given precedence over system extensions. Hydraulic models of both the water distribution and wastewater collection systems were used to establish the phasing plans.

A 20-year phasing plan was developed for all recommended projects. Projects that need immediate or near-term implementation are included in the first five years of the phasing plan. These projects are included in the Five-Year Capital Improvements Program (CIP).

A Five-Year CIP and a Revenue Sufficiency Analysis was developed for the infrastructure recommendations identified in the Master Plan. A financial spreadsheet model was created to analyze water and wastewater system revenues, expenses, and existing and proposed debt. The result is a five-year projection of revenues necessary to fund expenses for system operations and maintenance and existing and future debt service.

It is expected that $2.3 million will be spent on water system capital improvements during the five-year planning period (2005 through 2009) and $15.8 million will be spent on wastewater system projects. A total of $0.8 million is to be spent in fiscal year (FY) 05 on both water and wastewater capital projects.

The majority of the proposed projects should be funded using Georgia Environmental Facilities Authority (GEFA) loans, due to the advantageous interest rates available for water and wastewater projects. The remainder of the CIP is to be funded using typical revenue sources, such the enterprise fund, as opposed to general fund revenues or SPLOST proceeds.

The City must increase its revenues in order to fund the CIP, maintain the O&M budget and provide an adequate coverage for debt service. The revenues should be accrued through adjustments in rates, fees and charges related to the operation of the water and sewer system. The following recommended rate increases are based on Fiscal Year 2002 data, which is the last full year for which data were available:

- FY 2005 - 6 percent
- FY 2006 - 6 percent
- FY 2007 - 4 percent
- FY 2008 - 4 percent
- FY 2009 - 4 percent

These rate increases are necessary to fund the improvements and expansions needed to provide the desired level of service, both current and future, to the City's water and wastewater customers. The City's costs to provide this level of service by the end of the fifth year of the CIP are estimated to be almost 80% higher than they were in FY 2002 ($4.2 million versus $2.4 million, in 2004 dollars). The initial recommended annual rate increase should be implemented as soon as possible to provide for the needs in the current fiscal year. By planning for annual rate increases, the City will be in a more flexible position as required to address any changes in costs for providing services.

Water and Wastewater Master Plan

Section 1
Introduction

The City of St. Marys (City) is located in southeastern Georgia in Camden County. The City is situated on the northern bank of the St. Marys River in the coastal plain region of Georgia. The City is located 35 miles north of Jacksonville, Florida and 114 miles south of Savannah, Georgia.

The area served by the City's water and wastewater systems is approximately 15.3 square miles with a population of over 15,000. Water services are provided to nearly 100 percent of the City's population; the City also provides water service to a portion of Camden County. Sewer services are provided to nearly 90 percent of the City's population. The City's service area is shown in Figure 1.1.

The City's drinking water supply is obtained from three groundwater wells located within the service area. Approximately 1.68 Million Gallons per Day (MGD) of water is pumped from these wells that draw water from the Floridan Aquifer. Treated water is distributed to customers through a network of over 120 miles of water mains, with a maximum pipe size of 12 inches in diameter.

The City's wastewater collection system is comprised of 110 miles of pipes in sizes up to 24 inches in diameter, and includes both gravity sewers and force mains. The wastewater collected is treated at either the Point Peter Wastewater Treatment Facility (WWTF) or Weed Street WWTF, which have a combined effective capacity of 1.25 Million Gallons per Day (MGD). A third facility, Scrubby Bluff WWTF, is due to come on line in late Summer 2004 with a design capacity of 0.5 MGD.

On December 15, 2003, the City was issued a consent order by the Georgia Environmental Protection Division (EPD) of the Department of Natural Resources that addressed the following areas of concern:

- Treatment capacity at the City's WWTF's is at or near capacity,
- The City continues to request expansions to the wastewater collection system,
- Sewer line overflows due to failure of lift stations,
- Inflow and Infiltration issues within the collection system, and
- Lack of adequate lift station maintenance

The consent order requires that St. Marys develop a master plan for the water and wastewater system. Jordan, Jones & Goulding, Inc. (JJG) has prepared this Water and Wastewater Master Plan (Master Plan) to address the areas of concern identified in the consent order and to assist the City in meeting its water and wastewater infrastructure needs through planning year 2025. The Master Plan contains projections of future water demand and wastewater flows; reviews and computer simulations of the existing water and wastewater systems; descriptions of areas where operating, maintenance and capital improvements are needed to meet future levels of service; estimated costs of improvements; and rate study/revenue projections.

The Master Plan includes the following sections:

- Water Demand and Wastewater Flow Projections (Section 2) – includes population projections, future water demands and future wastewater flows;
- Water System Evaluation and Modeling Results (Section 3) – includes an evaluation and computer simulation of the existing water system;
- Wastewater System Evaluation and Modeling Results (Section 4) – includes an evaluation and computer simulation of the existing wastewater collection system and an evaluation of the wastewater treatment system;
- Recommended Master Plan (Section 5) – identifies specific projects needed to upgrade and expand the water distribution and wastewater collection/treatment systems to meet the current and future needs of St. Marys; and
- Five-Year CIP (Section 6) – identifies the revenue required to pay for upgrades or expansions, in addition to the regular operations and maintenance costs, and related funding sources.

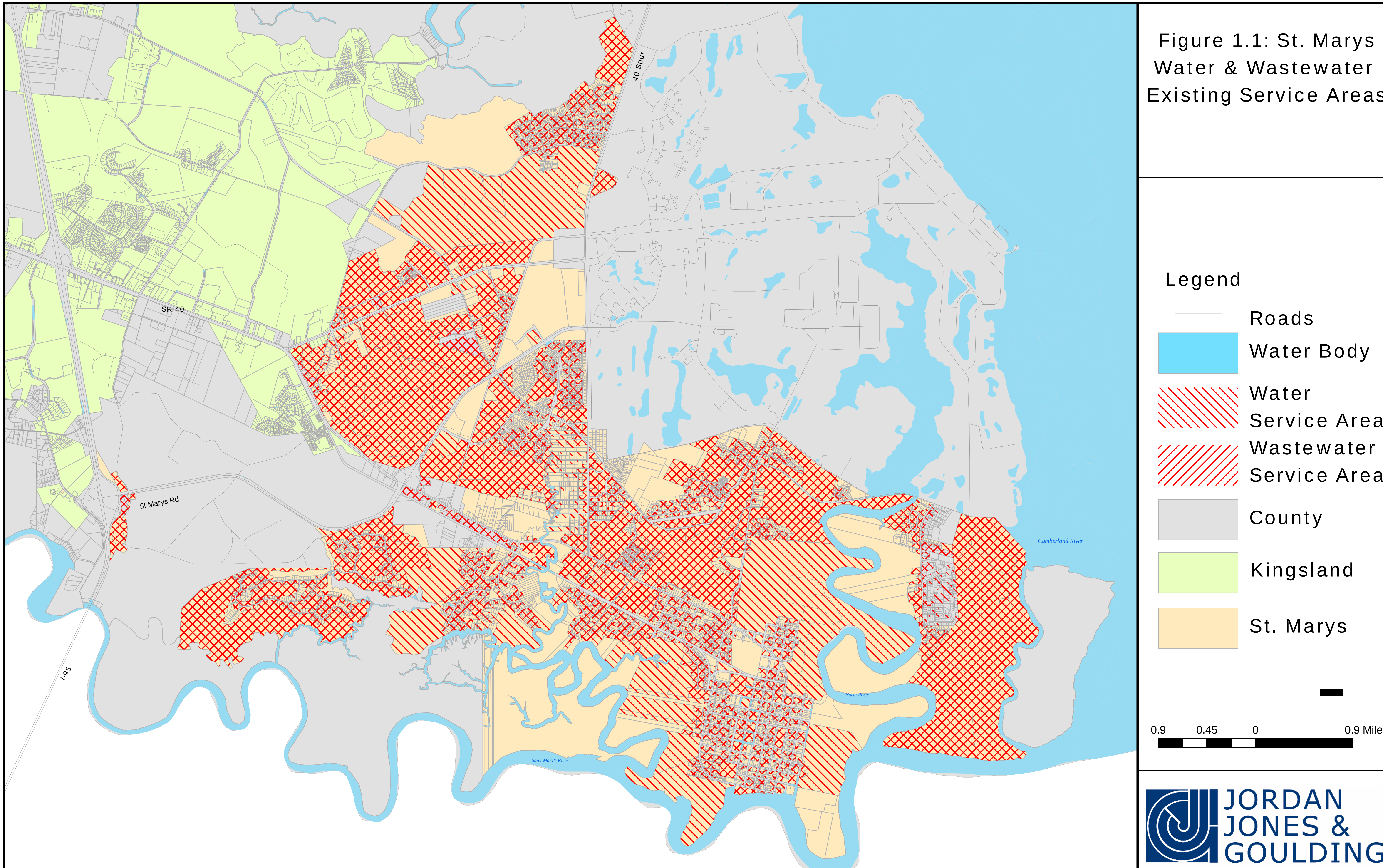


Figure 1.1: St. Marys Water & Wastewater Existing Service Areas

Water and Wastewater Master Plan

Section 2
Water Demand and Wastewater Flow Projections

The City of St. Marys is committed to providing its residents and businesses with the appropriate level of drinking water and wastewater system infrastructure to sustain growth over both the near term and long term planning horizons. Population growth (or decline) and development trends drive water usage and demand and resulting wastewater collection and treatment capacity needs. The projections of these water demands and wastewater flows are ultimately used to provide the basis for short term (i.e., one to five years) and long term (i.e., five to 20 years) water and sewer infrastructure needs. Infrastructure improvements and expansions must be planned such that system capacity is in place in advance of the need; however, the development of these improved systems generally must be prioritized and phased to align with the community's ability to fund and pay for them.

This section of the Master Plan outlines the methodology used to develop population, water demand, and wastewater flow projections for the study planning horizons. The resulting projections follow the description of the methodology. The projections ultimately form the framework of the hydraulic models used to develop recommendations for system improvements and expansion.

Methodology

The development of population, water demand, and wastewater flow forecasts is a complex process that requires the collection and evaluation of large quantities of data. The methodology is dictated by the quality and quantity of information available. The approach taken for the development of projections for St. Marys is outlined below; details and results are presented later in this section.

Population

Residential and commercial water demands and wastewater flows are related to the population. Thus, forecasting the population growth or decline is the first step in the process of estimating future water demands and wastewater flows. The methodology used to project the population is as follows:

- Historical population figures for St. Marys and Camden County were obtained from the United States Census Department (US Census) for years 1930 through 2000.
- Projected population through 2010 was obtained from the Georgia Office of Planning and Budget.

- A declining percentage trend was found to be the best fit to the historical and projected data and was used to forecast the population for years 2015, 2020 and 2025.
- The St. Marys' Planning Director reviewed the projections and provided known and proposed residential development locations that were used to supplement the other data sources.

Water Demands

With the population projections completed, the next step in the process was to develop water demand projections. Two data sets were evaluated to characterize the existing water usage: water billing records, which consist of the metered water sales to all customers, and the monthly monitoring reports (MMRs) for each water supply source, representing records of the metered amount of water withdrawn from the wells and input into the distribution system. These data sets were provided by the St. Marys Finance Department and Public Works Department for the period September 2002 through August 2003.

For St. Marys, the water demand consists of two components – residential/commercial demands, which are directly related to the population, and a component of unbilled water known as unaccounted for water (UFW). Unbilled water consists of the amount of water that is pumped to the system but is not billed. Unbilled water is the result of flushing programs, fire department use, leaks, or construction testing; it is common to all water distribution systems. Unbilled water can be broken down into two categories: (1) unbilled but accounted for water, and (2) UFW. Unbilled but accounted for water includes water use that has been measured but has not been billed. This generally includes water used by fire departments and water used to flush lines and clean sewers. The remainder of unbilled water that cannot be accounted for is primarily associated with leaks, construction testing, and unmetered taps.

Both of the residential/commercial and UFW components were estimated based on the data provided by St. Marys. The following analyses were performed for the existing system:

- Calculate the water usage rate per person
    - Using the billing data, the number of customers with water service was estimated.
    - To estimate the percentage of the population with water service, the number of customers with water service was multiplied by the average number of people per household obtained from the US 2000 Census. This number was divided by the total population.
    - Using the billing data, the annual average daily amount of water sold to customers was calculated.
    - The annual average day water usage rate per person, or per capita rate, was calculated by dividing the annual average daily (AAD) water sold by the served population.
- Estimate existing UFW

- Using MMR data, the amount of water pumped to the system on an average annual day basis for the three wells was summed to determine the total water that was pumped to the system.
- UFW was estimated by subtracting the annual average day billed from the annual average day water pumped to the system. This difference was then divided by the total water pumped to the system to calculate the percentage UFW represents of the total water demand.

- Compute peak day factor
  - The MMRs were also used to determine a peak day to average day ratio. The peak day represents the highest water usage for the system for a given year.
  - The peak day to average day ratio is calculated by dividing the highest water usage demand by the annual average day demand. This ratio, or peaking factor, is used to estimate future peak day demands so that infrastructure can be sized appropriately.

These computations characterize the existing water usage patterns and are used as a basis for projecting future water demands. The three components of future water for St. Marys include residential/commercial, contractual agreement, and UFW; each of these was estimated as described below:

- The first component, residential/commercial water demands, was estimated by multiplying the forecasted population for each planning year by the per capita rate.
- Contractually required water demands were added to the first component by year as specified in the agreement.
- The third component, UFW, was estimated by applying the existing percentage of the UFW to the future flows. A UFW goal was also established to take into account reduction of UFW over the planning period. The UFW goal amount was estimated by multiplying the UFW goal percentage by the total flow.

The sums of these three components represent the total annual average day demand. The peaking factor was applied to the projected annual average day demand to estimate future peak day water demands.

Wastewater Flows

The next step involved developing wastewater flow projections. Wastewater flows are not typically metered at residential/commercial connections; therefore, water billing data are used in the assessment of existing wastewater generation characteristics. Wastewater flows are related to water demand through a return factor. The return factor is used to determine how much of the water that is delivered through the distribution system is actually returned to the sewer system for collection and treatment. Another piece of information used in this assessment is the total flow received at the wastewater treatment facilities (WWTFs), which is obtained from MMRs. These reports were provided by the St. Marys Public Works Department for the period September 2002 through August 2003.

For St. Marys, the existing wastewater flow consists of two components – residential/commercial flows and inflow/infiltration (I/I). I/I refers to extraneous water entering the collection system. Inflow is water discharged into the sewer system from directly connected sources such as foundation drains, roof leaders, cellar area drains, cooling water from air conditioners, and other non-wastewater discharges from commercial and industrial establishments. Infiltration refers to groundwater that enters sewers and service connections through defective joints and broken or cracked pipes and manholes. Some quantity of I/I is unavoidable, but excessive amounts can surcharge sewer lines or consume hydraulic capacity at wastewater treatment facilities.

Quantifying I/I is best done at the source level. Estimating I/I for an entire collection system requires knowledge of the individual sources, so that the results can be accumulated. Without this information, the best approach for approximating for I/I is to evaluate flow patterns over an extended period of time. I/I flows are related to wet weather conditions; therefore, comparison of wastewater flow rates during wet weather and dry weather conditions is often used to approximate I/I flows.

The process of developing existing wastewater flow characteristics included the following elements:

- Evaluate the MMRs to determine total wastewater flow generation
  - Statistical analysis was performed on the MMR data received; the annual average daily flow (AADF) and maximum month average daily flow (MMADF) were calculated.
  - The MMADF was divided by the AADF to calculate the MMADF to AAD ratio. The MMADF is used to size treatment facilities and is therefore an important characteristic of the system. The ratio is used to estimate future MMADF.
- Estimate the percentage of the population with sewer service using water billing data and US Census 2000 data
  - The water billing data was provided by customer category (residential, commercial, institutional, and governmental), customer location (inside or outside the city limits), and customer services (water and wastewater or water only). Customers with water only service do not have sewer service. This component of the billing data was used to estimate the percentage of the population with sewer service.
  - The water only (no sewer) residential customers were multiplied by the number of people per household, obtained from US Census 2000 data to estimate the population without sewer service.
  - Next, the population without sewer service was subtracted from the total existing population to yield the number of people with sewer service. This number was then divided by the total population to estimate the percentage of the population with water and sewer service.
- Estimate the relationship between water usage and wastewater generation (return ratio) by using water billing data and MMRs

  - The amount of water sold to water and sewer customers on an AAD basis (water only customers were removed from the data set) was divided by the total AAD wastewater flow to the WWTFs to estimate the return ratio.
- Estimate I/I using MMRs and rainfall data to evaluate flows during dry weather periods
  - Dry weather periods were selected using rainfall data collected at the WWTFs.
  - Average daily flows for the dry periods were calculated.
  - The total AAD flows to the WWTFs was divided by the dry weather flows to estimate I/I contributions to the system.
  - While newly constructed sewers typically have lower rates of I/I, the I/I in existing, older sewer pipes would be expected to gradually increase. Due to these counterbalancing effects, the estimated I/I was assumed to remain constant over the planning period.

These elements of the existing wastewater flow system provide the basis for projecting future wastewater flows. The following describes the procedure for developing projections of future wastewater flows:

- Future wastewater flows consist of flows generated by the following components:
  - The existing population served
  - New population growth (all new development was assumed to be sewered).
  - Percentage of the existing but unsewered population
  - Contractual agreement for sewer flows/capacity
  - I/I
- Wastewater flows generated by the existing (serviced) population and future population (due to growth) were estimated using the following equation:

  Existing and Future Growth Sewered Population Flows =

  (Planning year population) x (water use per capita rate) x (percent served) x (return factor) x (I/I percentage)
- The City desires to serve 100 percent of customers located within the City Limits with sewer; therefore, it was assumed that the current unsewered population would gradually be provided service by 2025. Wastewater flows generated by the existing but unsewered population were estimated using the following equation:

  Existing Unsewered Population Flows =

  (Existing unsewered population) x [percent served (25 percent in 2010; 50 percent in 2015; 75 percent in 2020; and 100 percent in 2025)] x (water use per capita rate) x (return factor) x (I/I percentage)

- Contractually required wastewater flow capacity was added to the other two components by year as specified in the agreement.

The sum of the flows referenced above equals the estimated future wastewater flows for each planning year.

The results of the population, water demand, and wastewater flow projections are presented in the following sections.

Population Projections

The population of St. Marys has grown steadily over the years, with the largest population increase occurring between 1980 and 1991, largely due to the development of the Kings Bay Submarine Base. The historic population figures are presented in Table 2.1.

Table 2.1
St. Marys Historic Population

Year	Population	Annualized Change
1930	732	
1940	733	0.01%
1950	1,348	6.28%
1960	3,272	9.27%
1970	3,408	0.41%
1980	3,596	0.54%
1990	8,391	8.84%
1991	9,373	11.70%
1992	10,252	9.38%
1993	10,991	7.21%
1994	11,675	6.22%
1995	11,666	-0.08%
1996	12,411	6.39%
1997	13,221	6.53%
1998	13,823	4.55%
1999	14,152	1.34%
2000	13,761	-2.76%
2001	14,784	7.43%
2002	15,103	2.16%

Note: 1930-2000 Population obtained from U.S. Census; 2001-2002 data obtained from Georgia Office of Planning and Budget.

The population of St. Marys is anticipated to continue to grow through the planning year 2025. The proximity of the City to the coast makes it an attractive location for retirees and families purchasing second (vacation) homes. In addition, the Interstate 95 (I-95) and State Route (SR) 40 corridors provide easy access to other nearby cities, such as Brunswick, GA and Jacksonville, FL.

The majority of the land use within St. Marys is residential. However, there are a number of light commercial/retail centers located along SR 40, SR 40 Spur, as well as in the downtown area along Osbourne and St. Marys Streets.

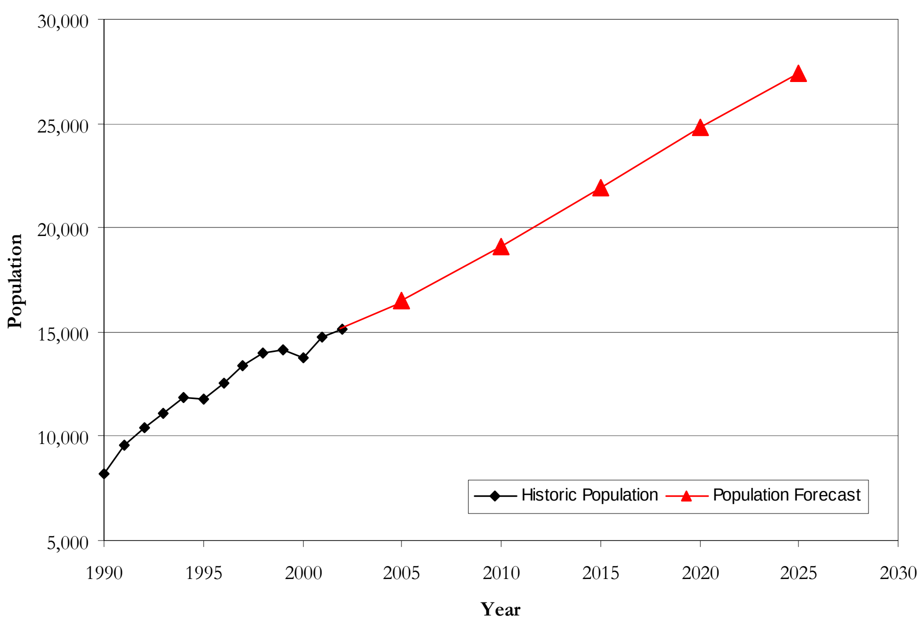
Population projections through 2025 were derived based on historic trends, regional growth patterns, and local conditions. Projections for year 2010 were obtained from the Georgia Office of Planning and Budget. The population estimate for 2005 was made by linear interpolation between years 2002 and 2010. Population forecasts for years 2015, 2020 and 2025 were calculated using a declining percentage.

These forecasts were reviewed with the City Planning Director, who also provided a list of residential developments that are anticipated to be constructed in the next five to ten years. The list included the location and number of houses. An estimate of the population associated with these developments was made using demographic information for Camden County obtained from the US Census. This estimate compared favorably with the population projections developed for St. Marys. The projected population for St. Marys is presented in Table 2.2 and graphically in Figure 2.1.

Table2.2
St. Marys Projected Population

Year	Population	Annualized Change
2002	15,103	2.16%
2005	16,503	3.00%
2010	19,132	3.00%
2015	21,911	2.75%
2020	24,791	2.50%
2025	27,371	2.00%

Figure 2.1
Population Projections for the City of St. Marys



Even with the closing of the Durango Paper Company in 2002, a large employer for the area, the population growth has maintained a consistent upward trend. This industrial site was previously serviced by its own water and wastewater treatment systems and is currently in the midst of bankruptcy proceedings. Future development of this property could vary widely, ranging from commercial/industrial uses to mixed use or residential development. The Master Plan should be updated as future uses of this or other similar properties are identified. Moreover, due to the dynamic nature of community development and growth, the City should plan to review local conditions and the underlying assumptions used to develop this Master Plan at least every five years.

Water Demand Projections

The first step in planning for the future of the St. Marys' water system is to determine how much water will be needed during the planning timeframe. The need for water is commonly referred to as water demand. The existing water demands for the St. Marys system were analyzed to establish the basis for projecting the anticipated future water demand. Future water demands were projected for the 2005, 2010, 2015, 2020, and 2025 planning horizons.

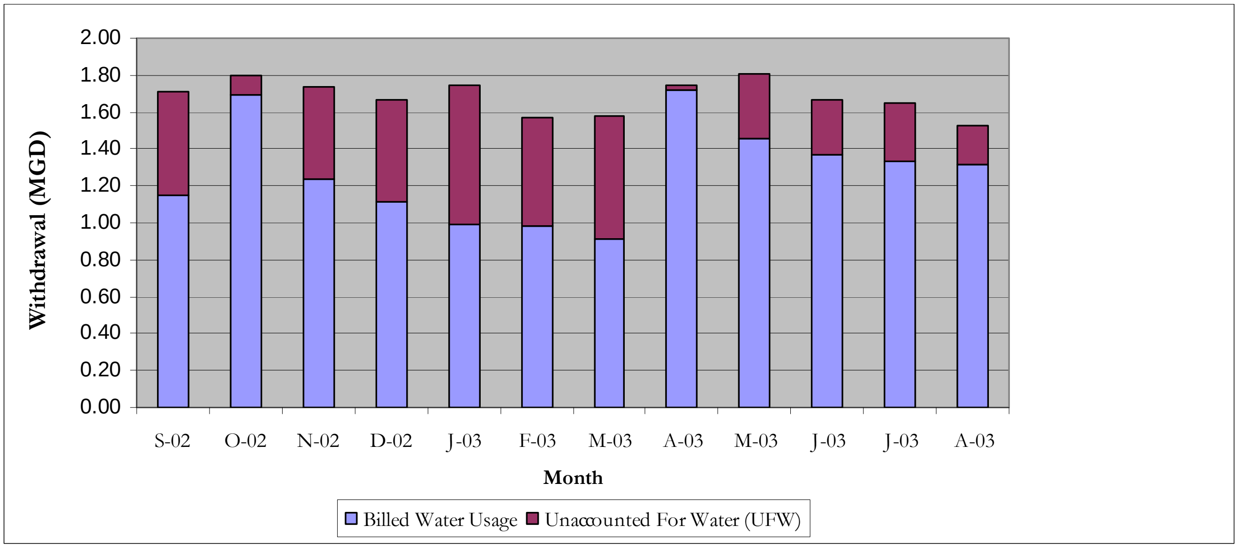
Existing Water Demand Analysis

The existing water demands were analyzed to determine characteristics of the service area needed for input into the hydraulic model and estimating future demands. Billing records for the period September 2002 through August 2003 were obtained from St. Marys' staff. The data included 12 monthly consumption amounts for an average of 5,500 water customers. The annual average daily water usage billed over this time period was 1.3 million gallons per day (MGD). These billing records included residential, commercial, and institutional (such as governmental and schools) customers, as well as temporary meter usage. Based on the data, residential use makes up approximately 78 percent of the total water use for the referenced period on an average annual basis. The remaining 22 percent of the total water use is commercial, institutional, and temporary metered users. St. Marys does not currently have industrial water customers.

One portion of the water demand that is not reflected in the billing records is the amount of water that is pumped to the system but is not billed. Unbilled water can be broken down into two categories: (1) unbilled but accounted for water, and (2) unaccounted for water (UFW). Both of these components are described in more detail under the heading "Methodology" in this Section.

UFW can be substantial and is an important consideration in projecting future water demand. According to the American Water Works Association (AWWA) *Distribution Network Analysis for Water Utilities* (AWWA M32), the average UFW varies widely between systems, with values ranging between 4 percent and 30 percent of total system production. The annual average UFW for St. Marys' system was calculated to be 25 percent, which is within the range of typical values. The UFW may be high due to the age of the infrastructure in St. Marys. Older meters may not be as accurate and therefore not all water consumed is metered. Reducing UFW is an important means of extending available water supply, reducing overall costs of supplying water and maximizing revenue for all water used. Figure 2.2 shows the monthly average water withdrawal with components for billed water usage and UFW.

Figure 2.2
Average Monthly Water Usage



The AAD demand forms the basis for developing other demand statistics that are important in sizing water infrastructure. According to published data, the peak day to AAD ratio, or peak day ratio, is generally in the range of 1.2 to 2.5. Based on 2002 to 2003 plant pumping records, the peak day ratio for the St. Marys' system was 1.5. Table 2.3 presents a summary of the existing water system demand based on the review of the reference period billing data and plant pumping records.

Table 2.3
Existing Water System Demands

	Annual Average Day Without UFW (MGD)	Peak Day Without UFW (MGD)	Annual Average Day With UFW (MGD)	Peak Day With UFW (MGD)
2002 Base Year	1.30	1.95	1.70	2.55
Notes: UFW = 25% Peak Factor = 1.5				

Projected Water Demands

Water usage is related to the type of facility at each service connection. Residential water usage includes uses within homes by the resident population, and is therefore directly related to the population connected to the water system. Commercial water usage, which generally includes such customers as restaurants, retail stores, and office space, and institutional water usage, including schools and governmental agencies, are also linked to the population for whom services are provided. Therefore, population projections can thus be applied to the existing demands to develop water demand projections for residential, commercial and institutional water users. No industrial developments are anticipated to locate in the City of St. Marys over the planning horizon; therefore, industrial water demands were not included in the projections contained in this Master Plan.

The population projections were also adjusted to account for a new residential development named Cumberland Harbour. The developer of Cumberland Harbour has entered into a contractual agreement with the City of St. Marys for water service. Based on this agreement, the City is obligated to have adequate capacity to provide a water demand of 287,500 gallons per day (gpd) in 2005 and 400,000 gpd in 2008 and thereafter. In order to prevent double counting of the population and demand associated with this development, the City's projected population was adjusted to account for the Cumberland Harbour population. The number and anticipated development of lots in Cumberland Harbour were provided by the developer. Based on this data, the Cumberland Harbour population for each planning year was estimated and subtracted from the overall St.Marys' population projections. This adjusted population projections was used to project the City's future water demands.

Based on the 2002 population and water usage data, a per capita water usage rate was calculated to be 84 gallons per person per day (gallons per capita per day, or gpcd). This rate was applied to the adjusted projected population for years 2005 through 2025 to estimate the projected base water demands. The water demand for Cumberland Harbour was reflected by the addition of 287,500 gpd for 2005, and 400,000 gpd for planning horizon years 2010, 2015, 2020, and 2025. To this base water demand, the UFW component must be added to estimate the total water demand. UFW is currently estimated to be 25 percent of the total water withdrawn; however, over the course of the planning period this percentage could decrease with the implementation of a UFW reduction program. Over the planning period, a reasonable goal would be to reduce UFW to 15 percent of the total water withdrawn.

Table 2.4 presents the total water withdrawn, which includes the base demand and the UFW. The total water withdrawn is shown with two levels of UFW - the current level of 25 percent and a goal level of 15 percent. The projected water demand with 25 percent UFW was used to evaluate the water system infrastructure and needs.

Table 2.4
Future Water Demands

Year	Population	Total Water Billed (MGD)	Annual Average Day Water Withdrawal (MGD)		Peak Day Water Withdrawal (MGD)	
			15% UFW	25% UFW	15% UFW	25% UFW
2002	15,103	1.30	n/a	1.70	n/a	2.55
2005	16,503	1.70	2.00	2.20	3.00	3.30
2010	19,132	1.90	2.30	2.50	3.40	3.80
2015	21,911	2.00	2.40	2.70	3.60	4.00
2020	24,791	2.20	2.60	3.00	4.00	4.40
2025	27,371	2.40	2.80	3.20	4.30	4.80

The ability of the existing distribution system to deliver these projected water demands is discussed in detail in Section 3: Water System Evaluation and Modeling Results. This current Master Plan does not address the availability of adequate water supply capacity to meet the future demands. The Georgia EPD is currently studying regional capacity, water withdrawal and source water protection issues associated with the Upper Floridan Aquifer as a part of its "Sound Science Study." . This study is scheduled to be released in December 2005.

Wastewater Flow Projections

In order to plan for the future of the St. Marys' wastewater system, it is necessary to determine how much wastewater flow will be generated during the planning timeframe. Statistical analyses of the existing flows to the WWTFs were performed to characterize wastewater generation patterns that were used to project future wastewater flows. Wastewater flows were projected for each five-year increment between 2005 and 2025.

Existing Wastewater Flow Analysis

The existing wastewater flow patterns were characterized by analyzing two data sets – the MMRs for both the WWTFs and the water billing data. This data was provided by the St. Marys Finance Department and Public Works Department for the period September 2002 through August 2003.

Based on the MMRs for the Point Peter and Weed Street WWTFs, the total AAD flow was 1.16 for the referenced period. The MMAD flow for the same period was 1.33 MGD. The MMAD flow is an important system characteristic because the permitted wastewater treatment capacity is based on MMAD flow to the facility. In order to estimate MMAD flows in the future a MMAD to AAD flow ratio is applied to future AAD flows. For the entire St. Marys' system, this ratio is calculated to be 1.15, which is slightly lower than the industry standard of 1.25.

From the review of water billing records, it was determined that approximately 90 percent of water customers have sewer service. The remaining 10 percent of the population who are not currently served by the sewer system use private on-site treatment systems, such as septic tanks.

In order to relate water demands and wastewater flows, a return factor was estimated. This return factor is used to reflect the amount of water that is returned to the sewer system. The return factor was calculated by dividing the AAD flow treated at both WWTF's by the billed AAD water usage for sewer customers, which yielded an annual average return factor of 100 percent. Residential and commercial customers typically return between 90 and 100 percent of the water to the wastewater collection system.

The quantity of I/I that enters the St. Marys' system was estimated by calculating a ratio of the AAD to dry weather flows. Using the daily rainfall data, two dry weather periods were selected - April 16-22, 2003 and May 4-10, 2003. For this period, the combined AAD for the two WWTFs was divided by the combined dry weather wastewater flow to the WWTFs. Based on this analysis, the AAD to dry weather flow ratio was computed to be 1.2, indicating that approximately 20 percent of the flow is due to I/I.

The AAD to dry weather flow ratio of 1.2 is within the typical range found for many systems, which range from 1.0 to 1.5. This method of estimating I/I is based on an analysis of the flow records from the WWTFs. These records represent the discharge flow, as reported to meet requirements of the WWTF's National Pollutant Discharge Elimination System (NPDES) permits. Because these flow readings were taken at the WWTFs, they represent only the wastewater flows entering the treatment plants. Any flows that that may have been released from the collection system upstream of the plant, such as due to sanitary sewer overflows (SSOs), is not included. In addition, this method of estimating I/I likely captures only the inflow type of extraneous flow in St. Marys. This is due to the high, year-round groundwater table, which creates a baseline level of infiltration that does not fluctuate substantially in response to rainfall.

Table 2.5 presents the wastewater flows generated in the St. Marys service area for the period September 2002 through August 2003.

Table 2.5
Existing Wastewater System Flows

Month	Total Average Daily Flow Treated (MGD)
October-02	1.24
November-02	1.11
December-02	1.17
January-03	1.06
February-03	1.05
March-03	1.34
April-03	1.21
May-03	1.16
June-03	1.11
July-03	1.16
August-03	1.24
September-03	1.07
AAD	**1.16**
MMAD	**1.33**

Projected Wastewater Flows

Future wastewater flows consist of flows generated by five elements that include the following: existing sewered population, new population growth, percentage of existing but unsewered population, contractual agreement, and I/I.

Wastewater flows were estimated for the existing sewered population and new population growth for each planning year by multiplying the water per capita rate of 84 gpcd by the return ratio of 1.0. The amount of I/I system-wide was assumed to remain at 20 percent over the planning period.

Therefore, a 20 percent increase was added to estimate the total wastewater flow associated with this element.

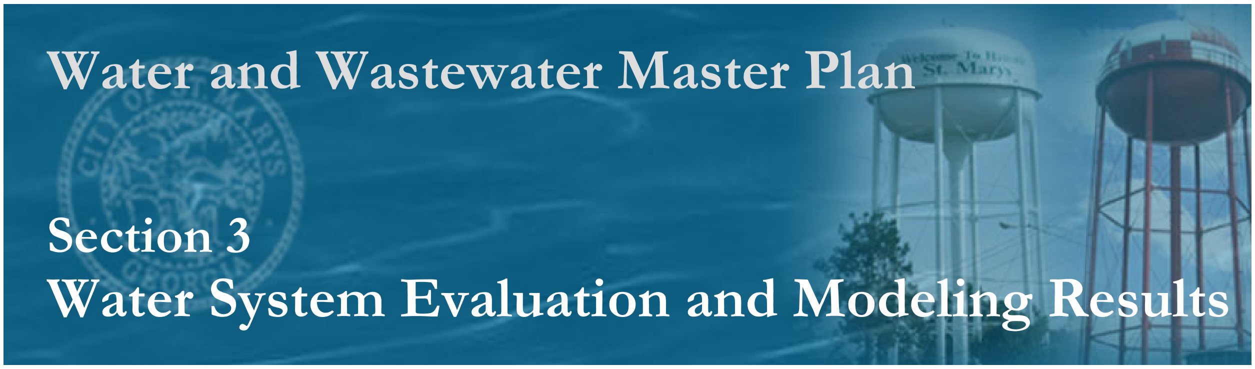
St. Marys has a goal of providing wastewater service to all customers located within the City Limits. Currently, approximately 1,400 people, or about 10 percent of the population, do not have sewer service. It was assumed that this existing but unsewered population would gradually be provided service by 2025. The incremental increases are proposed to be 25 percent by 2010, 50 percent by 2015, 75 percent by 2020 and 100 percent by 2025. The wastewater flows associated with this element were projected in the same was as the existing sewered population; the percentage of the served population was multiplied by the per capita rate of 84 gpcd by the return ratio of 1.0. A 20 percent increase was applied to the projection to take into account I/I.

The new Cumberland Harbour development also has a contractual agreement with the City to provide wastewater service. Based on this agreement, the City is obligated to have adequate capacity to provide a wastewater collection and treatment capacity of 287,500 gpd in 2005 and 400,000 gpd in 2008 and thereafter. Accordingly, these flows were also included in the projections. Table 2.6 presents a summary of the projected average annual day and maximum month average day flows.

Table 2.6
Wastewater Flow Projections

Year	Total Population	Estimated Sewered Population	AAD Wastewater Flow (MGD)	MMAD Wastewater Flow (MGD)
2002	15,103	13,712	1.16	1.33
2005	16,503	15,112	1.61	1.86
2010	19,132	18,089	1.88	2.16
2015	21,911	21,216	2.03	2.33
2020	24,791	24,443	2.24	2.60
2025	27,371	27,371	2.42	2.79

The ability of the existing wastewater infrastructure to provide adequate collection and treatment of the projected flows is discussed in detail in Section 4: Wastewater System Evaluation and Modeling Results. Recommendations for capacity upgrades, reliability and regulatory improvements are also discussed in Section 4.



Water and Wastewater Master Plan

Section 3
Water System Evaluation and Modeling Results

This section presents the results of JJG's evaluation of the City's water system. The City provides water service to all of the residential, commercial, and institutional customers within the city limits of St. Marys, Georgia, with a few additional customers outside of the city limits, as shown in Figure 3.1. The City currently provides approximately 1.7 MGD of water to roughly 5,500 customers on an average daily basis.

JJG's evaluation of the existing water system and future water needs includes:

- Field review of the existing water system infrastructure, including groundwater well pumps, elevated storage tanks, and water distribution system pumps.
- Development of the hydraulic model of the water distribution system, including discussion of existing and future conditions along with recommended improvements
- Discussion of water supply needs

Existing Water System Field Review and Evaluation

Water supply for the City is obtained from three groundwater wells that withdraw water from the Upper Floridian Aquifer. The water distribution system is composed of three Water Treatment Plants (WTP's), two elevated storage tanks and approximately 120 miles of water transmission and distribution mains ranging in size from 2 inches to 12 inches in diameter.

As part of the infrastructure evaluation, the groundwater well pumps, elevated storage tanks, and water distribution pumps were evaluated. Each of these components is discussed below.

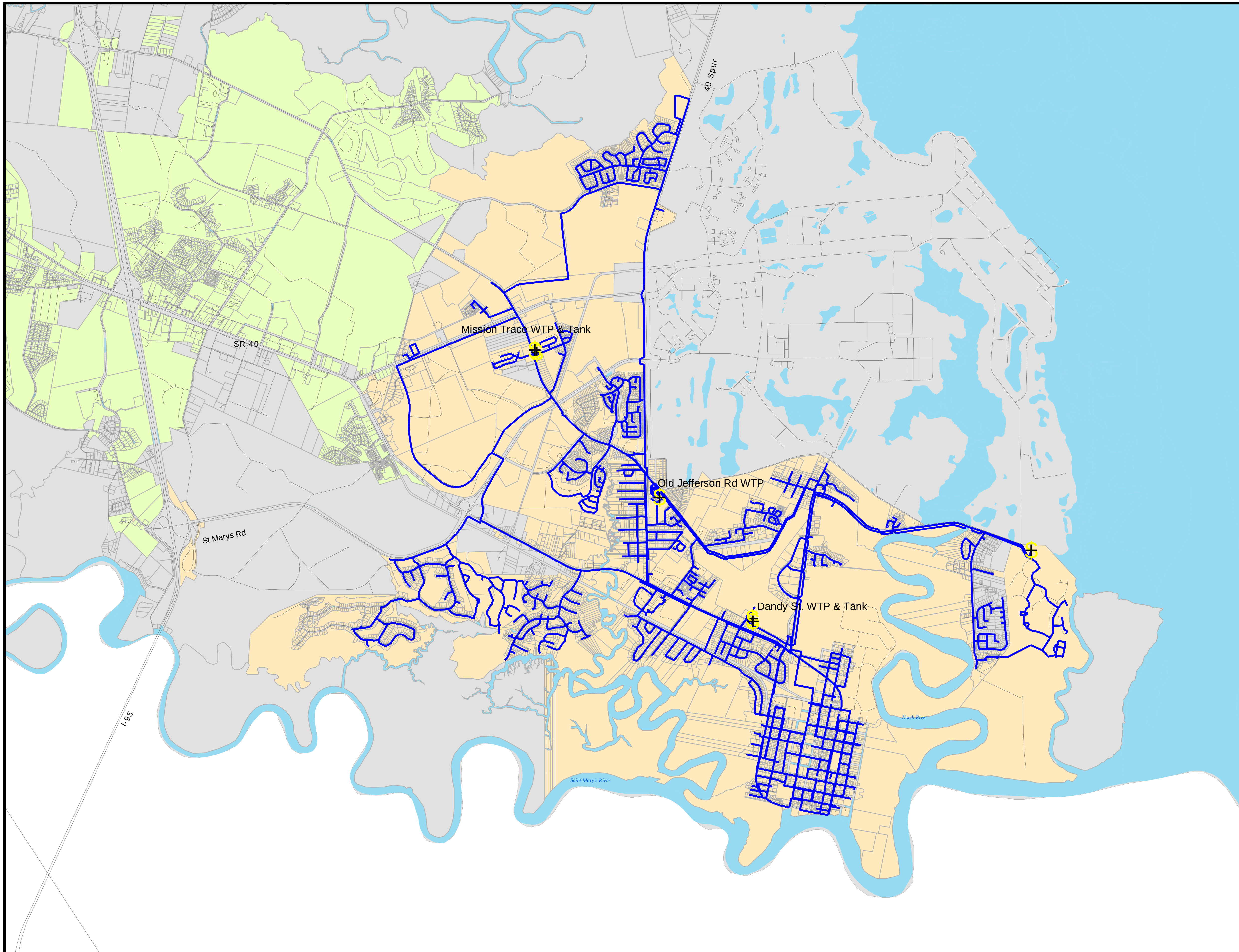
Groundwater Well Pumps

The City currently operates three groundwater wells including the following:

- Mission Trace (No. 4)
- Old Jefferson (No. 3)
- Dandy Street (No. 2)

Each of the well pumps was evaluated and all were found to be in "good" operating condition, with life expectancies of at least 10 years if properly maintained. The combined daily flow supplied to the system from these wells is approximately 2.25 MGD. The water is pumped from these wells using

Figure 3.1:
St. Marys Water
Distribution System



Legend

- Roads
- County
- Kingsland
- St. Marys
- Water Body
- Water Junction
- Wells & Tanks
- Water Pipe

1 0.5 0 1 Miles

JORDAN
JONES &
GOULDING

vertical turbine pumps; the number of stages varies depending on the site. The Mission Trace groundwater well pump has a 125 horsepower (hp) motor with three stages. The Old Jefferson groundwater well pump has a 25 hp motor with four stages, and the Dandy Street groundwater well has a 40 hp motor with four stages. Emergency power is supplied in the form of on-site diesel generators at Dandy Street and Old Jefferson. Dual power feeds (power supplied from two different sources) provide electrical supply redundancy at the Mission Trace site.

Water pumped from the wells is treated with gaseous chlorine and a small amount of fluoride before distribution. Both the Mission Trace and Old Jefferson Street sites store chlorine in the form of one-ton cylinders on-site, which puts them over the threshold amount of chlorine allowed on site without a Risk Management Plan (RMP). According to City water personnel, a RMP has been prepared for this location; however, the plan was not reviewed as part of this evaluation. Figure 3.2 shows the groundwater well pump at Mission Trace, which is typical of the installation at each of the sites.

Figure 3.2
Mission Trace Groundwater Well Pump

Elevated Storage Tanks

Mission Trace and Dandy Street sites each store finished water on-site in elevated storage tanks. The Mission Trace Tank was constructed in 1995 and has a storage capacity of 500,000 gallons. The Dandy Street Tank was constructed in 1972 and has a storage capacity of 250,000 gallons. Both tanks appear to be in "good" condition and are currently maintained by a service contract between the City and Utility Service, Inc. This contract provides for yearly maintenance and inspection as well as scheduled painting. Also, the contract covers all emergency repairs for the tanks as well as corrective and preventive maintenance.

Distribution Pumps

The distribution pumps at each of the sites were inspected and all were found to be in "good" condition, with an expected life in excess of 10 years, if properly maintained. Figure 3.3 shows the distribution pumps at the Old Jefferson site, which are typical of the installation at the other two sites.

Figure 3.3
Old Jefferson Distribution Pumps

Water Distribution System Model Development

The City water distribution system was evaluated using the H2OMAP Water network analysis computer software developed by MWHSoft, Inc. H2OMAP Water performs steady-state and extended-period analyses of closed-conduit, liquid piping networks, and is built around the EPANET computational engine. Steady-state modeling determines the system condition at one point in time. Extended-period simulation (EPS) models the system over a period of time. This allows the fluctuations in pressures, flows and tank levels to be observed over time. EPS modeling is extremely useful, for example, in determining the effects of extended periods of peak demand. Under steady-state conditions it would not be possible to determine if the storage tanks in the system were re-filled during the overnight hours. With the EPS model, the water levels in the tanks can be monitored to determine if the system is capable of re-filling the tanks or what changes are necessary to insure that the tanks can be re-filled. The City's distribution system was evaluated by performing a 60-hour EPS of the system operation under annual average day and peak day demand conditions.

System Layout

A computer model of the existing water distribution system was developed to include essentially all water mains in the system. In order to build the model, the framework of piping was imported from AutoCAD data provided by City staff. The imported AutoCAD data included the pipe locations, sizes, lengths and materials. In order for the water model to work properly, accurate connectivity is needed to identify the available flow paths within the distribution system. In general, AutoCAD depictions of infrastructure do not record this information. Therefore, the piping connection points and attribute data were verified for accuracy against copies of schematic maps of the water distribution system provided by City staff.

Hazen-Williams roughness coefficients, known as C-values, were assigned to all existing pipes. A C-value of 140 to 130 is typical for new pipe, while a value of 110 to 120 is typical of pipes in service 20 to 30 years. The majority of the City pipes were assigned C-values ranging from 120 to 130.

Once the piping layout was complete, the water storage tanks, WTPs, high service pumps, and other necessary infrastructure were input to the water model. First, the WTPs and high service pump station locations and associated piping connections were input. Next, pump information was obtained from City staff. Since an EPS model requires more than simply a design point to maximize the accuracy of the model, pump curves were obtained from the manufacturer. Table 3.1 provides operational information for the pumps at each pumping station. The complete pump curves used in the model are provided in Appendix A.

Table 3.1
Pump Information Used in the St. Marys Existing Water System Model

Name	Design Flow (gpm)	Design Head (ft)	Shutoff Head (ft)	High Flow (gpm)	High Head (ft)	Impeller Diameter (in)
Mission Trace Pump Nos. 1, 2, and 3	1,500	150	186	2,500	50	13.5
Old Jefferson Pump Nos. 1, 2, 3 and 4	1,000	95	176	1,090	77	12.75
Dandy Street Pump Nos. 1, 2 and 3	730	140	176	1,090	77	12.75

Elevated storage tank location information was provided by City staff and input into the model. Tank overflow elevations were estimated using field pressure data collected at each tank location. The tank bowl depth for the Mission Trace Tank was provided by City staff and the bowl depth for the Dandy Street Tank was estimated based on typical tank dimensions for a 250,000-gallon tank. Table 3.2 summarizes the information used in the model for each tank. Pump controls were provided by City staff and are presented in Table 3.3. A digital elevation map from the Georgia GIS Clearinghouse was used to assign elevations to each pipe junction in the model. Currently, the entire system is operated under one pressure zone.

Table 3.2
Tank Information Used in the St. Marys Existing System Model

Name	Diameter (ft)	Maximum Level (ft)	Ground Elevation at Tank (ft)	Bottom of Bowl Elevation (ft)	Elevation to Overflow (ft)	Service Line Diameter (in)	Altitude Valve (Y/N)	Volume (gal)
Mission Trace Tank	53.3	30	19	128	158	12	Y	500,000
Dandy Street Tank	41.3	25	20	122	147	8	Y	250,000

Table 3.3
Pump Control Information Used in the St. Marys Existing System Model

Name	Control Tank	Pump Controls		Special Control Considerations
		Start Tank Level (ft)	Stop Tank Level (ft)	
Mission Trace Pump Nos. 1-3	Mission Trace	17.0	30.0	Pumps are rotated. Only one pump is operated at any given time.
Old Jefferson Pump Nos. 1-4	Mission Trace	17.0	27.0	Pumps are rotated. Only one pump is operated at any given time.
Dandy Street Pump Nos. 1-3	Mission Trace	17.0	25.0	Pumps are rotated. Only one pump is operated at any given time.

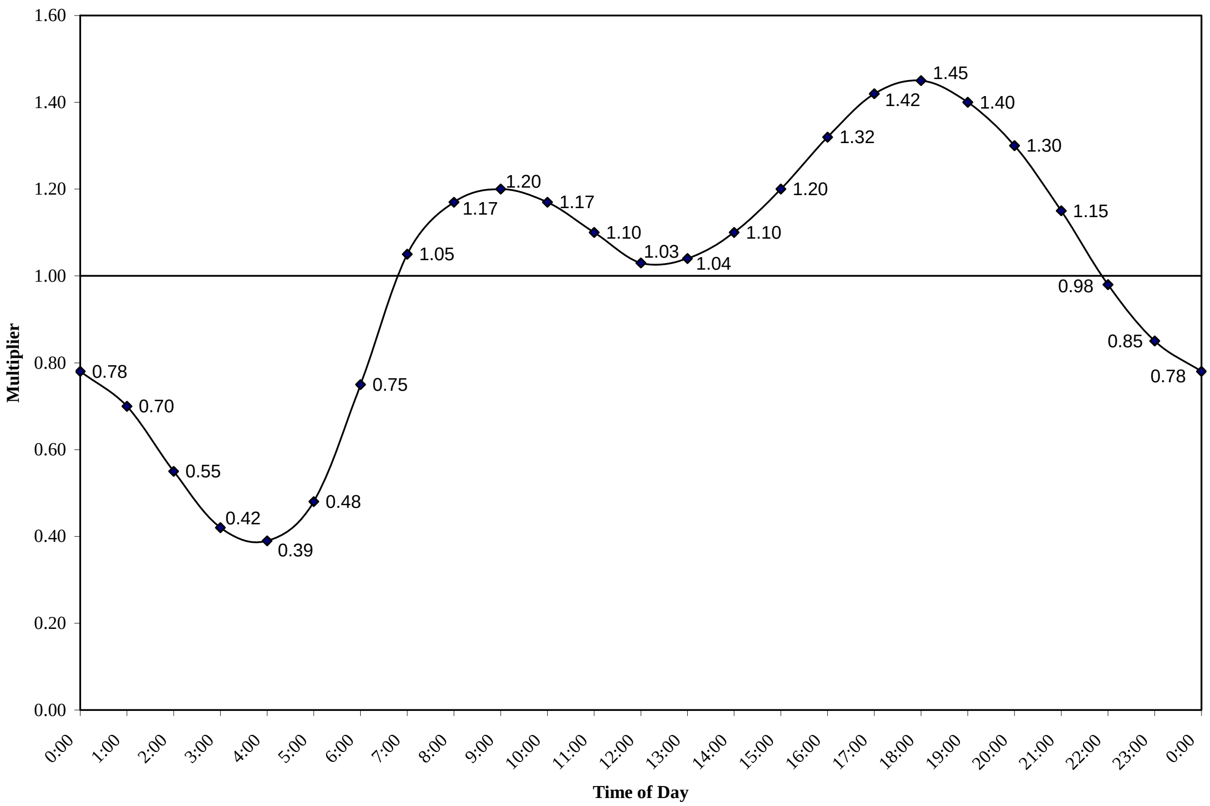
Modeled Water Demands

Water demands were entered into the model based on the 24 month period of monthly billing records from December 2001 to November 2003. Only customers who had billing data as recent as October 2003 were included in the demand disaggregation (allocation of demands within the model). The existing annual average day water demands in the distribution system were disaggregated among the junction nodes in the hydraulic model using ArcView software and custom Avenue software scripts. First, the water billing records provided by the City were spatially located using a geocodable address set. The use of GIS allowed for 93 percent of the non-miscellaneous billing records to be spatially located (1.28 MGD). Next, a script was used to spatially associate the demands of each meter to the closest node from the water model. Once all of the water nodes had been assigned demands, these values were then exported to the model. Finally, a universal multiplier was used to increase all of the demands proportionally until the total demands in the system were equivalent to the annual average amount of water pumped to the system (1.68 MGD) from October 2002 to September 2003. This accounts for billed as well as non-billed water usage within the system.

Diurnal Demand Curve Development

In order to simulate hourly fluctuations in individual water demands, a diurnal demand curve was applied to the demands in the model. A custom diurnal demand curve could not be developed due to a lack of hourly pump discharge and tank level information; therefore, a typical diurnal demand curve developed by the American Water Works Association (AWWA) was used (see Figure 3.4). The AWWA diurnal shows typical peaks in hourly demands during the morning and evening hours, with the largest peak occurring in the evening.

Figure 3.4
AWWA Diurnal Demand Curve



Model Verification

For model verification, City and JJG personnel conducted fire hydrant flow and pressure tests at five key locations in the water distribution system. Fire flow tests within the City's distribution system were conducted on March 24, 2004. General locations of the fire hydrant tests performed are shown on Figure 3.5. These locations included residential and commercial zones within the system.

A minimum of three hydrants was selected for each test. Two hydrants were designated as the residual hydrants and the remaining hydrant was the flowing hydrant. The hydrants were located in the vicinity of small diameter water mains (8 inches or smaller) to provide the greatest localized pressure drop. Pressure gauges were installed on all hydrants, and the normal system pressure (static pressure) was recorded. A flow gauge was installed on the selected flowing hydrant, and this hydrant was opened and allowed to flow until the system pressure stabilized. During the flow tests,

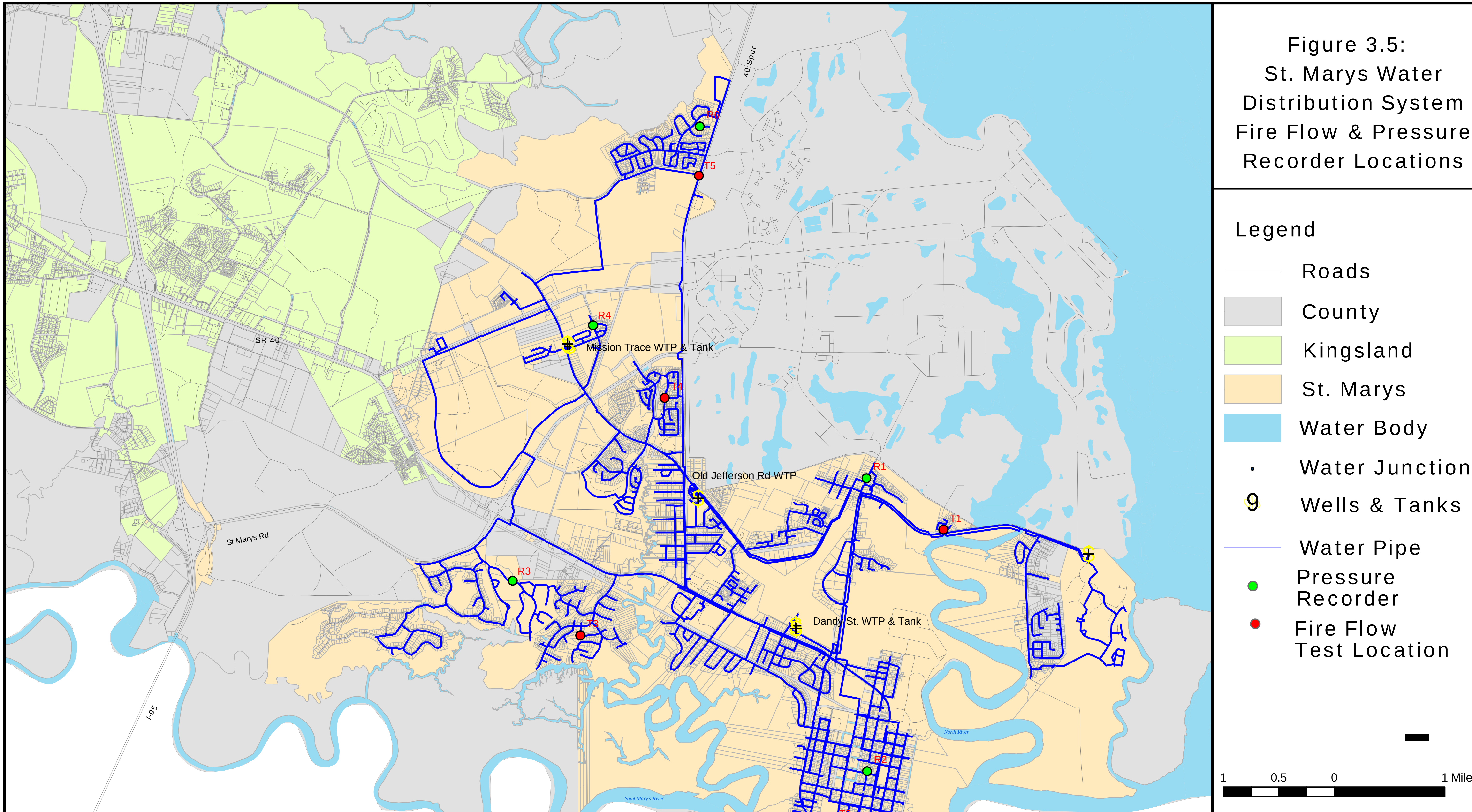


Figure 3.5:
St. Marys Water Distribution System
Fire Flow & Pressure Recorder Locations

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pressures at the residual hydrants were recorded along with the hydrant flow gauge pitot pressure. Using the gauge pitot pressure at the flowing hydrant, a flow rate was calculated. Flows ranged from 701 gpm at North River Causeway and Dolphin Drive to 891 gpm at McIntosh Drive and McQueen Circle.

During the fire hydrant flow testing, other conditions in the distribution system were monitored as follows:

- Pressures at five locations other than the fire hydrant flow testing locations using pressure recorders provided by JJG; these additional pressure locations are shown in Figure 3.5

- Operation of the high service pumps at the three WTPs using the Supervisory Control And Data Acquisition (SCADA) system

- Water levels in all the storage tanks in the system using the SCADA system

The verification analysis consisted of comparing pressures at key locations generated with the H2OMAP model with pressures recorded during field measurements. Verification analyses provide confidence that the model can simulate the actual system performance with reasonable accuracy. A series of model simulations was performed with the existing water distribution network, and the storage tanks generally operated according to observed data. The model results were reviewed for each location, and adjustments were made where appropriate to accurately represent the system operation. The final analysis produced pressures at key locations that were reasonably close to the expected ranges, as shown in Table 3.4. Based on the data in Table 3.4, the hydraulic model was considered verified under steady-state conditions.

Table 3.4
Summary of Model Verification Results

Field Test Results						Model Results		Percent Difference	
Test	**Location**	**Discharge (gpm)**	**Residual Hydrant**	**Static Pressure (psi)**	**Residual Pressure (psi)**	**Static Pressure (psi)**	**Residual Pressure (psi)**	**Static Pressure**	**Residual Pressure**
1	N. River Cswy & Dolphin Dr	701	R1	61	35	60	27.2	2%	22%
			R2	60	30	60	23.8	1%	21%
2	St. Marys St & Barlett St	728	R1	63	42	59	40.1	6%	5%
			R2	60	38	57	38.3	5%	-1%
3	Oakstump Cir	777	R1	59	40	60	42.5	-1%	-6%
			R2	61	32	57	38.5	7%	-20%
4	McIntosh Dr & McQueen Cir	891	R1	62	53	58	48.5	6%	9%
			R2	58	50	60	52.1	-4%	-4%
5	Spur 40 & County Rd 78	843	R1	56	40	54	44.2	3%	-11%
			R2	56	39	54	42.3	4%	-8%

Water System Operating Standards

Operating standards are necessary to ensure that an adequate level of water service is available to customers. These standards are also used to evaluate water distribution system models. If the model indicates that a certain criteria cannot be met, then the model will be used to determine what improvements are necessary to meet the standard. Therefore, the operating standards are both an important part of daily operations, as well as an important part of evaluating recommendations for future service. Operating standards were developed using information from the following sources:

- AWWA *Manual of Water Supply Practices*
- AWWA M31 *Distribution System Requirements for Fire Protection*
- AWWA M32 *Distribution Network Analysis for Water Utilities*
- *Water Distribution Systems Handbook* by Larry W. Mays
- *Modeling, Analysis, and Design of Water Distribution Systems* by Lee Cesario, published by AWWA
- *Water Distribution Modeling* by Thomas M. Walski, Donald V. Chase, and Dragan A. Savic

Water distribution systems generally are designed to meet peak day demand; therefore, most criteria are established based on the peak day demand condition. The operating criteria established can be divided into four categories: system pressure, piping system, fire protection, and system storage. Each of these categories is discussed in detail below.

System Pressure

Pressure criteria vary with particular features and conditions of individual distribution systems. However, the AWWA recommends system pressure within the range of 20 to 100 psi. The maximum recommended pressure is based on the limitations of household appliances, such as water heaters, that can withstand 120 to 130 psi. Based on elevated storage tank elevations and standard operations, the system is currently maintained at a pressure less than 60 psi. Pressures within this range should be available during the various types of demand conditions including average day, peak day and peak hour demands.

The recommended operating criteria are:

- Minimum system pressure: 20 psi at peak day demand condition
- Maximum system pressure: 70 psi at average day demand condition

When evaluating a model, a safety factor of 5 psi generally is applied to the results. For example, if the minimum system pressure goal is 20 psi, then a minimum system pressure of 25 psi would be established for model evaluation. Using the safety factor approach provides an additional level of confidence in evaluating the model conditions, as simplifying assumptions are inherent in the use and application of these types of models. Site-specific conditions may warrant higher operating goals and will be included in the analysis as necessary.

Pipe System

Establishing goals for maximum velocities and headloss within the water distribution system piping is associated with maintaining system pressures and water quality. Pipes with high headlosses or high velocities generally cannot deliver acceptable pressures to the customers within the system. As velocities reach 5 feet per second (fps) or headlosses reach 10 feet/1,000 feet, pressures begin to decrease. AWWA recommends a maximum velocity of 5 fps and a maximum headloss of 10 feet/1,000 feet. In addition, AWWA recommends a maximum headloss of 3 feet/1,000 feet for large diameter transmission mains (generally, pipes 16 inches in diameter and larger). The rationale behind this recommendation is that the large diameter pipes usually convey water long distances and are central to the transmission of water. In large diameter pipes, headlosses greater than 3 feet/1,000 feet tend to become significant because of headloss accumulation in long runs of pipe. Although these recommendations generally are applicable, the effect of high velocities or headlosses on the system pressure should be evaluated to determine if a problem exists. A minimum velocity is also recommended, because low velocities in a pipe can also cause problems, such as the potential for low chlorine residual and bacterial regrowth.

The recommended operating criteria are:

- Maximum instantaneous velocity: 5 fps at peak day demand condition
- Minimum average velocity: 0.1 fps at average day demand condition
- Maximum headloss: 10 feet (4.3 psi) per 1,000 feet of pipe at peak day demand condition
- Maximum headloss for large diameter transmission mains: 3 feet (1.3 psi) per 1,000 feet at peak day demand condition

Fire Protection

Fire protection is an important function of a water service provider. The ability to provide necessary water supply at a given pressure is essential to providing adequate fire protection. Therefore, operating criteria that establish the sustainable fire flow, residual pressure and duration required for specific land use types are necessary. Recommendations for fire flows, residual pressures and durations for different land use types are presented in Table 3.5. Fire flows greater than 1,000 gpm require using more than one hydrant. Therefore, in areas where these types of fire flow demands could occur, fire hydrant spacing should be between 300 feet and 600 feet apart. Areas requiring lower fire flows can have fire hydrants spaced farther apart, up to 1,000 feet.

Table 3.5
Fire Flow Recommendations

Land Use Type	Maximum Level of Service Provided (gpm)	Minimum Residual Pressure (psi)	Duration (hours)
Single Family Residential	1,000	25	2
Multi-family Residential	1,500	25	2
Commercial/Industrial	3,000	25	3

When using a distribution system model to evaluate fire flows, AWWA recommends that the fire flow be evaluated at the average demand of the peak day. The likelihood of a large fire occurring at the peak hour of the peak day is small, and planning for this condition could result in over-design of system components.

System Storage Capacity

Storage of water is an important component of system operation. Water is stored to equalize supply and demand in the long term, to equalize pumping rates in the short term, and to furnish water during emergencies such as fires, pipe breakage, loss of pumping capacity, and contamination of the water supply source. AWWA recommends that enough storage capacity be available to provide fire flows, emergency demands and to meet hourly fluctuations in demand. Typically, storage capacities varying from 20 percent to 25 percent of the annual average day demands are recommended.

Water Distribution System Evaluation

This section describes the specific modeling scenarios of the City water system, and identifies the issues to be overcome. It is organized by the major components of all water systems: System Storage, Distribution System, and Water Supply. Recommendations and results are discussed herein, but detailed phasing and cost projections for each recommendation are listed in Section 5.

Existing System Analysis

The four basic water demand conditions modeled for the existing system during this study include the following:

- Average Annual Day demand analyses tested the City water system's capability to meet the annual average daily demand as it varies throughout the day
- Peak Day demand analyses tested system capability to meet the peak day demand as it varies throughout the day without depleting system storage
- Replenishment analyses tested system capability to refill existing storage facilities during off-peak hours
- Fire flow analyses tested system capability to maintain a minimum residual pressure under peak day demand conditions throughout the system in the event of a fire

For the purpose of hydraulic analysis, the modeling base year is represented by the years 2002-2003, since the billing data reference period covered the time period from October 2002 to September 2003. The modeling results indicate that the City water distribution system is capable of providing adequate flow and pressure under existing average day and peak day demand conditions. A few locations in the system were identified as having pipes with high operating velocities (> 4.0 fps) under average and peak day demands. However, these locations were typically at pump station discharges and tank service lines. There were no areas identified with sustained pressures above 70 psi.

Capacity and Operation of Elevated Storage Tanks

The AWWA recommends that system storage should be in the range of 20-25 percent of the annual average day system demand. The annual average day demand in 2025 is projected to be 3.2 MGD. With the planned addition of an elevated tank at the Cumberland Harbor development, the usable storage in the City distribution system will be 1.25 MG, or nearly 40 percent of the AAD. Therefore, no additional system storage is needed to meet the AWWA recommendation.

Storage tanks are used to provide flow in an area when the demand exceeds the system capacity to supply flow to the area and to maintain a hydraulic grade line (system pressure). In general, water in the storage tanks flows out during the peak hour demands and is replenished during off-peak demand periods and the overnight hours. Water system operators typically attempt to maintain tank levels at least 70 to 80 percent full at all times. This guideline provides water volume for an emergency reserve, fire flow demands, transmission line breaks, or loss of supply.

The tanks in the model were evaluated for the simulation period under average day demand conditions and were consistently refilled throughout EPS. All of the tanks maintained a minimum of 57 percent of total volume for the simulation period under average day demand conditions. This high turnover is due to the pump controls currently used by the City that do not activate the system high service pumps until the Mission Trace Tank has dropped to the 57 percent full level (17 feet). The Mission Trace Tank is operated in this manner because the Dandy Street Tank has a lower overflow elevation and therefore, the water level in the Mission Trace Tank must be allowed to drop significantly before the Dandy Street Tank will have any turnover. The Dandy Street Tank typically drops to 66 percent full under these operating conditions.

Under peak day demand conditions the model predicted that the Dandy Street Tank would be completely emptied using the current pump controls. This problem was rectified by adjusting the pump controls for the Dandy Street WTP high service pumps so that they were controlled by the level in the Dandy Street Tank. Once this adjustment was made to the controls, there were no additional operational problems with the tanks.

Distribution System

There are distribution standards regarding the minimum and maximum pressures and velocities in a distribution system. Low pressures can indicate the inability to provide flow to customers and more importantly can expose the distribution system to intrusion of contamination. High pressures are undesirable because of the potential to damage a customer's system or appliances. Low velocities in a distribution system at annual average day flows mean that water may be in the system for a longer period of time, potentially resulting in the loss of disinfectant residual. This could lead to microbial growth in the system, which could be a public health issue or violate disinfectant residual requirements. High velocities cause excessive friction losses and require increased energy to be input to the system to maintain the required pressures and flows and to refill tanks. High velocities can also result in abrasion to the pipe walls and shortened life of the pipe.

Both the average and peak day demand model scenarios were checked for pressures above or below the standards discussed. No areas of the system were noted to have pressures outside the desired range.

There were no areas in the City system with low velocities that cause concern. However, a regular flushing program should be conducted on all dead end lines to ensure a fresh water supply for the customers connected to these lines. The only locations identified as having high velocities were pump discharges and tank service lines where higher velocities are expected to occur.

Fire Flows

The City is committed to providing fire protection to all customers within the city limits of St. Marys. The City has indicated that they would like to provide a minimum of 1,000 gpm at all fire hydrants located in residential zones and 3,000 gpm at hydrants in commercial/industrial zones. These fire flows were determined by the City's desire to improve their Fire Suppression Rating as determined by Insurance Services Office, Inc. (ISO). The model predicts that the distribution system is currently unable to provide these flows at many residential and commercial locations. Therefore, improvements in the distribution system will be needed to achieve the City's fire protection goals.

Future System Analysis

Similar to the existing system analysis, four basic water demand conditions were modeled for the future system during this study:

- Average Annual Day demand analyses tested the City water system's capability to meet the annual average daily demand as it varies throughout the day
- Peak Day demand analyses tested system capability to meet the peak day demand as it varies throughout the day without depleting system storage
- Replenishment analyses tested system capability to refill existing storage facilities during off-peak hours
- Fire flow analyses tested system capability to maintain a minimum residual pressure under peak day demand conditions throughout the system in the event of a fire

For the purpose of hydraulic analysis, the future modeling year is represented by the year 2025, in accordance with the scope of this project. Additional demands were added to the system to achieve the 2025 average day demand of 3.2 MGD (including 25 percent UFW) as shown in Table 2.4. Most of the new system demands were added in locations at which the City has indicated they expect future development to occur. Any additional demands that were not included with these expected developments were applied to various locations along the western area of the distribution system.

In addition to the future demands, a few infrastructure improvements have already been planned and these were incorporated into the future system model as well. These improvements include:

- A 12-inch transmission main along Point Peter Road from Osborne Road to the North River Causeway and along the North River Causeway from Point Peter Road to the new Cumberland Harbor development

- A new 500,000-gallon elevated storage tank and pump station located near the entrance of the new Cumberland Harbor Development

Additionally, distribution system improvements needed to upgrade the City's fire protection capabilities were also developed using the 2025 system model under peak day demand conditions.

The modeling results indicate that the City water distribution system is capable of providing adequate flow and pressure under the 2025 average day and peak day demand conditions. A few locations in the system were identified as having pipes with high operating velocities (> 4.0 fps) under average and peak day demands. However, these locations were typically at pump station discharges and tank service lines. There were no areas identified with sustained pressures above 70 psi.

For continued good operation of the system, existing pipes should be replaced once they reach the end of their useful life. For estimating purposes, a pipe replacement program was developed that assumes one percent of the existing pipes are replaced annually. There is approximately 500,000 ft of pipe with diameters 6-inches or larger; therefore, the annual replacement would be approximately 5,000 ft of pipe. Older pipes should be replaced first. In addition, a small pipe replacement program should be established to replace those pipes smaller than 6-inches in diameter; this will serve to increase fire flow capacity and the number of fire hydrants within the City. The following protocol was established to consider the small pipes that need to be replaced:

- Dead end lines longer than 300 ft
- Loop lines longer than 500 ft

There is approximately 103,400 ft of small diameter pipes in the system. Not all these pipes will require replacement based on the above criteria. The City Staff should determine which pipes should be replaced based on the model and field evaluation.

Capacity and Operation of Elevated Storage Tanks

The tanks in the model were checked for the simulation period under average day demand conditions and were refilled. The Mission Trace Tank maintained a minimum of 57 percent of total volume for the simulation period under average and peak day demand conditions. As stated previously, this high turnover is due to the pump controls currently used by the City which do not activate the system high service pumps until the Mission Trace Tank has dropped to the 57 percent full level (17 feet). However, there does not appear to be a problem refilling the Mission Trace Tank, using one high service pump at the Mission Trace WTP and one at the Old Jefferson WTP.

As discussed in the existing system evaluation the Dandy Street WTP high service pump controls should be adjusted to allow those pumps to be controlled by the level in the Dandy Street Tank. Additionally, two of the Dandy Street WTP high service pumps were needed to maintain a minimum level of 60 percent full in the Dandy Street Tank under peak day demand conditions.

Pump controls were developed for the new Cumberland Harbor Tank and Pump Station which allowed that tank to decrease to approximately 70 percent full before refilling the tank. There were no problems refilling the tank.

These minimum tank levels, along with the tank locations allow pressures above 40 psi to be provided to the entire system under 2025 peak day conditions as predicted by the model.

Table 3.6 summarizes the pump controls developed in the model for the future distribution system.

Table 3.6
Controls Information Used in the St. Marys Future System Model

Name	Control Tank	Pump Controls: Start Tank Level (ft)	Pump Controls: Stop Tank Level (ft)	Special Control Considerations
Mission Trace Pump Nos. 1-3	Mission Trace	17.0	30.0	Pumps are rotated. Only one pump is operated at any given time.
Old Jefferson Pump Nos. 1-4	Mission Trace	17.0	27.0	Pumps are rotated. Only one pump is operated at any given time.
Dandy Street Pump No. 1	Dandy Street	20.0	25.0	Dandy Street Pump No. 3 is on standby.
Dandy Street Pump No. 2	Dandy Street	15	22.5	Dandy Street Pump No. 3 is on standby.
Cumberland Harbor Pump Nos. 1-2	Cumberland Harbor	25	37.5	Pumps are rotated. Only one pump is operated at any given time.

Distribution System

Both the average and peak day demand model scenarios were checked for pressures above or below the standards discussed. No areas of the system were noted to have pressures outside the desired range.

There were no areas in the City system with low velocities that cause concern. However, a regular flushing program should be conducted on all dead end lines to ensure a fresh water supply for the customers connected to these lines. The only locations identified as having high velocities were pump discharges and tank service lines where higher velocities are expected to occur as well as the 8-inch transmission main on the bridge portion of the North River Causeway. A replacement of this pipe was not recommended because it was just recently installed and the velocities predicted are not unreasonably high (approximately 7.5 fps).

Fire Flows

Several new transmission mains and service lines are recommended to achieve the City's fire protection goals discussed previously. These improvements are summarized in Table 3.7. A detailed listing of the improvements, including probable costs, is provided in Section 5. A total of 44 projects have been identified for the fire protection improvements program. Project sheets highlighting the recommended improvements are provided at the end of this section.

Table 3.7
Summary of Water Distribution System Improvements

Project ID	Project Description	Diameter (in)	Length (ft)
W1	Transmission main along Douglas Drive and Sloan Street from Old Jefferson WTP to the intersection of Point Peter Road and N. River Causeway	12	12,100
W2	Transmission main along Douglas Drive, Spur 40, and Osborne Road from the intersection of Douglas Drive and Colerain Road to the intersection of Point Peter Road and Osborne Road	12	16,100
W3	Transmission main along Osborne Road, Osborne Street, and Ready Street from the intersection of Point Peter Road and Osborne Road to the intersection of Ready Street and East Bryant Street	12	9,500
W4	Transmission main along Dillworth Street from the intersection of Dillworth Street and Osborne Road to the intersection of Dillworth Street and Mildred Street	12	6,900
W5 - W44	Additional pipe replacements and installations throughout the system	6 - 12	45,700
	Small pipe replacement program (< 6-inch diameter)	6	103,400
	Pipe replacement program	6-12	500,000

Water Supply

Table 3.8 summarizes the predicted water supply requirements at each WTP under 2025 peak day demand conditions with and without the 3000 gpm commercial/industrial fire flow, as well as the existing pumping capacity for each well. As shown in Table 3.8, larger well pumps will need to be installed at the Dandy Street WTP and the Old Jefferson WTP to meet 2025 peak day instantaneous demands under the commercial/industrial fire flow conditions. Additionally, the wells at all three of the WTP's should be evaluated to determine their current condition, their need for future maintenance, and their effective yields.

Table 3.8
2025 Peak Day Water Supply Needs for each WTP

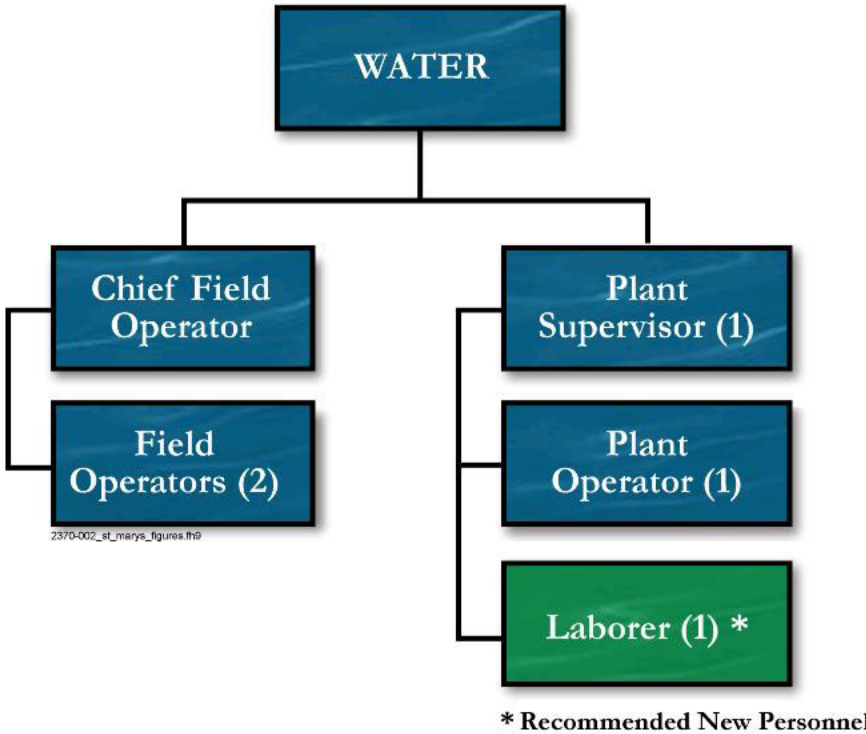
Name	Current Well Pump Capacity (gpm)	2025 Peak Day Average Demand without Fire Flows		2025 Peak Day Instantaneous Demand with Fire Flows	
		gpm	MGD	gpm	MGD
Mission Trace WTP	2,000	1,590	2.3	1,880	2.7
Old Jefferson WTP	1,000	760	1.1	1,840	2.6
Dandy Street WTP	750	950	1.4	1,950	2.8

St. Marys has a water withdrawal permit of 3.0 MGD on a monthly average basis and a yearly average withdrawal of 2.5 MGD. The 2025 projected annual average water demand is 3.2 MGD if UFW remains at the same level as today. An increase in the water supply permit, which could require the development of additional groundwater sources, will need to be obtained by 2010 to meet projected demands, if UFW remains at the same levels. A water supply study to evaluate the availability of water resources to meet the projected demands is recommended once EPD has completed the "Sound Science Study", which is currently being conducted to gather aquifer information and to develop strategies for future water use and protection of the Upper Floridan Aquifer. This study is scheduled to be released in December 2005.

Evaluation of Personnel Needs

The Public Works Department has 5 employees who operate and maintain the water treatment and distribution system. Currently, two individuals are in charge of operating the water treatment plants with three individuals assisting with distribution system repairs and maintenance. Proper distribution system maintenance includes exercising valves, investigating and repairing leaks, and flushing low velocity lines. To provide assistance to the existing staff – both at the WTPs as well as in the field operations, a laborer position is recommended. This staffing level will ensure that daily maintenance and repair issues can be addressed in a timely manner. Additional backup staffing should also be provided from other water/wastewater staff in the City, such as plant operators. Figure 3.6 presents the organizational chart for the water operations and maintenance.

Figure 3.6
Water System Organizational Chart



Water and Wastewater Master Plan

Section 4
Wastewater System Evaluation and Modeling Results

This section presents the evaluation of the wastewater collection and treatment facilities. St. Marys' wastewater collection system serves the majority of the City and portions of Camden County, as shown in Figure 4.1. The sanitary sewer system includes a network of approximately 110-miles of force mains and gravity sewers ranging in size from 2-inches to 24-inches in diameter. Due to the relatively flat terrain of the area, the system currently operates 60 lift stations that transfer flow from one gravity system to another or directly to one of the wastewater treatment facilities. The Georgia EPD issued St. Marys a consent order on December 15, 2003 requiring the City to evaluate its lift stations and to eliminate overflows.

Wastewater is conveyed to one of two existing treatment facilities: The Weed Street WWTF and the Point Peter WWTF. The two treatment facilities have a design treatment capacity of 1.25 MGD on a Maximum Month Average Day Flow (MMADF) basis. A third wastewater treatment facility, the Scrubby Bluff WWTF, is currently under construction and is scheduled for completion by late Summer 2004. The Scrubby Bluff WWTF has a design capacity of 0.5 MGD, which will provide the City with a total of 1.75 MGD of treatment capacity on a MMADF basis.

This section includes the following topics:

- Field review of the existing wastewater collection system facilities, which includes recommended improvements
- Development of the hydraulic model of the collection system, including discussion of existing and future conditions along with recommended improvements
- Discussion of the existing treatment facilities and future capacity needs

Collection System Evaluation

The wastewater collection system was evaluated by performing a field inspection as well as hydraulic modeling. During the field evaluation the condition of the existing infrastructure was assessed. The hydraulic model was developed and used to assess the ability of the existing system to convey wastewater flows to treatment facilities under existing and future flow conditions. The results of both evaluations are presented below.

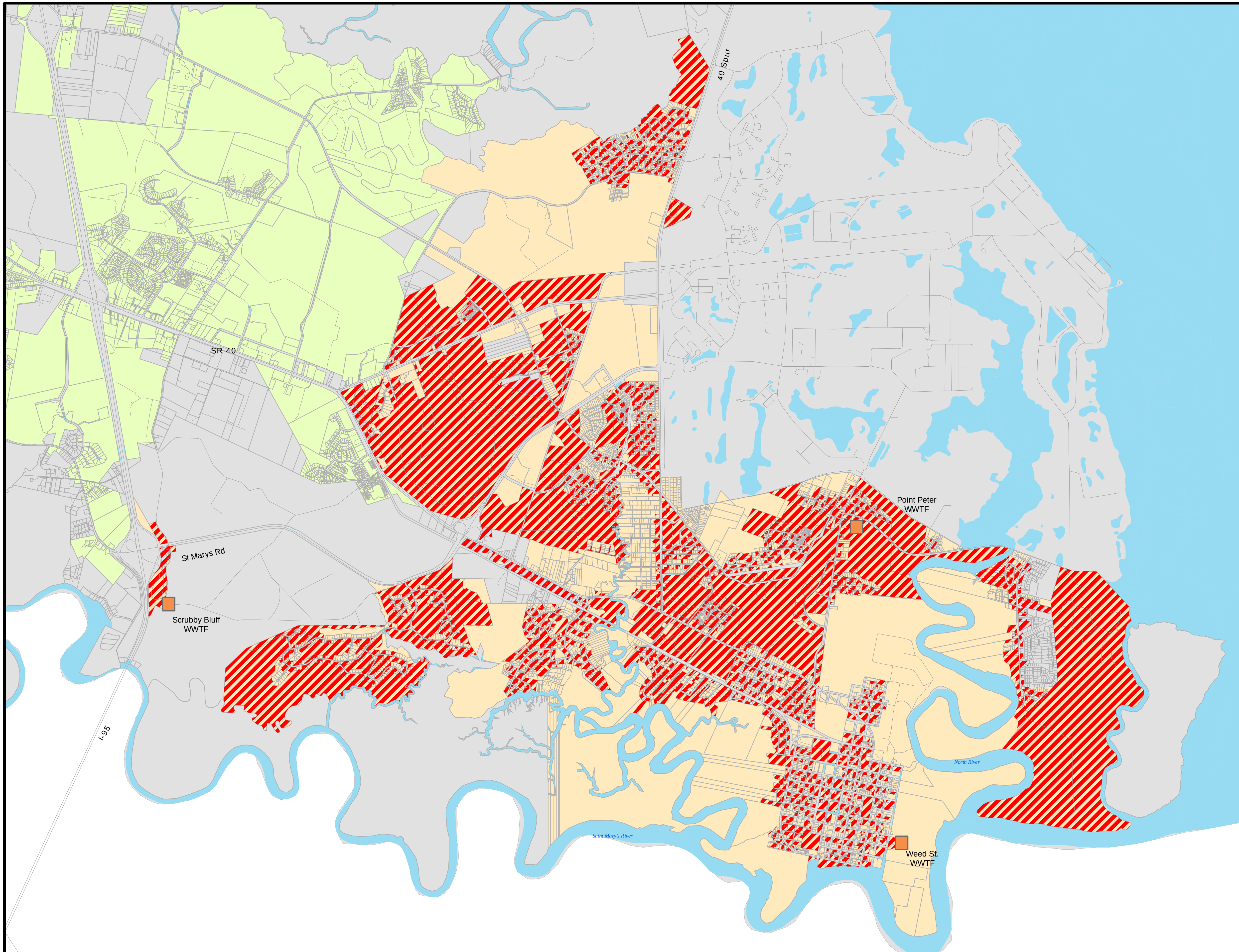


Figure 4.1: St. Marys Wastewater Collection System Existing Service Area

Legend
Roads
Water Body
Existing Service Area
County
Kingsland
St. Marys

0.9 0.45 0 0.9 Miles

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Field Evaluation of Lift Stations

On January 20-21, 2004, a field evaluation of the wastewater infrastructure was conducted for the City. The inspection focused on the wastewater lift stations and two wastewater treatment facilities. The findings of the evaluation and recommendations of any immediate actions needed to address serious problems noted in the system are presented in this Plan.

At the time of the field evaluation, 55 lift stations were in operation and were assessed. Since January, five additional lift stations have begun operation. These 60 lift stations convey wastewater flow to the Point Peter and Weed Street WWTFs. A new wastewater treatment facility, the Scrubby Bluff WWTF, is currently under construction to relieve capacity issues.

The lift stations were evaluated using a three-tier system, which consisted of assigning a rating of good, fair and poor to various critical components of each station. The components evaluated and rated consisted of the wet well condition, discharge valve condition, discharge-piping condition, guide rail conditions, outside panel conditions, and when possible, pump conditions. Lift station ratings are defined as follows:

- ***Good:*** indicates the lift station may need rehabilitation in the next 5 to 10 years
- ***Fair:*** indicates the lift station may need rehabilitation in the next 3 to 5 years
- ***Poor:*** indicates the lift station needs rehabilitation within the next year

Each evaluation component is described below.

Wet Wells

The condition of each of the lift station wet wells was evaluated. The only stations needing immediate wet well rehabilitation are Lift Stations Nos. 9, 29, and 39, where visible signs of deterioration or liner separation were apparent (See Figure 4.3 for lift station locations). The deterioration of the liners could lead to potential failure at any time and liner material could potentially damage the station pumps. The condition of these wet wells was rated as "poor" (requiring immediate attention).

Discharge Valves

The discharge valves at each station were evaluated during site visits, and the majority of the valves and valve vaults appeared to be in "good" operational condition. However, in the process of evaluating the valves, it was apparent that many of the valve vaults have not been inspected in recent months. As part of the routine inspection program for the stations, the valve vaults should be opened and the valves inspected on a weekly basis. Additional problems noted at several of the stations were missing valve springs and submerged valves. It is important to keep the proper closure springs on the valves for proper and consistent operation. Further, it is important to keep the valve vault dry to avoid corrosion and to provide maintenance access. It is recommended that missing springs be replaced and that the water in the valve vaults be removed.

Guide Rails

In several of the stations, problems with the pump guide rail system were noted. These problems ranged from severe corrosion to loose or detached rails. The guide rail system plays an integral part in aligning pumps in correct orientation to the discharge piping during installation and ensuring proper pump performance. Misalignment of the pumps with the discharge piping could cause the station to be unable to pump required flow and potentially lead to a station overflow. Problems with the guide rail system can also make it extremely difficult to remove and set pumps. Guide rails in all lift stations should be inspected monthly for integrity. The life span of the guide rails will depend on age of the station, number of times pumps are removed, and the relative corrosive atmosphere of the station.

Discharge Piping

The condition of the discharge piping was evaluated at each of the stations. Because of the long detention times in the force mains, high concentrations of hydrogen sulfide are produced in the mains and released in the station wet wells. This is not an unusual situation in areas where there are long, relatively flat runs of collection lines and force mains, such as in coastal areas. This corrosive atmosphere can cause accelerated deterioration of the stations' piping as well as the other components inside the wet well and above the water line. The piping of Lift station No. 22 is a good example of this type of severe corrosion. If left unchecked, the corrosion will eventually deteriorate the piping to the point of failure.

Electrical Panels

The outside electrical panel conditions were evaluated at each station; the majority of the panels were constructed of stainless steel and appeared to be in "good" shape. However, there were several deficiencies noted throughout the system relating to wiring and inside panel conditions. The majority of the inner panel doors were missing, which allows someone to open the outside panel door and gain easy access to high voltage starters and circuits. This type of situation creates a major safety hazard for personnel working on the panel. Proper hand-off-automatic (H-O-A) switches were missing from several of the panels and non-standard replacements for these components had been installed. There was also evidence of short-circuiting leading to an electrical fire in one of the panels. The deficiencies in the panels should be addressed immediately and proper switches and safety guards should be installed.

Pumps

The majority of the lift stations in the City's system contain submersible pumps. Submersible pumps are placed directly in the station wet well and are normally completely under water during normal operation. Because of the difficulty in inspecting and assessing the submersible pumps, only the above ground, wet well-mounted pumps were inspected. There are currently three types of lift stations in service in the collection system besides the submersible lift stations. These stations consist of the following: four Smith & Loveless above ground stations (Nos. 6, 13, 14, and 42); one Smith & Loveless can station (dry pit, below ground station, No. 37); and one Hydromatic above ground station (No. 16). The major problem identified with these six lift stations was the inability to maintain a reliable vacuum assist system. The vacuum assist system is used on Smith & Loveless stations to aid the pumps in creating suction in order to lift the sewage from the wet well and pump it through the discharge piping. According to City personnel, vacuum pumps are routinely in need of replacement in these stations due to the high concentration of corrosive gases found at these stations (e.g. hydrogen sulfide). It was also reported that check valves at these stations have been an on-going maintenance problem.

At Lift Station No. 6, a Smith and Loveless above ground station, several problems were identified. These problems included severe corrosion in the station and a pump leaking oil. As a possible improvement to the system, the City might investigate standardizing the system by replacing these above ground stations with submersible pumps as the stations reach the end of their useful lives.

Supervisory Control and Data Acquisition (SCADA)

Eighteen lift stations currently have alarm auto dialers. Upgrading the existing auto dialer system to an expandable auto dialer system is a scheduled system improvement currently underway. The new auto dialer system can be expanded to a true Supervisory Control and Data Acquisition (SCADA) system that could collect data in addition to alerting personnel to failures. A centrally located SCADA PC would be used to automatically call each lift station and acquire status reports of functions being monitored. In addition, the new system is expandable and the majority of the lift stations will be connected to the system over the next 5 years.

A summary of each lift station and the rating for each component is presented in Table 4.1.

.

Table 4.1
Lift Station Evaluation Summary

Lift station Number	Type of Station	Wet Well Condition	Valve Condition	Guide Rail Condition	Discharge Piping Condition	Outside Panel Condition	Pump Condition	Equipped with IDS Monitoring
LS #1 - Weed St. Plant	Submersible	Fair – Some Corrosion	Good	Fair	Fair	Good	N/A	√
LS #2 - Seminole St.	Submersible	Good	Poor - Underwater	Good	Fair	Good	N/A	
LS #3 - Ashley@Nancy Drive	Submersible	Good	Good	Poor - Detached Rails	Good	Fair	N/A	
LS #4 - Borrel Blvd@Bridge	Submersible	Good	Good	Good	Good	Good	N/A	√
LS #5 - Park St.	Submersible	Fair – Some Corrosion	Fair - Some Corrosion	Good	Good	Good	N/A	
LS #6B - 40@SPR40@School	S&L - Above Ground	Fair – Some Corrosion	Fair	N/A	Good	Poor - Rust	Poor - Leaking Oil	√
LS #7 N. Julia@Plum	Submersible	Good	Fair	Good	Good	Fair	N/A	
LS #8 Pt. Peter Rd@T. St.	Submersible	Good	Fair	Good	Good	Fair - Rust	N/A	√
LS #9 Pt. Peter Rd@Ballpark	Submersible	Poor - Liner Separating	Good	Good	Good	Good	N/A	√
LS #10 Finley@Wheeler	Submersible	Good	Fair	Fair	Fair	Good	N/A	√
LS #11A Alexander St.	Submersible	Fair – Some Corrosion	Fair	Fair	Fair	Good	N/A	√
LS #11B Alexander St.	Submersible	Good	Good	Good	Fair	Good	N/A	
LS #12 907 Dilworth	Grinder	Good	N/A	N/A	Good	N/A	N/A	
LS #13 Douglas Dr.@Airport	S&L - Above Ground	Good	Fair	N/A	Fair	Poor - Rust	Fair	
LS #14 Dufour@Washington	S&L - Above Ground	Good	Fair	N/A	Good	Poor - Rust	Fair	
LS #15 Colerain@Sugarmill	Submersible	Fair - Some Corrosion	Fair	Poor - corrosion	Fair	Good - Inside Panel (Poor)	N/A	√

Table 4.1
Lift Station Evaluation Summary

Lift station Number	Type of Station	Wet Well Condition	Valve Condition	Guide Rail Condition	Discharge Piping Condition	Outside Panel Condition	Pump Condition	Equipped with IDS Monitoring
LS #16 10917 Colerain Rd.	Hydromatic – Above Ground	Fair – Some Corrosion	Good	N/A	Good	Good	Good	√
LS #17 Mission Tr.@Topique	Submersible	Good	Good		Good	Good	N/A	
LS #18 Colerain/KGSBay Rd.	Submersible	Fair – Some Corrosion	Good	Good	Poor	Good	N/A	√
LS #19 Winding Rd@Canal	Submersible	Fair – Some Corrosion	Fair	Good	Fair	Good	N/A	√
LS #20 CR Riv Plt@Plt Circle	Submersible	Fair – Some Corrosion	Fair	Good	Fair	Good	N/A	
LS #21 CKR Riv Plt@Woodln	Submersible	Good	Good	Good	Fair	Good	N/A	√
LS #22 FoodLion	Submersible	Good	Poor	Poor - Detached Rails	Poor	Good - Inside Panel (Poor)	N/A	
LS #23 Shdwlawn@Privettes	Submersible	Good	Good	Good	Good	Good - New	N/A	√
LS #24 Shdwlawn@Slt Grass	Submersible	Good	N/A - Below Ground	Good	Good	Good	N/A	
LS #25 Cinema 9	Submersible	Good	Fair	Fair	Poor	Good	N/A	
LS #26 Riverview Sub	Submersible	Fair – Some Corrosion	Poor - Underwater	Good	Good	Good	N/A	
LS #27 End S. Julia	Grinder	Good	N/A	N/A	Good	N/A	N/A	
LS #28 PPTP@Ponds	Submersible	Good	N/A	Poor - Heavy Corrosion	Good	Good	N/A	
LS #29 PPTP @Entrance Dr	Submersible	Poor - Liner Separating	Good	Good	Good	Good	N/A	√
LS #30 PPTP@Haybarn	Submersible	Good	N/A	Good	Good	Good	N/A	
LS #31 New PP Rd@Lonesome	Submersible	Fair - Some Corrosion	Poor - Underwater	Fair	Fair	Good	N/A	
LS #32 Sugar Mill@New Sav	Submersible	Good	Good	Good	Good	Good	N/A	√
LS #33 Sugar Mill@O Mill Blf	Submersible	Good	Could Not Open Lid	Fair - Some Corrosion	Fair	Good	N/A	

Table 4.1
Lift Station Evaluation Summary

Lift station Number	Type of Station	Wet Well Condition	Valve Condition	Guide Rail Condition	Discharge Piping Condition	Outside Panel Condition	Pump Condition	Equipped with IDS Monitoring
LS #34 Admirals Walk	Submersible	Good	Poor - Underwater	Poor - Heavy Corrosion	Fair	Good	N/A	
LS #35 Shdwlawn DR	Submersible	Good	Fair	Good	Good	Good	N/A	
LS #36 Colerain Oaks Trl Prk	Submersible	Good	Good	Good	Good	Good	N/A	
LS #37 N. Rvr Cswy@Marsh Cve	S&L - Can Station	Good	Good	N/A	Good	Fair - Evidence of Flooding	Good	
LS #38 Crossroads Sub	Submersible	Good	Good	Good	Good	Good	N/A	
LS #39 Osprey Cve@Card Cle E	Submersible	Poor - Needs Lining	Fair	Good	Good	Good	N/A	√
LS #40 Osprey Cve@Card Cle W	Submersible	Good	Fair	Fair	Fair	Good	N/A	
LS #41 Osprey Cve@Grnwall Dr	Submersible	Good	Good	Good	Good	Good	N/A	
LS #42 40@Drk Entry Crk	S&L - Above Ground	Good	Good	N/A	Good	Fair	Good	√
LS #43 Douglas Dr@Telegas	Grinder	Good	N/A	N/A	Good	N/A	N/A	
LS #44 40@Playtime Pools	Grinder	Good	N/A	N/A	Good	N/A	N/A	
LS #45 Pro 3 Golf	Submersible	Good	Good	Good	Good	Good	N/A	
LS #46 Osprey Cve@Tang Cle	Submersible	Good	Good	Good	Good	Good	N/A	
LS #47 Sheriff Substation	Submersible	Good	Good	Good	Good	Good	N/A	
LS #48 St. Marys Rd@Haddock	Submersible	Good	Good	Good	Good	Good	N/A	
LS #50 Herb Bauer Dr	Submersible	Good	Good	Good	Good	Good	N/A	
LS #51	Submersible	Good	Good	Good	Good	Good	N/A	
LS #52	Submersible	Good	Good	Good	Good	Good	N/A	
LS #53	Submersible	Good	Good	Good	Good	Good	N/A	
LS #54	Submersible	Good	Good	Good	Good	Good	N/A	
LS #55	Submersible	Good	Good	Good	Good	Good	N/A	

Inflow & Infiltration Program

The City has implemented an I/I reduction program. City staff are performing smoke testing on critical sections of the collection system. The testing consists of filling the sewer with smoke and locating any improper connections, such as roof drains, or leaks. If the smoke testing indicates any problems, these are corrected as long as they are not on private property. If leaks or faulty connections exist on private property, the property owner is sent a letter describing the problem and that it must be fixed or fines will be assessed. The City also owns one small service camera that is used to visually inspect pipes that are suspected of having leaks. The City does not have a specially designated television-sewer inspection crew, and the camera is only used in instances where other means of inspection are not practical.

Collection System Hydraulic Evaluation

A steady state wastewater collection model was developed for the City's collection system to identify improvements necessary to reliably convey projected wastewater flows to treatment facilities under normal and peak wet weather conditions. The modeling software H20Map Sewer, developed by MWHSoft, was used for this evaluation. Projected infrastructure requirements were identified for three planning horizons: 2010, 2015, and 2025.

Model Development

Model development consisted of first importing the layout of the collection system from existing AutoCAD drawings provided by the City into H20Map Sewer then adding information to the modeling database. The model database has two themes, nodes and links. The node theme represents manhole attributes in the wastewater collection system. The link theme represents sanitary sewer pipe attributes. Approximately 1,900 manholes and 2,000 pipes were included in the model. Special structures such as lift stations, wet wells, and flow control features were also included in the model.

The following data attributes are required for each manhole and wet well, which are represented as nodes (or junctions):

- Node or Junction ID
- X, Y Coordinates
- Top of node elevation
- Storage size of node, constant or stepwise by depth
- Initial depth of water
- Constant inflow (i.e., dry weather flow)

Constant inflows were assigned to manholes in the wastewater model based on the geographically referenced water demands provided by the water model.

The following data attributes are required for links, which are used to represent sewer pipes, force mains, pumps (lift stations) and control structures (i.e., division box, weir):

- Link ID
- Incoming node/Discharge node
- Incoming/discharge pipe invert elevation
- Pipe diameter
- Length, shape, and material of pipe

H20Map Sewer uses characteristic pump curves and operational controls (i.e., pump on/off elevations) to simulate pumping operations. The City provided pump curves, as well as operational controls, for pumps within the collection system. Details regarding the operation of the flow control structures were also provided by the City.

The City's AutoCAD drawings did not provide surveyed rim elevations for all nodes (manholes and storage structures) in the system. Where information was unavailable, a Digital Elevation Model (DEM) in GIS was used to approximate node rim elevations. The DEM was obtained from the Georgia Data Clearinghouse and was the best available elevation data for the area.

Manholes were assumed to be cylindrical with a diameter of 5 feet, which is a typical manhole size. Actual manhole diameters should be obtained and included in the dynamic model. For storage facilities, such as wet wells, constant floor areas were assumed to provide constant volume per unit water depth. In the absence of other data, wet well rim elevations were assumed to be at ground level.

Where manhole invert data was not available, estimates were made from known sewer and wet well invert elevations from the AutoCAD drawings. Estimates were based on minimum slope of the gravity sewer and 0.1 ft rise at manhole locations. Invert elevations of incoming pipes at the wet wells were assumed to be five feet above the floor of the wet well.

Once the data was included in the model, a simulation was attempted to test for any inaccuracies in the data. Reducing the manhole rise, increasing rim elevations, and adjusting pump discharge data corrected data problems that were encountered. A survey of invert elevations would improve the accuracy of the model.

Pump discharge data frequently required adjustment to accurately simulate pump operation data. As the majority of the invert elevations were estimated, inexactness in these estimates allowed the modeled pumps to operate at points along their curves which produced inaccurate discharge heads. Thus, the design point capacity of the pump was used, instead of the entire pump curve, to ensure more realistic pump operation until actual invert elevations can be provided.

Evaluation Criteria

The steady state model simulates an instantaneous point in time and calculates the depth to diameter ratio and velocity for every pipe in the collection system model. Both of these parameters are needed to evaluate the collection system and to determine if the pipe capacity is adequate.

Evaluation criteria were established to determine at what thresholds recommendations would be made. These criteria are as follows:

- When the water level in a pipe exceeded 75 percent of the pipe's depth under peak flow conditions, the pipe was recommended for expansion. The new pipe was sized such that at 2025 peak flow conditions the water level within the pipe was no more than 50 percent of pipe depth.

- When the velocity of a force main exceeded 5 feet per second (fps), expansion was recommended. The new pipe was sized so that at 2025 flow rates, the velocity was reduced to between 2.0 and 3.0 fps.

Operational Data

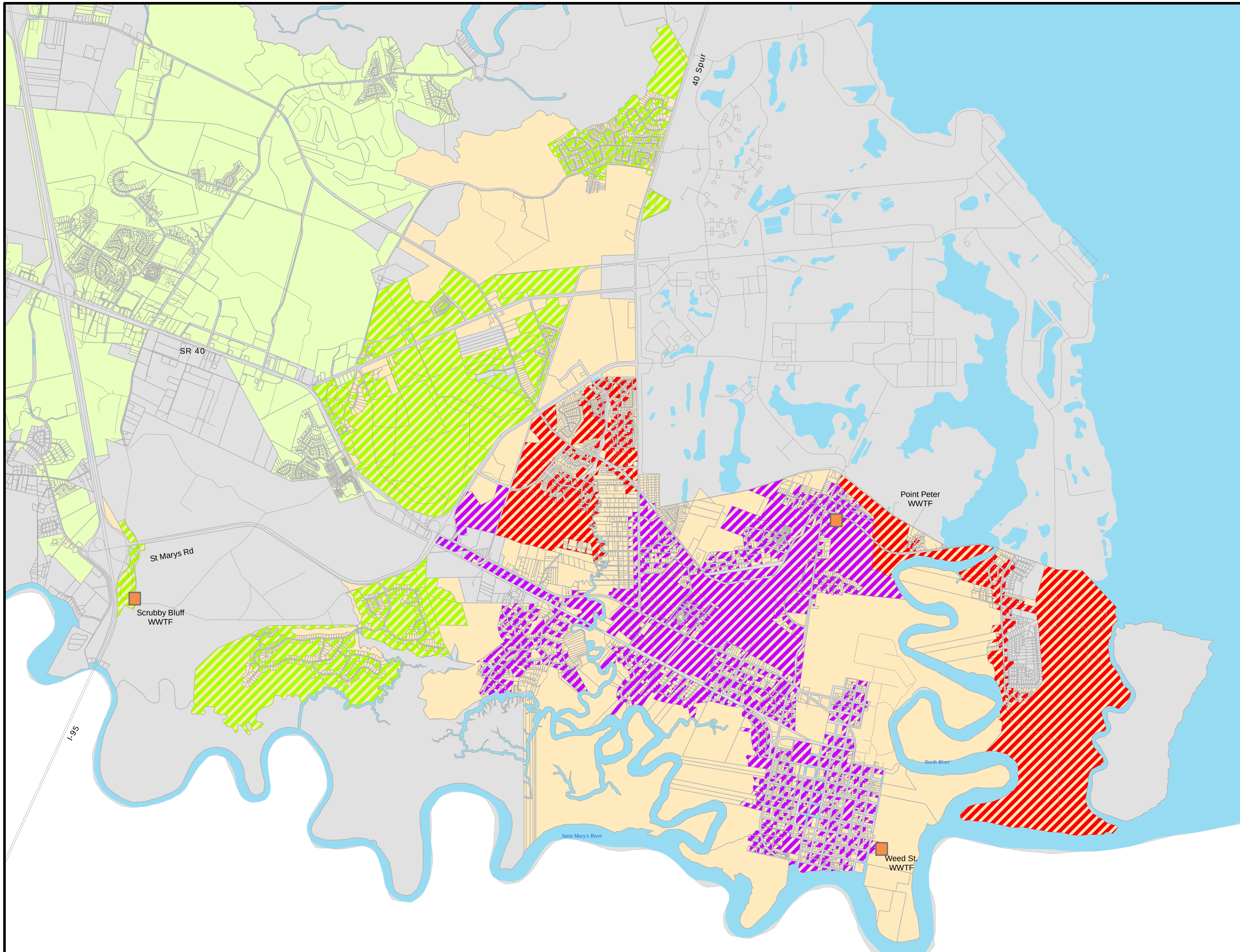
The existing system is serviced by two wastewater service areas: The Weed Street WWTF service area and the Point Peter WWTF service area. Currently, approximately 60 percent of the wastewater flows generated within the Weed Street WWTF service area are rerouted to the Point Peter WWTF via the Alexander Street lift station facility (LS #11A and #11B). As wastewater flows enter the Alexander Pump Station the wet well begins to fill, the lead pump at LS #11A begins pumping to the Weed Street WWTP and the timer starts for the lag pump. When the timer reaches its set point, the lag pump begins pumping to LS #11B until the off float turns off both pumps. Adjustments to the timer varies how long the lag pump runs and therefore, how much flow goes to Point Peter WWTF via LS #11B.

The new wastewater treatment facility, Scrubby Bluff WWTF, is currently under construction and will be operational by late Summer 2004. The Scrubby Bluff WWTF service area boundary was provided by City personnel.

Once Scrubby Bluff WWTF is operational, it will relieve flows from the existing Point Peter WWTF by serving a portion of the area currently served by Point Peter WWTF. A series of new lift stations and force mains are under construction to redirect the flow to the new WWTF. The collection system improvements have been designed with the flexibility of returning to the current flow pathways by utilizing weirs located within the manhole just prior to each of the new lift stations. This flexibility allows all flow to be redirected and treated at the Weed Street and Point Peter WWTFs in the event the Scrubby Bluff WWTF is out of service for any extended period of time.

Since the Scrubby Bluff WWTF will be in operation by late Summer 2004, the system including the Scrubby Bluff WWTF was considered as the existing system for which recommendations were made. Service areas for the three wastewater treatment plants are presented in Figure 4.2.

Figure 4.2:
St. Marys Wastewater Collection System by Service Areas



Legend

Roads

Water Body

Wastewater Treatment Service Areas

Point Peter WWTF

Scrubby Bluff WWTF

Weed Street WWTF

County

Kingsland

St. Marys

0.9 0.45 0 0.9 Miles

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Existing Collection System Evaluation

Sewers are sized based on peak daily flow (PDF); therefore, the existing maximum monthly average day flow (MMADF) that was estimated for each pipe must be increased by a peaking factor to adjust it accordingly. However, the City's system is more complex than the typical one due to the multi-pumping conditions than can create higher peaks than would normally be seen. This is due to the relatively flat terrain that creates the need for the number of lift stations required to convey the flow to another lift station or to gravity sewers.

In order to consider the potentially higher peaks, two peak day scenarios were established for evaluation purposes. These are described as follows:

- Model Scenario A1: Evaluates the ability of the collection system to convey pump discharges plus the peak day inflows from collector sewers, which were estimated by multiplying the MMAD flows by a peaking factor of 2.0.

- Model Scenario A2: Evaluates the ability of the system to convey peak flows without pump discharges. A peak day to MMADF factor of 2.5 was used to represent peak instantaneous flows, which were used in analyzing gravity sewers without considering the impacts of discharges from lift stations.

Model scenario A1 includes evaluations of pump discharges; therefore, it was not used to evaluate gravity sewers that do not have upstream pumps. Both of these modeling scenarios were used to evaluate all gravity sewers downstream of lift stations. The model results from the scenario that produced the worst case were used to identify if infrastructure improvements were needed and to size those improvements.

The majority of the lift stations within the collection system have more than one pump; these pumps typically operate under lead/lag controls based on wastewater depth in the wet well. Steady state computer simulations do not allow evaluation of wet well cycling, pump operation, or diurnal variation in wastewater flows, thus it becomes increasingly difficult to determine the number of pumps in operation at any given lift station at any one point in time.

In an effort to evaluate these pumping effects, an iterative process was used in the model analyses. The model was run once with only one pump on at each facility. Pumps known to not operate concurrently due to differences in head were set to not operate. Moving downstream through the system, the incoming wastewater flow was summed to determine the peak flow being delivered to a particular lift station. If the peak flow was higher than the capacity of one pump then an additional pump(s) was turned on until the lift station capacity exceeded the inflow, or until the maximum number of pumps was in operation. The model was then run again and evaluation continued downstream until all peak flows were transported effectively, or until the full capacity of the station was reached.

<u>Evaluation Results</u>

The existing system analysis indicated that many of the gravity sewers that convey discharge flow from lift stations are not adequately sized to transport these flows and as a result experienced surcharging and in some cases pressurized flows. Figure 4.3 presents the locations of gravity sewers

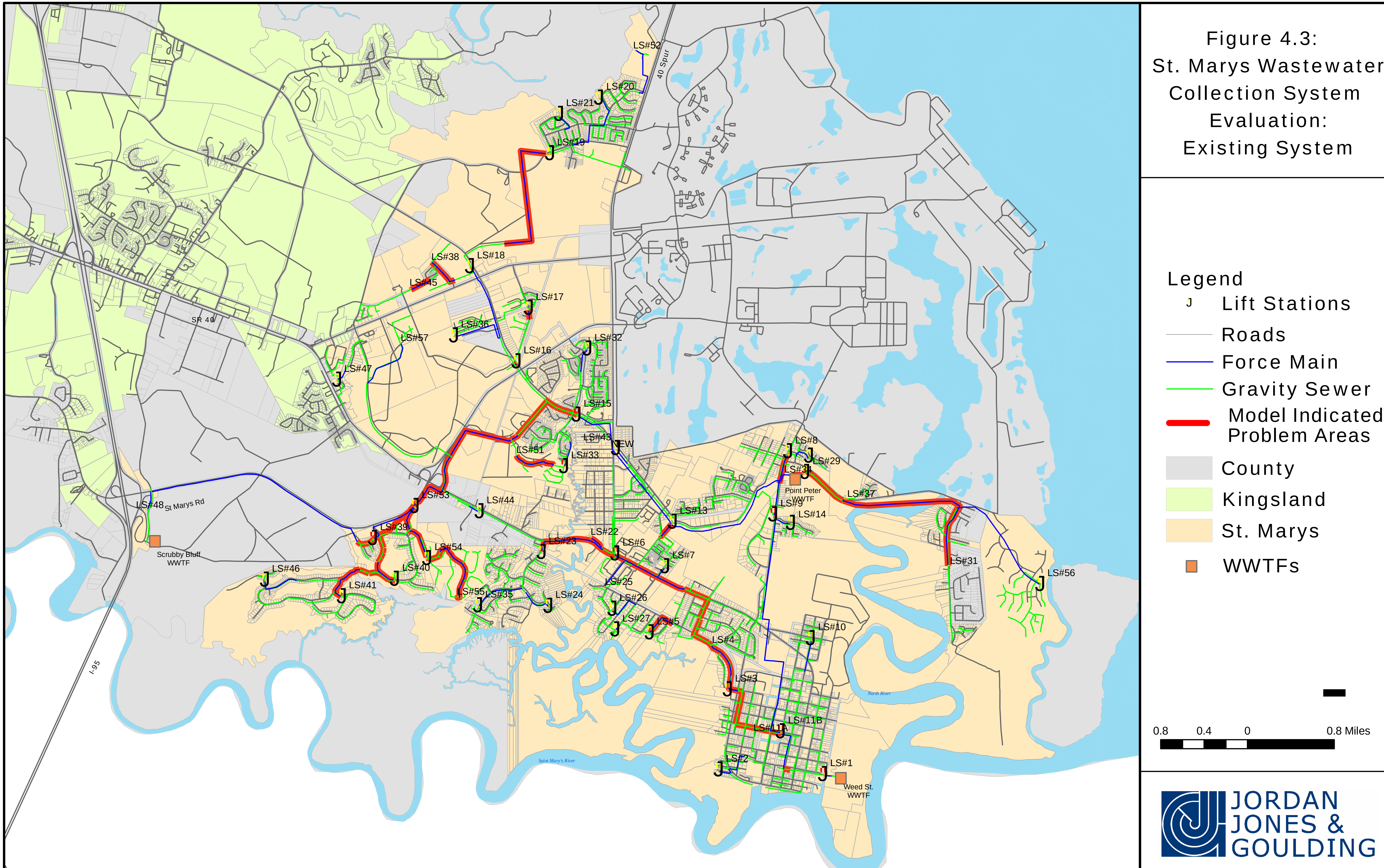

Figure 4.3: St. Marys Wastewater Collection System Evaluation: Existing System

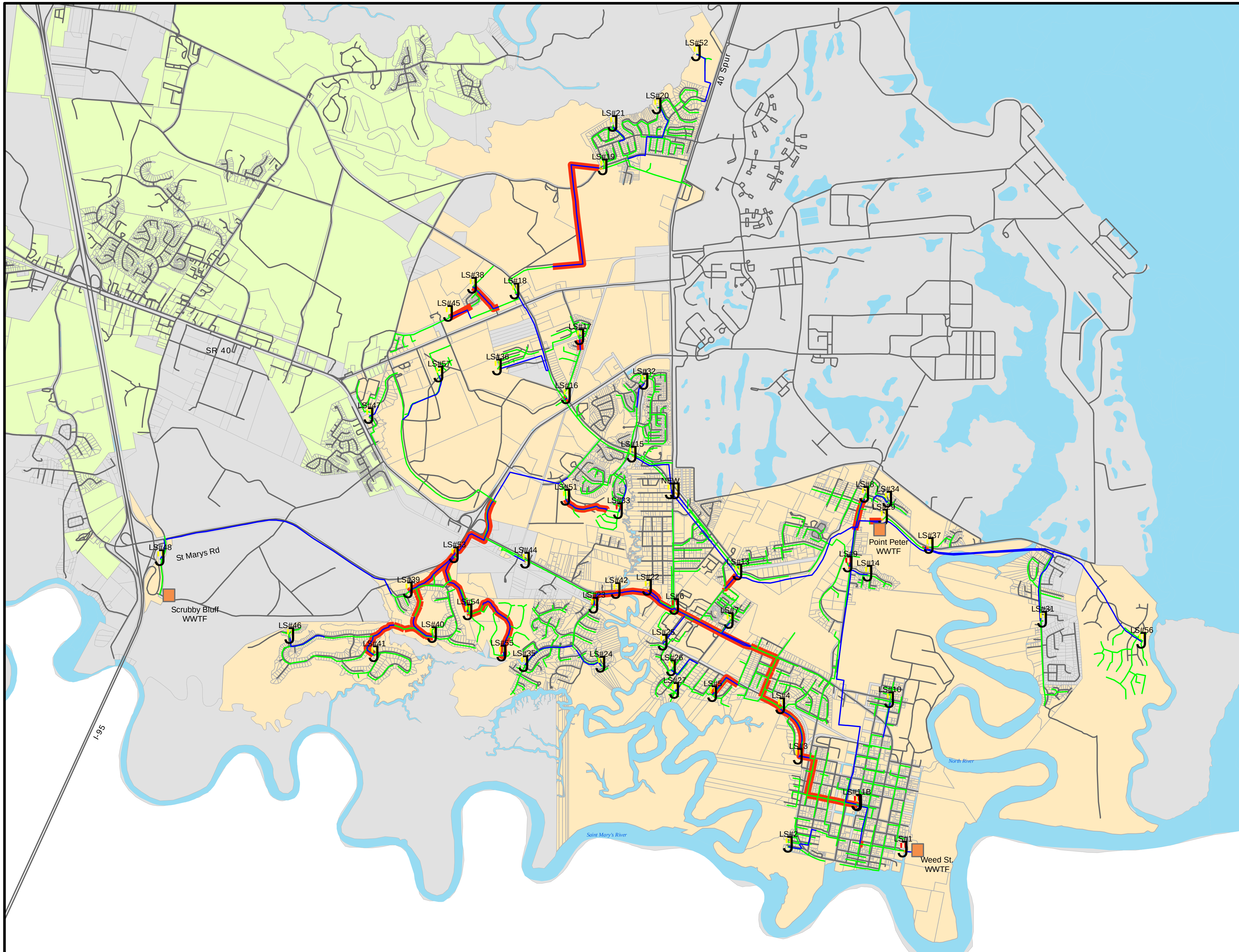

Figure 4.4:
St. Marys Wastewater Collection System Evaluation:
Scrubby Bluff WWTF in Operation

Legend

- Lift Stations
- Roads
- Force Main
- Gravity Sewer
- Model Indicated Problem Areas
- County
- Kingsland
- St. Marys
- WWTFs

0.9 0.45 0 0.9 Miles

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that were found to have problems under Model Scenario A1 without Scrubby Bluff WWTF in operation. Figure 4.4 presents the locations of gravity sewers that were found to have problems under Model Scenario A1, but with the Scrubby Bluff WWTF in operation. Upon comparison of the figures, it is evident that the addition of the Scrubby Bluff WWTF, while relieving capacity needs at the WWTFs, will not eliminate any surcharged lines.

Several pumps within the system were found to be undersized due to peak inflows to the lift stations based on the existing system evaluation; however, a number of pumps were found to be much larger than needed based on peak inflows to the lift stations. In some cases, the oversized, upstream pump caused the downstream lift station's capacity to be exceeded due to peak instantaneous flows delivered to the downstream lift station. Under these circumstances, the most effective solution is to reduce the capacity of the oversized pumps, thereby eliminating the need to increase downstream infrastructure. Where existing facilities were found to be undersized to convey the flow, new pumps, gravity sewers and force mains were recommended to prevent surcharging.

A steady state hydraulic model is not capable of simulating wet well cycling or timing pump operation. Thus, no flow attenuation could be simulated to provide a more accurate measure of the peak flow condition. A dynamic modeling evaluation is recommended to more accurately depict peak instantaneous flows to lift stations and to determine the capabilities of the pumps to transport flows from one or more lift stations.

Future Collection System Evaluation

The existing wastewater collection system was used as the basis for the future wastewater collection system model analyses. The projected 2010, 2015 and 2025 wastewater flows were superimposed on the existing system. Extensions of sanitary service were not physically represented in the models; the proposed flows to be serviced were incorporated at an appropriate, nearby location in the model.

Based on the future modeling scenario results, when all the improvements necessary to prevent surcharging in the existing system are implemented, no additional capacity improvements are required. Of course, due to budgetary constraints not all of the recommended projects can be constructed at once. Therefore, the model was used to prioritize the implementation of recommended improvements for the collections system. Collection system recommendations are presented in Table 4.2. The proposed phasing plan and cost estimates for collection system improvements are presented in Section 5 along with figures depicting the recommended collection system improvements.

Table 4.2
Recommended Piping and Pump Station Capacity Improvements

Lift Station	Description	Diameter (in)	Length (ft)
LS #1	Replace 8-inch GS from LS #11A - 12" FM to existing 15-inch GS on East Weed St.	15	325
LS #5	Replace 4-inch FM from LS #5	8	1,567
LS #6	Replace existing pumps with two 750-gpm pumps and refurbish wet well		
LS #8	Reroute 4-inch FM from LS #8 to new GS of LS #29	8	975
LS #9/15	Replace 6-inch FM with 10-inch FM	10	16
LS #13	Replace existing pumps with two 1,000-gpm pumps		
LS #16	Replace 6-inch FM from LS #16	10	121
LS #16	Modify manhole at LS #16 to redirect flow to Point Peter WWTF		
LS #17	Replace 4-inch FM from LS #17	8	450
LS #22	Replace 4-inch FM from LS #22	8	700
LS #22	New GS for southern portion of Annex	8	10,200
LS #23	Replace 6-inch FM from LS #23 to manifold of LS #23/42	8	1,367
LS #23/42	Replace 6-inch FM from manifold of LS #23/42 and reroute to feed directly to LS #6	8	2,840
LS #29	Rebuild/ repair wet well		
LS #35	Reduce capacity to 2-250 gpm pumps		
LS #37	Replace 4-inch FM from LS #37	8	95
LS #38	Replace 6-inch FM from LS #38	10	1,565
LS #41	Reduce capacity to 2- 250 gpm pumps		
LS #42	Replace 6-inch FM from LS #42 to manifold of LS #23/42	8	18
LS #42	New GS along Sandhill Road and Beverly Street	8	7,560
LS #45	Replace and reroute 6-inch FM from LS #45	8	1,050
LS #51	Reduce capacity to 2-100 gpm pumps		
LS #53	Replace 8-inch FM from manifold of LS #53/39	16	3,075
LS #55	Reduce capacity to 2-250 gpm pumps		
New	Install new 10-inch FM along Winding Road (County Road 78) from LS #19 to GS feeding new lift station	10	2,520
New	New lift station for northern portion of Annex		
New	New GS along Olympic Lane	8	1,300
New	New lift station near the intersection of Deerwood Court and Moeckel Place with 50-gpm pumps		

Wastewater Treatment Facilities Evaluation

The wastewater treatment facilities were evaluated during a field inspection to assess the condition of the infrastructure. In addition, the performance of the existing WWTFs was evaluated using MMR and permit limit data. Capacity needs and recommendations for treatment facility expansions and upgrades are also recommended. Each of these topics is presented below.

Evaluation of Existing Wastewater Treatment Facilities

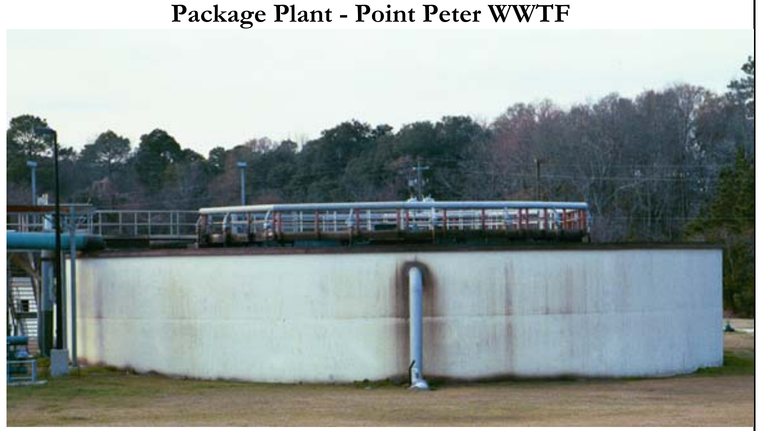
The condition of the City's two wastewater treatment facilities, the Point Peter and Weed Street WWTFs, was assessed during the field evaluation performed on January 20-21, 2004. Recommendations for repairs or rehabilitation are provided.

Point Peter Wastewater Treatment Facility

Located northeast of the St. Marys Airport, the Point Peter WWTF was constructed in 1986 as a package plant (all processes contained in a single tank) treatment facility with a design flow of 0.8 MGD on an MMAD basis. Conventional biological treatment processes are used to treat the wastewater to discharge standards. The facility was upgraded in 2001 with the addition of a new preliminary treatment system consisting of a new fine screen with a screenings compactor, a cyclone grit collector, and two aerated equalization basins to regulate the flow to the aeration zone of the treatment process. A picture of the WWTF is shown in Figure 4.5.

Waste solids generated in the course of treatment are stabilized in an aerobic digester, which is part of the package plant. They are then dewatered using a mobile belt filter press and the dewatered cake solids are placed in a solid waste landfill.

Figure 4.5
Package Plant - Point Peter WWTF



The treated flow from the facility is managed by land applying it on designated fields adjacent to the treatment facility. Four ponds provide storage during wet weather, when the fields are too wet to accept the treated flow.

In January 2004, EPD approved a wasteload allocation for discharge from the facility to the North River. This allows the City to apply for a discharge permit for the WWTF. If the permit is granted the treated flow from the WWTF could be discharged into the North River, and the land application operation could be discontinued.

The facility's land application permit No. GAU020068 specifies water quality limits on the treated flow leaving the plant. The quality of the treated flow, obtained from the Monthly Monitoring Reports (MMRs), is compared to the limits in Table 4.3.

Table 4.3
Discharge Quality Compared to Permitted Limits for Major Parameters
Point Peter WWTF

Month	Flow	CBOD5	TSS
November 2002	0.686 MGD	3 mg/L	1 mg/L
December 2002	0.698 MGD	<2 mg/L	2 mg/L
January 2003	0.646 MGD	5 mg/L	1 mg/L
February 2003	1.007 MGD	8 mg/L	5 mg/L
March 2003	0.954 MGD	16 mg/L	14 mg/L
April 2003	0.777 MGD	12 mg/L	16 mg/L
May 2003	0.744 MGD	17 mg/L	13 mg/L
June 2003	0.733 MGD	20 mg/L	16 mg/L
July 2003	0.729 MGD	8 mg/L	6 mg/L
August 2003	0.835 MGD	19 mg/L	16 mg/L
September 2003	0.780 MGD	10 mg/L	9 mg/L
October 2003	0.700 MGD	11 mg/L	4 mg/L
Average	**0.774 MGD**	**11 mg/L**	**9 mg/L**
Peak Month	**1.007 MGD**	**20 mg/L**	**16 mg/L**
Permit Limits	**0.80 MGD**	**50 mg/L**	**50 mg/L**

For the 12 months reviewed, the quality of the discharge from the facility was much better than required by the discharge permit. During February 2003, the flow peaked at 1.007 MGD because the Weed Street WWTF was off-line for refurbishment and all the City's wastewater was treated at the Point Peter WWTF. During March 2003 and August 2003, the flow treated at the facility exceeded the permitted limit of 0.80 MGD. Based on the monthly average effluent flows, the WWTF is consistently operating near its permitted limit.

From the field evaluation, it appears that the facilities at the Point Peter WWTF have several years of serviceable life left, if properly maintained. These types of facilities normally have a 20 year service life. The package plant tank appears well maintained and is in "good" shape. As for the inside structures of the tank, the following items need attention:

- Air header leaks

- Solids carryover from the clarifier weirs because of short-circuiting. Leveling of the clarifier discharge weirs will significantly reduce this short-circuiting problem.

- Interior stilling well ring is not level

Based on the inspection, the interior structures of the plant are rated in "fair" condition indicating that it will need to be refurbished in the next three to five years. According to plant personnel, when the new Scrubby Bluff WWTF comes on-line later this year, the Point Peter WWTF will be taken out of service to refurbish the interior structures of the treatment tank. This should help extend the life of the treatment plant as long as no significant structural issues are found during the refurbishing process.

Weed Street Wastewater Treatment Facility

The Weed Street WWTF was originally constructed in 1976 with a design treatment capacity of 0.55 MGD on a MMAD basis. It is located at the east end of Weed Street near downtown St. Marys. Most of the treatment processes at this facility are contained in a package plant, as illustrated in Figure 4.6. Conventional biological treatment processes are used to treat the wastewater to discharge standards. The facility was upgraded in 2001, which added new preliminary treatment processes, including a screen, compactor, and grit collector. Treated flow from the plant is discharged to the St. Marys River.

Figure 4.6
Weed Street WWTF

Waste solids from the treatment processes are stabilized in an aerobic digester and then dewatered on a mobile belt filter press. The dewatered cake solids are placed in a solid waste landfill.

While the design flow for the Weed Street WWTF is 0.55 MGD, the discharge permit allows for up to 0.7 MGD of effluent flow. According to plant personnel, a temporary permit modification was granted by EPD while the Point Peter WWTF was under construction. This modified permit is still in effect; however, plant operators indicate that the facility will not effectively treat the design flow of 0.55 MGD. The aeration basin, which was sized based on 1976 standards, is too small to effectively treat the design flow to current standards. The effective treatment capacity is approximately 0.45 MGD. The quality of the treated flow from the facility, obtained from the MMRs, is compared in Table 4.4 to the discharge limits given in Permit No. GA0026255.

Table 4.4
Discharge Quality Compared to Permitted Limits for Major Parameters Weed Street WWTF

Month	Flow	CBOD5		TSS	
November 2002	0.431 MGD	4 mg/L	5 kg/d	3 mg/L	5 kg/d
December 2002	0.472 MGD	8 mg/L	14 kg/d	4 mg/L	7 kg/d
January 2003	0.424 MGD	11 mg/L	18 kg/d	16 mg/L	26 kg/d
February 2003	Plant off-line for repairs				
March 2003	0.324 MGD	14 mg/L	17 kg/d	11 mg/L	13 kg/d
April 2003	0.425 MGD	9 mg/L	14 kg/d	9 mg/L	14 kg/d
May 2003	0.432 MGD	15 mg/L	24 kg/d	22 mg/L	36 kg/d
June 2003	0.381 MGD	6 mg/L	9 kg/d	8 mg/L	12 kg/d
July 2003	0.422 MGD	7 mg/L	11 kg/d	9 mg/L	14 kg/d
August 2003	0.419 MGD	2 mg/L	3 kg/d	4 mg/L	6 kg/d
September 2003	0.293 MGD	2 mg/L	2 kg/d	6 mg/L	7 kg/d
October 2003	0.287 MGD	2 mg/L	2 kg/d	4 mg/L	4 kg/d
Average	**0.359 MGD**	**7 mg/L**	**11 kg/d**	**9 mg/L**	**13 kg/d**
Peak Month	**0.472 MGD**	**15 mg/L**	**24 kg/d**	**22 mg/L**	**36 kg/d**
Permit Limits	**0.70 MGD**	**30 mg/L**	**80 kg/d**	**30 mg/L**	**80 kg/d**

For the 12 month period, the effluent quality from the facility met the major parameters specified in the discharge permit, due in part to the lower flows treated at this WWTF. During December 2002, when the flow peaked at 0.472 MGD, the facility was operating at 67% of its design capacity.

The package plant tank is of concrete construction and was refurbished in 2003. It appeared to be in “good” condition during the inspection. The interior structures of the treatment tank were also rated in “good” rating. In case of plant failure or an emergency, flow can be directed from this facility to the Point Peter WWTF.

As with most WWTFs located near neighborhoods, there have been odor complaints when the prevailing wind blows from the plant into these areas. At the time of this evaluation, there were no unusually strong or offensive odors emanating from the facility.

Scrubby Bluff Wastewater Treatment Facility

The Scrubby Bluff WWTF is currently under construction with completion projected for late Summer 2004. Located west of St. Marys in the proximity of I-95, the facility will have a 0.50-MGD capacity on a MMAD basis.

The plant will include a headworks incorporating mechanical screening and grit removal followed by the sequencing batch reactor (SBR) variation of the activated sludge process, chlorination disinfection, post aeration, effluent pumping, aerobic digestion, and solids dewatering with belt filter presses.

Treated flow from the facility will be discharged to Casey Creek, a tributary of the St. Marys River. After dewatering, the residual solids will be placed in a solid waste landfill. Once construction is completed, the facility will be operated under Permit No. GA0037931.

Wastewater Treatment Needs

Wastewater treatment needs relate primarily to providing adequate treatment capacity to keep abreast of the wastewater flow from new developments. When the Scrubby Bluff WWTF goes on line, the effective system wastewater treatment capacity will be 1.75 MGD. Currently, the peak month flow treated by the system peaked in August 2003 at 1.24 MGD. With the contractual obligation with developer of Cumberland Harbour to provide a 287,500 gpd of wastewater treatment capacity in 2005, the system will have only approximately 0.22 MGD excess capacity, or about 12 percent of the total capacity available for immediate developments.

Flow projections indicate that the wastewater treatment capacity needed by 2025 is nearly 2.8 MGD. This can be provided by expanding the Point Peter WWTF from 0.8 to 1.8 MGD by 2008 and by expanding the Scrubby Bluff WWTF from 0.5 to 1.0 MGD by 2023. The Weed Street WWTF would continue to operate without expansion, although a major project to refurbish the old equipment at the plant is anticipated within the next five years. The Weed Street WWTF could continue to operate until it reaches the end of its useful life, at which point flows could be diverted to Point Peter and Scrubby Bluff WWTFs for treatment.

The projected flows to each WWTF are presented in Table 4.5. The phasing and estimated costs of recommended projects are presented in Section 5.

Table 4.5
Projected Flows to WWTFs

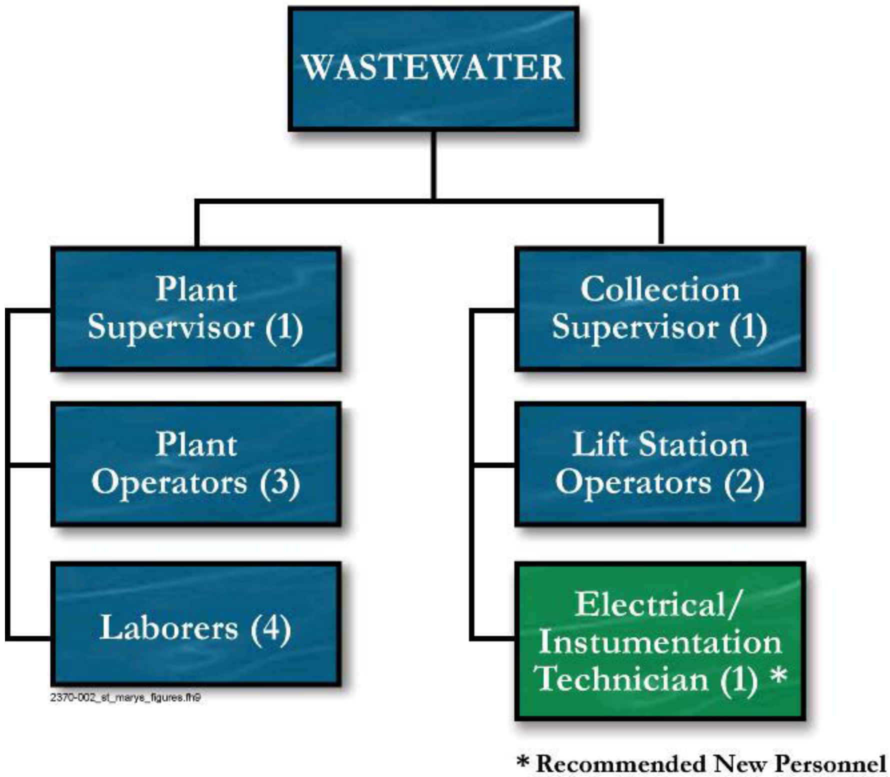
WWTF	Existing Treatment Capacity (MMAD-MGD)	MMAD Wastewater Flows (MGD)			
		Existing	2010	2015	2025
Weed Street	0.45[A]	0.37	0.39	0.41	0.45
Point Peter	0.80	0.74	1.35	1.38	1.47
Scrubby Bluff	0.50	0.22[B]	0.42	0.54	0.87
TOTALS	1.75	1.33	2.16	2.30	2.79

[A] Effective treatment capacity
[B] Estimated portion of flow when Scrubby Bluff WWTF is operational.

Evaluation of Personnel Needs

The Public Works Department has 11 employees who operate and maintain the wastewater treatment and collection system. Currently, two personnel maintain and repair the lift stations. Proper maintenance of each station involves daily checks, including inspection of the wet well and valve boxes, along with collecting meter readings indicating the number of hours each pump has operated. During these inspections, maintenance issues should be identified and scheduled for repair. Performance of all these duties by two people is proving to be a formidable task, especially when other duties within the City might divert attention from the lift stations. To properly staff and maintain the stations, a minimum of two maintenance personnel and one electrical technician should be assigned to the system full time. Therefore, an electrical technician should be added to the wastewater operations staff. This staffing level will ensure that all stations are checked on a daily basis and maintenance issues can be addressed in a timely manner. Additional backup staffing should also be provided from other water/wastewater staff in the City, such as plant operators. Figure 4.7 presents the organizational chart for the wastewater operations and maintenance.

Figure 4.7
Wastewater System Organizational Chart



Water and Wastewater Master Plan

Section 5
Recommended Master Plan

Based on the analyses performed for this Master Plan, several improvements in the water and wastewater systems will be needed over the next twenty years. This section presents the estimated capital costs and phasing of the recommended projects. In addition, the recommendations for staffing of both the water and wastewater administration is presented in this section.

Unit Costs

Conceptual cost estimates were made for all recommended water and wastewater projects. The costs associated with each type project include the following information:

- Water mains, gravity sewers and force mains: cost to install a particular diameter pipe based on the length of the project, easement acquisition, survey, and engineering and contingency

- Pump stations: cost to provide the pumping capacity required, engineering and contingency

- Wastewater treatment facilities: cost of constructing the facility, effluent pumping, river diffuser, engineering and contingency.

- Repairs and improvements to existing facilities: cost of repair based on information provided by field inspection and discussion with City staff

Developing cost estimates for distribution and collection system improvements included determining approximate cost per linear foot, or unit cost, for the St. Marys area. Table 5.1 presents a summary of the unit costs for pipe sizes ranging from 4 inches in diameter to 54 inches in diameter.

The total project unit cost for force mains and water mains includes estimates for design engineering, surveying, contingency, hydrants (water only) and valves, jack and bore, pavement replacement, easement acquisition, resident inspection, construction administration and testing and disinfection (water only). The total project unit cost for gravity sewers includes estimates for design engineering, surveying, contingency, dewatering, construction administration, resident inspection, and pavement replacement. Erosion and sediment control measures are also included in the unit costs.

Table 5.1
Water Transmission Main Unit Cost

Gravity Sewer Main		Water Main and Force Main	
Diameter (in)	Total Unit Cost ($/LF)	Diameter (in)	Total Unit Cost ($/LF)
8	75	6	28
10	77	8	34
12	81	10	37
15	92	12	41
18	106	16	49
21	125	20	57
24	133	24	65
27	144	30	82
30	156	36	111
36	170	42	144
		48	182
		54	231

Estimated Project Costs and Phasing

Water and wastewater projects were ranked based on priority. Projects related to regulatory requirements and reliability improvements were given precedent. Capacity upgrades and system expansion for long-term growth were given a lower priority. Hydraulic models of both the water distribution and wastewater collection systems were used to establish the effects of the phasing plans.

Water system projects recommended for implementation after 2010 are related to improving overall fire flow capabilities so that the more stringent fire protection goals of the City can be met. These projects were assigned to a particular year in an effort to evenly split the water expenditure over the planning period. However, the implementation of these water projects should be coordinated with roadway improvements, or other construction, to minimize cost and inconvenience.

The wastewater system projects are interdependent in that downstream capacity needs to be in place prior to the construction of upstream capacity. Therefore, the recommended phasing of these projects should be followed as indicated.

Tables 5.2 through 5.5 present the phasing plan and estimated costs for the recommended projects in five-year increments. Each project has been given an alpha-numeric code for reference in the Master Plan. Projects with a “W” indicate a water system project, while projects with a “WW” indicate a wastewater system project. Other abbreviations included on the tables are as follows:

LS = lift station; GS = Gravity Sewer; FM = force main.

Figure 5.2
Recommended Projects 2005 through 2009

Year	ID	Figure No.	WW LS	Project Description	Diameter (in)	Length (ft)	Estimated Cost
2005	WW 1			Point Peter WWTF Expansion to 1.8 MGD - watershed assessment			$100,000
2005	WW 2			Point Peter WWTF upgrades per NPDES discharge permit			$1,000,000
2005	WW 3			Dynamic model and survey of collection system			$75,000
2005	WW 4	5.7	New	Install new 10-inch FM along Winding Road (County Road 78) from LS #19 to GS feeding new lift station	10	2,520	$93,200
				Install new 10-inch GS along Winding Road (County Road 78) from LS #19 FM to new lift station	10	1,750	$134,800
				New lift station with 2-800-gpm pumps			$650,000
				Install new 10-inch FM from new lift station to GS on Winding Road and Colerain Road feeding LS #18	10	4,000	$148,000
				Install new 18-inch GS along Winding Road (County Road 78) and Colerain Road feeding LS #18	18	4,640	$491,800
2005	WW 5	5.16	LS #29	Rebuild/ repair wet well			$100,000
				Replace existing pumps with two 2,000-gpm pumps			$260,000
				Install new 18-inch GS from Point Peter Road to LS #29	18	1,056	$111,900
				Replace 10-inch FM with 24-inch FM from LS #29 to Point Peter WWTF	24	500	$32,500
2005	WW 6	5.16	LS #9/15	Replace 6-inch FM with 10-inch FM	10	16	$600
				Reroute FM from manifold of LS #9/15 to new GS of LS #29	12	445	$18,200
2005	WW 7	5.16	LS #8	Reroute 4-inch FM from LS #8 to new GS of LS #29	8	975	$33,200
2005	WW 8	5.16	LS #13	Replace existing pumps with two 1,000-gpm pumps			$260,000
				Construct new wet well			$200,000
				Reroute FM from LS #13 to new GS of LS #29	20	6,900	$393,300
2005	W 1	5.5		Parallel existing 12" transmission main from the Cumberland Harbor Tank service line to New Point Peter Road and connect to existing 8" transmission main on New Point Peter Road. The existing connection to the 8" transmission main on the North River Causeway	12	2,700	$110,700
2006	WW 9			Design of Point Peter WWTF expansion to 1.8 MGD			$800,000

Figure 5.2
Recommended Projects 2005 through 2009

Year	ID	Figure No.	WW LS	Project Description	Diameter (in)	Length (ft)	Estimated Cost
2006	WW 10	5.6	LS #1	Replace 8-inch GS from LS #11A - 12" FM to existing 15-inch GS on East Weed St.	15	325	$29,900
2006	WW 11			Lift station improvements and repairs as indicated in Section 4 of this report (includes items such as wet well rehabilitation, discharge valve repairs, guide rail realignment, and electrical repairs)			$125,000
2006	WW 12			Autodialers at 20 lift stations			$100,000
2006	WW 13	5.13	LS #6	Replace existing pumps with two 750-gpm pumps and refurbish wet well			$360,000
				Reroute FM from LS #6 to LS #13 along Osborne Road and Martha Drive	16	4,000	$196,000
2006	W 2			Water Supply Study			$100,000
2006	W 3	5.4		Transmission main along Douglas Drive, Spur 40, and Osborne Road from the intersection of Douglas Drive and Colerain Road to the intersection of Point Peter Road and Osborne Road	12	16,100	$660,100
2006	W 4			Transmission main along Douglas Drive and Sloan Street from Old Jefferson WTP to the intersection of Point Peter Road and N. River Causeway	12	12,100	$496,100
2007	WW 14			Construction of Point Peter WWTF expansion to 1.8 MGD			$3,150,000
2007	WW 15			Autodialers at 20 lift stations			$100,000
2007	WW 16			Lift station repairs and standby by power improvements			$75,000
2008	WW 17			Construction of Point Peter WWTF expansion to 1.8 MGD			$3,150,000
2008	WW 18	5.15	LS #35	Reduce capacity to 2-250 gpm pumps			$2,000
2008	WW 19	5.11	LS #41	Reduce capacity to 2-250 gpm pumps			$2,000
2008	WW 20	5.10	LS #51	Reduce capacity to 2-100 gpm pumps			$2,000
2008	WW 21	5.11	LS #55	Reduce capacity to 2-250 gpm pumps			$2,000
2008	WW 22	5.12	LS #22	Replace 4-inch FM from LS #22	8	700	$23,800
2008	WW 23	5.19	LS #22	New GS for southern portion of Annex	8	10,200	$765,000
2008	WW 24			Lift station repairs and standby by power improvements			$75,000
2009	WW 25	5.12	LS #23/42	Replace 6-inch FM from manifold of LS #23/42 and reroute to feed directly to LS #6	8	2,840	$96,600
2009	WW 26	5.12	LS #42	Replace 6-inch FM from LS #42 to manifold of LS #23/42	8	18	$600

Figure 5.2
Recommended Projects 2005 through 2009

Year	ID	Figure No.	WW LS	Project Description	Diameter (in)	Length (ft)	Estimated Cost
2009	WW 27	5.12	LS #23	Replace 6-inch FM from LS #23 to manifold of LS #23/42	8	1,367	$46,500
2009	WW 28	5.19	LS #42	New GS along Sandhill Road and Beverly Street	8	7,560	$567,000
2009	WW 29	5.19	New	New lift station for northern portion of Annex 2-50 gpm pumps			$650,000
				New GS for northern portion of Annex	12	2,070	$167,700
					8	4,730	$354,800
2009	WW 30	5.19	New	New GS along Olympic Lane	8	1,300	$97,500
2009	WW 31	5.15	New	New lift station near the intersection of Deerwood Court and Moeckel Place with 50-gpm pumps			$300,000
				New GS along Deerwood Court & Moeckel Place	8	4,140	$310,500
				New FM feeding LS #24	6	3,115	$87,200
2009	WW 32			Lift station repairs and standby by power improvements			$75,000
2009	W 5	5.3		Transmission main along Osborne Road, Osborne Street, and Ready Street from the intersection of Point Peter Road and Osborne Road to the intersection of Ready Street and East Bryant Street	12	9,500	$389,500
2009	W 6	5.3		Transmission main along Dillworth Street from the intersection of Dillworth Street and Osborne Road to the intersection of Dillworth Street and Mildred Street	12	6,900	$282,900
2009	W 7	5.2		Replace 6" pipe on Longwood Road from Shadowlawn Drive to East Marsh Lane	12	1,600	$65,600
2009	W 8	5.2		Install new water distribution pipes in the Shadowlawn subdivision on Moeckel Place and Deerwood Court	8	4,400	$149,600
2009	WW 26	5.12	LS #42	Replace 6-inch FM from LS #42 to manifold of LS #23/42	8	18	$600
2009	WW 27	5.12	LS #23	Replace 6-inch FM from LS #23 to manifold of LS #23/42	8	1,367	$46,500
2009	WW 28	5.19	LS #42	New GS along Sandhill Road and Beverly Street	8	7,560	$567,000
2009	WW 29	5.19	New	New lift station for northern portion of Annex			$650,000
				New GS for northern portion of Annex	12	2,070	$167,700
					8	4,730	$354,800
2009	WW 30	5.19	New	New GS along Olympic Lane	8	1,300	$97,500

Figure 5.2
Recommended Projects 2005 through 2009

Year	ID	Figure No.	WW LS	Project Description	Diameter (in)	Length (ft)	Estimated Cost
2009	WW 31	5.15	New	New lift station near the intersection of Deerwood Court and Moeckel Place with 50-gpm pumps			$300,000
				New GS along Deerwood Court & Moeckel Place	8	4,140	$310,500
				New FM feeding LS #24	6	3,115	$87,200
2009	WW 32			Lift station repairs and standby by power improvements			$75,000
2009	W 5	5.3		Transmission main along Osborne Road, Osborne Street, and Ready Street from the intersection of Point Peter Road and Osborne Road to the intersection of Ready Street and East Bryant Street	12	9,500	$389,500
2009	W 6	5.3		Transmission main along Dillworth Street from the intersection of Dillworth Street and Osborne Road to the intersection of Dillworth Street and Mildred Street	12	6,900	$282,900
2009	W 7	5.2		Replace 6" pipe on Longwood Road from Shadowlawn Drive to East Marsh Lane	12	1,600	$65,600
2009	W 8	5.2		Install new water distribution pipes in the Shadowlawn subdivision on Moeckel Place and Deerwood Court	8	4,400	$149,600

Figure 5.3
Recommended Projects 2010 through 2014

Year	ID	Figure No.	WW LS	Project Description	Diameter (in)	Length (ft)	Estimated Cost
2010	WW 33			Refurbish equipment at Weed Street WWTF			$900,000
2010	WW 34			Lift station repairs and standby by power improvements			$75,000
2010	WW 35			Upgrade autodialers w/ SCADA control system			$150,000
2010	WW 36	5.8	LS #45	Replace and reroute 6-inch FM from LS #45	8	1,050	$35,700
2010	WW 37	5.9	LS #17	Replace 4-inch FM from LS #17	8	450	$15,300
2010	WW 38	5.9	LS #16	Replace 6-inch FM from LS #16	10	121	$4,500
2010	WWW 1			Update Water and Wastewater Master Plan			$75,000
2011	WW 39			Lift station repairs and standby by power improvements			$75,000
2011	WW 40	5.17	LS #37	Replace 4-inch FM from LS #37	8	95	$3,200

Figure 5.3
Recommended Projects 2010 through 2014

Year	ID	Figure No.	WW LS	Project Description	Diameter (in)	Length (ft)	Estimated Cost
2011	WW 41	5.18	LS #53	Replace 8-inch FM from manifold of LS #53/39	16	3,075	$150,700
2011	WW 42	5.14	LS #5	Replace 4-inch FM from LS #5	8	1,567	$53,300
2011	WW 43	5.8	LS #38	Replace 6-inch FM from LS #38	10	1,565	$57,900
2011	W 9	5.2		Replace 6" pipe on East Marsh Lane from Longwood Road to Long Point Circle	8	500	$17,000
2011	W 10	5.2		Replace 6" pipe on Somerset Road from Shadowlawn Drive to Regal Road	12	2,000	$82,000
2011	W 11	5.2		Replace 6" pipe on Regal Road from Somerset Road to Carolina Court	8	800	$27,200
2011	W 12	5.2		Replace 6" pipe halfway up Crane Island Circle from Shadowlawn Drive	8	400	$13,600
2011	W 13	5.2		Replace 6" pipe halfway up New Hammock Circle from Shadowlawn Drive	8	500	$17,000
2011	W 14	5.5		Replace 6" pipe on Cypress Lane, Quail Run, Lookout Road, Lagoon Run and Powder Horn Road from Lagoon Run to the end of Powder Horn Road	8	3,600	$122,400
2011	W 15	5.5		Replace 6" pipe on Von Stueben Court, install new pipe on Yorktown Road from Von Stueben Court to Liberty Tree Road and replace 6" pipe on Liberty Tree Road from Yorktown Road to the end of Liberty Tree Road	8	1,900	$64,600
2011	W 16	5.3		Replace 6" pipe on Wheeler Street from Union Street to the end	8	400	$13,600
2011	W 17	5.3		Install new pipe on Finley Street from existing 12" transmission main near Osborne Road to existing 6" on Finley Street	12	1,000	$41,000
2011	W 18	5.3		Install new pipe on Union Street from Wheeler Street to North Osborne Street	6	500	$14,000
2011	W 19	5.3		Install new pipe on West Dillingham Street from Dillworth Street to Anne Street	6	200	$5,600
2011	W 20	5.3		Install new pipe on West Weed Street from Seagrove Street to Bartlett Street	6	500	$14,000
2011	W 21	5.3		Install new pipe on Wheeler Street from West Gallop Street to West. Meeting Street	6	500	$14,000
2011	W 22	5.4		Replace 6" pipe on Sloan St from Douglas Drive to the end	8	1,700	$57,800
2011	W 23	5.4		Replace 6" pipe on Admirals Walk Drive from S Street to approximately 400 feet from the end of Admirals Walk Drive	8	1,300	$44,200

Figure 5.3
Recommended Projects 2010 through 2014

Year	ID	Figure No.	WW LS	Project Description	Diameter (in)	Length (ft)	Estimated Cost
2011	W 24	5.4		Install new pipe along Lanes Lane, T Street and S Street from North River Causeway to Admirals Walk Drive	12	700	$28,700
2011	W 25	5.4		Replace 6" pipe on Dufour Drive from Point Peter Road to Rudolph Terrace	8	1,700	$57,800
2011	W 26	5.1		Replace existing 6" pipe on County Road 78 from end of 10" transmission main to Spur 40. Parallel existing 8" on Spur 40 from County Road 78 to Plantation Village Drive. Install new 12" from Plantation Village Drive to private driveway 1,900 feet north	12	5,700	$233,700
2011	W 27	5.1		Replace 6" pipe on Sunnyside Court from Sunnyside Drive to the end	8	800	$27,200
2011	W 28	5.1		Replace 6" pipe on West Gate Circle	8	1,700	$57,800
2011	W 29	5.1		Replace 6" pipe on Cottage Court from Plantation Drive to the end	8	800	$27,200
2011	W 30	5.1		Replace 6" pipe on Plantation Court from Plantation Drive to the end	8	800	$27,200
2011	W 31	5.1		Replace 6" pipe at Crooked River Elementary School	8	500	$17,000
2011	W 32	5.4		Replace 6" pipe on South Julia Street from Osborne Road to the end	8	2,800	$95,200
2011	W 33	5.4		Install new pipe on West Myrtle Street from Pelican Point to North Julia Street	6	500	$14,000
2011	W 34	5.4		Replace 6" pipe on Park Street off Borrell Blvd	8	900	$30,600
2011	W 35	5.4		Replace 6" pipe approximately 400 ft up Hollywood Lane from Douglas Drive	8	400	$13,600
2011	W 36	5.4		Replace 6" pipe on 8th Street from Spur 40 to the end	8	500	$17,000
2011	W 37	5.4		Replace 6" pipe on Hightower Street from Spur 40 to the end	8	500	$17,000
2011	W 38	5.4		Replace 6" pipe on Magnolia Street from Spur 40 to the end	8	500	$17,000
2011	W 39	5.4		Replace 6" pipe on 4th Street from Spur 40 to Charles Street	8	400	$13,600
2011	W 40	5.4		Replace 6" pipe on Bowen Street from South Dandy Street to Faye Court	8	300	$10,200
2011	W 41	5.4		Replace 6" pipe approximately 200 ft up Bobwhite Blvd off Palmetto Street	8	200	$6,800
2011	W 42	5.4		Replace 6" pipe on Dolphin Drive from North River Causeway to Oyster Cove	8	500	$17,000
2011	W 43	5.4		Install new pipe on Harbor Pines Drive near Bay Run Road	8	200	$6,800
2011	W 44	5.1		Replace 6" pipe on Reid Drive from Ryan Drive to the end	8	700	$23,800

Figure 5.3
Recommended Projects 2010 through 2014

Year	ID	Figure No.	WW LS	Project Description	Diameter (in)	Length (ft)	Estimated Cost
2011	W 45	5.4		Replace 2" pipe at Shopping Center on City Smitty Drive	6	100	$2,800
2011	W 46			Small Main replacement program	6	5,000	$140,000
2011	W 47			Water Main replacement program	6-12	5,000	$165,000
2012	W 48			Small Main replacement program	6	5,000	$140,000
2012	W 49			Water Main replacement program	6-12	5,000	$165,000
2013	W 50			Small Main replacement program	6	5,000	$140,000
2013	W 51			Water Main replacement program	6-12	5,000	$165,000
2014	W 52			Small Main replacement program	6	5,000	$140,000
2014	W 53			Water Main replacement program	6-12	5,000	$165,000

Figure 5.4
Recommended Projects 2015 through 2019

Year	ID	Figure No.	WW LS	Project Description	Diameter (in)	Length (ft)	Estimated Cost
2015	W 52			Small Main replacement program	6	5,000	$140,000
2015	W 53			Water Main replacement program	6-12	5,000	$165,000
2015	WWW 2			Update Water and Wastewater Master Plan			$75,000
2015	WW 44		LS #16	Modify manhole at LS #16 to redirect flow to Point Peter WWTF			$100,000
2016	W 52			Small Main replacement program	6	5,000	$140,000
2016	W 53			Water Main replacement program	6-12	5,000	$165,000
2017	W 54			Small Main replacement program	6	5,000	$140,000
2017	W 55			Water Main replacement program	6-12	5,000	$165,000
2018	W 56			Small Main replacement program	6	5,000	$140,000
2018	W 57			Water Main replacement program	6-12	5,000	$165,000
2019	W 58			Small Main replacement program	6	5,000	$140,000
2019	W 59			Water Main replacement program	6-12	5,000	$165,000
2019	WW 45			Preliminary engineering/watershed assessment studies for Scrubby Bluff WWTF expansion			$100,000

Figure 5.5
Recommended Projects 2020 through 2025

Year	ID	Figure No.	WW LS	Project Description	Diameter (in)	Length (ft)	Estimated Cost
2020	WW 46			Design of Scrubby Bluff WWTP expansion to 1.0 MGD			$300,000
2020	WWW 3			Update Water and Wastewater Master Plan			$75,000
2020	W 58			Small Main replacement program	6	5,000	$140,000
2020	W 59			Water Main replacement program	6-12	5,000	$165,000
2021	W 60			Small Main replacement program	6	5,000	$140,000
2021	W 61			Water Main replacement program	6-12	5,000	$165,000
2021	WW 47			Construction of Scrubby Bluff WWTF expansion to 1.0 MGD			$2,350,000
2021	W 62			Small Main replacement program	6	5,000	$140,000
2021	W 63			Water Main replacement program	6-12	5,000	$165,000
2022	W 64			Small Main replacement program	6	5,000	$140,000
2022	W 65			Water Main replacement program	6-12	5,000	$165,000
2022	WW 48			Construction of Scrubby Bluff WWTF expansion to 1.0 MGD			$2,350,000
2023	W 66			Small Main replacement program	6	5,000	$140,000
2023	W 67			Water Main replacement program	6-12	5,000	$165,000
2024	W 68			Small Main replacement program	6	5,000	$140,000
2024	W 69			Water Main replacement program	6-12	5,000	$165,000
2025	W 70			Small Main replacement program	6	5,000	$140,000
2025	W 71			Water Main replacement program	6-12	5,000	$165,000
2025	WWW 4			Update Water and Wastewater Master Plan			$75,000

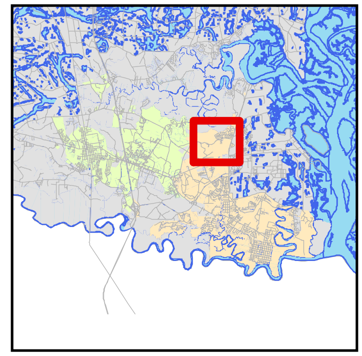
The total project costs for the entire planning period are estimated to be $31.3 million in 2004 dollars. Figures and descriptions for each project are included at the end of this section. Section 6 presents the initial five year capital improvements program (FY2005 through FY2009) and an analysis of the revenues required for the water and wastewater systems during this period.

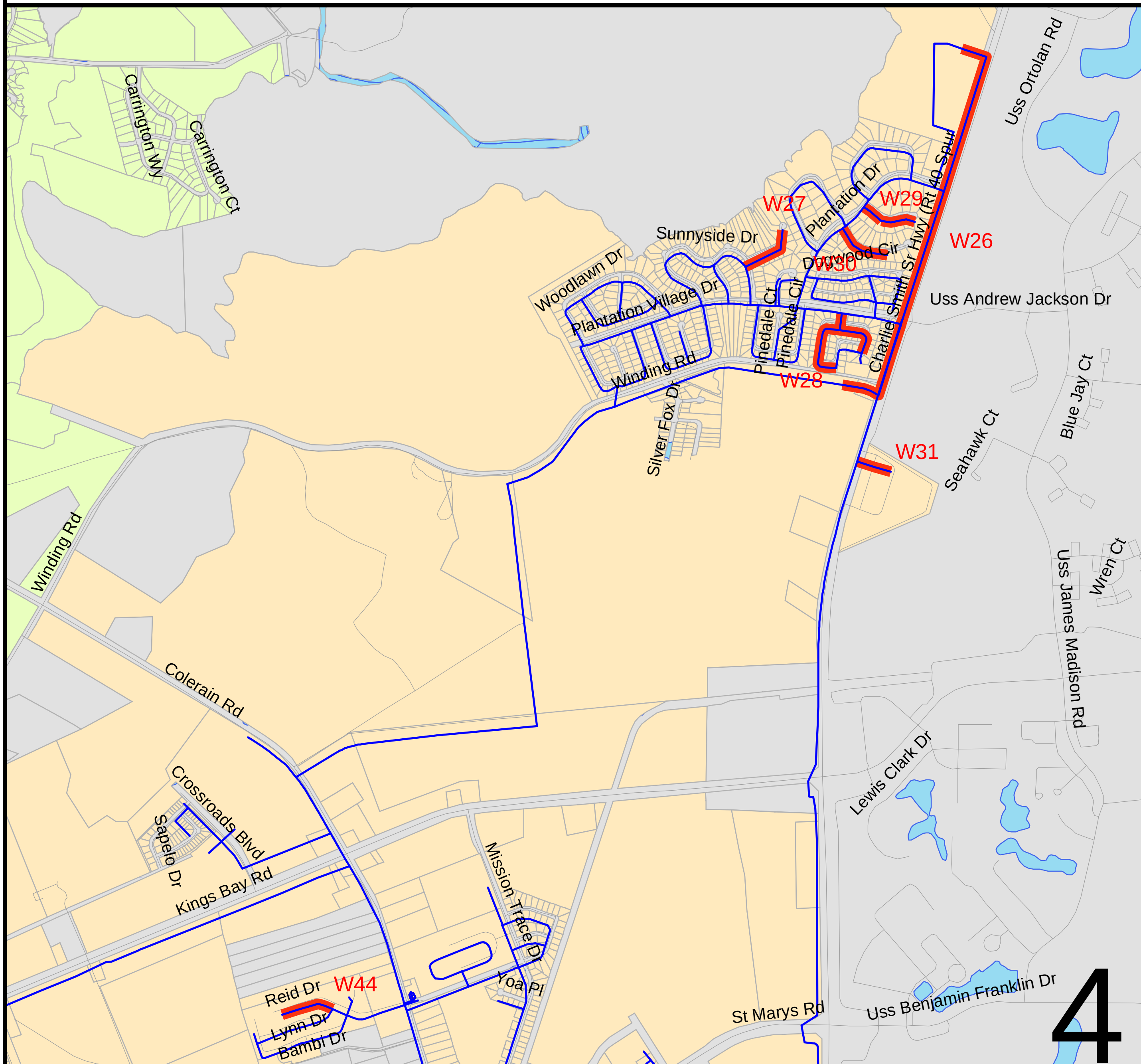
Personnel Recommendations

An evaluation of the St. Marys water and wastewater operations staffing was also developed as part of the master planning effort. As discussed in Sections 3 and 4, two additional staff positions are recommended based on the assessment. A laborer position is recommended for the water system, which would also support field operations. The annual salary, including benefits, is estimated to be $26,000 per year for this position. An electrical/instrumentation technician is recommended for the wastewater system; this position would also support the water system operations. The annual salary including benefits is estimated to $47,000 per year for this position. Both of these positions are should be created within the next year.

St. Marys Water Distribution System Improvements

Project Location: Northwestern St. Marys
Project Description: Replace & Install Water Mains
Project ID's: W26-W31, W44





JORDAN JONES & GOULDING

Legend

- Wells & Tanks
- Existing Pipe
- Proposed Improvements

Figure 5.1

0 650 1,300 2,600 Ft

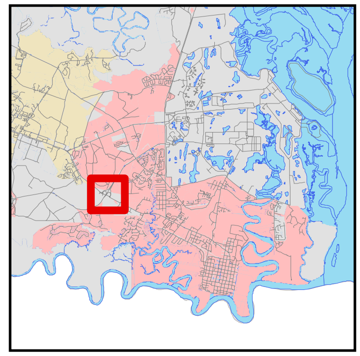
St. Marys Wastewater Collection System Improvements

Project Name: WW41

Project Description:

(WW41) Replace 3,075 LF of 8" FM with 16" FM from Manifold of LS#39, and LS#53

Project Price: $150,700.00



JORDAN JONES & GOULDING

Legend

Lift Stations	New GS
Existing GS	Force Main
	Improvements

Figure 5.18

0 155 310 620 Ft

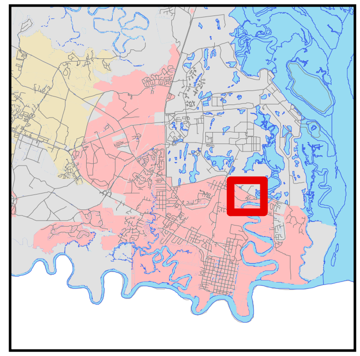
St. Marys Wastewater Collection System Improvements

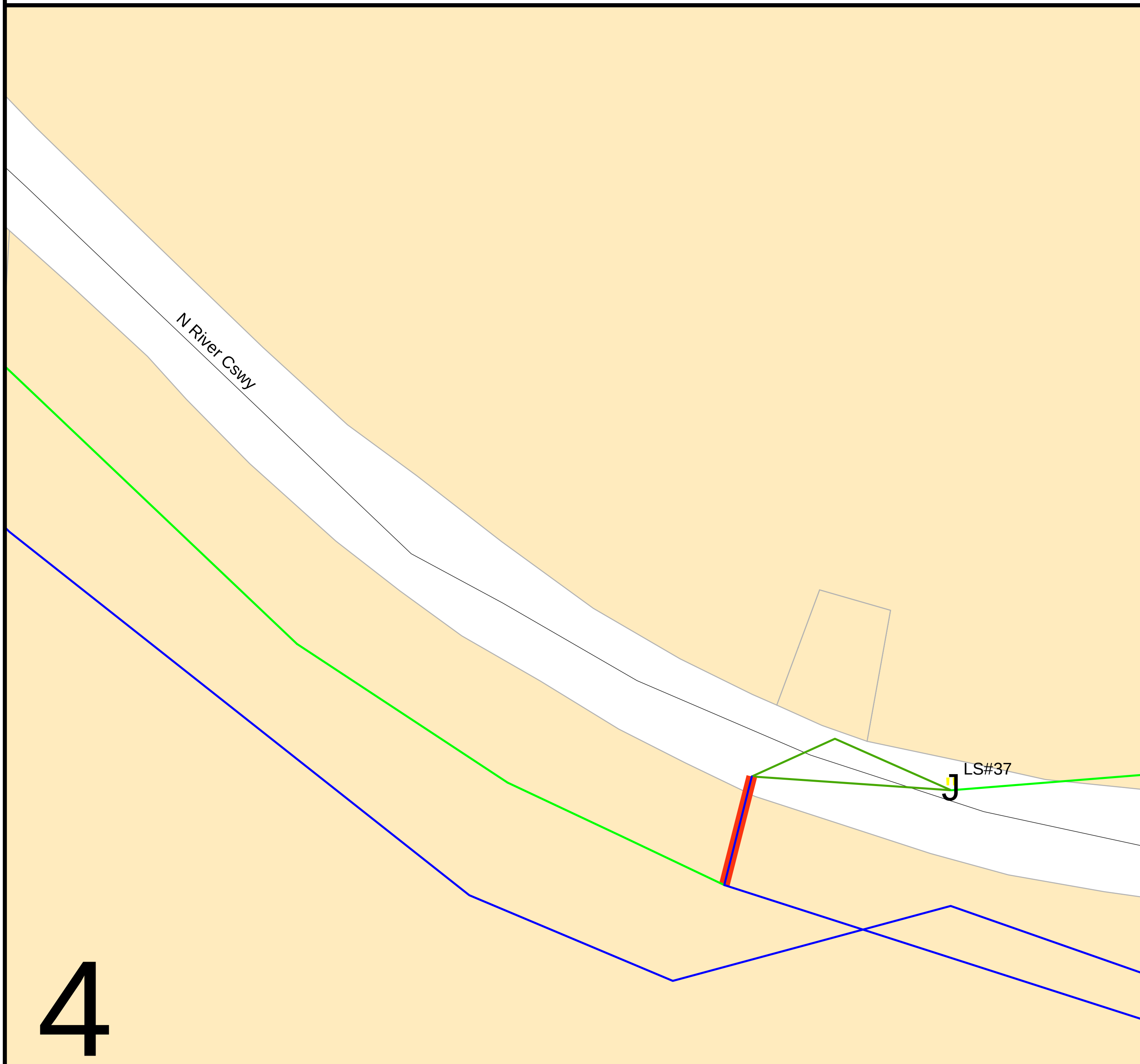
Project Name: WW40

Project Description:

(WW40) Replace LS#37 FM with 95 LF of 8"FM

Project Price: $3,200.00





JORDAN JONES & GOULDING

Legend

J Lift Stations

Existing GS

New GS

Force Main

Improvements

Figure 5.17

0 50 100 200 Ft

St. Marys Wastewater Collection System Improvements

Project Name: WW5, WW6, WW7, WW8

Project Description:

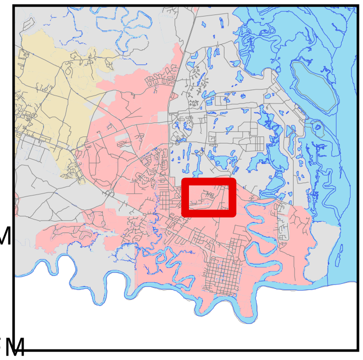
(WW5) Rebuild/Repair Wet Well
- Replace LS#29 pumps with two 2,000 gpm pumps
- Install 1,056 LF of New 18" GS
- Replace 10"FM from LS#29 with 24"FM

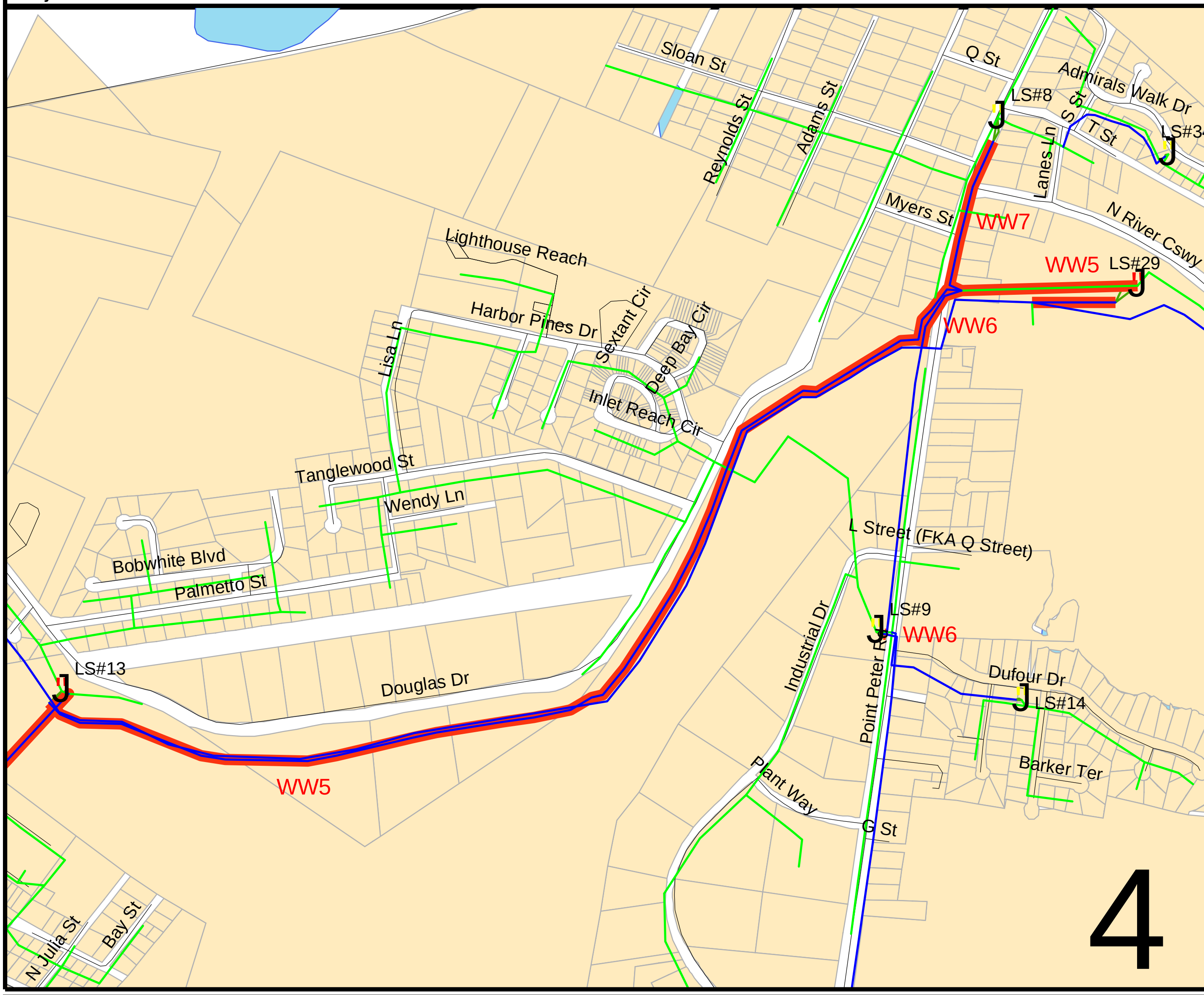
(WW6) Replace 6"FM from LS#9 to LS#9/15 manifold with 10"FM
- Install 445 LF of New 12"FM from manifold of LS#9/11B (Disconnect from LS#15 manifold)

(WW7) Reroute LS#8 FM to new GS of LS#29 with 975 LF of 8"FM

(WW8) Replace LS#13 pumps with two 1,000 gpm pumps
- Reconstruct LS#13
- Reroute LS#13 FM to New GS of LS#29 with 6,900 LF of 20"FM

Project Price: $1,409,700





JORDAN JONES & GOULDING

Legend
- Lift Stations
- Existing GS
- New GS
- Force Main
- Improvements

Figure 5.16

0 495 990 Ft

St. Marys Wastewater Collection System Improvements

Project Name: WW18, WW31

Project Description:

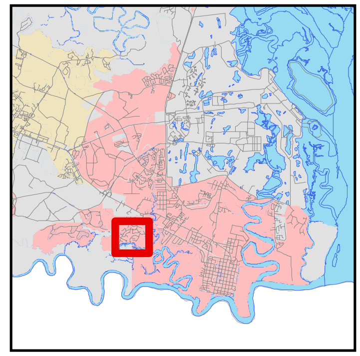
(WW18) Reduce capacity of LS#35 two 250 gpm pumps

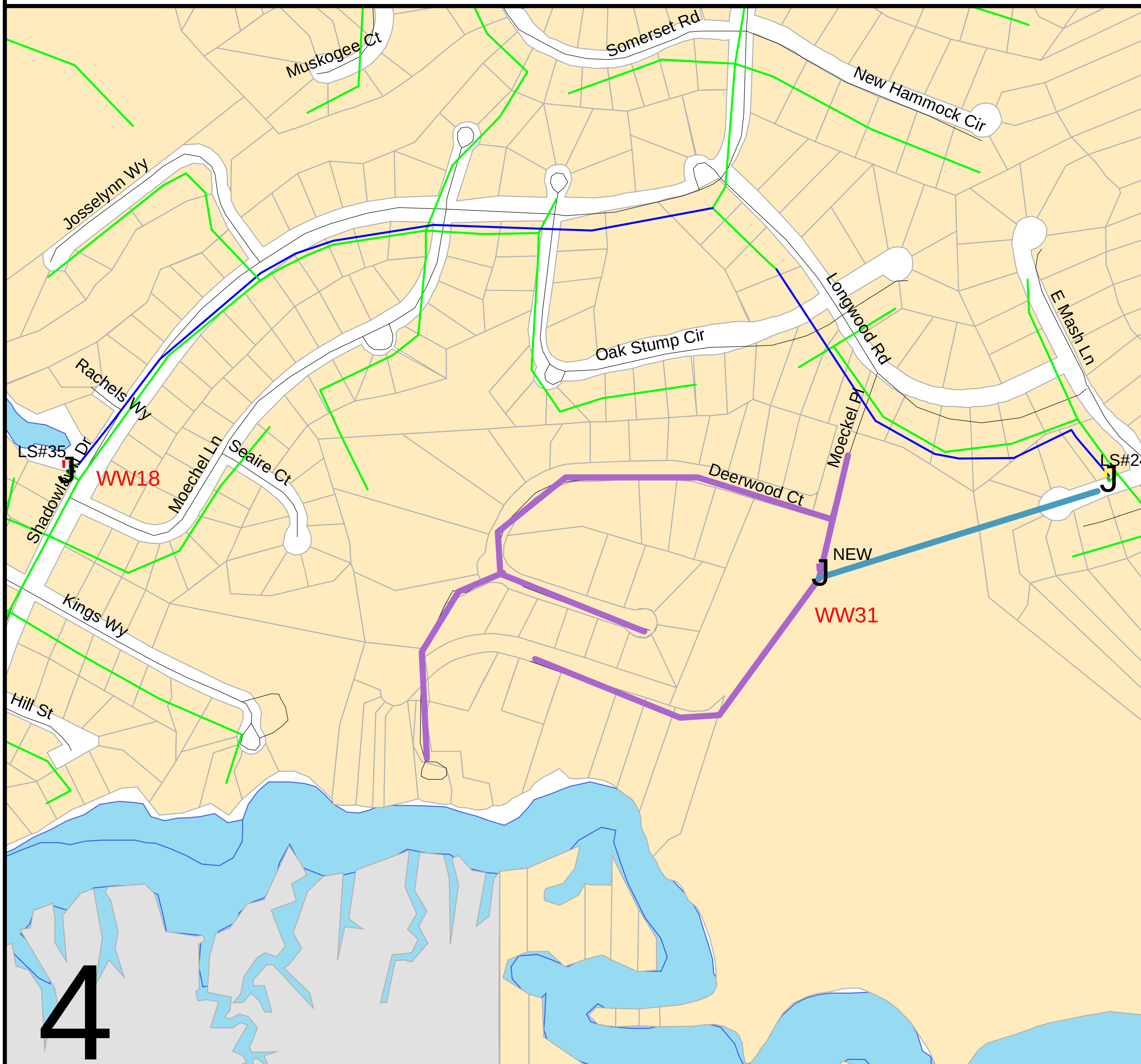
(WW31) New Lift Station along Deerwood Road with two 50 gpm pumps

Install 3,115 LF of New 6"FM

Install 4,140 LF of New 8"GS

Project Price: $699,700





JORDAN JONES & GOULDING

Legend

J Lift Stations

Existing GS

New GS

Existing ForceMain

New ForceMain

Figure 5.15

0 270 540 Ft

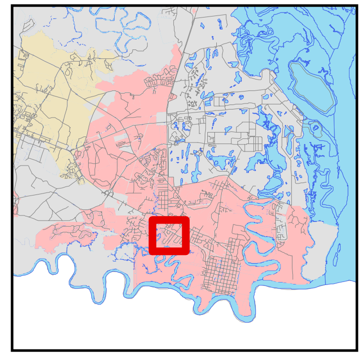
St. Marys Wastewater Collection System Improvements

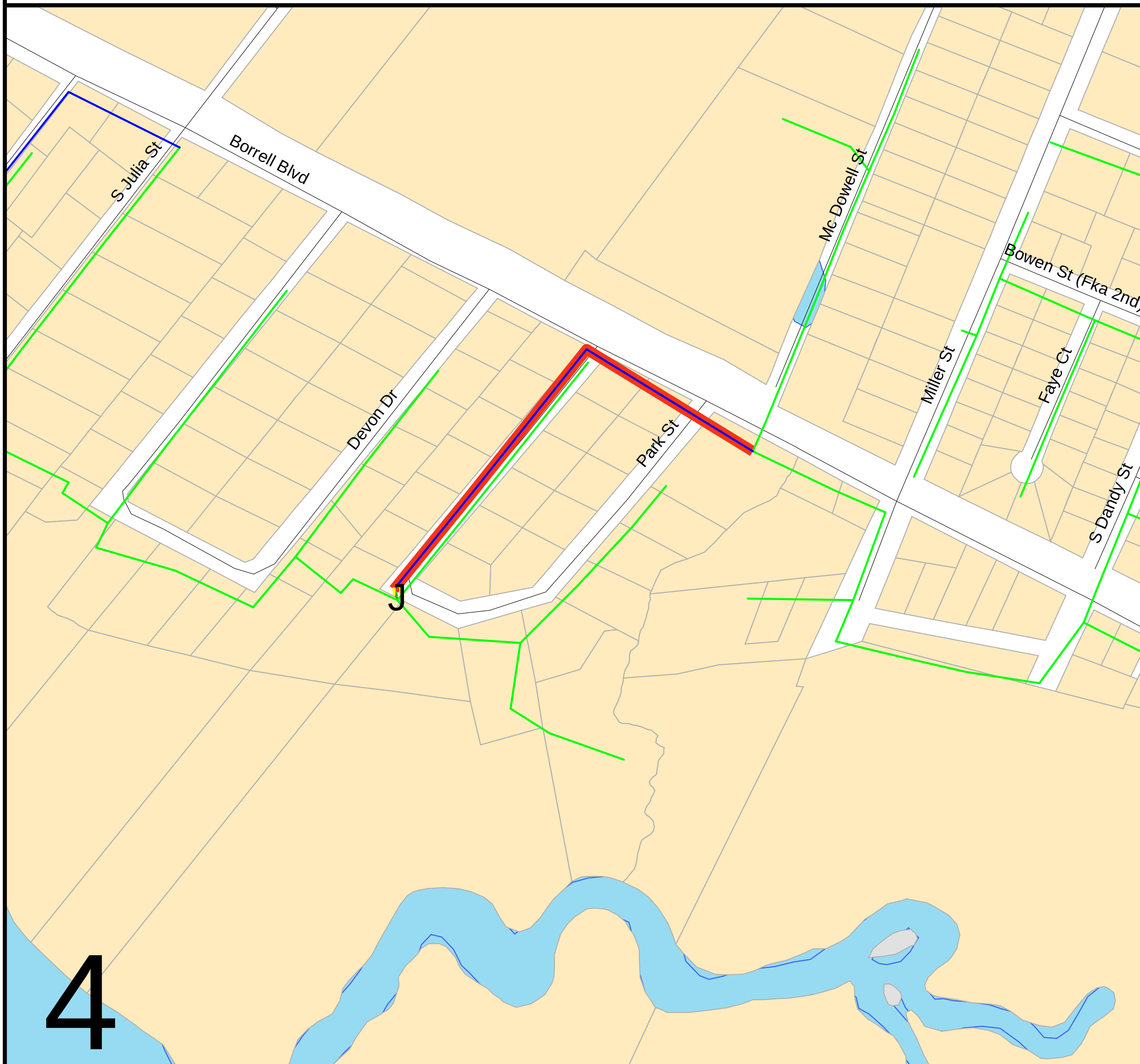
Project Name: WW42

Project Description:

(WW42) Replace LS#5 FM with 1,567 LF of 8"FM

Project Price: $53,300.00





JORDAN JONES & GOULDING

Legend

J Lift Stations

Existing GS

New GS

Force Main

Improvements

Figure 5.14

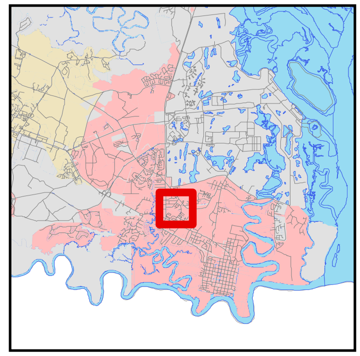
0 305 610 Ft

St. Marys Wastewater Collection System Improvements

Project Name: WW13

Project Description: Replace pumps at LS#6 with two 750 gpm pumps
Refurbish Wet Well
Reroute LS#16 FM to LS#13 with 4,000 LF of 16"FM

Project Price: $556,000



JORDAN JONES & GOULDING

Legend

Lift Stations
Existing GS
New GS
Force Main
Improvements

Figure 5.13

0 275 550 Ft

St. Marys Wastewater Collection System Improvements

Project Name: WW22, WW25, WW26, WW27

Project Description:

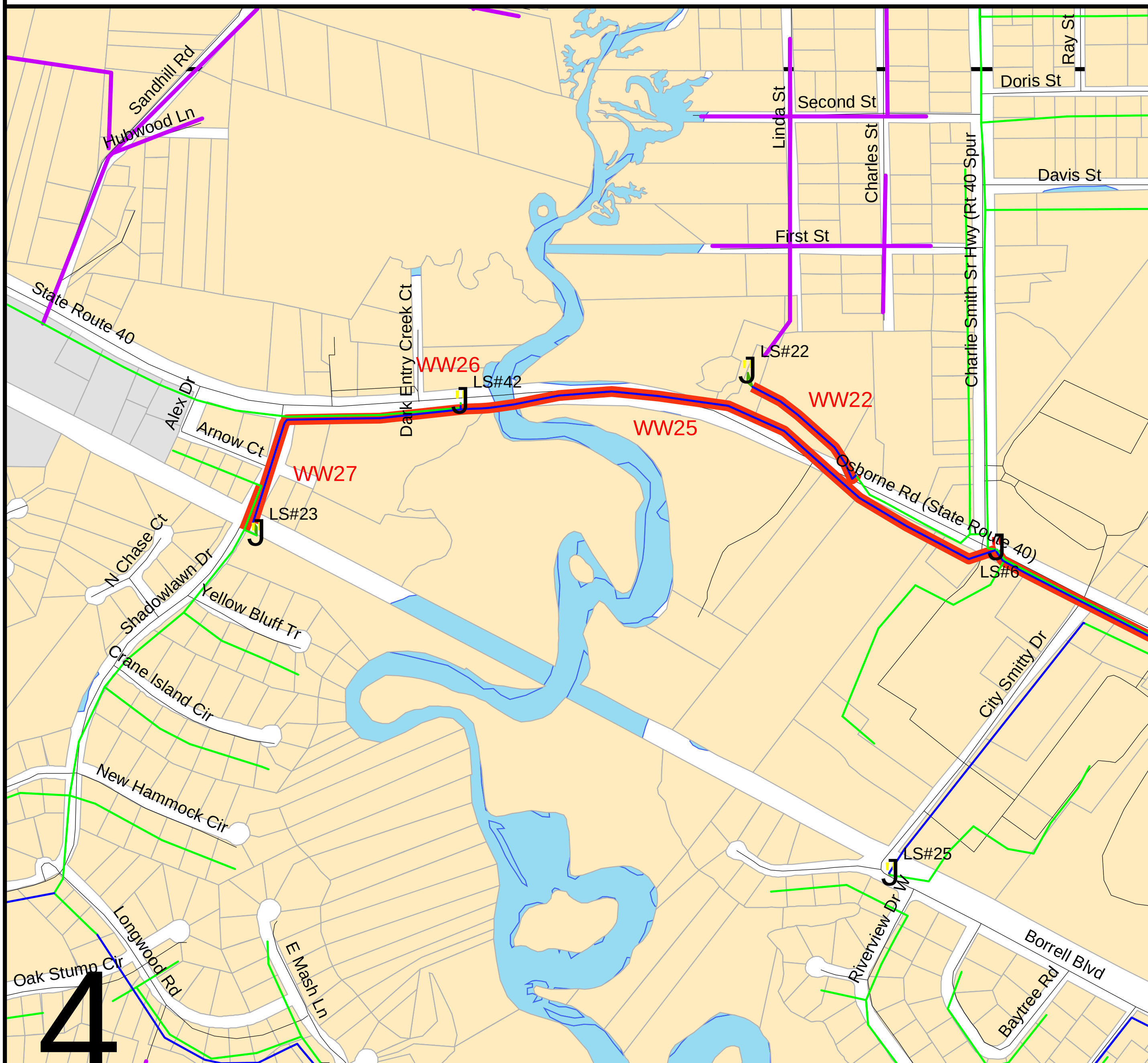
(WW22) Replace LS#22 FM with 8"FM

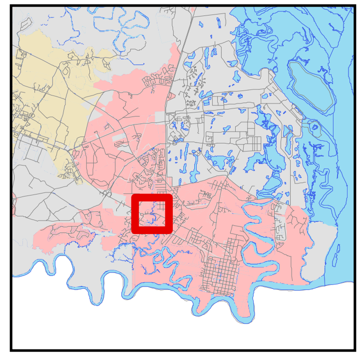
(WW25) Replace FM from manifold of LS#23/42 with 8"FM and reroute to feed directly into LS#6

(WW26) Replace LS#42 FM to manifold of LS#23/42 with 8"FM

(WW27) Replace LS#23 FM to manifold of LS#23/42 with 8"FM

Project Price: $167,500.00





JORDAN JONES & GOULDING

Legend

Lift Stations

Existing GS

New GS

Force Main

Improvements

Figure 5.12

0 500 1,000 Ft

St. Marys Wastewater Collection System Improvements

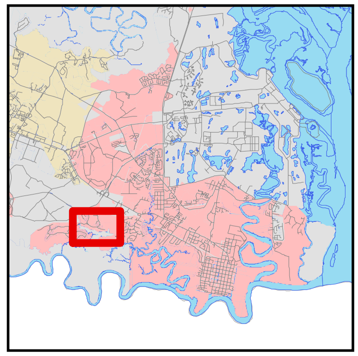
Project Name: WW19, WW21

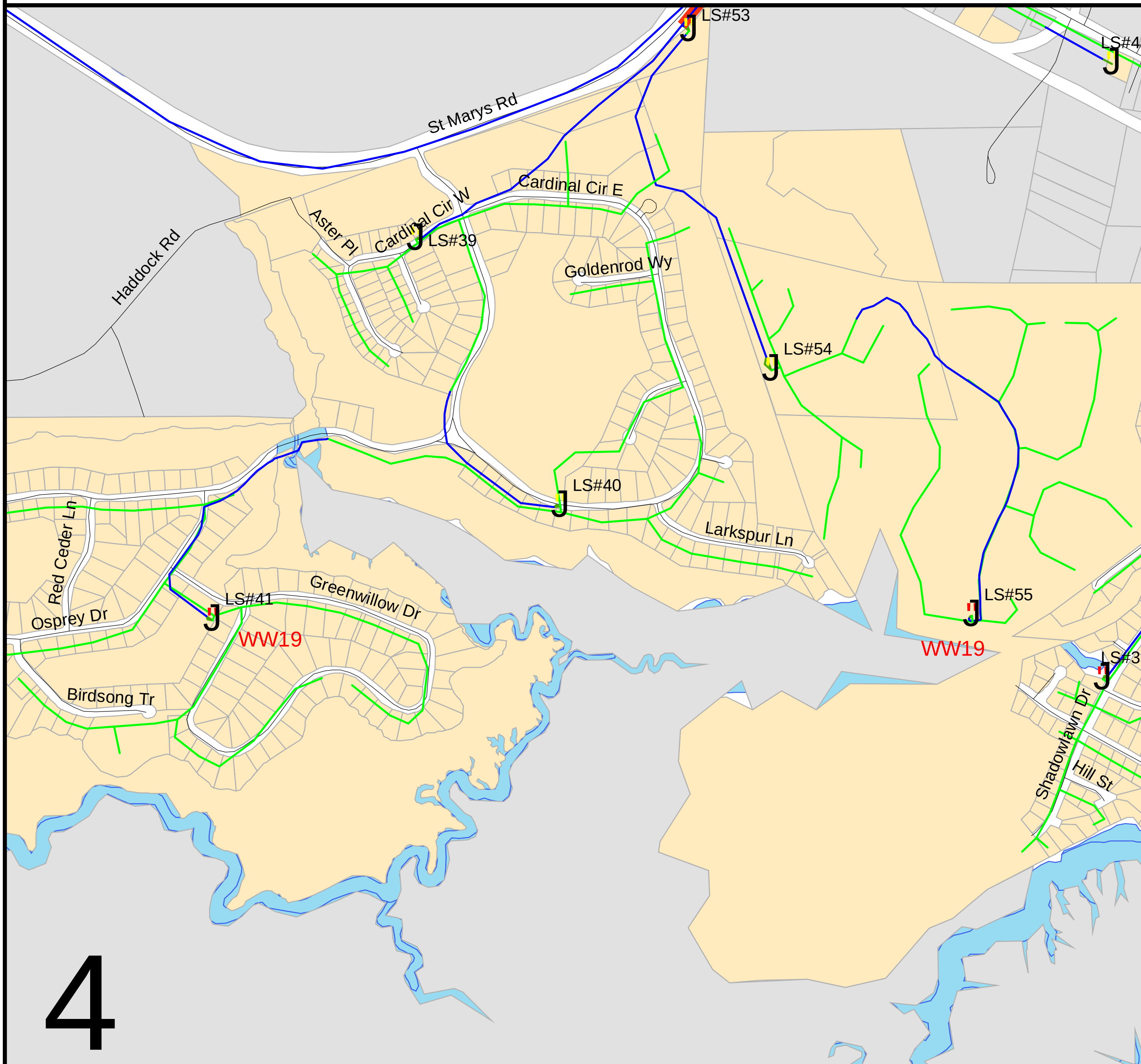
Project Description:

(WW19) Reduce capacity of LS#41 to two 250 gpm pumps

(WW21) Reduce capacity of LS#55 to two 250 gpm pumps

Project Price: $4,000.00





JORDAN JONES & GOULDING

Legend

- Lift Stations
- Existing GS
- New GS
- Force Main
- Improvements

Figure 5.11

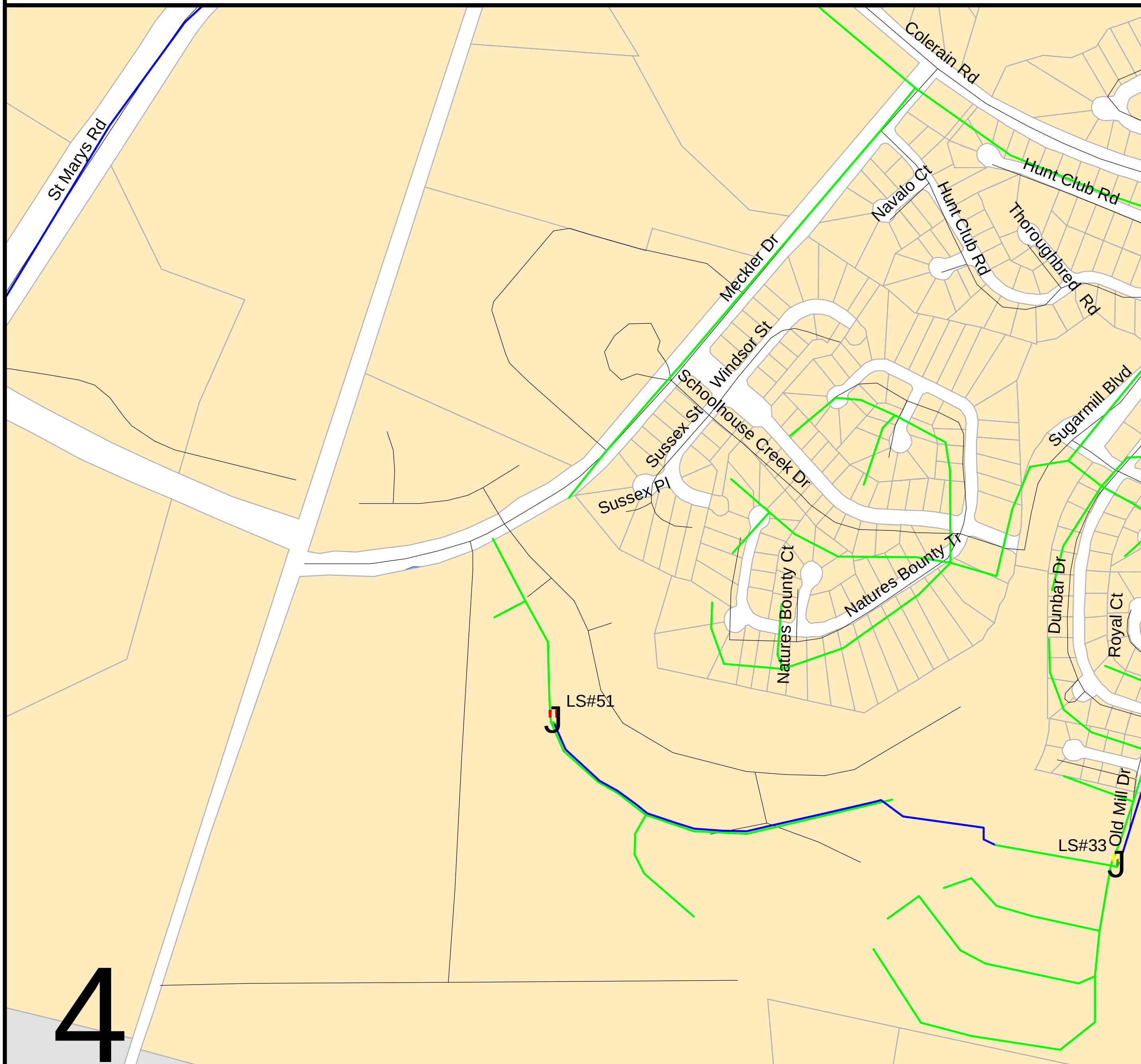
0 500 1,000 Ft

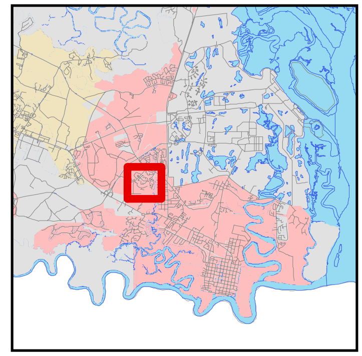
St. Marys Wastewater Collection System Improvements

Project Name: WW20

Project Description: Reduce capacity of LS#51 to two 100 gpm pumps

Project Price: $2.000.00





JORDAN JONES & GOULDING

Legend

Lift Stations
Existing GS
New GS
Force Main
Improvements

Figure 5.10

0 270 540 Ft

St. Marys Wastewater Collection System Improvements

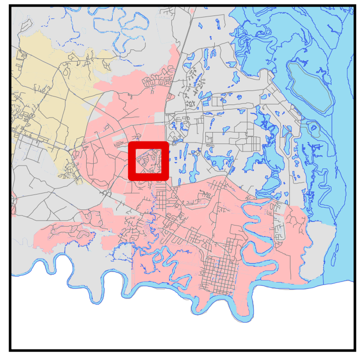
Project Name: WW37, WW38

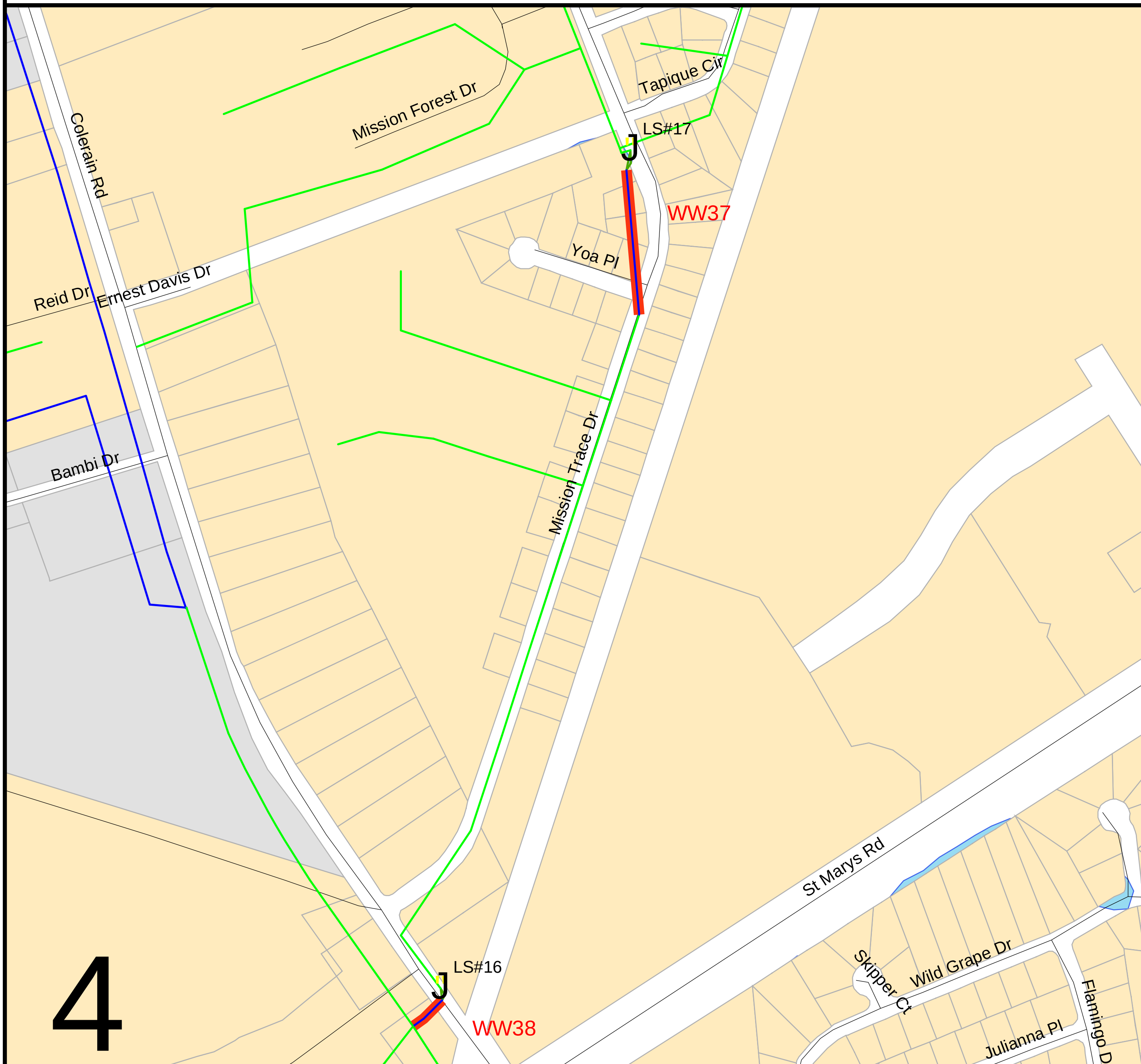
Project Description:

(WW37) Replace LS#17 FM with 450 LF of 8"FM

(WW38) Replace LS#16 FM with 120 LF of 10"FM

Project Price: $19,800.00





JORDAN JONES & GOULDING

Legend

Lift Stations

Existing GS

New GS

Force Main

Improvements

Figure 5.9

0 290 580 Ft

St. Marys Wastewater Collection System Improvements

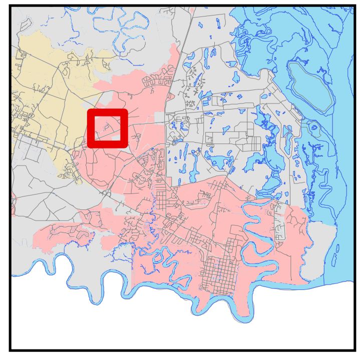
Project Name: WW36, WW43

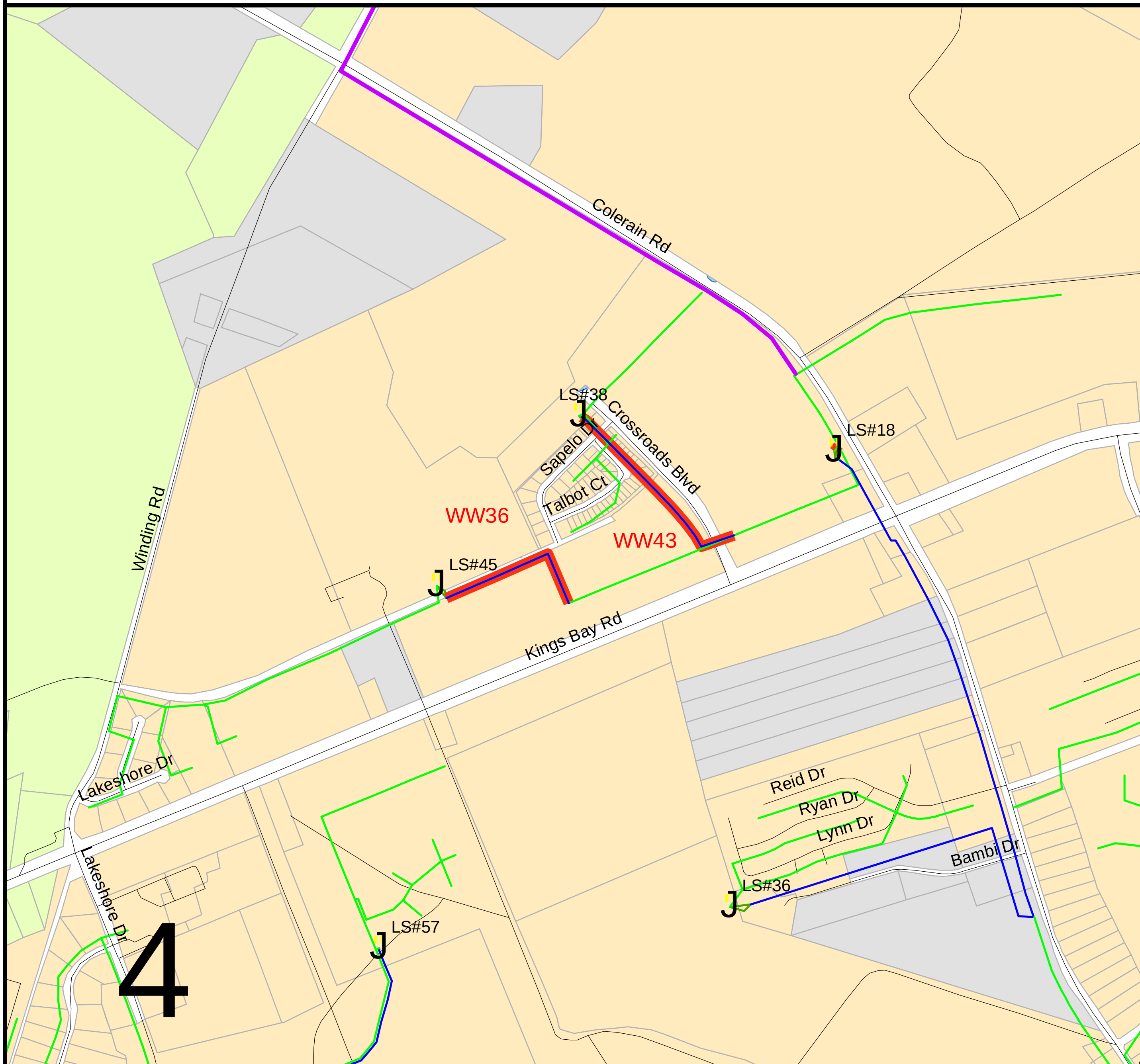
Project Description:

(WW36) Replace LS#45 FM & Reroute to GS of LS#18 with 1,050 LF of 8"FM

(WW43) Replace LS#38 FM with 1,565 LF of 10"FM

Project Price: $93,600.00





JORDAN JONES & GOULDING

Legend

Lift Stations	New GS
Existing GS	Force Main
	Improvements

Figure 5.8

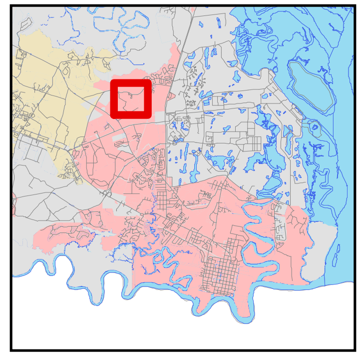
0 425 850 1,700 Ft

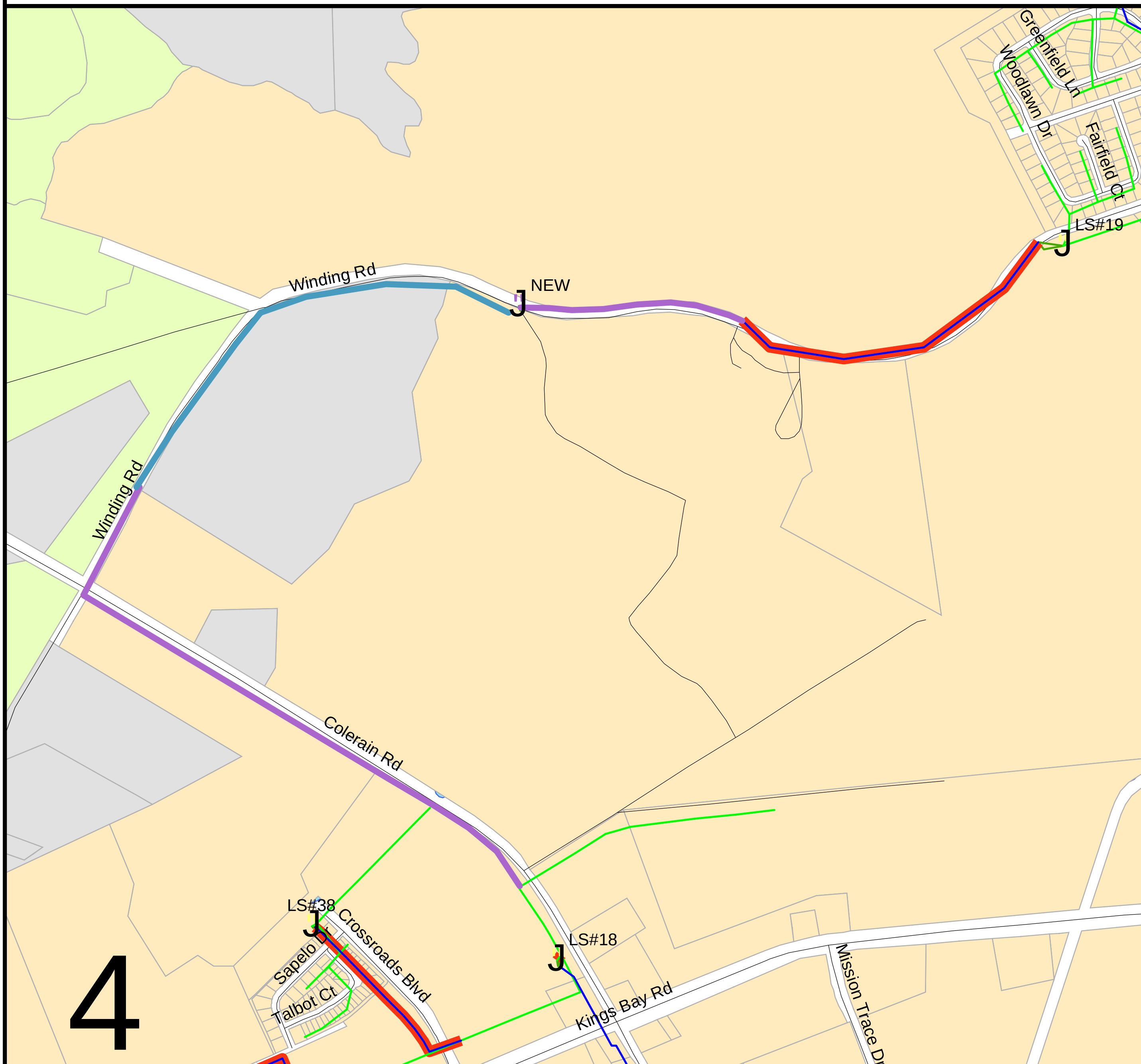
St. Marys Wastewater Collection System Improvements

Project Name: WW4

Project Description: New Lift Station with two 800 gpm pumps
1,750 LF of New 10"GS
4,640 LF of New 18"GS
6,520 LF of New 10"FM
Reroute 2,520 LF 6"FM and Replace with
10"FM

Project Price: $ 1,517,800.00





JORDAN JONES & GOULDING

Legend

- New Lift Station
- Existing GS
- New GS
- New Force Main
- Improvements

Figure 5.7

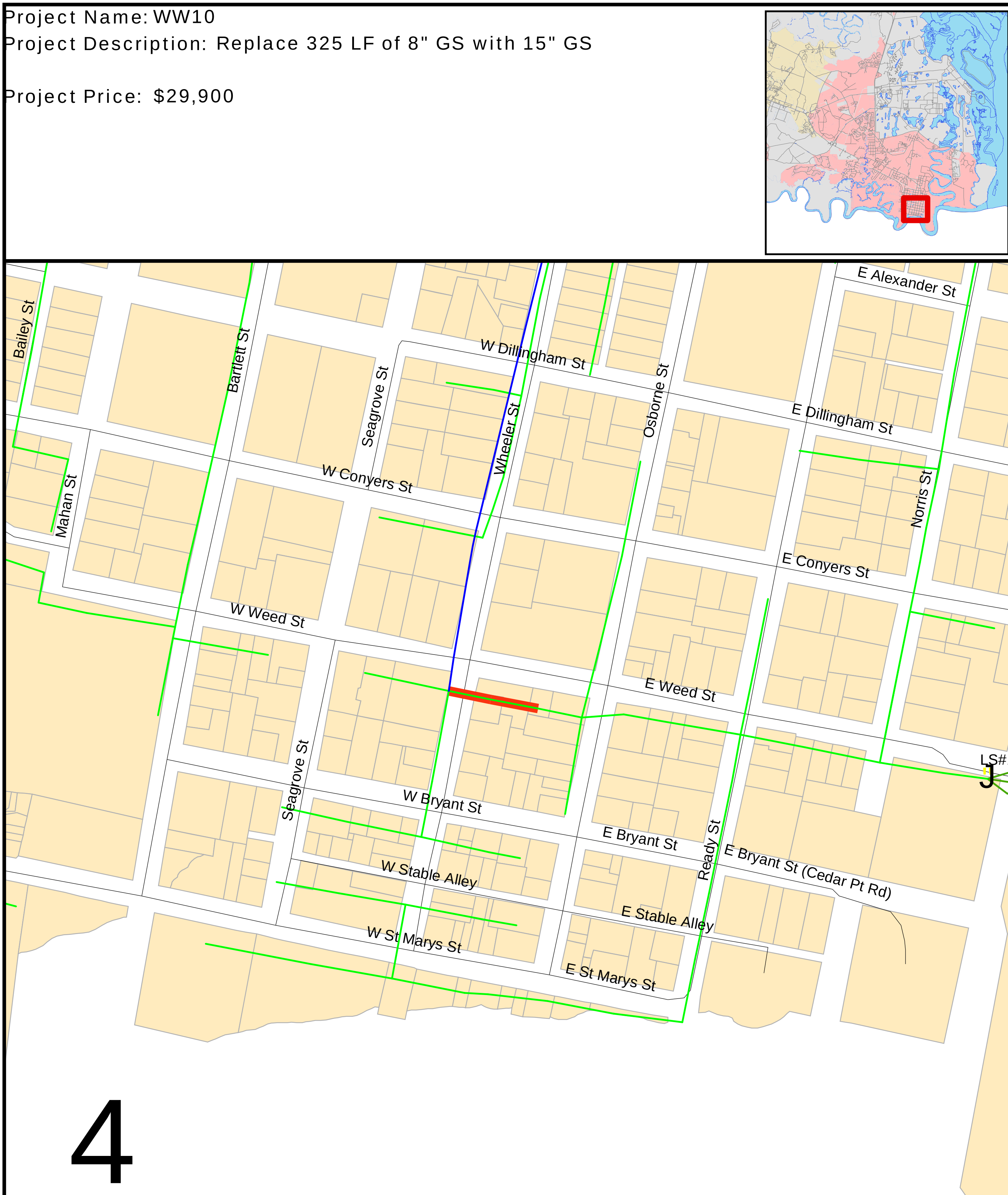
0 495 990 Ft

St. Marys Wastewater Collection System Improvements

Project Name: WW10

Project Description: Replace 325 LF of 8" GS with 15" GS

Project Price: $29,900



JORDAN JONES & GOULDING

Legend

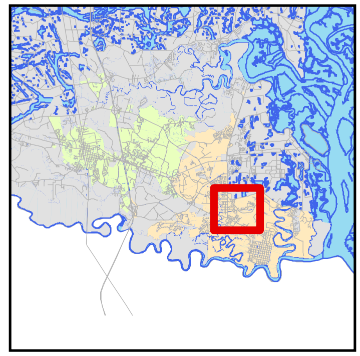
- Lift Stations
- Existing GS
- New GS
- Force Main
- Improvements

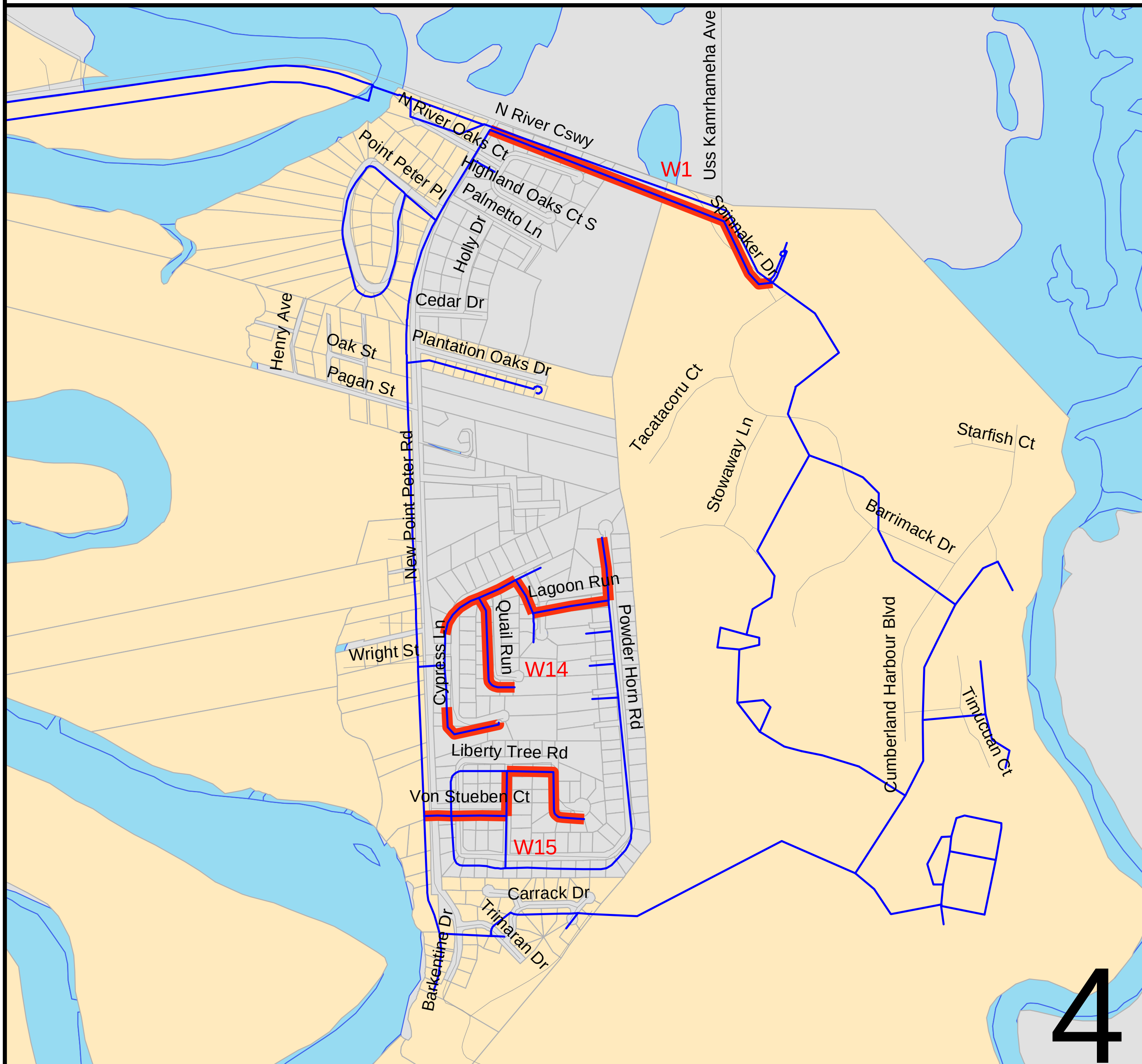
Figure 5.6

0 235 470 Ft

St. Marys Water Distribution System Improvements

Project Location: East St. Marys
Project Description: Replace & Install Water Mains
Project ID's: W1,W14-W15





JORDAN JONES & GOULDING

Legend

Wells & Tanks
Existing Pipe
Proposed Improvements

Figure 5.5

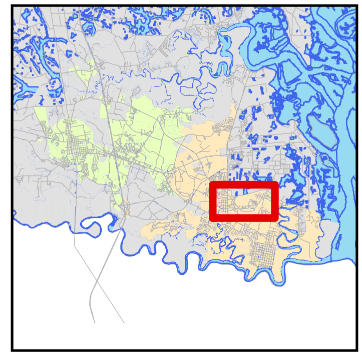
0 387.5 775 1,550 Ft

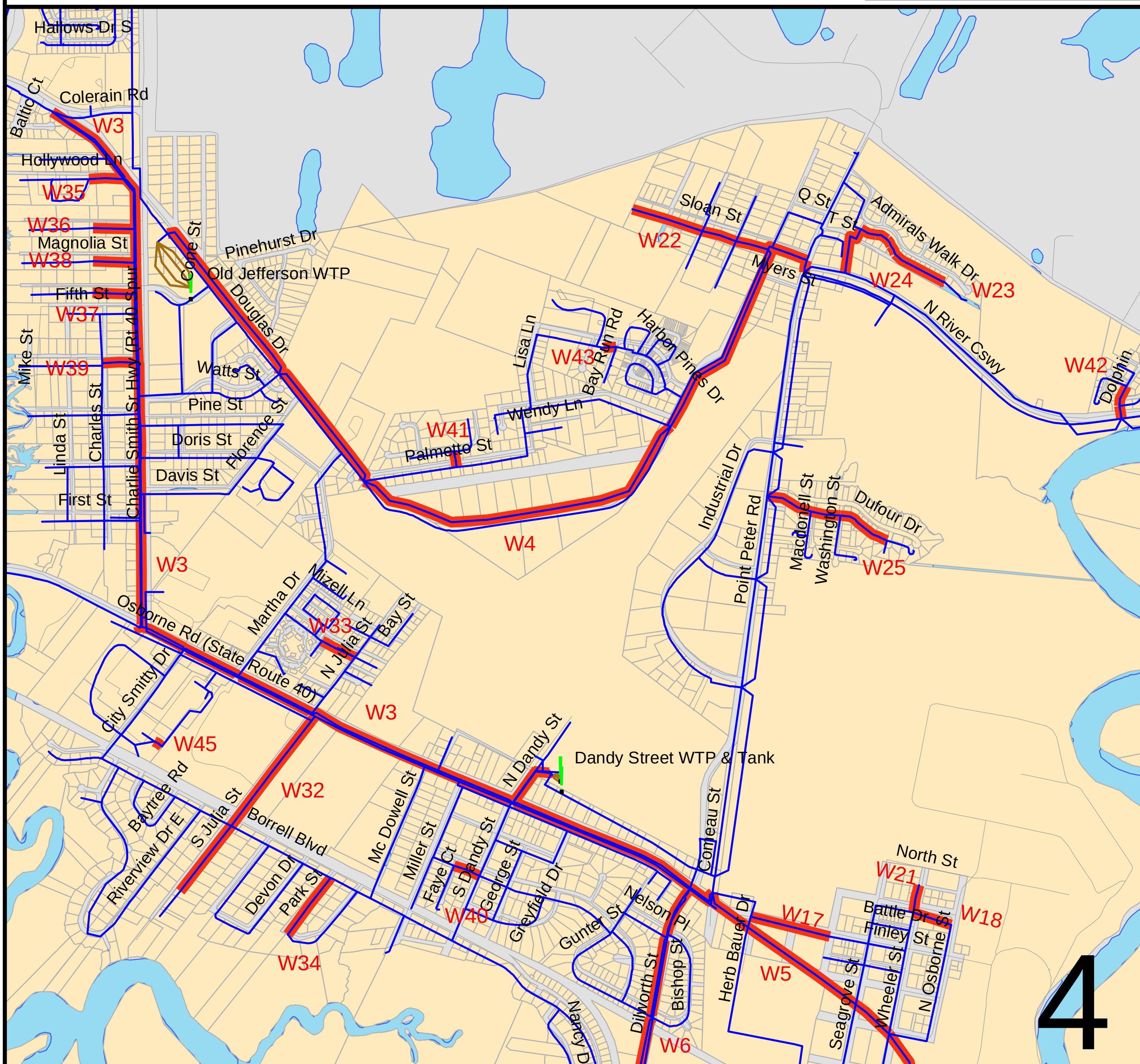
St. Marys Water Distribution System Improvements

Project Location: Central St. Marys

Project Description: Replace & Install Water Mains

Project ID's: W3,W4,W6,W17,W18,W21-W25,W32-W43,W45





JORDAN JONES & GOULDING

Legend

Wells & Tanks

Existing Pipe

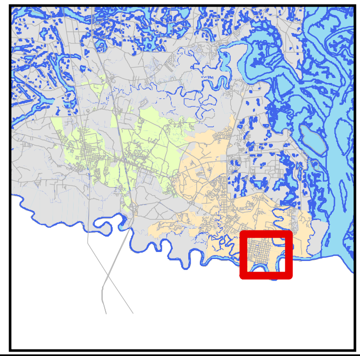
Proposed Improvements

Figure 5.4

0 625 1,250 2,500 Ft

St. Marys Water Distribution System Improvements

Project Location: Downtown St. Marys
Project Description: Replace & Install Water Mains
Project ID's: W5,W6,W16-W21



JORDAN JONES & GOULDING

Legend

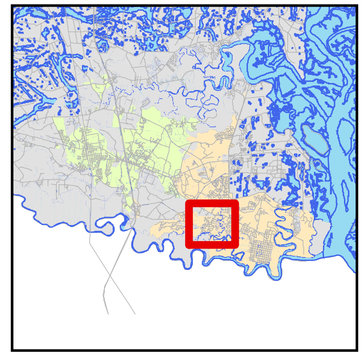
Wells & Tanks
Existing Pipe
Proposed Improvements

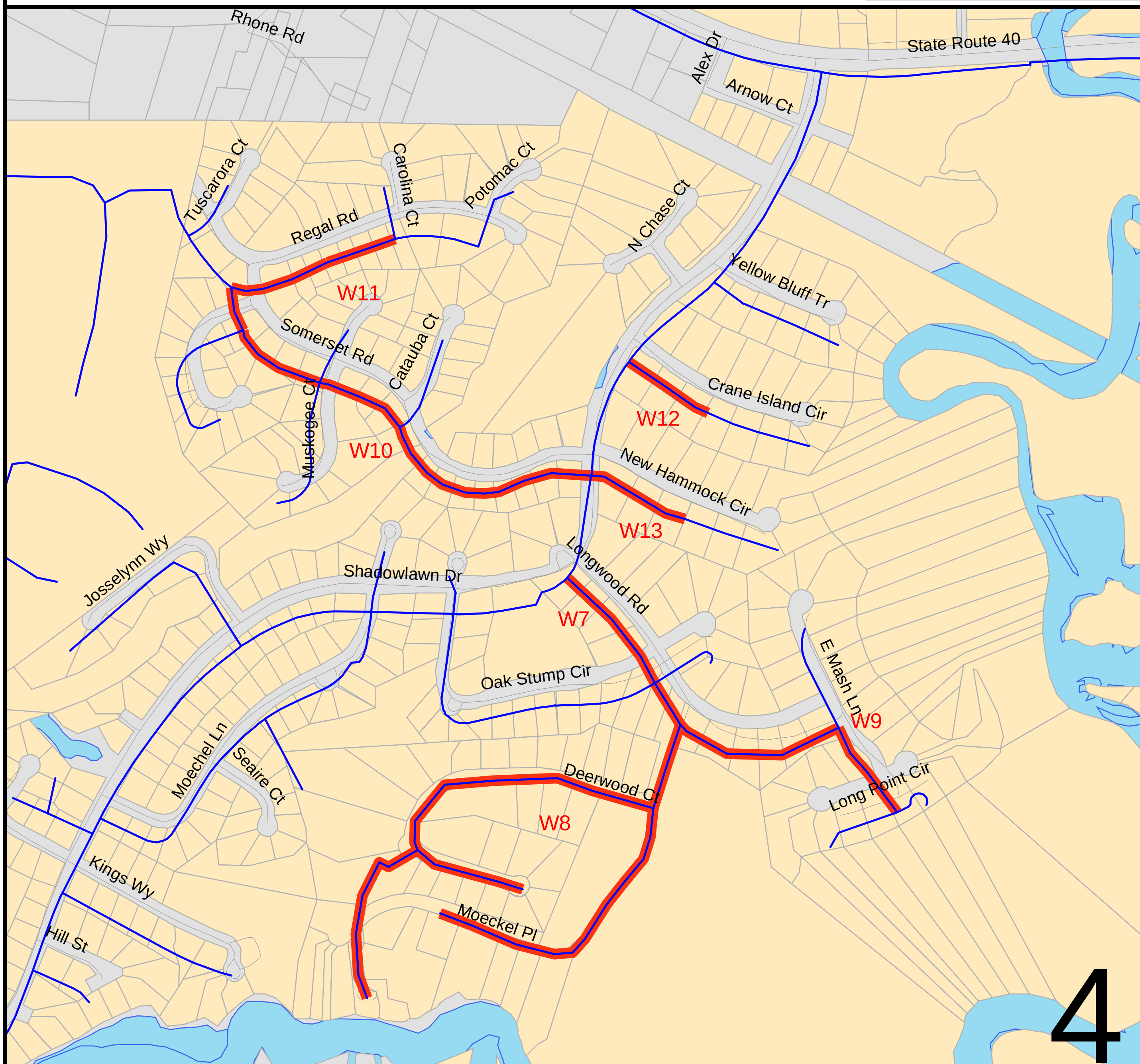
Figure 5.3

0 360 720 1,440 Ft

St. Marys Water Distribution System Improvements

Project Location: Southwestern St. Marys
Project Description: Replace & Install Water Mains
Project ID's: W8-W13





JORDAN JONES & GOULDING

Legend

Wells & Tanks

Existing Pipe

Proposed Improvements

Figure 5.2

0 225 450 900 Ft

St. Marys Wastewater Collection System Improvements

Project Name: WW23, WW28, WW29

Project Description:

(WW23) Install 10,200 LF of New 8"GS

(WW28) Install 7,560 LF of New 8"GS

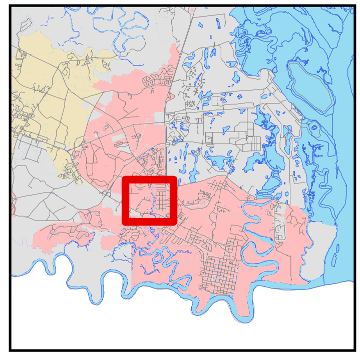
New Lift Station with two 50 gpm pumps

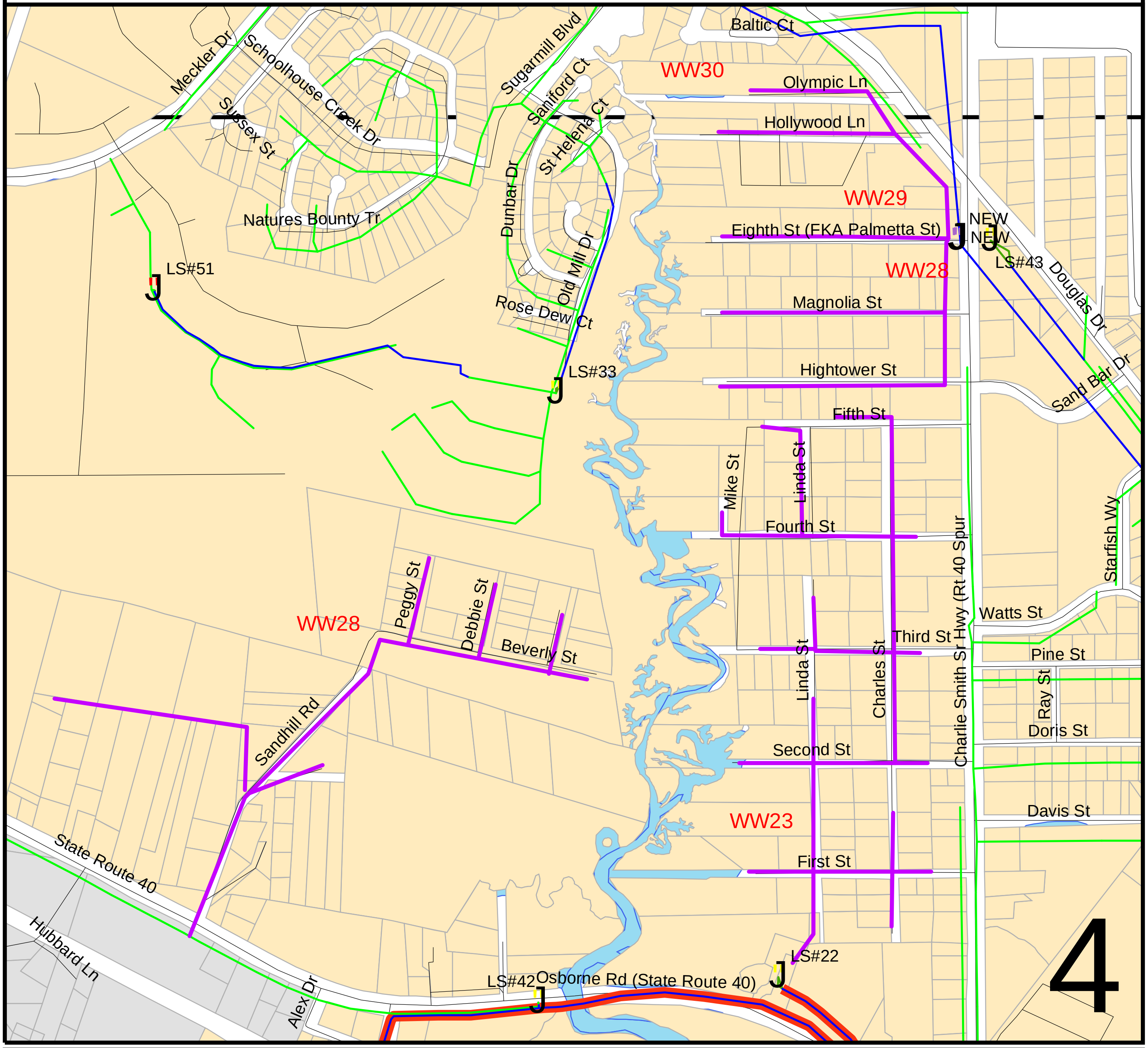
(WW29) Install 2,070 LF of New 12"GS

Install 4,730 LF of New 8"GS

(WW30) Install 1,300 LF of New 8"GS

Project Price: $2,602,000.00





JORDAN JONES & GOULDING

Legend

Lift Stations	New Facilities
Existing GS	Force Main
	Improvements

Figure 5.19

0 500 1,000 Ft

Water and Wastewater Master Plan

Section 6

Five-Year CIP

A component of the overall Water and Wastewater Master Plan includes developing a Five-Year Capital Improvements Program (CIP) and a Revenue Sufficiency Analysis. As part of the CIP and Revenue Sufficiency Analysis, a spreadsheet model using Microsoft Excel was developed to analyze water and wastewater system revenues, expenses, and existing and proposed debt. The result is a five-year projection of revenues, expenses for operations and maintenance, and existing debt payments presented in this report. This section also summarizes the recommended sources of funds for the CIP and provides a section of assumptions, conclusions and recommendations related to revenue increases and other issues pertinent to the overall revenue sufficiency of the water and wastewater system.

Based on analyses performed as part of this Master Plan, water and wastewater system improvements have been identified for both the short-term (5 years) and long-term (5-20 years). The short-term recommendations are projects that are needed immediately to provide additional capacity and reliability, as well as to meet regulatory requirements. This CIP focuses on projects recommended for implementation over the next five years. Priorities for these projects were established for the CIP based on JJG's evaluation of the systems' current operational capabilities and future needs as well as the City Staff's working knowledge of the systems. It is expected that $2,257,000 will be spent on Water System Capital Improvements during the five-year planning period and $15,818,000 will be spent on Wastewater System projects. A total capital expenditure of $843,000 is to be spent in fiscal year (FY) 05 on both water and wastewater projects.

Water System Projects

The water system projects outlined in the City's Five-Year CIP include the design and construction of water main replacements, extensions and relocations as well as water supply planning. The CIP for the water system is outlined in Table 6.1.

The CIP water projects that are proposed to be funded by typical revenue sources within the system's Enterprise Fund, such as operating income, are designated as "Capital" projects in the CIP. The water projects requiring revenue outside the system's Enterprise Fund are planned to be funded by Georgia Environmental Facilities Authority (GEFA) loans. These loans are available for water projects and were chosen based on their low interest rate (approximately 4 percent) and the requirements for obtaining the GEFA loan. Generally, other outside sources such as Revenue Bonds have higher interest rates and require more procedural work and expense to acquire.

Table 6.1
Water System Projects Five-Year CIP

Project	Funding Source	Fiscal Year Costs (in $1,000s)					
		2005	2006	2007	2008	2009	Total
W1: Parallel existing 12" transmission main from the Cumberland Harbor Tank service line to New Point Peter Road and connect to existing 8" transmission main on New Point Peter Road. The existing connection to the 8" transmission main on the North River Causeway.	CAPITAL	$ 111	-	-	-	-	$ 111
W2: Water Supply Study	CAPITAL	-	$ 100	-	-	-	$ 100
W3: Water Transmission Main along Douglas Drive, Spur 40 and Osborne Road from the intersection of Douglas Drive and Colerain Road to the intersection of Point Peter Road and Osborn Road	GEFA	-	$ 661	-	-	-	$ 661
W4: Water Transmission main along Douglas Drive and Sloan Street from Old Jefferson WTP to the intersection of Point Peter Road and N. River Causeway.	GEFA	-	$496	-	-	-	$496
W5:.Water Transmission Main along Osborne Road, Osborne Street and Ready Street from the intersection of Point Peter Road and Osborne Road to the intersection of Ready Street and East Bryant Street	GEFA	-	-	-	-	$390	$390
W6: Water Transmission Main along Dillworth Street from the intersection of Dillworth Street and Osborne Road to the intersection of Dillworth Street and Mildred Street	GEFA	-	-	-	-	$ 283	$ 283
W7: Replace 6" pipe on Longwood Road from Shadowlawn Drive to East Marsh Lane	CAPITAL	-	-	-	-	$ 66	$ 66
W8: Install New water distribution pipes in the Shadowlawn subdivision on Moeckel Place and Deerwood Court.	CAPITAL					$150	$150
WATER TOTAL:		**$ 111**	**$ 1,257**	**-**	**-**	**$889**	**$ 2,257**

Note: Above estimates are for the years stated. Any delayed projects will require adjustment for construction cost inflation.

Wastewater System Projects

The wastewater system projects in the City's Five-Year CIP include the engineering studies, design and construction of the Point Peter WWTF expansion from 0.8 MGD to 1.8 MGD; dynamic model of the collection system, sanitary sewer replacements and relocations, lift station improvements (including standby power and auto dialers), lift station repairs and capacity adjustments. The wastewater CIP is shown in Table 6.2.

The wastewater projects in the CIP that are to be funded by typical revenue sources within the system's Enterprise Fund, such as operating income, are designated as "Capital" projects in the CIP. The wastewater projects requiring revenue outside the system's Enterprise Fund are planned to be funded by GEFA loans. These loans are available for wastewater projects and were chosen based on their low interest rate (approximately 4 percent) and the requirements for obtaining the GEFA loan.

Generally, other outside sources such as Revenue Bonds have higher interest rates and require more procedural work and expense to acquire.

Table 6.2
Wastewater System Projects Five-Year CIP

Project	Funding Source	Fiscal Year Costs (in $1,000s)					
		2005	2006	2007	2008	2009	Total
Point Peter WWTF Expansion from 0.8 to 1.8 MGD							
WW1: Engineering Studies and Watershed Assessment	GEFA	$ 100	-	-	-	-	$ 100
WW4: Design	GEFA	-	$ 800	-	-	-	$ 800
WW9 & WW 13: Construction	GEFA	-	-	$ 3,150	$ 3,150	-	$ 6,300
WW2: Point Peter WWTF upgrades per NPDES permit	GEFA	$ 1,000	-	-	-	-	$ 200
WW3: Dynamic Model and survey of collection system	CAPITAL	$ 75	-	-	-	-	$ 75
WW4: Install new Lift Station, Force Main and Gravity Sewer Along Winding Road and Colerain Road.	GEFA	$1,518	-	-	-	-	$1,518
WW5: New Gravity Sewer, Force Mains and pumps for LS 29	CAPITAL	$ 505	-	-	-	-	$ 505
WW6: Replace and Reroute Force Main from LS #9/15	CAPITAL	$ 19	-	-	-	-	$ 19
WW7: Reroute 4" FM from LS #8 to new GS of LS#29	CAPITAL	$ 33	-	-	-	-	$ 33
WW8: Replace Pumps, new wet well & reroute FM from LS#13	GEFA	$ 854	-	-	-	-	$ 854
WW9: Replace 8-inch GS from LS #11A - 12" FM	CAPITAL	-	$ 30	-	-	-	$ 30
WW10: Lift Station Improvements and Repairs	CAPITAL	-	$ 125	$ 75	$ 75	$ 75	$ 350
WW11: Autodialers at 20 lift stations	CAPITAL	-	$ 100	$ 100	-	-	$ 200
WW12: Replace pumps and reroute FM from LS#6 to LS#13	CAPITAL	-	$ 556	-	-	-	$ 556
WW13: Reduce Capacity LS's 35,41,51,55	CAPITAL	-	-	-	$ 8	-	$ 8
WW14: Replace 4-inch FM from LS #22	CAPITAL	-	-	-	$ 24	-	$ 24
WW15: New Gravity Sewer for southern portion of Annex	CAPITAL	-	-	-	$ 765	-	$ 765
WW16: Replace 6-inch FM from manifold of LS#23/42	CAPITAL	-	-	-	-	$ 97	$ 97
WW17: Replace 6-inch FM from LS #42 to manifold	CAPITAL	-	-	-	-	$ 1	$ 1
WW18: Replace 6-inch FM from LS #23 to manifold	CAPITAL	-	-	-	-	$ 47	$ 47
WW19: New GS along Sandhill Road and Beverly Street	CAPITAL	-	-	-	-	$ 567	$ 567
WW20: New LS and GS for northern portion of Annex	GEFA	-	-	-	-	$ 1,173	$ 1,173
WW21: New GS along Olympic Lane	CAPITAL	-	-	-	-	$ 98	$ 98
WW22: New LS, FM & GS near Deerwood Ct. & Moeckel Pl.	CAPITAL	-	-	-	-	$ 698	$ 698
WASTEWATER TOTAL:		**$ 4,104**	**$ 1,611**	**$ 3,325**	**$ 4,022**	**$ 2,756**	**$ 15,818**
Note: Above estimates are for the years stated. Any delayed projects will require adjustment for construction cost inflation.							

Funding Sources

The proposed funding sources for the Five-Year CIP are summarized in Table 6.3. The total CIP is $18,075,000 for the 5-year period with a capital expense of $843,000 planned for FY 05.

Table 6.3
Proposed Project Funding Sources (in $1,000s)

Water System Improvements

	Fiscal Year					
Funding Source	**2005**	**2006**	**2007**	**2008**	**2009**	**Total**
Bond	$0	$0	$0	$0	$0	$0
GEFA	$0	$1,157	$0	$0	$673	$1,830
Capital	$111	$100	$0	$0	$216	$427
Total	**$111**	**$1,257**	**$0**	**$0**	**$889**	**$2,257**

Wastewater System Improvements

	Fiscal Year					
Funding Source	**2005**	**2006**	**2007**	**2008**	**2009**	**Total**
Bond	$0	$0	$0	$0	$0	$0
GEFA	$3,372	$800	$3,150	$3,150	$1,173	$11,645
Capital	$732	$811	$175	$872	$1,583	$4,173
Grant/Capital	$0	$0	$0	$0	$0	$0
Total	**$4,104**	**$1,611**	**$3,325**	**$4,022**	**$2,756**	**$15,818**

Total System Improvements

	Fiscal Year					Total	
Funding Source	**2005**	**2006**	**2007**	**2008**	**2009**	**$**	**%**
Bond	$0	$0	$0	$0	$0	$0	0%
GEFA	$3,372	$1,957	$3,150	$3,150	$1,846	$13,475	75%
Capital	$843	$911	$175	$872	$1,799	$4,600	25%
Grant/Capital	$0	$0	$0	$0	$0	$0	0%
Total	**$4,215**	**$2,868**	**$3,325**	**$4,022**	**$3,645**	**$18,075**	100%

Projected Revenue Requirements

Revenue requirements consist of the operating, maintenance, capital and other monetary expenditures necessary to provide, maintain and perpetuate quality service to the customers of the City. This analysis utilizes historical data supplied by the City as the basis for developing the revenue requirements for the projection period.

Operating Revenues

The Operating Revenues calculated within this Report includes revenues generated from water and sewerage charges as well as other fees and charges. The revenues for each fiscal year of the Projection Period are estimated utilizing recent trends in customer accounts and usage. This includes estimated customer account growth as well as estimated revenue increases. Revenues generated by the water and wastewater system are shown in Table 6.4 of this section.

Operation and Maintenance Expenses

The Operation and Maintenance (O&M) expenses are primarily those ongoing costs for labor, materials, supplies, services, etc., required to manage and operate the utility system on a day-to-day basis while maintaining a dependable level of service. The estimated O&M requirements are generally a function of a budgetary process and are directly related to the level of service provided to customers of the water and wastewater system.

The costs associated with certain operating expenses that are typically more variable in nature, such as chemicals and electrical power, are escalated pursuant to factors based on a combination of estimated customer and/or flow growth, and assumed inflationary forces. Personnel related costs such as employee salaries and benefits are generally escalated based on assumed labor escalator factors that, over the projection period, include adjustments in pay and incremental addition of employees as necessary. Expense items that do not generally vary with System growth (i.e. insurance, telephones, publications, contracted service, etc.) either escalate based only on inflation or remain relatively constant. Materials, supplies, general repairs and maintenance expenses generally increase from current levels based on inflationary factors that directly impact that water and wastewater industry. Such factors are derived on a composite basis from historical analysis of price indices used by many utilities for financial forecasting. The applicable indices include the following:

- Gross National Product Implicit Price Deflator Index which is sometimes used by utility regulatory agencies in the establishment of price indexing factors for operating costs of private and investor-owned utilities;
- Consumer Price Index which reflects the change in consumer prices;
- Indices derived from the Engineering News Record, a publication that tracks trends in construction and material costs; and
- Indices reflected in the Handy-Whitman Index of Public Utility Construction Costs for the South Atlantic Region.

Historical expenses incurred by the City over the last five (5) years were reviewed; however, a clear trend relating to consistent percentage increases could not be ascertained. Therefore, based on the aforementioned indices, a conservative escalation rate of 3 percent was estimated and is applied to the FY 2005 budget expenses for FY 06 and for each year thereafter.

The Analysis performed in Table 5.4 utilizes the City's fiscal year (FY) 2000, 2001, 2002 and 2003 end of the year expenditures and projected 2004 end of the year expenditures coupled with budget information as the starting point for the development of FY 2005 expenditures and applies the aforementioned escalation factor to each year of the projection period of this Report. O&M expenses incurred by the water and wastewater system are shown in Table 6.4 of this section.

Capital Costs

Capital Costs represent existing and future debt to be incurred by the City. These include Revenue Bonds, GEFA loans and equipment loans. The bonds and loans are amortized over the expected payback period and the associated yearly cost (principle and interest) of each bond and loan is included in the revenue sufficiency assessment.

Debt Service Coverage Ratio

The Debt service coverage ratio is generally viewed as an indicator of the financial strength of the water and wastewater system. The Debt Coverage Ratio is determined by dividing the income available for Debt Service or the Total Available Income by the Debt Service Requirement. In the case of revenue bonds, this ratio is usually required to be between 1.20 and 1.40 depending on the bond issue's Official Statement requirements which is directly attributable to the financial strength of the local government. GEFA loans require that the debt service ratio be 1.05 or higher.

Table 6.4
Projected Revenue and Expenses ($1,000 dollars)

	FY 05	FY 06	FY 07	FY 08	FY 09
Water Revenue Growth Adjustment		1.027	1.027	1.027	1.027
Wastewater Revenue Growth Adjustment		1.025	1.025	1.025	1.025
Revenue Adjustment	1.06	1.06	1.04	1.04	1.04
OPERATING REVENUE:					
Water Charges	$1,537	$1,673	$1,787	$1,909	$2,039
Sewerage Charges	$1,325	$1,440	$1,535	$1,636	$1,744
Temporary Services	$16	$17	$18	$18	$19
Reconnection Fees	$53	$58	$62	$66	$70
Late Fees and Penalties	$53	$54	$56	$57	$59
Total Operating Income	**$2,984**	**$3,242**	**$3,457**	**$3,686**	**$3,931**
Grants and Loans	$2,600	$0	$0	$0	$0
Capital Recovery Revenues	$785	$785	$785	$785	$785
Payment from Others	$600	$0	$0	$0	$0
Revenues from Other Sources	**$3,985**	**$785**	**$785**	**$785**	**$785**
TOTAL OPERATING INCOME	**$6,969**	**$4,027**	**$4,242**	**$4,471**	**$4,716**
Enterprise Fund Equity - Unrestricted	**$2,250**	**$2,014**	**$2,225**	**$2,535**	**$2,955**
OPERATING EXPENSE:					
Expense Adjustment Factor		1.03	1.03	1.03	1.03
WATER ADMINISTRATION					
Salaries, Wages and Employee Benefits	$534	$576	$593	$611	$629
Purchased/Contracted Services	$424	$274	$282	$291	$299
Supplies	$335	$345	$355	$366	$377
Capital Outlays	$1,545	$100	$103	$106	$109
Other Costs	$244	$251	$259	$267	$275
SEWER ADMINISTRATION					
Salaries, Wages and Employee Benefits	$600	$647	$666	$686	$707
Purchased/Contracted Services	$821	$536	$552	$569	$586
Supplies	$481	$495	$510	$526	$541
Capital Outlays	$2,550	$120	$124	$127	$131
Other Costs	$507	$522	$538	$554	$571
Reconciliation of Budget Capital and CIP projects	($785)	$0	$0	$0	$0
TOTAL OPERATING EXPENSE	**$7,256**	**$3,867**	**$3,983**	**$4,103**	**$4,226**
NET OPERATING INCOME:	**$1,963**	**$2,174**	**$2,484**	**$2,904**	**$3,445**
NON-OPERATING INCOME:					
Miscellaneous	$1	$1	$1	$1	$1
Total Non-Operating Income	**$1**	**$1**	**$1**	**$1**	**$1**
INTEREST INCOME:					
Bank Account	$50	$50	$50	$50	$50
Total Interest Income	**$50**	**$50**	**$50**	**$50**	**$50**
TOTAL AVAILABLE INCOME:	**$2,014**	**$2,225**	**$2,535**	**$2,955**	**$3,496**
FORCASTED ANNUAL DEBT SERVICE REQUIREMENTS:					
Existing Bond Payment 88 & 92	$430	$430	$430	$430	$430
Total Debt Service	**$430**	**$430**	**$430**	**$430**	**$430**
GEFA LOAN PAYMENTS					
GEFA 95-E41	$13	$13	$13	$13	$13
GEFA 95-021	$19	$19	$19	$19	$19
GEFA 97-L97	$39	$39	$39	$39	$39
GEFA 98-L46	$250	$250	$250	$250	$250
GEFA CWS-RF-02	$250	$250	$250	$250	$250
Equipment Loans	$36	$36	$36	$36	$36
GEFA 2005 (proposed)	$0	$248	$248	$248	$248
GEFA 2006 (proposed)	$0	$0	$144	$144	$144
GEFA 2007 (proposed)	$0	$0	$0	$232	$232
GEFA 2008 (proposed)	$0	$0	$0	$0	$232
GEFA 2009 (proposed)	$0	$0	$0	$0	$0
Total GEFA Payments	**$607**	**$855**	**$999**	**$1,231**	**$1,463**
Bond and GEFA Coverage	1.94	1.73	1.77	1.78	1.85
Water and Sewer Revenue Adjustment Factor	1.06	1.06	1.04	1.04	1.04

The complete sources of funds for the CIP are identified in Table 6.5 and analyze such funding sources as Revenue Bonds, GEFA loans and Grants**.** Given the size of the City's water and wastewater system and the revenue requirements of each, GEFA loans would be a more logical funding source compared to Revenue Bonds. This conclusion is based on the interest rate of each and the procedures necessary to secure the funds. Grants were not included in the sources of funds; however, grant revenues can be added if funds are received.

Net Operating Income, Non-Operating Income, and Interest Income shown in Table 6.5 were calculated in Table 6.4**.** Some of the CIP's projects will be funded from revenues received through rates, fees and charges. These items are designated CAPITAL Improvements in Table 6.5. GEFA loans will make up the funding for many of the CIP projects and will total $13,475,000 over the next five years. These GEFA loans are spaced out over the CIP planning period and the projects chosen for GEFA loans were designated based on size and timing with an eye toward minimizing debt service and maximizing cash flow into the system while keeping revenue increases reasonable. Debt service and GEFA loan payments were calculated based on the proceeds received and are shown at the bottom of Table 6.4**.**

In order to fund the CIP, maintain the O&M budget and provide an adequate coverage for debt service, revenues would need to increase by 6 percent in FY 2005, 6 percent in FY 2006, 4 percent in FY 2007, 4 percent in FY 2008 and 4 percent in FY 2009. The revenue increases were calculated using the projected growth factors and would apply to all the City's water and wastewater revenue sources, including but not limited to, rates, fees and charges.

Table 6.5
Sources of Funds for the Five-Year CIP ($1,000 dollars)

	Fiscal Year				
	2005	**2006**	**2007**	**2008**	**2009**
Beginning Balance	$0	$134	$163	$1,094	$1,516
Add: Net Operating Income	$1,963	$2,174	$2,484	$2,904	$3,445
Add: Existing Revenue Bond Proceeds	$0	$0	$0	$0	$0
Add: Non-Operating Income	$1	$1	$1	$1	$1
Add: Interest Income	$50	$50	$50	$50	$50
Add: Grant Revenue	$0	$0	$0	$0	$0
Add: GEFA Loan Proceeds (Proposed)	$3,372	$1,957	$3,150	$3,150	$1,846
Less: Revenue Bond Debt Service	($430)	($430)	($430)	($430)	($430)
Less: Existing and Proposed GEFA Loan Payments	($607)	($855)	($999)	($1,231)	($1,463)
Less: Future CAPITAL Improvements from CIP	($843)	($911)	($175)	($872)	($1,799)
Less: Future GEFA Project Costs	($3,372)	($1,957)	($3,150)	($3,150)	($1,846)
Ending Balance	$134	$163	$1094	$1,516	$1,320
Revenue Increase	1.060	1.060	1.040	1.040	1.040
Revenue Increase (Percentage)	**6%**	**6%**	**4%**	**4%**	**4%**
Coverage of Revenue Bond Debt Service by Net Revenues including investment earnings	4.68	5.17	5.90	6.87	8.13
Coverage of Bond and GEFA	1.94	1.73	1.77	1.78	1.85

Assumptions

The analyses and projections developed in this section utilize certain assumptions with respect to conditions that may occur in the future. While these assumptions are believed to be reasonable for the purpose of this Plan, they are dependent upon future events and, therefore, actual events may differ from those assumed. In addition, the development of assumptions and applicable projections relies upon certain information provided by others. While these sources and the applicable information are believed to be reliable, the information has not been independently verified and there are no assurances offered with respect thereto. To the extent that future conditions differ from those assumed herein or provided by others, the actual results will vary from those developed and presented as the projected operating results. The principal assumptions and considerations include the following:

- Customer account growth for the System is projected based on historical customer's account data as provided by the City. The customer information indicates that the water and wastewater system has historically experienced moderate new growth in volumes of water supplied and wastewater treated. As such, for the purpose of the analyses, the percentage of volume increase due to growth is conservatively expected to be 2.7 percent for water and 2.5 percent for wastewater.

- It is assumed that the average flow statistics for the Projection Period will be consistent with historical average flow levels. Applying the estimated average flow statistics, it is assumed that aggregate water production will increase consistently by approximately two to three percent. Annual variations in rainfall and other weather factors may significantly influence the level of future water demands, and as such could affect the financial results of system operations.

- The costs associated with certain operating expenses that are typically more variable in nature are adjusted pursuant to factors based on inflation, as well as changes in the number of customers and accompanying flows. Other less variable costs are assumed to increase from current budgetary levels based on inflationary factors that directly impact the water utility industry. Such factors are consistent with historical price indices used by many utilities for financial forecasting and rate setting processes. With this in mind, JJG has assumed operating expenses will increase at 3 percent annually.

- Future water rate increases will be approved by the City Council and implemented on a timely basis, and will occur as described pursuant to planning estimates developed by the City, or as otherwise determined necessary by the City pursuant to normal budgeting procedures and future revenue requirements.

- Future capital improvement projects are assumed to occur as outlined in Tables 6.1 and 6.2. To the extent that the timing or implementation of such projects may change from that estimated herein, the cost of such projects and resulting impact on future revenue increases may vary from those indicated.

- No revenue was expected to be received through grants (line 20 of Table 6.4) or through Payment from Others (line 22 of Table 6.4) after FY 2005. These values were zeroed out for the remaining fiscal years.

- GEFA loans will be available based on information retrieved from GEFA's website.

- Repayment of future GEFA loans will begin in the fiscal year following the completion of the CIP project for which the loan was secured.

- SPLOST funds will be used as available, but for this analysis no SPLOST funds were considered available.

CIP Recommendations

The following items are recommended for implementation:

- Implement the revenue increase for FY 2005 as soon as practical; the revenue stream shown in Table 6.4 assumes that the new revenue increases will be implemented in early fiscal year 2005.

- Update the CIP and the revenue sufficiency calculation spreadsheet each year to re-evaluate existing and proposed conditions that may affect revenues and expenses.

- Review unit rate calculations annually and implement adjustments in July of the fiscal year for which the rates were calculated.

- Undertake a Cost of Services Analysis of the water and wastewater systems' rates, fees and charges to ensure customers are paying their equitable share of water and wastewater services provided by the City and to ensure that each system funds itself.

- As revenues grow, look to fund an Operational Reserve. Industry standard calls for a 6-month reserve, however, the City can ramp-up to this amount over a period of years. The Operational Reserve is a cash reserve used to operate the System if funds were cut off or delayed.

CITY OF ST. MARYS GEORGIA

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