WASTEWATER MASTER PLAN

City of Palm Bay, Florida
July 2024

Prepared by Infrastructure Solution Services

WASTEWATER MASTER PLAN
CITY OF PALM BAY UTILITIES DEPARTMENT

JULY 2024

INFRASTRUCTURE
SOLUTION SERVICES

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ABBREVIATIONS AND TERMINOLOGY

AACE = Association for the Advancement of Cost Engineering

AADF = Annual Average Daily Flow

ACP = Asbestos Clay Pipe

ADF = Average Daily Flow

AID = Assist ID

ARV = Air Release Valve

Bls = Below Land Surface

BMAP = Basin Management Action Plan

BNR = Biological Nutrient Removal

BEBR = University of Florida Bureau of Economic and Business Research

CF/HR = Cubic Feet per Hour

CIP = Capital Improvement Projects

City = City of Palm Bay

CSTR = Continuous Stirred-Tank Reactor

DEM – Digital Elevation Model

Dia. = Diameter

DIP = Ductile Iron Pipe

DIW = Deep Injection Well

DMR = Discharge Monitoring Report

EPA = U.S. Environmental Protection Agency

EPS = Extended Period Simulation

ERC = Equivalent Residential Connection

FAC = Florida Administrative Code

FDEP = Florida Department of Environmental Protection

FDOT = Florida Department of Transportation

FPL = Florida Power and Light

fps = feet per second

FS = Florida Statues

ft = Feet

GDU = General Development Utilities, Inc.

GIS = Geographic Information System

gpd = Gallons per Day

gph = Gallons per Hour

gpm = Gallons per Minute

GST = Ground Storage Tank

HDPE = High-Density Polyethylene

HMI = Human Machine Interface

HP = Horsepower

I&I = Inflow and Infiltration

ID = Identification Numbers

in = inch

IRL = Indian River Lagoon

ISS = Infrastructure Solution Services

lbs/hr = Pounds per Hour

LF = Linear Feet

LS = Lift Station

IRL = Indian River Lagoon

MBS = Malabar Booster Station

MBR = Membrane Biological Reactor

MCC = Motor Control Center

MADF = Maximum Average Daily Flow

MG = Million Gallons

mg/L = Milligrams per Liter

MGD = Million Gallons per Day

MHP = Mobile Home Park

MLE = Modified Ludzack Ettinger

mm = millimeter

MMADF = Maximum Month Average Daily Flow

M-TWCD = Melbourne Tillman Water Control District

NRDIW = North Regional Deep Injection Well

NRWRF = North Regional Water Reclamation Facility

NRWWTP = North Regional Wastewater Treatment Plant

OUL =Original Useful Life

OSTDS = Onsite Sewage Treatment and Disposal System

PBUC = Palm Bay Utility Corporation

PBUD = Palm Bay Utilities Department

PHF = Peak Hourly Flow

PLC = Programmable Logic Controller

ppmv = parts per million by volume

psi = Pounds per Square Inch

PVC = Polyvinyl Chloride

R&R = Renewal and Replacement

RFP = Request for Proposal

RO = Reverse Osmosis

RSL01 = Regional Lift Station No. 1

RUL = Remaining Useful Life

SANC = Sewer Available Not Connected

SCADA = Supervisory Control and Data Acquisition

SF = Square Feet

SJRWMD = St. Johns River Water Management District

SRDIW = South Regional Deep Injection Well

SRWRF = South Regional Water Reclamation Facility

SRWTP = South Regional Water Treatment Plant

TDH = Total Dynamic Head

TN = Total Nitrogen

TP = Total Phosphorus

TS = Total Solids

VCP = Vitrified Clay Pipe

WTP = Water Treatment Plant

CERTIFICATION

Certification as to Sections 1, 2, 3, 10, 11, and 12

Engineer of Record:	Infrastructure Solution Services, LLC 7175 Murrell Road Melbourne, FL 32940 Certification of Authorization No. 29992
Engineer of Record Contact:	Clayton E. McCormack, PE Florida Registration No. 65473

Infrastructure Solution Services, LLC believes the information contained in this report is true and correct to the best of my knowledge, and that this report was prepared in accordance with sound engineering principles.

7/24/24

Clayton E. McCormack, PE — Date
Florida Registration No. 65473

CERTIFICATION

Certification as to Sections 4 through 9

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Engineer of Record Contact:	David A. Myers, PE Florida Registration No. 66483

Infrastructure Solution Services, LLC believes the information contained in this report is true and correct to the best of my knowledge, and that this report was prepared in accordance with sound engineering principles.

7/24/2024

David A. Myers, PE — Date
Florida Registration No. 66483

Section 1 - Executive Summary

The City of Palm Bay (City) expects continued growth from an estimated city-wide population of 140,000 in 2024 to approximately 167,000 in 2045. This 19% increase in the population over the next 20 years will cause an additional increase in wastewater flows from within the sanitary wastewater utility service area. To meet the demand and to continue to provide safe, high-quality, wastewater conveyance, treatment, and disposal, the City intends to expand, modify, and further reinvest in the wastewater collection system and treatment facilities.

The goal of this Water Master Plan is to identify capital improvement needs and associated costs over the next twenty-year planning period to support projected demands so the City can develop and institute various funding strategies and mechanisms to support the construction of the identified improvements. Improvements include wastewater collection system capacity, wastewater conveyance capacity, treatment capacity, and effluent disposal capacity. This Wastewater Master Plan only includes facility improvements related to capacity and does not address improvements associated with the renewal and replacement of facilities, equipment, finished water quality, and/or treatment techniques unless otherwise described.

The City's wastewater system is currently comprised of approximately 237 miles of gravity sewer mains, approximately 104 miles of sanitary force mains (FM), 131 city-owned sanitary lift stations, 132 privately owned sanitary lift stations, two existing (2) wastewater treatment facilities (North Regional Wastewater Treatment Plant (NRWWTP) and North Regional Water Reclamation Facility (NRWRF)), one (1) Deep Injection Well (DIW) for effluent disposal for the North Regional treatment facilities, one (1) DIW for effluent disposal for the South Regional treatment facilities, and reclaimed water treatment and pumping equipment used to produce and distribute reclaimed water for beneficial reuse to customers near the NRWRF. The City also has underway the construction of the initial phase of the South Regional Wastewater Reclamation Facility (SRWRF).

As part of this Wastewater Master Plan, a new hydraulic model representation of the existing wastewater collection system was developed using the City's most current and updated geographic information system (GIS) database of the wastewater collection system infrastructure (i.e., customer connections, gravity sewers, city-owned lift stations, privately owned lift stations, force mains, etc.). Wastewater flows, estimated from water billing data, were incorporated into the model at the point of the connection to the gravity sewer system. The model was calibrated to wastewater flow, force main pressure, and lift station run time field data collected by City staff.

The calibrated sanitary collection hydraulic system model was used to evaluate the existing wastewater collection system (including gravity sewer, lift stations, and force mains) under three steady-state design conditions and an extended period simulation for several criteria including:

- Wastewater Treatment Plant Capacity;
- Gravity Sewer Surcharging ;
- Lift Station High-Level Conditions and Excessive Pump Cycling;
- Lift Station Ability to Discharge into Force Mains;
- Lift Station Pumps Operating within Pump Performance Curves;
- Force Main Velocities; and
- Force Main Pressures.

The hydraulic model was used to evaluate the wastewater collection system at the future five-year, ten-year, and twenty-year planning horizons. The City's Growth Management and Utilities Department provided coordinated information on the known planned new developments expected within the wastewater service area for the three-planning horizons. The listing of development, their estimated number of equivalent residential connections (ERC), and the total wastewater flows for each planning period were provided. The wastewater flows from the existing customers along with the projects from the new developments were used to model the water distribution system under the five-year, ten-year, and twenty-year planning horizons. The model was used as a tool to identify potential wastewater system deficiencies at each planning horizon and to develop a series of system infrastructure needs to address each deficiency. Each need was further evaluated and developed into a series of capital improvement projects for each planning horizon along with project descriptions and planning-level project cost estimates.

For the first time, Palm Bay Utilities requested this Master Plan to incorporate an evaluation of the current condition of the two existing wastewater treatment facilities. This was assessed by assigning an asset condition rating (1 to 5 scale) to all the equipment and facilities at the two facilities using both visual inspection and an assessment of the estimated remaining useful service life of the asset. This work served as a basis for a series of system needs to address infrastructure approaching the end of their use service life. Each need to be identified through this work was developed into capital improvement projects as previously described.

The future wastewater treatment and disposal capacity needs were developed by comparing the operational and rated capacity of each facility against the total modeled wastewater flows at each of the five-year, ten-year, and twenty-year planning horizons. A series of wastewater treatment and effluent disposal infrastructure improvement needs at each planning horizon were identified and developed into capital improvement projects.

The results of all the wastewater master plan evaluations indicated that the City's projected increase in wastewater flows will require significant expansion and investments into the City's wastewater system over the next twenty-year planning period.

The following table provides a summary of the projected wastewater flows over the next twenty (20) years.

Table 1-1. Projected Wastewater Flows by Planning Horizon

Timeframe	*Number of ERCs*	*Average Annual Daily Flow (MGD)*	*Max Day Ave Daily Flow (MGD)*	*Max Day Peak Hour Flow (MGD)*
Current	16,214	3.4	6.1	7.8
Five-Year	31,733	6.7	11.5	14.3
Ten-Year	42,225	8.9	15.6	19.1
Twenty-Year	63,352	13.3	23.5	29.0

1 – Million gallons per day (MGD)

The following table summarizes the projected wastewater system improvements by facility type:

Table 1-2. Projected Capacity Expansion by Facility Type

Timeframe	*Treatment Capacity (MGD)*	*Effluent Disposal Capacity (MGD)*	*Booster / Repump Capacity (MGD)*	*Gravity Sewer / Force Main Piping (Miles)*	*Septic to Sewer Conversions (No of Connections*
Five-Year	1	0	0	10.7	2,301
Ten-Year	2	7.6	6.5	6.9	0
Twenty-Year	3	0	0	6.2	0
Total Increase	**6**	**7.6**	**6.5**	**23.8**	**2,301**

Major system improvements recommended for the five-year planning horizon are identified below:

- Expand SRWRF treatment capacity to 3.0 MGD annual average day flow (AADF);
- Upgrade NRWRF to provide nutrient removal depending on the Florida Department of Environmental Protection (FDEP) regulatory requirements as directed;
- Complete several projects to improve gravity sewer surcharging conditions;
- Construct several force main segments to support the anticipated growth in the St Johns Heritage Parkway and Babcock St Area; and
- Construct multiple Septic-to-Sewer Conversion Projects depending on FDEP direction and project funding.

Major system improvements recommended for the ten-year planning horizon are identified below:

- Expand SRWRF treatment capacity to 5.0 MGD AADF;
- Construct a second deep injection well for SRWRF;
- Construct Malabar Booster Station reducing force main pressures in the St Johns Heritage Parkway area north of Malabar Rd; and
- Construct force main in the Florida Power and Light (FPL) corridor from Degroodt Rd to Malabar Rd.

Major system improvements recommended for the twenty-year planning horizon are identified below:

- Expand SRWRF treatment capacity to 8.0 MGD AADF; and
- Construct 20-in force mains to serve Willowbrook Calumet Farms and development.

The planning level total estimated cost of the recommended improvements over the twenty-year planning horizon is approximately $375 million (in 2024 dollars). **Table 1-3** below summarizes the projected improvement costs for each planning period. Detailed planning level cost estimates for all improvement projects can be found in **Section 12** of this report.

Table 1-3. Projected Improvement Project Costs by Planning Horizon

Timeframe	*Treatment & Effluent Disposal Capacity ($)*	*Booster / Repump Capacity ($)*	*Gravity Sewer / Force Main Piping ($)*	*Septic to Sewer Conversions ($)*	*TOTAL ($)*
Five-Year	$27,869,800		$33,602,000	$154,799,800	**$216,271,600**
Ten-Year	$64,055,000	$3,300,000	$13,277,500		**$80,632,500**
Twenty-Year	$62,100,000		$16,170,000		**$78,270,000**
TOTAL	**$154,024,800**	**$3,300,000**	**$63,049,500**	**$154,799,800**	**$375,174,100**

Section 2 - Background

2.1 Goals & Objectives

The City of Palm Bay (City) expects continued growth over the next twenty (20) years, increasing wastewater flows. To meet the increased flow and to continue to provide safe, high-quality wastewater conveyance, treatment, and disposal, the City intends to expand and modify its existing wastewater collection system, force mains, and treatment facilities.

The goal of this Wastewater Master Plan is to identify capital improvement needs and associated costs over the next twenty-year period to support projected demands so the City can develop and institute various funding strategies and mechanisms to support the construction of the identified improvements. Improvements to the wastewater system include the following:

- Lift Station (Pumping) Capacity,
- Force Main Transmission (Conveyance) Capacity,
- Treatment Capacity, and
- Effluent Disposal Capacity.

This Wastewater Master Plan only includes facility improvements related to capacity and does not address improvements associated with the renewal and replacement of facilities, source, and finished water quality and/or treatment techniques.

In addition to identifying future capital improvement needs, the wastewater collection and force main hydraulic model developed as part of this Wastewater Master Plan can be used for multiple purposes including 1) troubleshooting operational issues, 2) determining needs for specific, isolated service requests, and 3) conceptual projects design.

2.2 City of Palm Bay Location

The City of Palm Bay is located in southern Brevard County along Florida's east coast bordered by the Cities of Melbourne and West Melbourne to the north, the Towns of Malabar and Grant-Valkaria and the Indian River Lagoon (IRL) to the east, unincorporated Brevard and Indian River Counties to the south and unincorporated Brevard County (St. Johns River Basin) to the west. The city spans approximately 88 square miles.

The City of Palm Bay has an estimated population of 137,837 residents as of January 2024 (City of Palm Bay Growth Management Department). The median income for a household in the city was $55,542 and the median home value of $214,832 (City of Palm Bay 2045 Comprehensive Plan, Section 1.3, 2024).

The following table shows the existing land use composition for the city.

Table 2-1. Existing Land Use Composition

Existing Land Use[1]	*Acres*	*Percentage of Total*
Low Density Residential	13,158	*28.1%*
Agricultural	5,475	*11.7%*
Public/Institutional	2,056	*4.4%*
Industrial	1,141	*2.4%*
Commercial	942	*2.0%*
Recreational	893	*1.9%*
Moderate Density Residential	568	*1.2%*
High Density Residential	201	*0.6%*
Office/Professional	222	*0.5%*
Right-of-Way/Utilities	123	*0.3%*
Total Developed Area	24,878	*53.1%*
Total Undeveloped Area (Vacant)	22,001	*46.9%*
Total Area	**46,879**	***100%***

1) Taken from Palm Bay 2045 Comprehensive Plan Table FLU-6.

Of the nearly 47,000 acres of land within the city, only 53.1% or 24,878 acres is considered developed. By a significant margin, the largest existing land use within the city is low-density residential comprising more than 28% of the total area (the *City of Palm Bay 2045 Comprehensive Plan,* Section 2, 2024).

2.3 Utility System History

The wastewater utilities within the city were originally controlled by two (2) separate entities: the City of Palm Bay and General Development Utilities, Inc. (GDU). The City controlled the utilities for the older section of Palm Bay in the northeast corner of the city.

In 1962, GDU was granted a franchise by the City for 30 years to provide utility services within the city limits outside of the northeastern portion of the city. In 1992, following the 30-year franchise agreement, the City purchased the assets of GDU and formed the Palm Bay Utility Corporation (PBUC). The two (2) systems were interconnected and PBUC began production, treatment, distribution, operation, and maintenance of the utilities for Palm Bay. PBUC transferred the utilities to the City in 1994, and the Palm Bay Utilities Commission began control of the utilities. In 2001, the utilities became a City entity and the Palm Bay Utilities Department (PBUD) was formed.

2.3.1 North Regional Wastewater Treatment Plant History

In 1962, GDU constructed the initial phase of the North Regional Wastewater Treatment Plant (NRWWTP) consisting of an aeration basin, secondary clarifier, effluent polishing pond, chlorine contact chamber, and surface water outfall. This original tankage from 1962 is currently being used as the square aerobic sludge digestor. A new aerobic sludge digester, sludge drying beds, and office/laboratory building were constructed in 1966. The plant was further expanded to 2.0 MGD capacity in 1975 by conversion of the plant to contact/stabilization activated sludge, construction of two (2) circular secondary clarifiers, traveling bridge sand filter, two (2) circular aerobic sludge digesters, and on-site submersible pump station. In 1985/1986, the 4.0 MGD treatment plant was constructed consisting of the headworks with mechanical screen and grit removal, the continuous stirred-tank reactor (CSTR) activated sludge aeration basin, and the original 90-foot diameter secondary clarifier. At the same time, the plant discontinued surface water discharges and began using the deep injection well system for effluent discharge. A sludge dewatering facility was constructed and placed into operation in approximately 2009. The wastewater treatment plant infrastructure originally constructed in 1985 continues to be used today after undergoing significant rehabilitation over the years.

2.3.2 North Regional Water Reclamation Facility History

The original North Regional Water Reclamation Facility (NRWRF) was constructed by the City of Palm Bay in 1990. The original aeration basin and secondary clarifier ring-steel tankage were relocated from the Town of Lauderhill. The facilities constructed at the time included the two (2) - ring-steel tanks, sand filters, high-level disinfection, reclaimed water storage tank, substandard effluent storage tank, and the control/blower building. The plant was constructed to treat domestic wastewater from the City's sanitary wastewater collection system service area north of Palm Bay Rd and discharge reclaimed water quality treated effluent to the Port Malabar County Club to be used for golf course irrigation.

Since being constructed, the NRWRF has undergone several improvements including the replacement of two (2) sand filters with cloth media disc filters, extensive rehabilitation of the ring-steel tankage, replacement of the reclaimed water distribution pumps, and the conversion of the extended aeration activated sludge biological treatment process to a Modified Ludzack Ettinger (MLE) biological nutrient removal activated sludge biological treatment process.

2.3.3 South Regional Water Reclamation Facility History

The initial phase of the South Regional Water Reclamation Facility (SRWRF) is currently under construction and is expected to be placed into operation in mid-2025. This facility was originally designed back in 2009 but its construction was delayed until the level of new development required the City be commence construction.

The facility was then redesigned as a membrane biological reactor (MBR) in a three (3)-stage configuration providing biological nutrient removal (BNR) achieving an effluent total nitrogen (TN) concentration of less than 10 mg/L. The facility has been designed to be expandable in multiple phases with flexible treatment capacity increments. The facility will initially discharge treated effluent to the existing deep injection well shared with the South Regional Water Treatment Plant. In the near future, a reuse distribution system will be designed and constructed to convey reclaimed water quality treated effluent to several subdivisions within the Bayside Lakes development for use as landscape irrigation. The City has plans to design and construct a sludge dewatering facility for the SRWRF in the future.

2.4 Wastewater Collections Service Area Description

The City owns and operates the wastewater collection and treatment systems within the city limits of Palm Bay and the town limits of Malabar. The Palm Bay Utilities Service Area covers approximately 265 square miles of which 48% of the total service area is undeveloped. **Figure 2-1** provides a map of the Utility Service Area and surrounding jurisdictions.

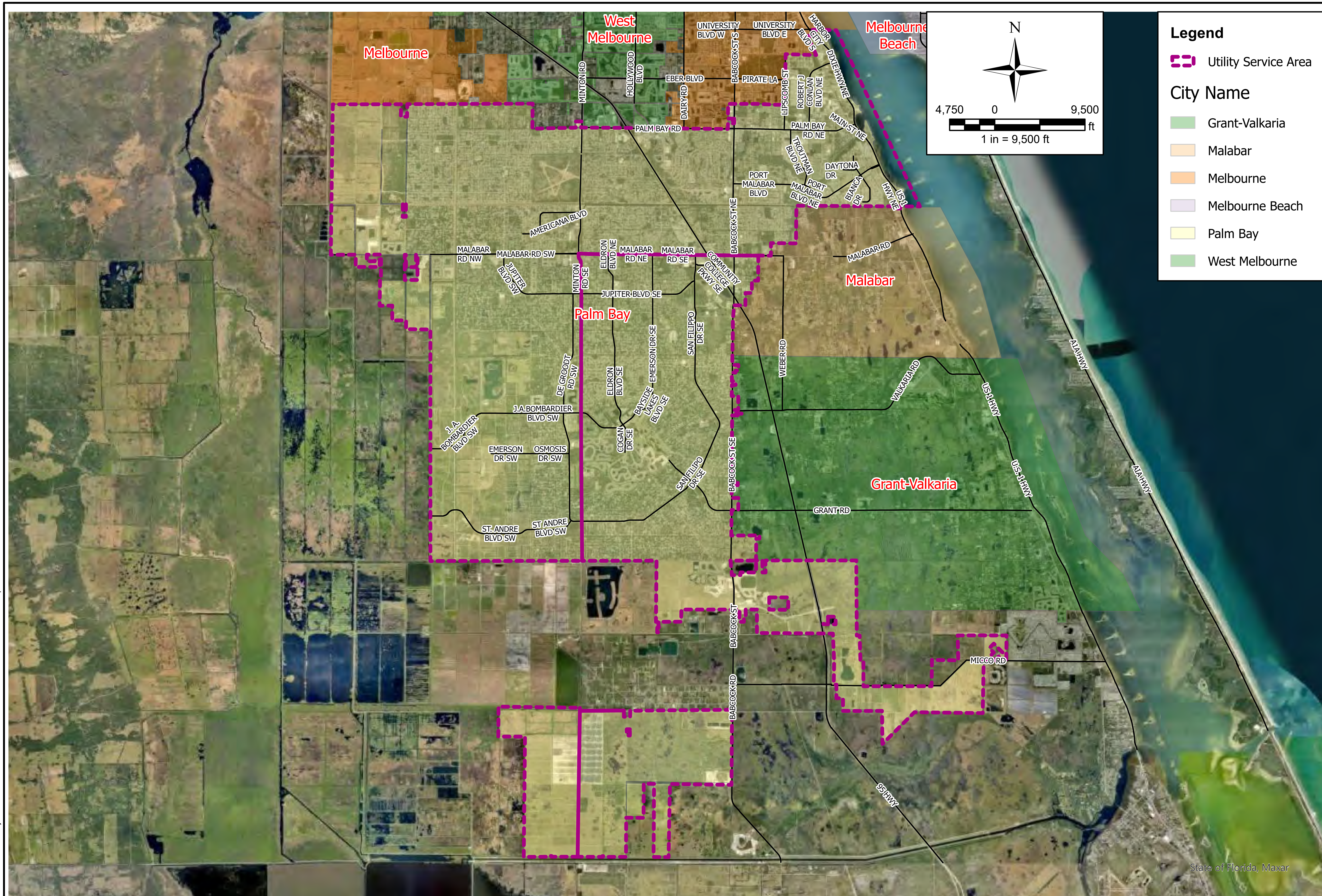
Municipal sanitary wastewater service is available generally east of I-95, Port Malabar Units Nos. 7, 8, 13, and 9 fronting Malabar Rd, Bayside Lakes development, and all newer development areas. By City ordinance, all new subdivisions are required to be served by the municipal sanitary wastewater system. Areas within the City not served by the wastewater system use private septic systems for wastewater disposal.

As of April 2024, the approximate number of wastewater accounts, including residential, commercial, and industrial users, within the City was 21,300 with an estimated population of 47,000. Approximately 35 percent of the City's population is connected to the wastewater system as shown in **Figure 2-2**.

Many of the homes within the southern portions of the city are not connected to the City wastewater system and are served by conventional septic tanks with drain fields otherwise known as Onsite Sewage Treatment and Disposal Systems (OSTDS).

2.5 Regulatory

The Florida Department of Environmental Protection (FDEP) regulates the City of Palm Bay's wastewater collection, treatment, and disposal system through the Domestic Wastewater Program. The authority to regulate public water systems is derived from Chapter 403, Part I, Florida Statutes (FS), and by delegation of the federal program from the U.S. Environmental Protection Agency (EPA).



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City of Palm Bay Utilities Service Boundary

Utility Service Area Map
Wastewater Master Plan
City of Palm Bay Utilities Department

PROJECT NO.: **PBU006**

DATE: **JUL 2024**

FIGURE NO. **2-1**

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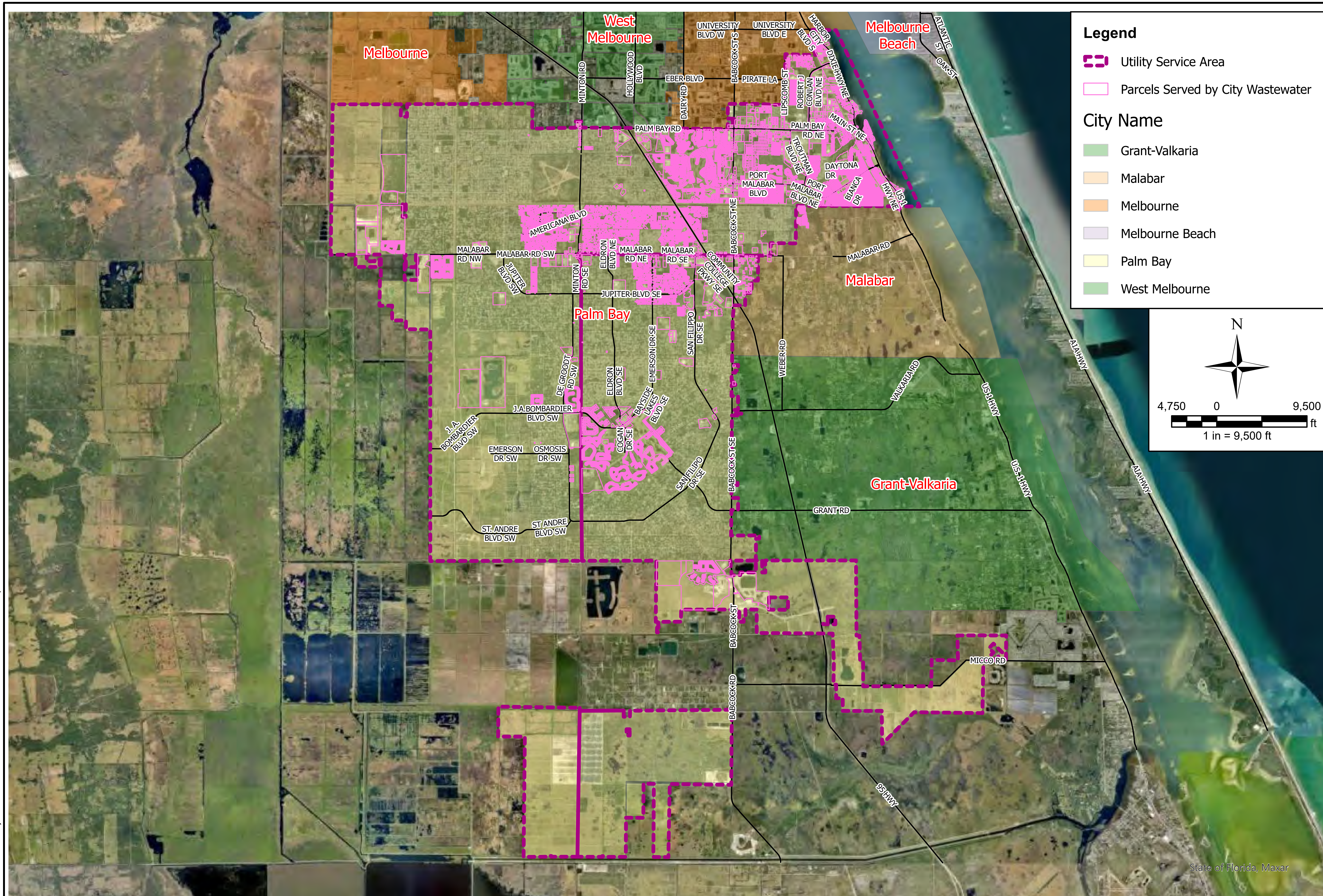

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Parcels with Water Services
City of Palm Bay

Parcels Served By City Wastewater System
Wastewater Master Plan
City of Palm Bay Utilities Department

PROJECT NO.: **PBU009**

DATE: **JUL 2024**

FIGURE NO. **2-2**

The City of Palm Bay water system is subject to regulation under the following Florida Administrative Code (FAC) rules:

- Chapter 62-528 FAC Underground Injection Control
- Chapter 62-600 FAC Domestic Wastewater Facilities
- Chapter 62-602 FAC Drinking Water and Domestic Wastewater Treatment Plant Operators
- Chapter 62-604 FAC Collection Systems and Transmission Facilities
- Chapter 62-610 FAC Reuse of Reclaimed Water and Land Application
- Chapter 62-620 FAC Wastewater Facility and Activities Permitting
- Chapter 62-640 FAC Biosolids
- Chapter 62-699 FAC Treatment Plant Classification and Staffing

The City's wastewater treatment and deep injection well disposal facilities are operated under several FDEP permits as shown in the following table:

Table 2-2. City of Palm Bay FDEP Wastewater Facilities Operating Permits

Permit	*Permit Number*	*Facility*	*Date Issued*	*Date Expires*
Domestic Wastewater Facility Permit[1]	FLA103357	NRWWTP & NRWRF	October 27, 2019	October 26, 2024
	FLA693782	SRWRF	April 26, 2021	April 25, 2026
Class I Injection Well Operation Permit[2]	354486-001-UO/1M	NRDIW	February 15, 2018	February 15, 2023
	328497-002-UO/1I	SRDIW	September 21, 2020	September 21, 2025

1- The Domestic Wastewater Facility Permit renewal was submitted by the City to the FDEP on April 26, 2024, and is currently under review. The City is allowed to continue operating the treatment facilities under an expired permit until the renewal is issued if needed.

2- The City is awaiting the FDEP to reissue the NRDIW operating permit. The City is allowed to continue operating the DIW under the expired permit until the renewal is issued.

2.6 Upcoming Regulatory Issues

The City is expected to be required to comply with new upcoming regulatory requirements which will significantly impact the capital improvement projects being developed within this Wastewater Master Plan. The following is a description of several of the expected upcoming regulatory requirements.

2.6.1 Basin Management Action Plan Onsite Sewage Treatment and Disposal System Remediation Plan

The City was notified by the FDEP in June 2023 of its responsibility under the Clean Waterways Act – Senate Bill 712 (2020) to submit an Onsite Sewage Treatment and Disposal System (OSTDS) Remediation Plan as required in the Final Order issued June 12, 2023 regarding OGC Case 23-0112 to 0125. The FDEP has determined the need to further limit nutrients (nitrogen and phosphorus) from the discharges of OSTDS sources within the city to achieve the nutrient reduction requirements outlined within the Indian River Lagoon Basin Management Action Plan (BMAP).

Recent action by the state legislature under House Bill 1379 (2023) and approved by the Governor created the Indian River Lagoon Protection Program (Section 373.469, FS). This statute requires any commercial or residential property with an existing OSTDS located within the Indian River Lagoon BMAP to connect to central sewer, if available, or upgrade to nutrient reduction OSTDS by July 1, 2030.

The City has prepared and submitted to the FDEP a draft OSTDS Remediation Plan identifying specific areas of the city that are proposed to be connected to central sewer (so-called Septic-to-Sewer conversion projects). These targeted areas of the city are identified in the five-year planning horizon are:

- Sewer Available Not Connect (SANC) Phases 1 through 5;
- Septic to Sewer Conversion Area A;
- Septic to Sewer Conversion Area B Phases 1 to 14; and
- Septic to Sewer Conversion Area C.

If funding becomes available to proceed forward with these projects, up to an additional 2,200 OSTDS will be eliminated through connection to the central sewer at an estimated cost of $153 million.

All other OSTDS not connected to central sewer within the city (some 24,472 remaining conventional septic systems) would be required by the FDEP to be upgraded to the enhanced nutrient-reducing OSTDS type by July 1, 2030, at an estimated cost of approximately $732 million but could range from $490 million to $1 billion (City of Palm Bay OSTDS Remediation Plan, 2024).

2.6.2 Basin Management Action Plan Wastewater Treatment Remediation Plan

Similarly to the OSTDS, the Final Order issued June 12, 2023, regarding OGC Case 23-0112 to 0125 also has determined the need to further limit nutrients from the discharges wastewater treatment plants within the city to achieve the nutrient reduction requirements outlined in the BMAP.

The NRWRF and SRWRF have been designed to provide biological nutrient removal at a level sufficient to satisfy the current BMAP requirements. No additional treatment plant upgrades/improvements to provide biological nutrient removal for these facilities are anticipated per this Plan unless the current regulatory requirements are modified.

The NRWWTP does not provide biological nutrient removal. This facility discharges treated secondary effluent to a Class I Deep Injection Well. The zone of discharge is over 2,000 feet below the surface into the low permeability boulder zone of the Oldsmar limestone formation. This discharge of secondary treated effluent under applicable FDEP rules and its current Domestic Wastewater Facilities Permit does not adversely impact the water quality of the groundwater or surface water resources.

If the FDEP were to impose nutrient reduction requirements upon the secondary treated effluent from the NRWWTP, then the City would be required to adapt the current biological treatment system into an MLE configuration with the construction of a new 1.0-million gallon (MG) Anoxic Basin and other related improvements with an estimated project cost of $11.8 million.

The City will be requesting an exemption from the requirement to implement biological nutrient removal at the NRWWTP due to the high likelihood of no demonstrable adverse impact on groundwater or surface water quality from the continued discharge of secondary treated effluent to the existing deep injection well.

2.7 Previous Wastewater Master Plans

Their most recent City of Palm Bay Wastewater Master Plan report was prepared in October 2017 by Wade Trim (Wade Trim, 2017). At that time, the previous wastewater collection system force main hydraulic model was updated and calibrated to accurately simulate the wastewater system flows and system pressures at the time. The model was then used to simulate the five-year, ten-year, and twenty-year planning horizon scenarios, including the current and future wastewater flows incorporating the new development areas known at the time. The following table presents the 2017 Wastewater Master Plan projected wastewater flow characteristics for the annual average daily flow (AADF), maximum day average daily flow, and peak hour flow (PHF) design conditions for each of the three planning horizon scenarios.

Table 2-3. 2017 Wastewater Master Plan Projected Planning Horizon Wastewater Flows

Timeframe	*Annual Average Daily Flow (MGD)*	*Maximum Day Average Daily Flow (MGD)*	*Peak Hour Flow (MGD)*
2017	3.63	6.53	9.69
Five-Year	5.84	10.51	15.21
Ten-Year	8.65	15.57	22.24
Twenty-Year	11.31	20.36	29.89

The results of the evaluations indicated the City's projected increase in wastewater flows required the expansion of the following facilities over the twenty-year plan.

Table 2-4. 2017 Wastewater Master Plan Projected Capacity Expansion by Facility Type

Timeframe	*Treatment Capacity (MGD – AADF)*	*Disposal Capacity (MGD – AADF)*	*Booster/ Repump Station Capacity (MGD – AADF)*	*Force Main Piping (miles)*
Five-Year	3	0.4	2	18.5
Ten-Year	2	4.1	2	3
Twenty-Year	2	3.6	0	1
TOTAL	**7**	**8.1**	**4**	**22.5**

Major system improvements recommended for the five-year planning horizon included the following:

- Construction of a new Wastewater Reclamation Facility at the South Regional Utilities Campus with a capacity of 3 MGD.
- Construction of a new booster/repump station (2 MGD AADF) to include wastewater force main booster pumps at the Avery Springs subdivision along Malabar Road.
- Construction of a new 16-inch force main along the St. Johns Heritage Parkway between Malabar Road and Emerson Drive.
- Construction of a new 20-inch force main along the Florida Power and Light (FPL) corridor and Melbourne-Tillman Water Control District (M-TWCD) Canal No. C-37 from DeGroodt Road south to the South Regional Water Reclamation Facility.
- Construction of new 16-in, 20-in, 24-in, and 30-in transmission main segments from the area surrounding the new southern I-95 Interchange to the new South Regional Water Reclamation Facility.

Major system improvements recommended for the ten-year planning horizon included the following:

- Expansion of the SRWRF from 3 MGD to 5 MGD.
- Construction of a new 20-inch force main along the FPL utility corridor between the booster/repump station at Malabar Road and DeGroodt Road.

Major system improvements recommended for the twenty-year planning horizon included the following:

- Expansion of the SRWRF from 5 MGD to 7 MGD including construction of a new deep injection well.

- Construction of new, dual 16-inch and 20-inch force mains along Cogan Drive and Osmosis Drive.

The total estimated cost of the recommended improvements over the twenty years is approximately $114.44 million (2017 dollars). The following table summarizes the projected improvement costs at the time of each planning period.

Table 2-5. 2017 Wastewater Master Plan Projected Improvement Cost by Planning Horizon

Timeframe	*Treatment & Disposal Capacity ($)*	*Booster / Repump Station Capacity ($)*	*Force Main Piping ($)*	*TOTAL ($)*
Five-Year	$44,110,000	$2,420,000	$11,126,000	$57,656,000
Ten-Year	$25,300,000	$2,200,000	$2,017,000	$29,517,000
Twenty-Year	$26,400,000	$0	$869,000	$27,269,000
TOTAL	**$95,810,000**	**$4,620,000**	**$14,012,000**	**$114,442,000**

2.8 Capital Improvement Projects Work Initiated or Completed Since the 2017 Wastewater Master Plan

The City has completed a number of the Capital Improvement Projects (CIP) identified in the 2017 Wastewater Master Plan. These projects include the following:

- 5-Year CIP No. 1: 16-in FM from Palm Vista to Malabar Rd
- 5-Year CIP No. 2: 8-in FM from Palmer to proposed 16-in FM
- 5-Year CIP No. 5: 8-in Gravity Sewer from Avery Springs Development to Regional Lift Station No. 1
- 5-Year CIP No. 6: Regional Lift Station No. 1 Initial Phase
- 5-Year CIP No. 9: 6-in FM on JA Bombardier Blvd SW to DeGroodt Rd SW
- 5-Year CIP No. 10: 4-in FM on Gaymor Dr. SW from Bayridge Development to JA Bombardier Blvd SW. Note: Change in pipe size and routing from the 2017 Master Plan.
- 5-Year CIP No. 16: 6-in FM from Cypress Bay Development to Babcock St.
- 5-Year CIP No. 18: 24-in FM along Cogan Drive, San Filippo Dr SE, and FPL Easement to Babcock St. Note 1) Change in pipe size and routing from 2017 Master Plan; 2) As of April 2024, FM was installed but not placed into operation.

- 5-Year CIP No. 19: 20-in FM from Osmosis Dr SE to SRWRF. Note 1) As of April 2024 FM was installed but not placed into operation; 2) Change in pipe size from the 2017 Master Plan
- 5-Year CIP No. 20: South Regional Water Reclamation Facility Construction Phase 1A (Structure & Equipment/1B (Structure Only). Note 1) Change in scope of improvements from 2017 Master Plan; 2) As of April 2024 facility under construction.

Section 3 - Description of Existing Wastewater System Infrastructure

3.1 Introduction

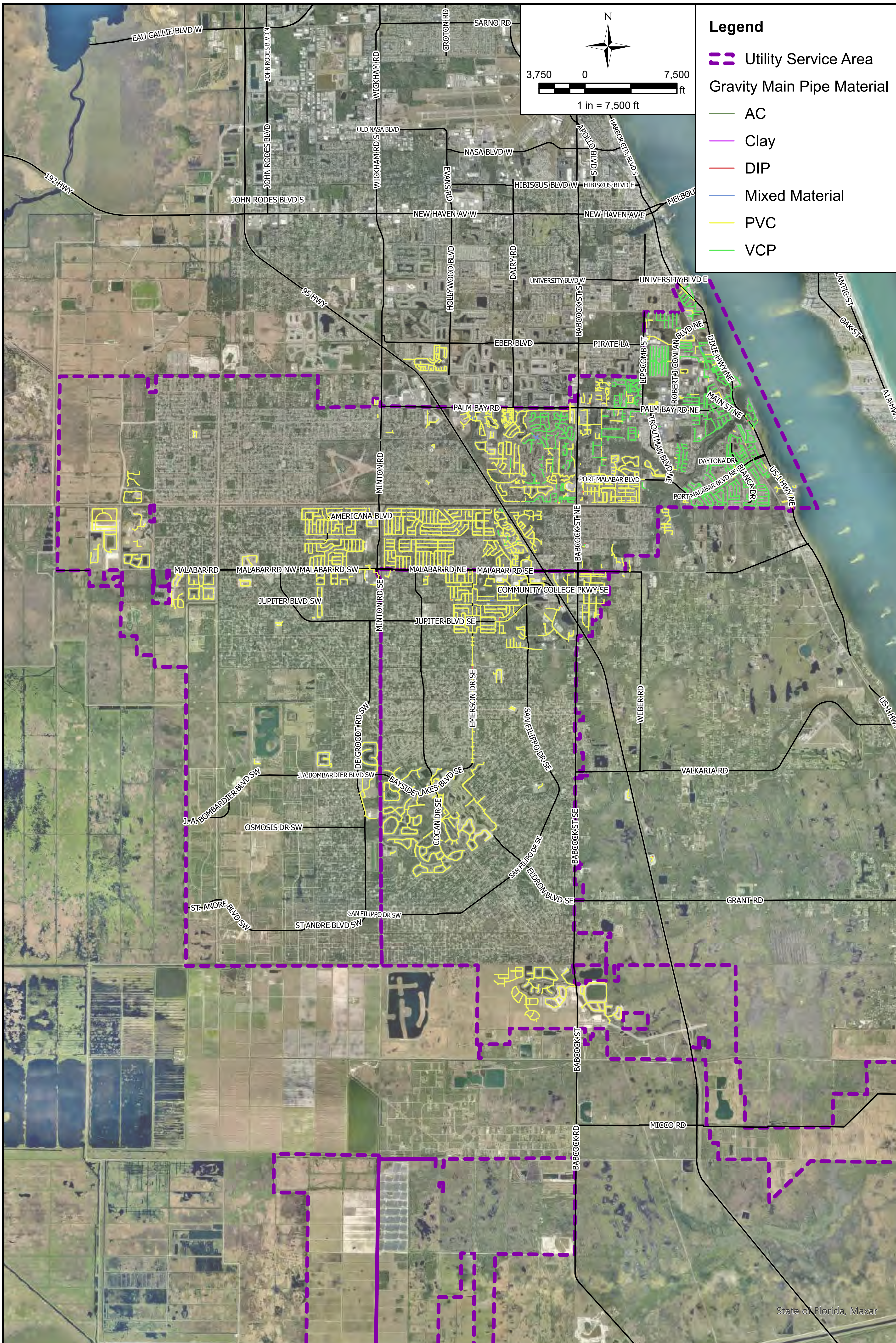
Section 3 of the City of Plam Bay Wastewater Master Plan provides a general description of the wastewater system infrastructure for the City including gravity collection system, lift stations, transmission force mains, wastewater treatment facilities, and the methods of effluent disposal.

3.2 Collection System

In general, wastewater from each customer flows by gravity through buried pipelines (gravity sewer mains) to a nearby public or private lift station where it is pumped into a pressurized, forced main pipeline and conveyed to the City's wastewater treatment plants for proper treatment and disposal.

3.2.1 Gravity Sanitary Sewer Mains

The City owns and maintains approximately 237 miles of gravity sewer mains ranging in size from 2-inches to 21-inches in diameter. Approximately three-quarters of the total sewer mains are made of polyvinyl chloride (PVC) pipe with the remaining one-quarter made of vitrified clay pipe (VCP) or ductile iron pipe (DIP). **Figure 3-1** depicts the locations of various gravity sewer mains by material type in the system and **Table 3-1** provides a tabulation of gravity sewer mains by size and material type.



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INFRASTRUCTURE SOLUTION SERVICES

Melbourne | Sarasota | Panama City Beach

Gravity Sewer Mains by Materials Type
Wastewater Master Plan
City of Palm Bay Utilities Department

PROJ. NO.
PBU006

DATE:
JUL 2024

FIGURE NO.
3-1

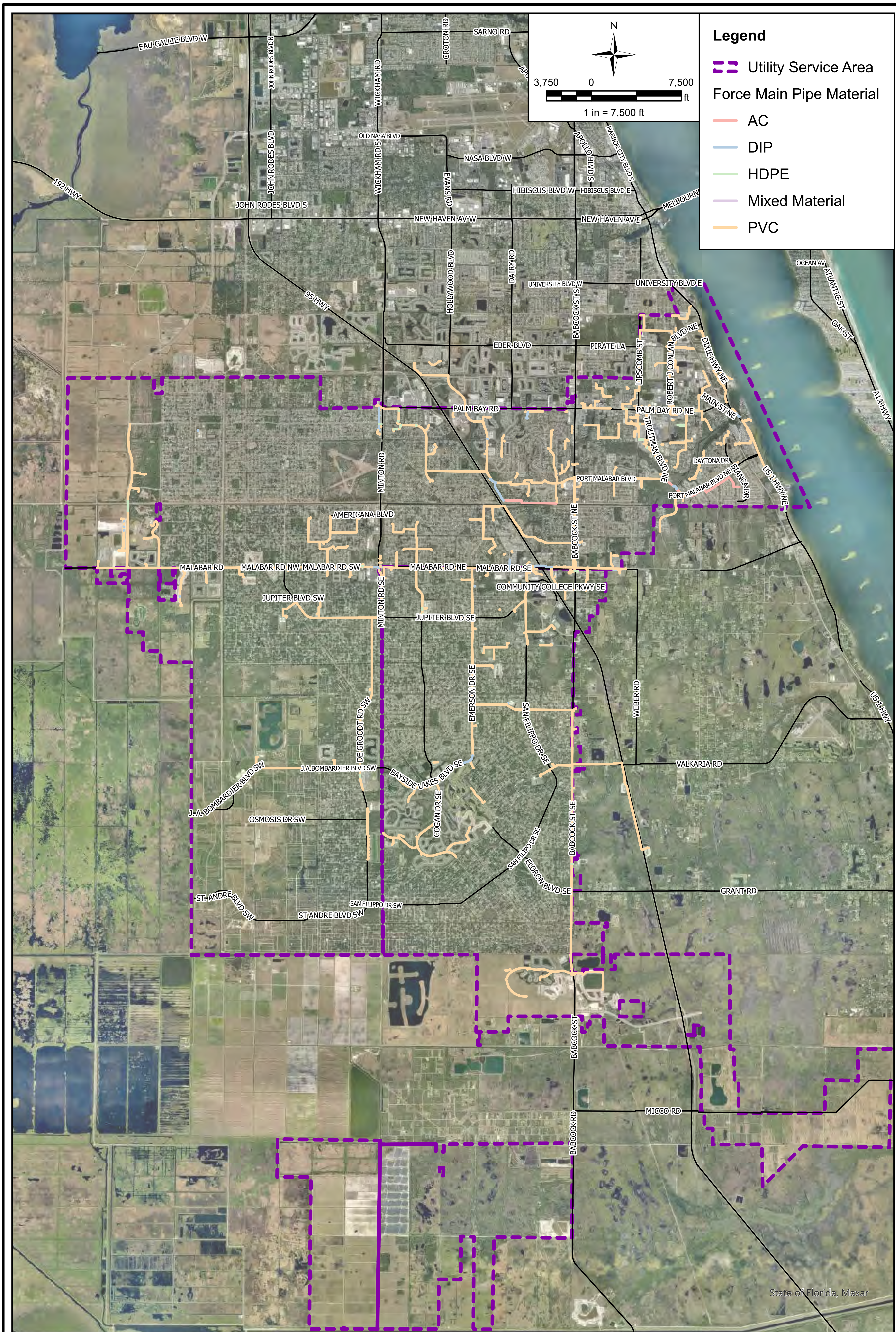
Table 3-1. Gravity Sewer Main Piping Summary

Gravity Sewer Main Diameter (inches)	*Pipe Length by Material*[1]			*Total Pipe Length (feet)*
	DIP (feet)	*Vitrified Clay Pipe (feet)*	*PVC Pipe (feet)*	
2	-	20	-	20
4	-	1,948	-	1,948
6	158	7,674	2,885	10,716
8	1,392	924,207	281,773	1,207,371
10	200	21,053	5,634	26,887
12	183	111	1,894	2,188
15	-	163	2,381	2,544
18	-	-	2,002	2,002
21	-	265	-	265
Total	**1,932**	**955,441**	**296,569**	**1,253,942**

1) Data obtained from the City of Palm Bay GIS Data, April 2024.

3.2.2 Sanitary Transmission Force Mains

The City owns and maintains approximately 104 miles of force main (FM) piping ranging in size from 2 inches to 24 inches in diameter. Ninety-three percent (93%) of the force mains are PVC. The remaining force mains are either: DIP, high-density polyethylene (HDPE), or asbestos cement pipe (ACP). **Figure 3-2** depicts the locations of various force mains by material type in the system and **Table 3-2** provides a tabulation of force mains by size and material type.



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Sanitary Transmission Force Mains by Materials Type
Wastewater Master Plan
City of Palm Bay Utilities Department

PROJ. NO. **PBU006**

DATE: **JUL 2024**

FIGURE NO. **3-2**

Table 3-2. Force Mains Piping Summary

Force Main Diameter (inches)	*Pipe Length by Material[1]*				*Total Pipe Length (feet)*
	DIP (feet)	*HDPE (feet)*	*PVC (feet)*	*ACP (feet)*	
2	164	1,085	11,285	-	12,534
3	54	-	19,567	-	19,622
4	536	5,044	97,605	-	103,186
6	5,426	137	93,112	-	98,676
8	824	227	96,668	9,001	106,721
10	143	216	34,929	-	35,287
12	3,898	233	81,335	3,396	88,862
16	1,334	848	63,363	-	65,545
20	-	966	124	-	1,090
24	1,492	-	16,947	-	18,439
Total	**13,871**	**8,757**	**514,977**	**12,397**	**550,002**

1) Data obtained from the City of Palm Bay GIS Data, April 2024.

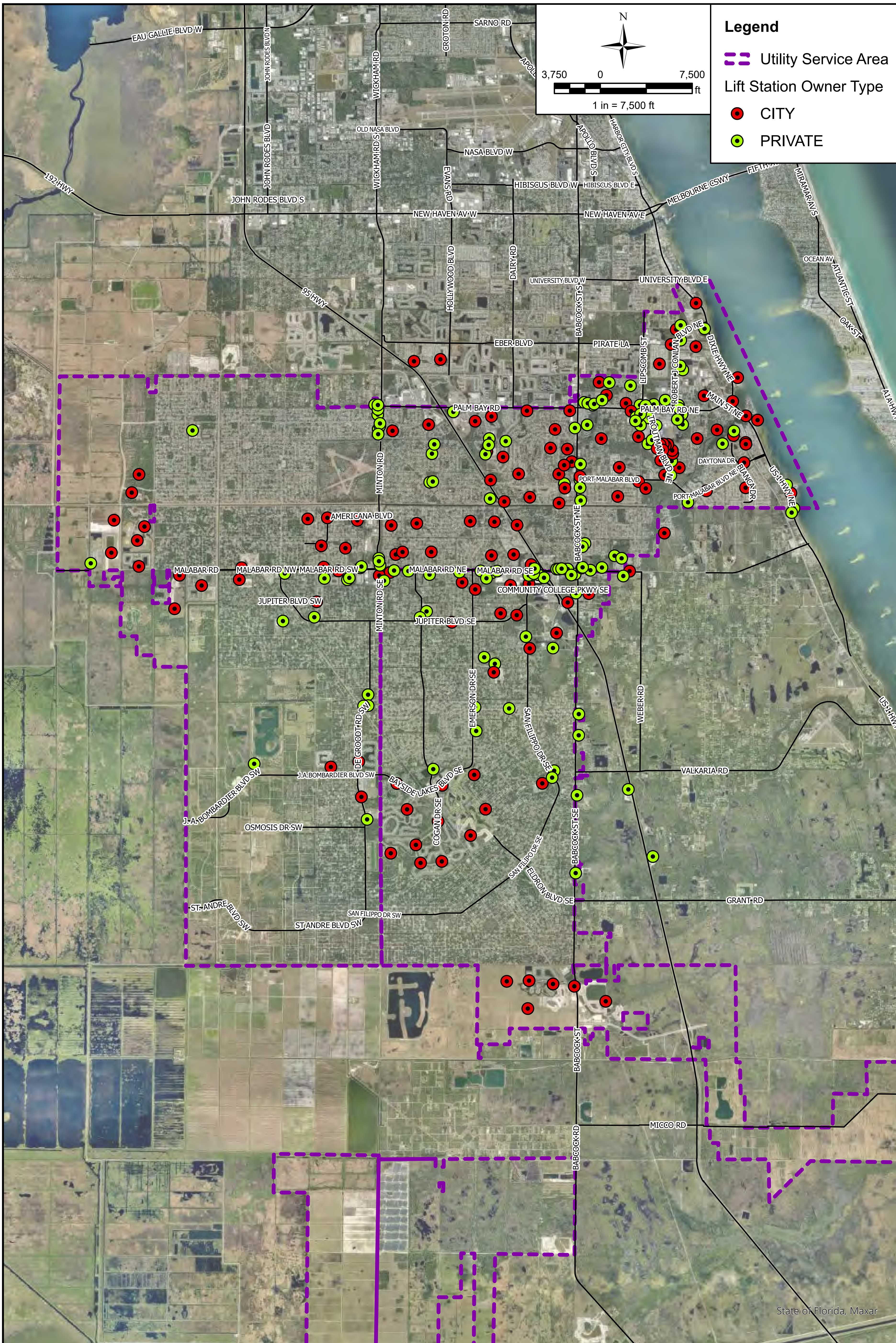
3.2.3 Sanitary Lift Stations

Wastewater from the gravity sewer mains flows into lift stations where the wastewater is pumped to the wastewater treatment plant through force mains. The City owns and operates 131 lift stations.

Lift stations are classified as either submersible or dry pit/wet pit type. Submersible stations consist of a wet well, submersible pump(s) installed directly in the wet well, isolation valves, and electrical/control panels. Dry pit/wet pit stations have a dry subsurface pump vault, a separate wet well, isolation valves, and electrical/control panels.

Most of the lift stations are equipped with an emergency pump-out connection and/or an adapter on the electrical/control panel allowing for the connection of an electrical generator.

The operation of the pumps is controlled by float sensors (or other level indicators) located in the wet well.



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INFRASTRUCTURE SOLUTION SERVICES

Melbourne | Sarasota | Panama City Beach

City and Privately Owned Lift Station Locations
Wastewater Master Plan
City of Palm Bay Utilities Department

PROJ. NO.
PBU006

DATE:
JUL 2024

FIGURE NO.
3-3

In addition to the City-owned lift stations, approximately 131 privately owned lift stations pump wastewater from private properties into the City's force main system.

Figure 3-3 depict the locations of the public and private lift stations. Information regarding station type, wet well size, number of pumps, duty point, and pump horsepower for each lift station is provided in **Section 3.5**.

3.3 Wastewater Treatment Plants

The City owns and operates two (2) wastewater treatment plants, the North Regional Wastewater Treatment Plant (NRWWTP) and the North Regional Water Reclamation Facility (NRWRF). The plants are located at the City of Palm Bay North Regional Utilities Campus. Combined, the NRWWTP and NRWRF have a total permitted capacity of 5.2 million gallons per day (MGD) on an average annual daily flow (AADF) basis.

The City is currently constructing the initial phase of the South Regional Water Reclamation Facility (SRWRF) located at the City of Palm Bay South Regional Utilities Campus along with the Utilities Department Administrative Offices and the South Regional Water Treatment Plant.

3.3.1 North Regional Wastewater Treatment Plant (NRWWTP)

The NRWWTP is a 4.0 MGD AADF-permitted capacity domestic wastewater treatment facility. The facility is located at 1105 Clearmont St NE Palm Bay, FL. The facility is operated under FDEP Domestic Wastewater Facility Permit No. 103357 which currently expires on October 26, 2024.

The WWTP is classified by the FDEP as a Category I, Class A facility. The plant is operated 24 hours per day by a staff consisting of the following certified operators:

Table 3-3. North Regional WWTP Current Authorized Staffing

Staff Position Title[1]	*FDEP Certified Operator License Class*	*Number of Staff*
Plant Superintendent	A	1
Lead Operator	A	1
Certified Operators	A	3

Staff Position Title[1]	*FDEP Certified Operator License Class*	*Number of Staff*
Certified Operators	C	4
Trainee	NA	2
	Total	**11**

1) Taken from City of Palm Bay Proposed FY 24 Position Control Plan adapted 09/20/23

The WWTP utilizes the following unit treatment processes:

- Influent Screening,
- Grit Removal,
- Complete-mix Activated Sludge Biological Secondary Treatment, and
- Secondary Clarification.

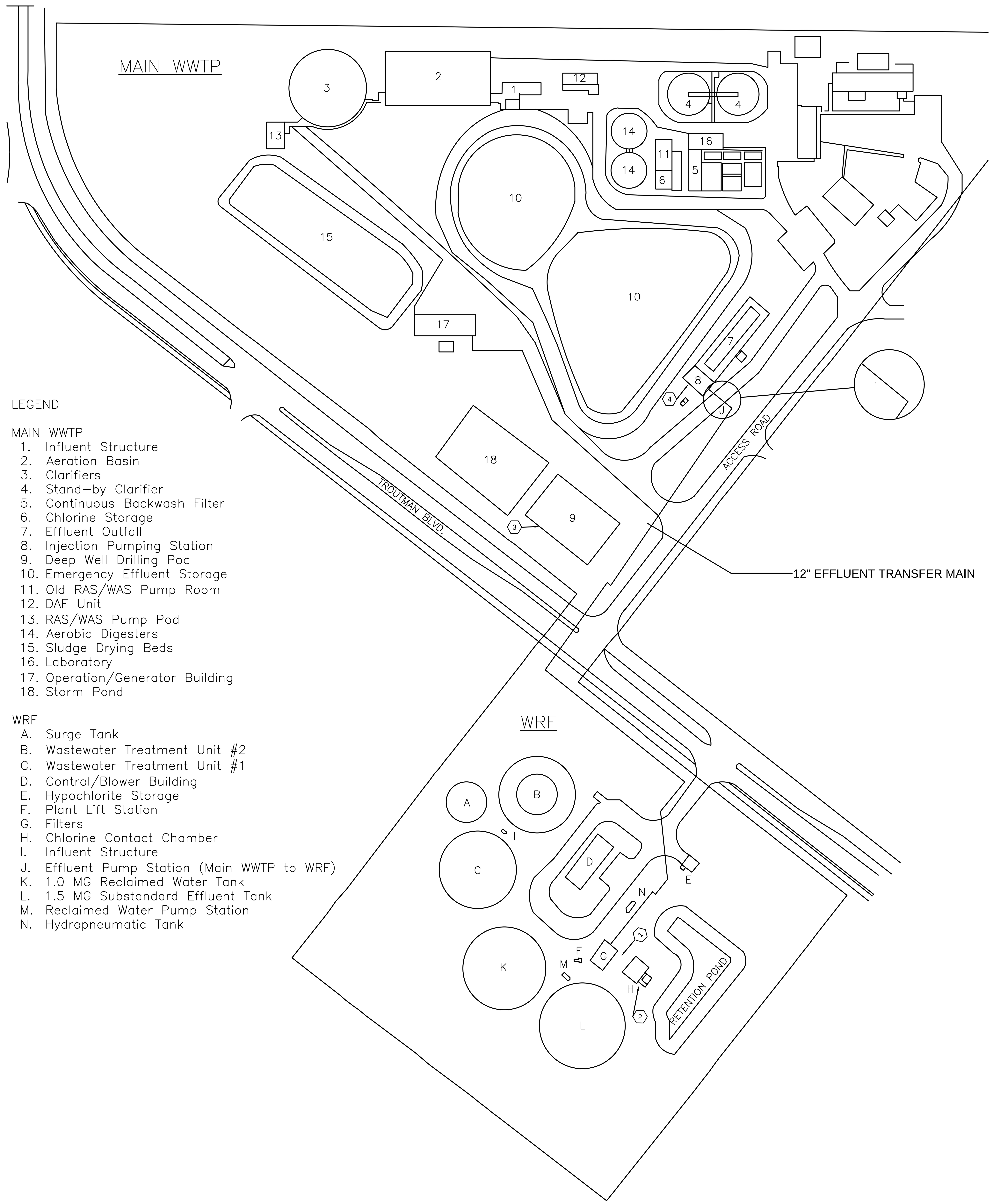
A second redundant secondary clarifier has recently been constructed and placed into operation.

Secondary effluent is either pumped to the WRF for tertiary treatment or directed to a 12.73 MGD maximum permitted capacity Class I deep injection well for disposal.

The facility also has two (2) existing effluent holding ponds located at the WWTP site with a capacity of 5.1 MG (1.9 MG + 3.2 MG) These ponds are used for emergency storage or the mechanical integrity testing (MIT) of the UIC well.

The NRWWTP utilizes aerobic digestion and mechanical dewatering for solids handling.

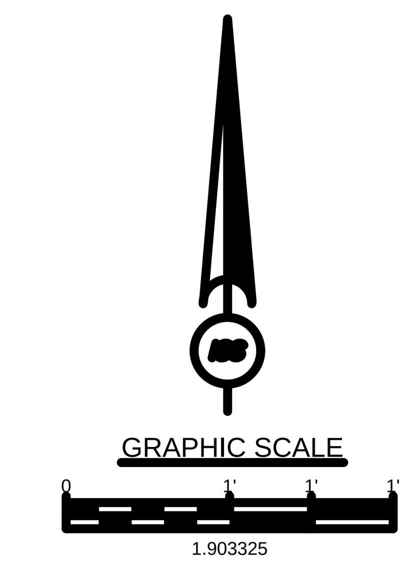
Figure 3-4 shows the site plan and **Figure 3-5** shows the process flow schematic of the NRWWTP.



LEGEND

MAIN WWTP
1. Influent Structure
2. Aeration Basin
3. Clarifiers
4. Stand–by Clarifier
5. Continuous Backwash Filter
6. Chlorine Storage
7. Effluent Outfall
8. Injection Pumping Station
9. Deep Well Drilling Pod
10. Emergency Effluent Storage
11. Old RAS/WAS Pump Room
12. DAF Unit
13. RAS/WAS Pump Pod
14. Aerobic Digesters
15. Sludge Drying Beds
16. Laboratory
17. Operation/Generator Building
18. Storm Pond

WRF
A. Surge Tank
B. Wastewater Treatment Unit #2
C. Wastewater Treatment Unit #1
D. Control/Blower Building
E. Hypochlorite Storage
F. Plant Lift Station
G. Filters
H. Chlorine Contact Chamber
I. Influent Structure
J. Effluent Pump Station (Main WWTP to WRF)
K. 1.0 MG Reclaimed Water Tank
L. 1.5 MG Substandard Effluent Tank
M. Reclaimed Water Pump Station
N. Hydropneumatic Tank



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Melbourne, Florida 32940
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www.InfrastructureSS.com

DRAWING TITLE:
NORTH REGIONAL WASTEWATER TREATMENT PLANT SITE PLAN
WASTEWATER MASTER PLAN

CLIENT:
CITY OF PALM BAY UTILITIES

PROJECT NO.: PBU006	PROJ. MGR.: CEM
DATE: JUL 2024	DRWN. BY: MR
SCALE: N.T.S.	CHKD. BY: CEM

SHEET NO.
FIG 3-4

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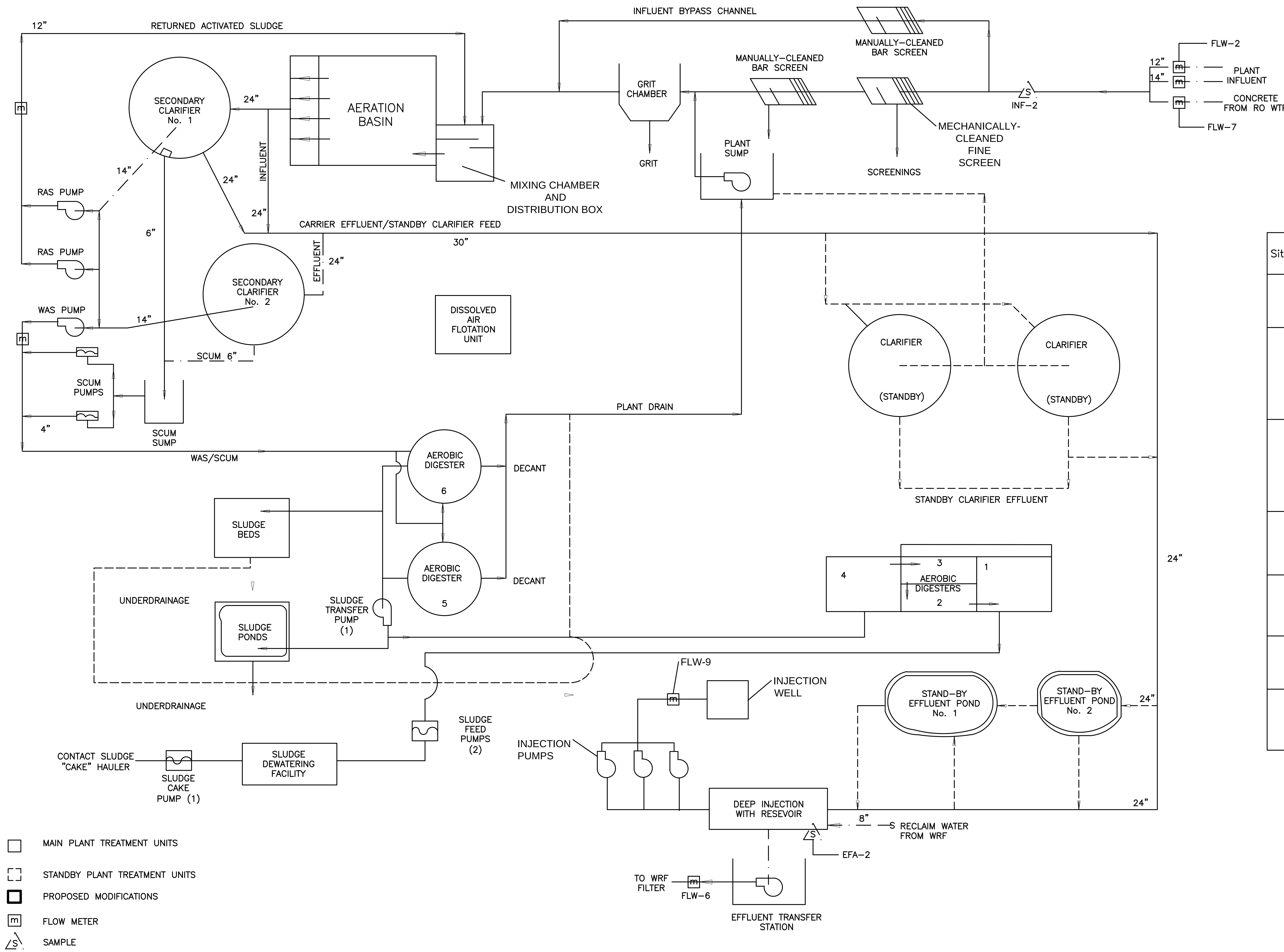

Site Number	Description
FLW–2	FLOW TO WWTF (PLANT 2)
FLW–3	Flow to the underground injection well from WWTP wastewater treatment facility
FLW–4	Flow to the underground injection well from WRF wastewater treatment facility
FLW–6	Flow from Palm Bay WWTF (plant 2) to WRF
FLW–7	RO Concentrate to the head of the facility
INF–2	Influent to WWTF (Plant 2)
EFA–2	Sampling point to underground injection well

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DRAWING TITLE:
NORTH REGIONAL WASTEWATER TREATMENT PLANT PROCESS FLOW SCHEMATIC
WASTEWATER MASTER PLAN

CLIENT:
CITY OF PALM BAY UTILITIES

PROJECT NO.: PBU006	PROJ. MGR.: CEM
DATE: JUL 2024	DRWN. BY: MR
SCALE: N.T.S.	CHKD. BY: CEM

SHEET NO.
FIG 3-5

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The following table provides a brief description of the existing unit treatment processes at the Palm Bay North Regional WWTP:

Table 3-4. Description of NRWWTP Unit Treatment Processes

Unit Process	***Description***
Preliminary Treatment	• One 6 mm perforated plate mechanically cleaned Band Screen (Huber) • One screw-type screenings Washer Press (Huber) • Two manually cleaned 1-in spacing bar rack • 16 ft diameter induced vortex type Grit Removal System with 2 HP paddle drive (Smith and Loveless Model 20) • One 5 HP grit pump rated at 150 gpm @ 24 ft TDH. • One Shafter Grit Screw Classifier with Hydro-Cyclone (Westech) • One duty 5 HP submersible pump Headworks lift station
Secondary Treatment	• One 154 ft long, 77 ft wide, 15 ft side water depth complete mix type Aeration Basin with two 125 HP VFD controlled Surface Aerators (Ovivo) • One 110 ft diameter, 13.5 ft side water depth secondary clarifier with suction header type clarifier mechanism (Evoqua Envirex Tow-Bro) • One 110 ft diameter, 13.5 ft side water depth secondary clarifier with plow-type clarifier mechanism (Ovivo) • One duty + One standby 40 HP self-priming centrifugal type Return Activated Sludge pumps rated at 2,780 gpm at 26 ft TDH (Gorman Rupp) • One duty 7.5 HP self-priming centrifugal type Waste Activated Sludge pump rated at 250 gpm at 41 ft TDH (Gorman Rupp) • One duty + one standby 5 HP progressive cavity type Scum Pump rated at 75 gpm • Two 56 ft diameter, 8 ft side water depth Standby Secondary Clarifiers without clarifier mechanism
Effluent Disposal	• Eff Pond Actuated Isolation Valves • Eff Pond • Transfer PS
Deep Injection Well	• Two duty + one standby 125 HP vertical turbine type two-stage deep well injection pumps rated at 3,500 gpm at 104 ft TDH (National Pump Model K20MC) • One 20 in diameter 3,000 ft depth deep Class I injection well rated 12.73 MGD maximum permitted capacity • Monitoring Wells

Unit Process	*Description*
Solids Handling	• Two 50 ft diameter, 12.5 ft side water depth 185,000-gallon circular aerobic digesters with 40 HP floating surface aerator operated in parallel and telescopic decanting valves (Basin No. 1 and 6) • One 56 ft long, 27 ft wide, 14.3 ft side water depth 161,000-gallon Aerobic Digester with two 15 HP floating surface aerators (Basin No. 2) • Two 25 ft long, 26 ft wide, 14.6 ft side water depth 79,500-gallon Aerobic Digester with one 10 HP floating surface aerator (Basin No. 3 & 4) • One 56 ft long, 27 ft wide, 14.6 ft side water depth 153,500-gallon Aerobic Digester with two 15 HP floating surface aerators (Basin No. 5) • One duty + one standby 30 HP progressive cavity type BFP Feed Pump rated at 400 gpm at 35 ft TDH (Seepex) • One duty self-priming centrifugal Sludge Transfer Pump • One duty 1.5 meter three belt type Belt Filter Press rated for 1,350 lbs/hr or 375 gpm at 0.75% TS (Ashbrook) • One duty 25 HP progressive cavity type Cake pump rated at 25 gpm at 250 ft TDH (Seepex) • One-duty Polymer Feed Make-up System • One 27,300 SF Sludge Drying Bed
Miscellaneous Facilities	• Emergency Generator • Operations Office • Maintenance Office • On-Site Lift Station • VAC Truck Dump Pad • Plant Wide SCADA System • Electrical System

3.3.2 North Regional Water Reclamation Facility (NRWRF)

The NRWRF is a 1.2 MGD AADF permitted capacity domestic water reclamation facility. The facility is located at 1080 Clearmont St NE Palm Bay, FL. The facility is operated under a Florida Department of Environmental Protection Domestic Wastewater Facility Permit No. 103357. Staffing of the NRWRF is shared with the NRWWTP.

The NRWRF utilizes the following unit treatment processes:

- Influent Manual Screening,
- Extended Aeration Activated Sludge Biological Nutrient Removal Secondary Treatment,

- Secondary Clarification,
- Tertiary Cloth Media Filtration,
- Chemical Feed Facilities,
- High-Level Sodium Hypochlorite Disinfection, and
- Aerated Sludge Storage.

The biological treatment, clarification, and sludge storage are performed with two (2) integrated steel-ring treatment units. The WRF was recently retrofitted with additional tankage and related equipment to provide limited biological nutrient removal and chemical phosphorus removal. These facilities became operational in 1Q 2022.

The WRF has one (1) 1.0MG reclaimed water storage tank and a 1.5 MG substandard effluent storage tank.

Reuse quality effluent is discharged to a 2.3 MGD AADF permitted capacity slow-rate public access reuse system to meet the irrigation needs for two (2) residential developments and an adjacent industrial user.

Excess reclaimed water is conveyed to the Class I Deep Injection Well at the NRWWTP for disposal.

Figure 3-6 shows the site plan and **Figure 3-7** shows the process flow schematic of the NRWRF.

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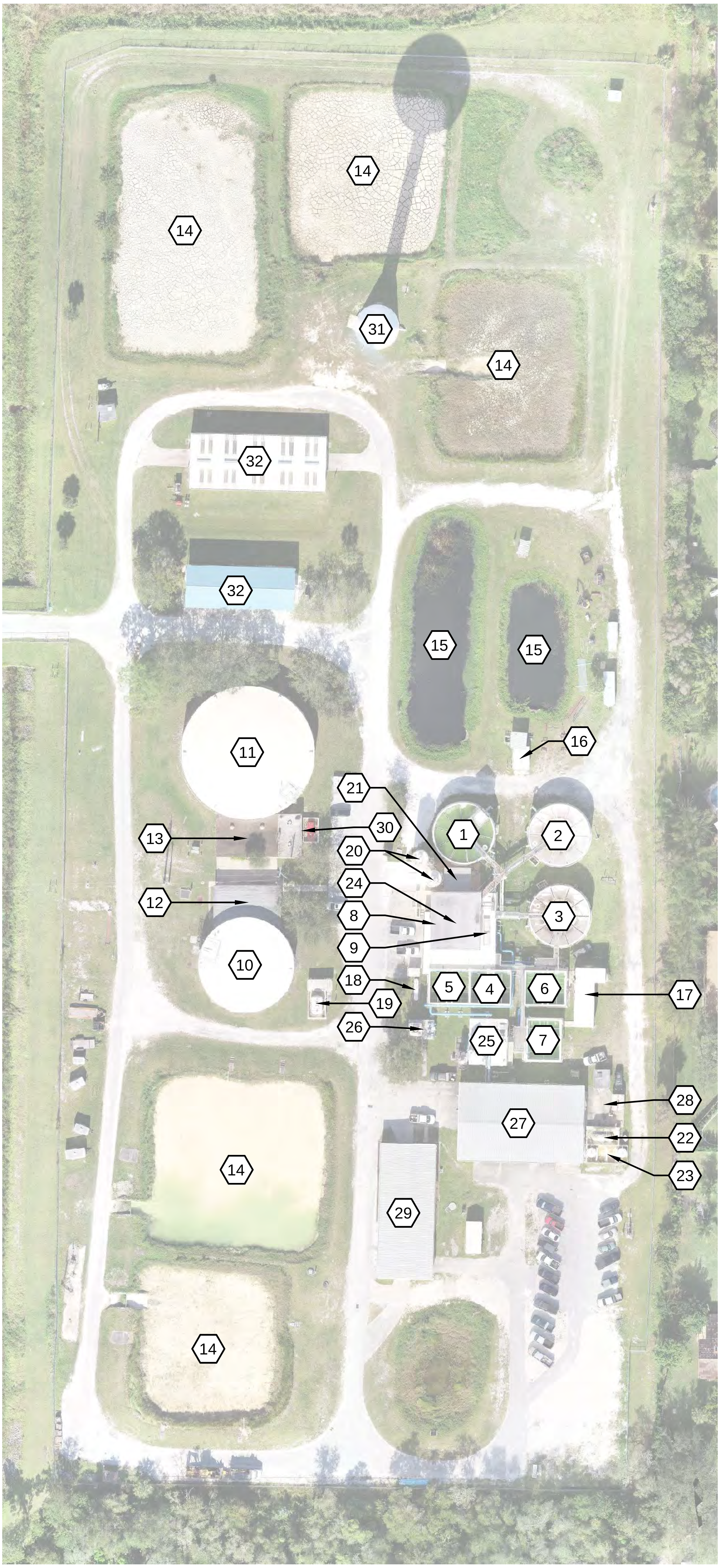

ISS

GRAPHIC SCALE

0 80 120 160

1"=80'

KEYNOTES:

1. SOLIDS CONTACT UNIT NO. 1
2. SOLIDS CONTACT UNIT NO. 2
3. SOLIDS CONTACT UNIT NO. 3
4. SAND FILTER NO. 1
5. SAND FILTER NO. 2
6. SAND FILTER NO. 3
7. SAND FILTER NO. 4
8. CLEAR WELL
9. TRANSFER PUMPS
10. 0.5 MG GROUND STORAGE TANK
11. 1.0 MG GROUND STORAGE TANK
12. HIGH SERVICE PUMP ROOM NO. 1
13. HIGH SERVICE PUMP ROOM NO. 2
14. LIME DRYING BED
15. BACKWASH PONDS
16. COAGULANT STORAGE AND FEED
17. HYPOCHLORITE STORAGE AND FEED
18. AMMONIA STORAGE AND FEED
19. FLUORIDE STORAGE AND FEED
20. LIME SILOS
21. LIME FEED AREA
22. CAUSTIC STORAGE
23. SULFURIC ACID STORAGE
24. WATER PLANT CONTROL BUILDING
25. RO CLEAR WELL
26. VOC TREATMENT
27. RO BUILDING
28. RO GENERATOR
29. WAREHOUSE BUILDING
30. GENERATOR BUILDING
31. ELEVATED WATER TOWER
32. STORAGE BUILDING

SHEET NO.: FIG 3-6
SCALE: 1" = 80'
DATE: JUL 2024
PROJECT NO.: PBU006
PROJ. MGR.: CEM
DRWN BY: MSC
CHKD BY: CEM

DRAWING TITLE:
SITE PLAN
PALM BAY NORTH REGIONAL WATER TREATMENT PLANT

CLIENT:
CITY OF PALM BAY UTILITIES DEPARTMENT

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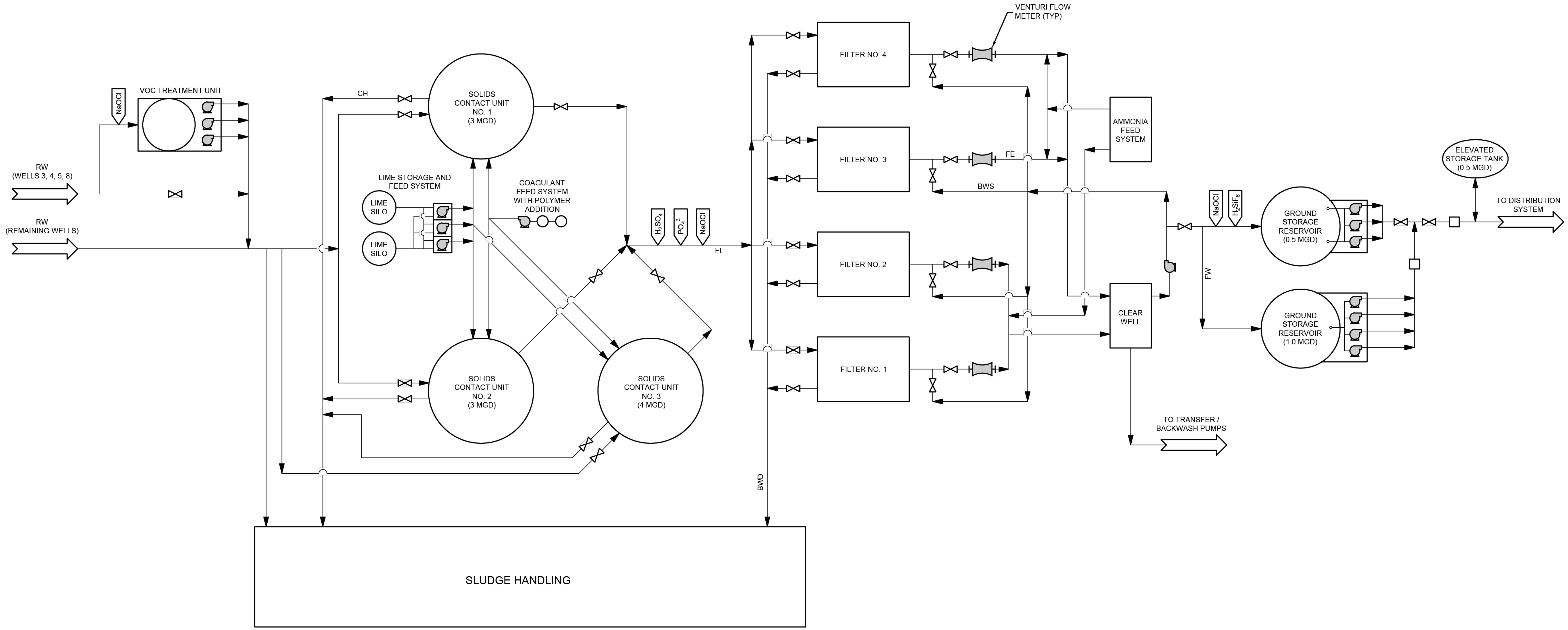

ABBREVIATIONS

BWD	BACKWASH DRAIN
BWS	BACKWASH SUPPLY
CH	CHEMICAL SLUDGE
FE	FILTER EFFLUENT
FI	FILTER INFLUENT
FW	FINISHED WATER
RW	RAW WATER
NaOCl	SODIUM HYPOCHLORITE
H_2SiF_6	HYDROFLUOSILICIC ACID
H_2SO_4	SULFURIC ACID
PO_4^3	PHOSPHATE

FIG 3-2. ADAPTED FROM CITY OF PALM BAY NORTH REGIONAL WATER TREATMENT PLANT UPGRADES PRELIMINARY DESIGN INVESTIGATIONS, FIGURE 2-2, PREPARED BY TETRA TECH, OCT 2020

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DRAWING TITLE:
NORTH REGIONAL WATER TREATMENT PLANT PROCESS FLOW SCHEMATIC

CLIENT:
CITY OF PALM BAY UTILITIES DEPARTMENT

PROJECT NO.: PBU006	PROJ. MGR.: CEM
DATE: JUL 2024	DRWN. BY: JFN
SCALE: N.T.S.	CHKD. BY: CEM
SHEET NO. FIG 3-7	

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The following table describes the existing unit treatment processes at the Palm Bay North Regional WRF:

Table 3-5. Description of NRWRF Unit Treatment Process

Unit Process	***Description***
Preliminary Treatment	• Two manually cleaned 1-in spacing bar rack
Secondary Treatment	• Two 56 ft long, 56 ft wide, 14.8 ft side water depth 347,000-gallon Anoxic/Equalization Basin with one 3 HP submersible mixer • Two duty + 1 Standby Feed Forward Internal Recycle Pumps • Alum Bulk Tanks • Alum Feed Pumps • Two Duty RAS Pumps + Air Lift Pumps • Two duty 734,000-gallon, 14.8 ft side water depth aeration basins with sixteen 2½ in airdrops with 6 coarse bubble aeration diffusers each. • Two duty 60 ft diameter, 14.8 ft side water depth secondary clarifiers with plow-type clarifier mechanism • One duty + one standby 200 HP centrifugal aeration blower rated at 4,000 scfm at 7 psig (Hoffman)
Tertiary Treatment	• Two duty six-disc cloth media type disc filters rated for 1.5 MGD peak flow (Aqua Aerobics) • One standby up-flow type continuous backwashing and filter rated at 0.66 MGD peak flow (Parkson Dynasand) • Two duty 1,700-gallon bulk hypochlorite storage tanks • Two duty + 1 standby hypochlorite feed pumps rated at 4.5 gph each • Two duty 74 ft long, 4.5 ft wide,5.5 ft side water depth 13,640-gallon chlorine contact chambers
Effluent Disposal	• One duty + one standby 15 HP vertical turbine type Effluent Transfer Pumps rated at 1,850 gpm @ 25 ft TDH • One 116 ft diameter, 15 ft side water depth 1.5-million-gallon steel Substandard Storage Tank • One 116 ft diameter, 12.5 ft side water depth 1.0-million-gallon steel covered Reuse Storage Substandard Tank • One 100 HP split case centrifugal reclaimed water pump rated for 1,000 gpm @ 190 ft TDH • Two 100 HP HP split case centrifugal reclaimed water pump rated for 1,600 gpm @ 170 ft TDH
Solids Handling	• Two duty 125,000-gallon aerated sludge storage tanks with four 2½ in airdrops with 6 coarse bubble aeration diffusers each
Miscellaneous Facilities	• Emergency Generator

Unit Process	*Description*
	• Operations Office • Laboratory Facility • On-Site Lift Station • Plant Wide SCADA System • Electrical System

3.3.3 South Regional Water Reclamation Facility (SRWRF)

The initial phase of the SRWRF will be a 2.0 MGD AADF permitting capacity domestic wastewater treatment facility. The facility is located at 250 Osmosis Dr. SE Palm Bay, FL. The facility is permitted under an FDEP Domestic Wastewater Facility Permit No. FLA693782. The facility is classified by the FDEP as a Category I, Class B facility requiring staffing by a Class C or higher licensed operator 16 hours per day for seven (7) days per week with a lead/chief operator being a Class B licensed operator or higher.

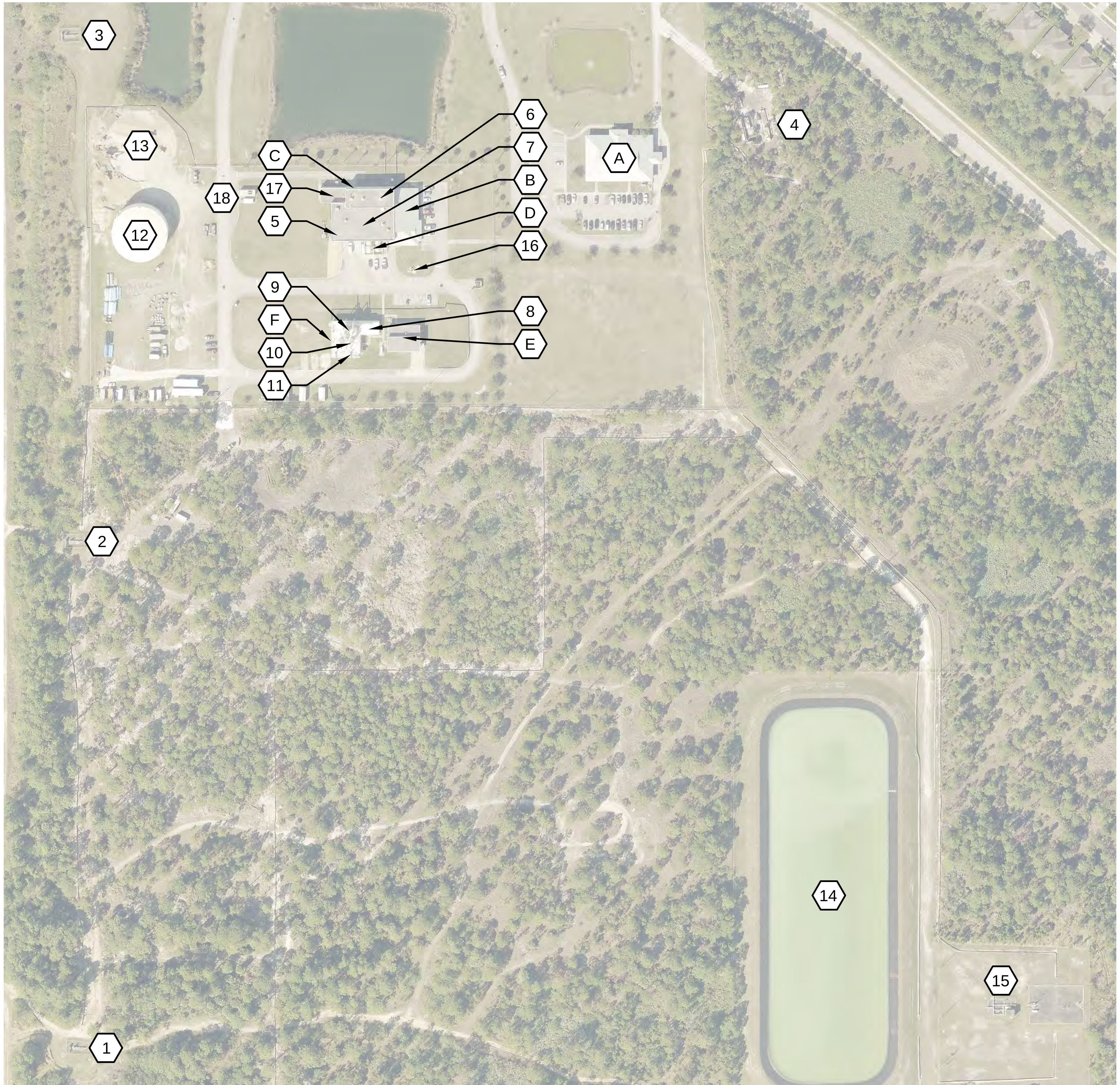
The SRWRF utilizes the following unit treatment processes:

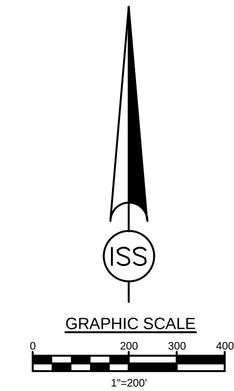
- Influent Fine Screening and Grit Removal;
- Anaerobic Selector, Pre-Anoxic, Aeration, and Flat Plate Membrane Bioreactor Basins;
- Dual Chlorine Contact Chamber;
- Effluent Transfer Pumping; and
- Aerated Sludge Storage

Secondary effluent is pumped to the existing 7.06 MGD maximum daily flow permitted capacity Class I deep injection well shared with the South Regional Water Treatment Plant for brine disposal. In the future reuse quality reclaimed water will be stored in a 3.0 MG ground storage tank along with three (3) 1 MG lines reclaimed water storage ponds for distribution as irrigation for a 0.66 MGD AADF permitted capacity slow-rate public access reuse system.

The facility is being constructed with the initial 1.0 MGD treatment capacity of wastewater tankage and equipment installed with the second 1.0 MGD treatment capacity of wastewater tankage constructed. The City has initiated the design to outfit the equipment for the second 1.0 MGD treatment capacity and a sludge dewatering facility.

Figure 3-8 shows the site plan and **Figure 3-9** shows the process flow schematic of the SRWRF.





KEYNOTES:

1 SOUTH REGIONAL RO WELL NO. 1
2 SOUTH REGIONAL RO WELL NO. 2
3 SOUTH REGIONAL RO WELL NO. 3
4 SOUTH REGIONAL RO WELL NO. 4
5 MICRON FILTER AREA
6 HIGH-PRESSURE RO FEED AND HIGH SERVICE PUMPS
7 REVERSE OSMOSIS TREATMENT SKIDS
8 BLOWER ROOM
9 DEGASIFIER TOWER
10 ODOR CONTROL SCRUBBER
11 TRANSFER PUMPS
12 2.0 MG GROUND STORAGE TANK NO. 1
13 2.0 MG GROUND STORAGE TANK NO. 2
14 LINED HOLDING POND
15 DEEP INJECTION WELL
16 ON-SITE LIFT STATION
17 ELECTRICAL ROOM
18 EMERGENCY GENERATOR AND FUEL SYSTEM

A UTILITIES ADMINISTRATION BUILDING
B WATER TREATMENT PLANT OPERATION BUILDING
C RO PROCESS AND HIGH-SERVICE PUMP BUILDING
D ACID AND CAUSTIC BULK CHEMICAL STORAGE AREA
E AMMONIA, FLUORIDE, & HYPOCHLORITE BUILDING
F DEGASIFIER AND CHLORINE CONTACT CHAMBER

AERIAL: FDOT 2021

NO.	DATE:	DESCRIPTION
		REVISIONS

INFRASTRUCTURE SOLUTION SERVICES
7175 Murrell Road
Melbourne, Florida 32940
Phone: (321) 622-4646
www.InfrastructureSS.com

DRAWING TITLE: SITE PLAN
PALM BAY SOUTH REGIONAL WATER TREATMENT PLANT

CLIENT: CITY OF PALM BAY UTILITIES DEPARTMENT

PROJECT NO.:	PROJ. MGR.:
PBU006	CEM
DATE:	DRWN. BY:
JUL 2024	MSC
SCALE:	CHKD. BY:
1" = 200'	CEM

SHEET NO.
FIG 3-8

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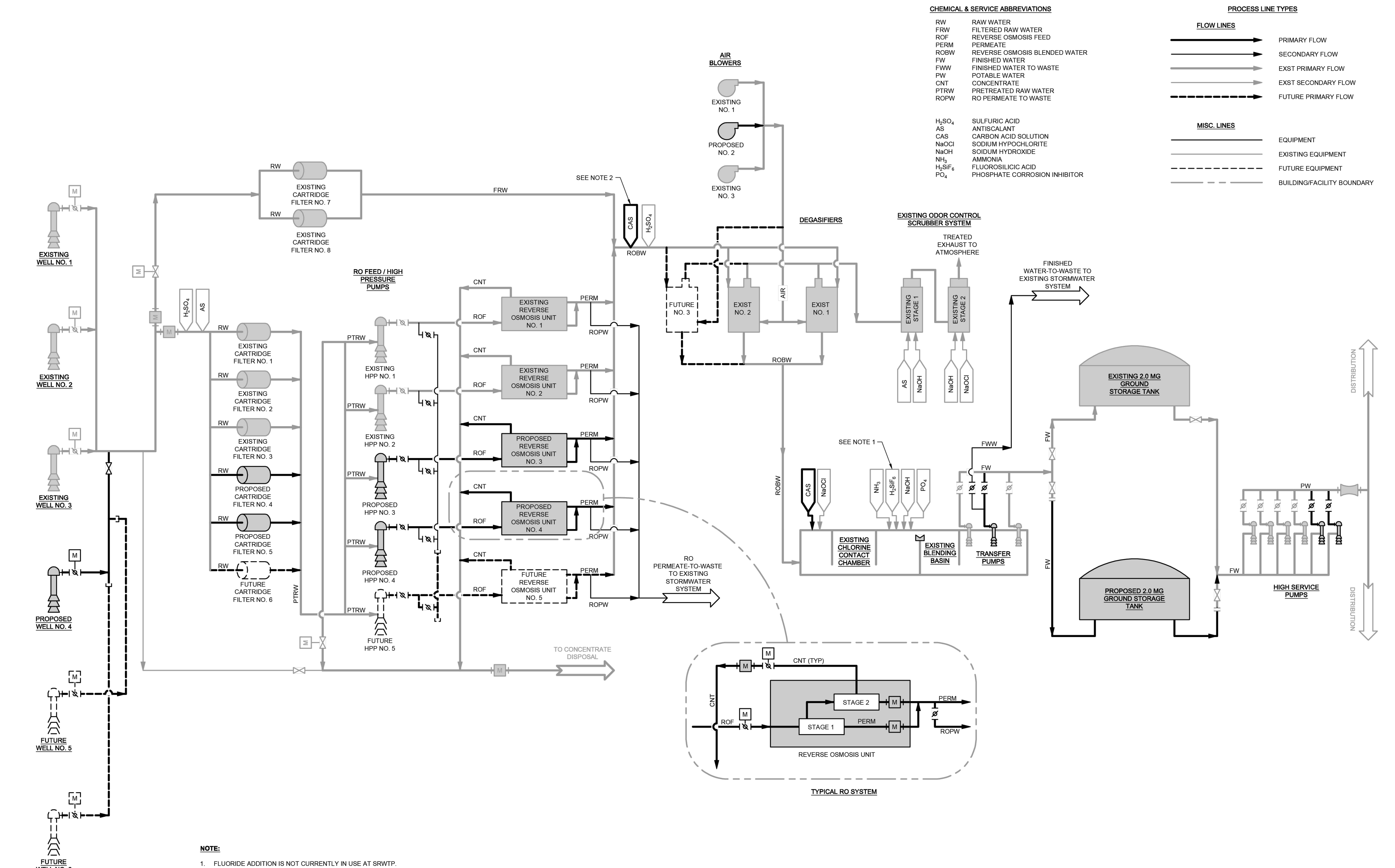

NOTE:

1. FLUORIDE ADDITION IS NOT CURRENTLY IN USE AT SRWTP.
2. PRE-DEGASIFICATION CO2 FEED SYSTEM IS AN ADDITIVE BID ALTERNATE. REFER TO DWG D-123.

NO. | DATE: | DESCRIPTION | REVISIONS

ISS INFRASTRUCTURE SOLUTION SERVICES
7175 Murrell Road
Melbourne, Florida 32940
Phone: (321) 622-4646
www.InfrastructureSS.com

DRAWING TITLE:
SOUTH REGIONAL REVERSE OSMOSIS WATER TREATMENT PLANT PROCESS FLOW SCHEMATIC

CLIENT:
CITY OF PALM BAY UTILITIES DEPARTMENT

PROJECT NO.:	PROJ. MGR.:
PBU006	CEM
DATE: JUL 2024	DRWN. BY: JFN
SCALE: N.T.S.	CHKD. BY: CEM
SHEET NO.	

FIG 3-9

6/7/2024 11:13:32 AM
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The following table provides a brief description of the unit treatment processes at the Palm Bay South Regional Water Reclamation Facility

Table 3-6. Description of SRWRF Unit Treatment Process

Unit Process	***Description***
Preliminary Treatment	• One (1) + One (1) Duty Rotary Drum Screens with 2 mm openings rated at 3.5 MGD peak flow (Parkson Rotoshear) • One (1) Screenings Screw Conveyor and Compactor rated at 70.5 cf/hr • One (1) Duty Grit Removal System consisting of One (1) Grit Concentrator unit, Two (2) Grit Pumps rated at 200 gpm at 15 ft TDH; One (1) Grit Washing/Classification unit, and One (1) Grit Dewatering Conveyor Unit. System rated at up to 9 MGD (Hydro International / Headcell) • Biotricking Filter Odor Control System rated at 9,000 cfm at 200 ppmv ave/400 ppmv peak hydrogen sulfide (BioAir Solutions)
Secondary Treatment	• Two (2) Parallel 8 ft long by 26 ft wide by 11 ft SWD, 17,100-gal Anaerobic Basins with one (1) duty 2 HP submersible mixer in each basin • Two (2) Parallel 32 ft long by 26 ft wide by up to 19 ft SWD, 49,800-gal Equalization / 68,500 gal Pre-Anoxic Basin with one (1) duty 3 HP submersible mixer in each basin • Two (2) Duty + One (1) Standby Feed Forward Submersible Pump rated at 1,850 gpm @ 28 ft TDH, VFDs Controlled • Two (2) Parallel 35 ft long by 25 ft wide by 19.5 ft SWD 127,600-gal Aeration Basins with Fine Bubble Aeration Diffusers • Four (4) Parallel 14 ft long by 12 ft wide by 14 ft SWD Membrane Bioreactor Bains with Six (6) Double Deck Submerged Membrane Units in each Basin with 2,400 15.6 SF cartridges per MBR Basin operating at 16 gpd/sf at MMADF. • Four (4) Duty Self Priming Centrifugal Permeate Pumps rated at 695 gpm at 38 ft TDH each, 12 HP, VFDs Controlled • Four (4) Duty 12-inch Recycle Control Telescopic Valves rated at 2,500 gpm each • One (1) Duty + One (1) Standby Self Priming Centrifugal Waste Activated Sludge Pumps rated at 70 gpm at 30 ft TDH, 3 HP • Two (2) Duty Aeration, Two (2) Duty MBR, and One (1) Common Standby Rotary-Lobe Positive Displacement Blowers rated at 750 icfm @ 11 psig, 40 HP
Tertiary Treatment	• Two (2) Parallel 36 ft long by 18 ft wide by 8 ft SWD Chlorine Contact Chambers • One (1) Duty 2,500-gal capacity Vertical Double Wall Polyethylene Bulk Chemical Storage Tank for 8 to 12% Trade Sodium Hypochlorite

Unit Process	*Description*
	• Triplex Sodium Hypochlorite Chemical Metering Pump Skid with 12.5 gph Diaphragm Type Metering Pumps
Effluent Disposal	• One (1) Duty + Two (2) Standby CCC Effluent Transfer Vertical Turbine Pumps rated at 2,100 gpm at 94 ft TDH; 75 HP max • One (1) Duty + One (1) Standby Self Priming Centrifugal Plant Reuse Water System Pumps rated at 600 gpm at 30 ft TDH, 15 HP • One (1) 120 ft inside dia, 35.5 ft SWD, 3.0 MG ANSI/AWW D110 Wire-Wound Pre-Stressed Concrete Ground Storage Tank (Pre-Con Corp) • One (1) Duty + One (1) Vertical Turbine High Service Pump Station Effluent Pump rated at 2,100 gpm at 153 ft TDH, 125 HP max
Solids Handling	• Two (2) 35 ft long by 26 ft wide by 15 ft SWD 102,100-gal Aerated Sludge Storage Basins with Coarse Bubble Aeration Diffusers • One (1) Duty + One Standby Rotary-Lobe Positive Displacement Sludge Storage Blower rated at 600 icfm @ 11 psig, 50 HP
Miscellaneous Facilities	• On-Site Lift Station • Standby Diesel Power Generator • 6,000-gal Above Grade Diesel Fuel Storage Tank

3.3.4 Historical Wastewater Treatment Influent Flows

Historical influent flows to the two (2) existing wastewater treatment facilities are presented below in the following table.

Table 3-7. Historical Treatment Facility Influent Flows

Year[1]	***NRWWTP***		***NRWRF[2]***		***Combined***	
	Annual Average Daily Flow (MGD)	***Maximum Day Flow (MGD)***	***Annual Average Daily Flow (MGD)***	***Maximum Day Flow (MGD)***	***Annual Average Daily Flow (MGD)***	***Maximum Day Flow (MGD)***
2019	2.59	4.85	0.92	1.41	3.83	5.66
2020	2.82	4.57	0.71	1.26	3.61	5.69
2021	3.20	4.34	0.00	0.00	3.47	5.21
2022	3.04	5.65	0.50	1.27	3.82	6.41
2023	3.19	6.12	0.64	1.28	4.06	6.73

1) Data obtain from FDEP Discharge Monitoring Reports for Permit No FLA 103357.

2) WRF was not operational in 2021 while undergoing its Biological Nutrient Removal project upgrades.

The NRWRF has been offline for several years to save costs. The reverse osmosis potable water process at the NRWTP also has been offline for several years for the same reason and no brine flows have been pumped to the NRWWTP.

3.4 Effluent Disposal

Two methods of effluent disposal are employed for the NRWWTP and NRWRF. The primary effluent disposal method is the Class I deep injection well (DIW) located at the NRWWTP site. The second method is the reuse water treatment system located at the NRWRF site.

3.4.1 Deep Injection Well

The North Regional Deep Injection Well (NRDIW) is classified as a Class I well with a maximum permitted flow capacity of 12.73 MGD.

The construction and operation of the deep injection well is authorized under FDEP UIC Permit No. 05-0174174-001.

Construction details of the deep injection well are presented in **Figure 3-10**. The outer casing of the deep injection well consists of a carbon steel 20-inch casing (19-inch I.D.) installed to a depth of 2,050 feet below the land surface (bls). The well is completed with an 18-inch diameter open hole to 2,530 feet bls and a 12-¼ inch pilot hole to 3,000 feet bls.

As part of the DIW, a monitoring well is located immediately adjacent to the DIW and is used to monitor pressures and water quality in the lower and upper Floridan aquifer.

Three (3) vertical turbine pumps, each with a rated capacity of 3,500 gpm (5 MGD) are used to pump treated effluent down the deep injection well.

The capacity (injectivity rate) of the DIW has diminished (approximately 50%) over time due to issues with screening, malfunctions of the treatment process, and blockages in the -open-hole-in portion of the well. The well needs to be regularly rehabilitated to restore and maintain injectivity.

3.4.2 Slow-Rate Public Access Reuse System

Reuse serves as the second method of effluent disposal. The permitted capacity of the reuse process is 2.3 MGD. Effluent from either the NRWWTP or the NRWRF can be treated to high-level disinfection reuse water quality standards suitable for public access-in-reuse purposes, such as irrigation and toilet flushing.

The reuse facilities consist of cloth media-type disc filters, a chlorine contact chamber, a sodium hypochlorite chemical feed system, a transfer pump station, a reuse ground storage tank (1-MG), and high service pumps.

The following table lists the major reuse customers and their permitted capacities.

Table 3-8. Major Reuse Customers and Rated Capacity

Site Identification[1]	***User Name***	***User Type***	***Capacity (MGD)***
PAA-1	Harris Corporation	Industrial Uses (Cooling Water, Process Water, and Wash Water	1.01
PAA-2	Sandy Pines Development	Residential Irrigation	0.26
PAA-3	City of Palm Bay WWTP/WRF	Other Landscape Irrigation	0.10
PAA-4	County Club Lake Estates	Residential Irrigation	0.21
		Total	**1.58**

1) Taken from FDEP Domestic Wastewater Facilities Permit No. FLA103357 Section IV.A.2

Refer to **Figure 3-11** for the location of the major reuse customers and the reclaimed water main routing.

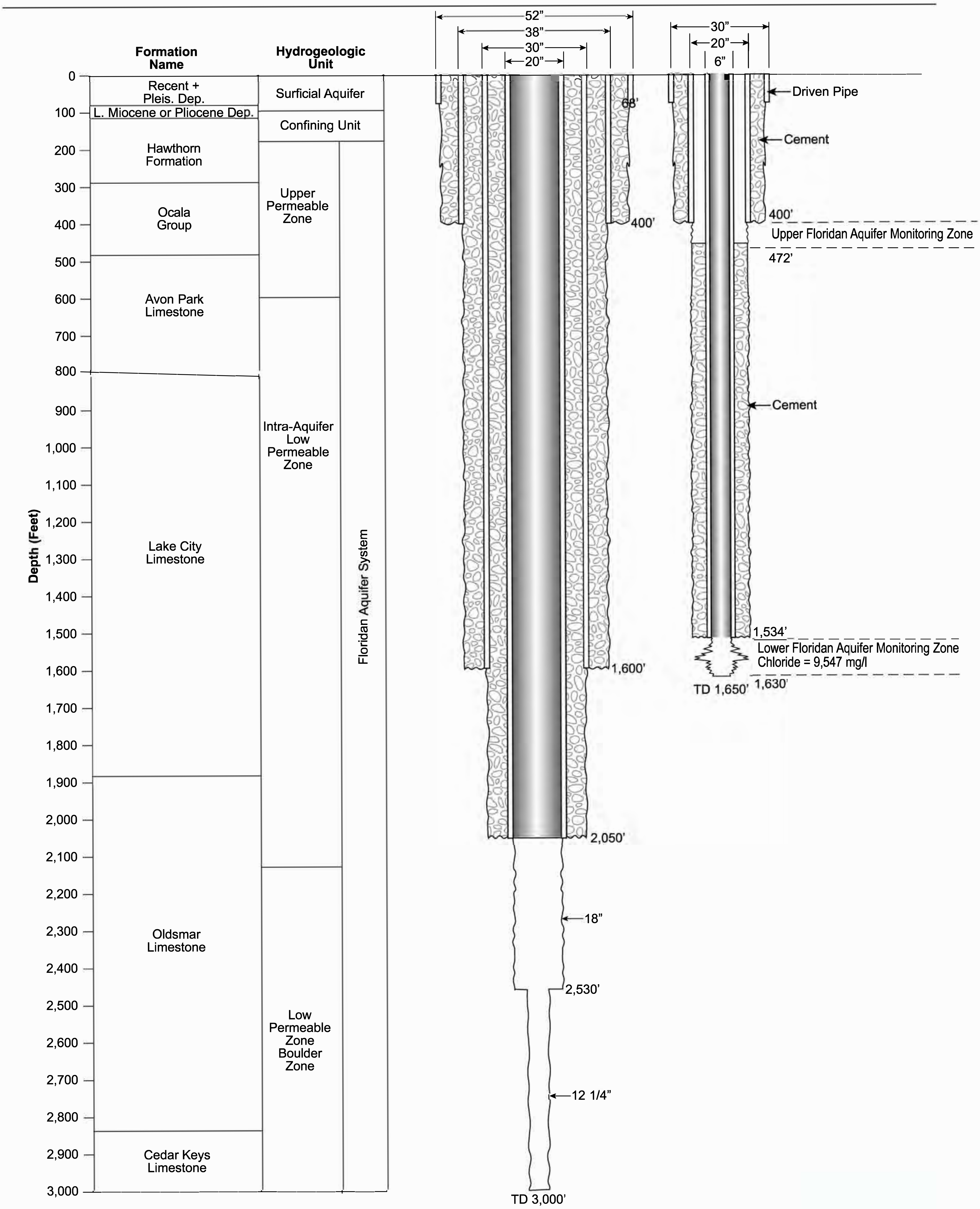
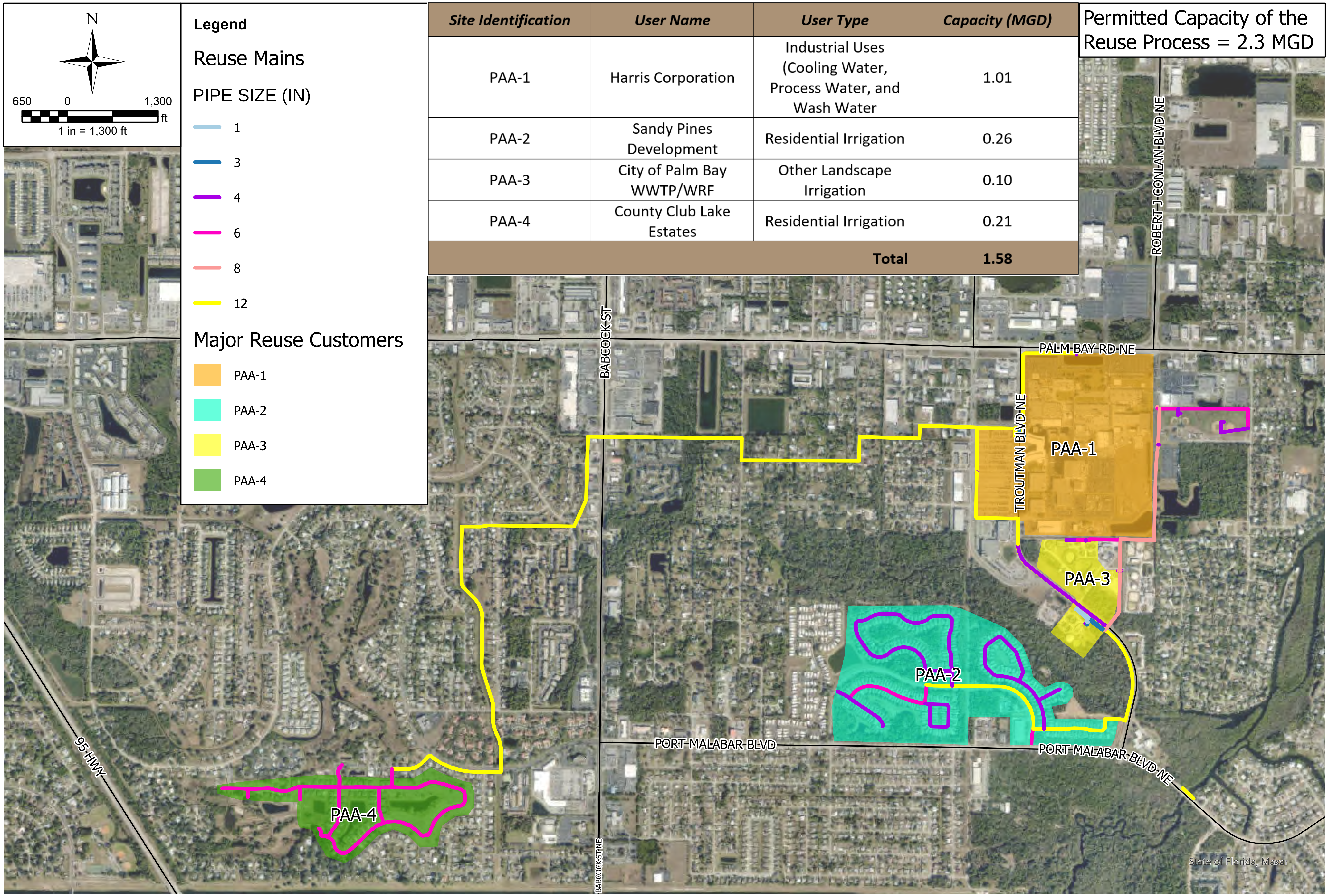


FIGURE 3-10
Deep Injection Well System Completion Details

Site Identification	User Name	User Type	Capacity (MGD)
PAA-1	Harris Corporation	Industrial Uses (Cooling Water, Process Water, and Wash Water	1.01
PAA-2	Sandy Pines Development	Residential Irrigation	0.26
PAA-3	City of Palm Bay WWTP/WRF	Other Landscape Irrigation	0.10
PAA-4	County Club Lake Estates	Residential Irrigation	0.21
		Total	1.58

Permitted Capacity of the Reuse Process = 2.3 MGD



Effluent from either the NRWWTP or the NRWRF can be treated to high-level disinfection reuse water quality standards suitable for public access-in-reuse purposes, such as irrigation and toilet flushing.

INFRASTRUCTURE SOLUTION SERVICES
Melbourne | Sarasota | Panama City Beach

Major Reuse Customers and Reclaimed Water Main Routing
Wastewater Master Plan
City of Palm Bay Utilities Department

PROJECT NO.: **PBU027**
DATE: **JUL 2024**
FIGURE NO. **3-11**

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3.5 Additional Information

The following is a listing of all City-owned lift stations provided by Palm Bay Utilities.

Table 3-9 City-Owned Lift Station Information Listing

Lift Station No.	*Address*	*Lift Station Type*	*Upstream Tributary Lift Station*	*Wet Well Diameter (feet)*	*Number of Pumps*	*Pump Duty Point*	*Pump Size (hp)*
LS-001	1031 CABOT LN NE	Dry Pit	3,5	Ø= 6'	2	280 gpm @ 42 ft TDH	10
LS-002	3050 ABBOTT AVE NE	Submersible	1,<3,5	Ø= 10'	2	500 gpm @ 58 ft TDH	20
LS-003	1297 BIANCA DR NE	Submersible	-	Ø= 4'	2	50 gpm @ 30 ft TDH	1
LS-004	2095 PORT MALABAR BLVD NE	Submersible	-	Ø= 8'	2	350 gpm @ 50 ft TDH	14
LS-005	3100 FLORIN RD NE	Submersible	-	Ø= 6'	2	125 gpm @ 33 ft TDH	5
LS-006	1644 SUNNY BROOK LN NE	Submersible	-	Ø= 6'	2	125 gpm @ 30 ft TDH	5
LS-007	1586 PALM BAY RD NE	Submersible	-	Ø= 6'	2	45 gpm @ 29 ft TDH	3
LS-008	995 SONESTA AVE NE	Submersible	-	Ø= 6'	2	280 gpm @ 24 ft TDH	10
LS-009	1570 NORWOOD ST NE	Submersible	30, 36, 39, 40, 14<22	Ø= 12'	2	538 gpm @ 46.5 ft TDH	28
LS-010	2661 SCHOOL DR NE	Dry Pit	-	5.5' x 5.5'	2	100 gpm @ 46 ft TDH	7.5
LS-011	1580 PAR ST NE	Submersible	6, 24	Ø= 6'	2	350 gpm @ 57 ft TDH	10
LS-012	1461 SALEM ST NE	Dry Pit	-	6' x 6'	2	250 gpm @ 43 ft TDH	15
LS-013	1601 RIVIERA DR NE	Submersible	7, 21, 17<18	7' x 7'	2	250 gpm @ 43 ft TDH	15
LS-014	1020 AMERICANA BLVD NE	Dry Pit	22	Ø= 7'	2	300 gpm @ 45 ft TDH	10
LS-015	890 CAYUGA AVE NE	Submersible	-	Ø= 6'	2	300 gpm @ 45 ft TDH	5
LS-016	747 CHELSEA AVE NE	Submersible	-	Ø= 6'	2	250 gpm @ 34 ft TDH	6.5
LS-017	1500 MARIPOSA DR NE	Submersible	18	Ø= 6'	2	230 gpm @ 24 ft TDH	3
LS-018	1025 MARIPOSA DR NE	Submersible	-	Ø= 6'	2	125 gpm @ 23 ft TDH	3
LS-019	999 RIVIERA DR NE	Submersible	-	Ø= 6'	2	125 gpm @ 16 ft TDH	3
LS-020	748 RIVIERA DR NE	Submersible	19, 37	Ø= 6'	2	350 gpm @ 54 ft TDH	10

Lift Station No.	*Address*	*Lift Station Type*	*Upstream Tributary Lift Station*	*Wet Well Diameter (feet)*	*Number of Pumps*	*Pump Duty Point*	*Pump Size (hp)*
LS-021	1600 TREERIDGE LN NE	Submersible	-	Ø= 6'	2	210 gpm @ 37 ft TDH	5
LS-022	291 MYSTIC BLVD NE	Submersible	-	Ø= 6'	2	175 gpm @ 8 ft TDH	3
LS-023	151 INTERCHANGE DR NE	Submersible	-	Ø= 6'	2	300 gpm @ 132 ft TDH	14
LS-024	1804 CLUB GARDENS DR NE	Submersible	-	Ø= 6'	2	100 gpm @ 21 ft TDH	3
LS-025	1047 PORT MALABAR BLVD NE	Submersible	-	Ø= 6'	2	15 gpm @ 56 ft TDH	3
LS-026	980 PORT MALABAR BLVD NE	Submersible	-	Ø= 6'	2	105 gpm @ 38 ft TDH	5
LS-027	19 SAN FILIPPO DR SE	Submersible	29, 33, 35, 34<65	Ø= 10'	2	140 gpm @ 66 ft TDH	14
LS-028	880 BASS PRO DR NE	Submersible	-	Ø= 8'	2	540 gpm @ 41 ft TDH	12
LS-029	1098 MALABAR RD SE	Submersible	-	Ø= 6'	2	135 gpm @ 43 ft TDH	4.7
LS-030	1051 CRICKET DR NE	Submersible	-	Ø= 6'	2	135 gpm @ 43 ft TDH	5
LS-031	298 INTERSTATE CT SE	Submersible	-	Ø= 6'	2	85 gpm @ 12 ft TDH	20
LS-032	2151 SANDY PINES DR NE	Submersible	-	Ø= 6'	2	335 gpm @ 91 ft TDH	20
LS-033	580 COMMUNITY COLLEGE PKWY SE	Submersible	-	Ø= 6'	2	300 gpm @ 73 ft TDH	20
LS-034	515 AZALEA AVE SE	Submersible	65	Ø= 6'	2	88 gpm @ 21 ft TDH	4.7
LS-035	1311 FOUNDATION PARK BLVD SE	Submersible	-	Ø= 6'	2	120 gpm @ 63 ft TDH	10
LS-036	1156 MEADOWBROOK RD NE	Submersible	-	Ø= 6'	2	100 gpm @ 68 ft TDH	7.5
LS-037	1305 CULVER DR NE	Submersible	-	Ø= 8'	2	500 gpm @ 57 ft TDH	10
LS-038	6455 MINTON RD SE	Submersible	-	Ø= 6'	2	395 gpm @ 53 ft TDH	14
LS-039	832 AMERICANA BLVD NE	Submersible	-	Ø= 8'	2	630 gpm @ 70 ft TDH	20
LS-040	1010 DOLORES RD NE	Submersible	-	Ø= 8'	2	900 gpm @ 74 ft TDH	30
LS-041	2496 DOREATHA FIELDS AVE NE	Submersible	44	Ø= 10'	2	130 gpm @ 90 ft TDH	14
LS-042	1985 DANR DR NE	Submersible	51, 45<46, 47, 58	Ø= 12'	2	585 gpm @ 65 ft TDH	45

Lift Station No.	Address	Lift Station Type	Upstream Tributary Lift Station	Wet Well Diameter (feet)	Number of Pumps	Pump Duty Point	Pump Size (hp)
LS-043	1590 RICHARDS DR NE	Submersible	48, 56	Ø= 8'	2	400 gpm @ 32 ft TDH	7.5
LS-044	3310 DIXIE HWY NE	Submersible	-	Ø= 6'	2	350 gpm @ 90 ft TDH	9.4
LS-045	1515 WATER DR NE	Submersible	46, 47<58	Ø= 6'	2	250 gpm @ 62 ft TDH	10
LS-046	1369 WORTH CT NE	Submersible	-	Ø= 4'	2	50 gpm @ 21 ft TDH	3.8
LS-047	4299 DIXIE HWY NE	Submersible	46, 58	Ø= 6'	2	50 gpm @ 35 ft TDH	5
LS-048	1301 ELLIOTT ST NE	Submersible	-	Ø= 4.5'	2	162 gpm @ 51 ft TDH	7.5
LS-049	1220 KNECHT RD NE	Submersible	-	Ø= 6'	2	150 gpm @ 62 ft TDH	10
LS-050	1506 BOTTLEBRUSH DR NE	Submersible	49, 60, 61	15' x 10'	3	700 gpm @ 82 ft TDH	30
LS-051	3107 BAY BLVD NE	Submersible	-	Ø= 5'	2	150 gpm @ 51 ft TDH	9.4
LS-052	2378 ERSOFF BLVD NE	Submersible	-	Ø= 6'	2	400 gpm @ 62 ft TDH	14
LS-053 (abandoned)	INDIAN RIVER DR NE (abandoned)	(Abandoned)	-	Ø= 6'	2	(Abandoned)	NA
LS-054	2148 HARRIS AVE NE	Submersible	-	Ø= 6'	2	125 gpm @ 7 ft TDH	4.7
LS-055	1512 PORT MALABAR BLVD NE	Submersible	-	Ø= 6'	2	75 gpm @ 38 ft TDH	4.7
LS-056	995 MANDARIN DR NE	Submersible	-	Ø= 6'	2	150 gpm @ 51 ft TDH	10
LS-057	2249 GUNPOWDER DR NE	Submersible	-	Ø= 6'	2	100 gpm @ 40 ft TDH	6.5
LS-058	5045 DIXIE HWY NE	Submersible	-	Ø= 6'	2	350 gpm @ 54 ft TDH	10
LS-059	2398 COMMERCE PARK DR NE	Submersible	-	Ø= 8'	2	46 gpm @ 32 ft TDH	9.4
LS-060	3200 PINEWOOD DR NE	Submersible	-	Ø= 5'	2	90 gpm @ 24 ft TDH	3
LS-061	9890 PINEWOOD DR NE	Submersible	-	Ø= 6'	2	90 gpm @ 24 ft TDH	3
LS-062	154 MALABAR RD SE	Submersible	-	Ø= 6'	2	68 gpm @ 22 ft TDH	4.7
LS-063	3965 CLUBSIDE DR, MELBOURNE	Submersible	-	Ø= 8'	2	160 gpm @ 30 ft TDH	3.8
LS-064	2342 LAKES OF MELBOURNE DR, MELBOURNE	Submersible	63	Ø= 10'	2	96 gpm @ 45 ft TDH	14
LS-065	1070 CASTILE RD SE	Submersible	-	Ø= 6'	2	90 gpm @ 16 ft TDH	2.4

Lift Station No.	Address	Lift Station Type	Upstream Tributary Lift Station	Wet Well Diameter (feet)	Number of Pumps	Pump Duty Point	Pump Size (hp)
LS-066	2455 HIDDEN PINE LN NE	Submersible	-	Ø= 6'	2	113 gpm @ 76 ft TDH	12
LS-067	2029 DEGROODT RD SW	Submersible	-	Ø= 8'	2	340 gpm @ 88 ft TDH	25
LS-068	860 COPLY ST SE	Submersible	-	Ø= 6'	2	132 gpm @ 81 ft TDH	14
LS-069	761 CONSUMER ST SE	Submersible	-	Ø= 6'	2	170 gpm @ 83 ft TDH	14
LS-070	3380 JUPITER BLVD SE	Submersible	-	Ø= 6'	2	313 gpm @ 78 ft TDH	20
LS-071	108 MASSINI AVE NW	Submersible	-	Ø= 6'	2	200 gpm @ 102 ft TDH	20
LS-072	215 NAGEL RD NW	Submersible	-	Ø= 6'	2	230 gpm @ 118 ft TDH	30
LS-073	265 MELIS AVE NW	Submersible	-	Ø= 6'	2	200 gpm @ 108 ft TDH	20
LS-074	260 ALCANTARA ST NW	Submersible	-	Ø= 6'	2	260 gpm @ 118 ft TDH	33
LS-075	489 AMERICANA BLVD NW	Submersible	-	Ø= 6'	2	260 gpm @ 118 ft TDH	33
LS-076	735 IVANHOE ST NW	Submersible	-	Ø= 6'	2	210 gpm @ 120 ft TDH	33.5
LS-077	198 DEAUVILLE AVE NE	Submersible	-	Ø= 6'	2	280 gpm @ 108 ft TDH	33.5
LS-078	316 BROOKEDGE ST NE	Submersible	-	Ø= 6'	2	100 gpm @ 112 ft TDH	20
LS-079	499 BROOKEDGE ST NE	Submersible	-	Ø= 8'	2	430 gpm @ 111 ft TDH	47
LS-080	454 CELLINI AVE NE	Submersible	-	Ø= 6'	2	270 gpm @ 115 ft TDH	30
LS-081	472 ELDRON BLVD NE	Submersible	-	Ø= 6'	2	270 gpm @ 115 ft TDH	30
LS-082	1799 WINDBROOK DR SE	Submersible	89	Ø= 6'	2	113 gpm @ 76 ft TDH	14
LS-083	3451 BAYSIDE LAKES BLVD SE	Submersible	-	Ø= 6'	2	611 gpm @ 116 ft TDH	14
LS-084	489 COGAN DR SE	Submersible	-	Ø= 6'	2	611 gpm @ 116 ft TDH	14
LS-085	3824 BAYSIDE LAKES BLVD SE	Submersible	-	Ø= 6'	2	225 gpm @ 70 ft TDH	14
LS-086	1695 DEGROODT RD SW	Submersible	-	Ø= 6'	2	125 gpm @ 43 ft TDH	4.7
LS-087	2040 BRAMBLEWOOD CIR SE	Submersible	-	Ø= 6'	2	784 gpm @ 152 ft TDH	28.2
LS-088	498 RIVIERA DR NE	Submersible	-	Ø= 6'	2	80 gpm @ 61 ft TDH	4.5
LS-089	998 WYOMING DR SE	Submersible	-	Ø= 6'	2	113 gpm @ 30 ft TDH	3
LS-090	250 THOR AVE SE	Submersible	-	Ø= 8'	2	350 gpm @ 80 ft TDH	20

Lift Station No.	Address	Lift Station Type	Upstream Tributary Lift Station	Wet Well Diameter (feet)	Number of Pumps	Pump Duty Point	Pump Size (hp)
LS-091	1381 MELODY AVE NE	Submersible	-	Ø= 6'	2	80 gpm @ 159.1 ft TDH	6.7
LS-092	340 NARDO AVE SW	Submersible	-	Ø= 6'	2	250 gpm @ 104 ft TDH	25
LS-093	9144 BABCOCK ST SE	Submersible	95, 96	Ø= 10'	2	960 gpm @ 169 ft TDH	88
LS-094	1390 WYOMING DR SE	Submersible	-	Ø= 8'	2	210 gpm @ 112 ft TDH	30
LS-095	1510 MARA LOMA BLVD SE	Submersible	-	Ø= 6'	2	160 gpm @ 33 ft TDH	5
LS-096	1500 MARA LOMA BLVD SE	Submersible	-	Ø= 6'	2	125 gpm @ 49 ft TDH	5
LS-097	720 COGAN DR SE	Submersible	-	Ø= 8'	2	402 gpm @ 122 ft TDH	30
LS-098	190 BENDING BRANCH LN SW	Submersible	-	Ø= 10'	2	410 gpm @ 145 ft TDH	47
LS-099	2295 SNAPDRAGON DR NW	Submersible	-	Ø= 8'	2	400 gpm @ TBD ft TDH	27
LS-100	975 COGAN DRIVE SE	Submersible	-	Ø= 8'	2	327 gpm @ 122 ft TDH	47
LS-101	101 SUTHERLAND DR SW	Submersible	-	Ø= 8'	2	229 gpm @ 107 ft TDH	31
LS-102	830 COGAN DR SE	Submersible	-	Ø= 8'	2	180 gpm @ 118 ft TDH	30
LS-103	350 CHAMPIONSHIP CIR NW	Submersible	-	Ø= 6'	2	107.9 gpm @ 155 ft TDH	6.2
LS-104	1214 BRIAR CREEK BLVD NE	Submersible	-	Ø= 8'	2	300 gpm @ 86 ft TDH	7.2
LS-105	730 MALABAR RD, MALABAR	Submersible	-	Ø= 6'	2	80 gpm @ 136 ft TDH	17
LS-106	875 OLD COUNTRY RD SE	Submersible	-	Ø= 8'		263 gpm @ 171 ft TDH	31
LS-107	1300 KILLIAN DR NE	Submersible	-	Ø= 6'		350 gpm @ 60 ft TDH	12
LS-108	501 GANTRY ST SW	Submersible	-	Ø= 8'		226 gpm @ 200 ft TDH	30.8
LS-109	2075 CAPITAL DR SE	Submersible		Ø= 8'	2	150 gpm @33 ft TDH	5.5
LS-110	203 ABILENE DR SW	Submersible		Ø= 6'	2	115 gpm @ 132 ft TDH	16.8
LS-111	907 GRAPEFRUIT RD SE	Submersible		Ø= 6'	2	94.5 gpm @ 110 ft TDH	11
LS-112	2309 PINWHERRY ST NW	Submersible		Ø= 6'	2	342 gpm @ 62.6 ft TDH	20
LS-113	211 GERTRUDE AVE SW	Submersible		Ø= 6'	2	128 gpm @ 103 ft TDH	11
LS-114	777 VERIDIAN CIR NW	Submersible		Ø= 6'	2	207 gpm @ 62.1 ft TDH	6.5

Lift Station No.	*Address*	*Lift Station Type*	*Upstream Tributary Lift Station*	*Wet Well Diameter (feet)*	*Number of Pumps*	*Pump Duty Point*	*Pump Size (hp)*
LS-115	661 CHAMPIONSHIP CIR NW	Submersible		Ø= 4'	2	84.1 gpm @ 97.1 ft TDH	5.5
LS-116	2337 CARRICK ST NW	Submersible		Ø= 6'	2	245 gpm @ 78.2 ft TDH	20
LS-117	3342 ARAMORE RD SE	Submersible		Ø= 8'	2	60 gpm @ 39 ft TDH	7.5
LS-118	MARA LOMA BLVD SE	Submersible		Ø= 8'	2	250 gpm @ 48 ft TDH	7.5
LS-119	904 ABILENE DR SW	Submersible		Ø= 10'	2	330 gpm @ 40 ft TDH	7.5

1. Tributary lift stations are those that feed into lift stations located closer to the treatment facilities. For example, lift station 1 receives flow from lift stations 3 and 5. However, lift station 2 receives flow from lift station 1 which includes the flows from lift stations 3 and 5 as depicted by the “<” symbol.

Section 4 - Analysis and Projection of Population and Wastewater Flows

4.1 Introduction

Section 4 of the City of Palm Bay Wastewater Master Plan reviews and analyzes the existing population and wastewater flow projections for the entire City wastewater system. The analysis evaluates:

- Population projections and wastewater flows from each parcel;
- Wastewater flows to the wastewater treatment facilities, including the diurnal flow characteristics;
- Future wastewater service area population and their associated sanitary wastewater flows based on proposed developments and future land use within the city; and
- Wastewater flows will be developed for three (3) planning horizons (five-, ten-, and twenty-year) for use in evaluating future system performance and needs.

4.2 Determination of Existing Wastewater Flows

The ISS Team collected data from various sources including the City of Palm Bay, the United States Census Bureau, the Florida Department of Environmental Protection (FDEP), and the University of Florida Bureau of Economic and Business Research (BEBR). The data obtained from these sources included: water billing data, wastewater treatment plant monthly Discharge Monitoring Reports (DMR), population estimates, and other types of data that were directly used in the analysis of existing wastewater flows.

4.2.1 City-Wide Population

Overall, the City of Palm Bay has experienced significant population growth over the last ten (10) years, increasing by over 22,700 people or 18% from 2010 to 2020 according to the U.S. Census data. The City is expected to continue to grow into the future based on the known or expected developments located in the northwest and southeast sections of the city. In addition, the City has seen a large amount of new home construction on vacant parcels within already-developed areas within the city. The following table shows the historical and future projected city-wide population for Palm Bay.

Table 4-1. Historical and Future City-Wide Population Projections

	Year	*City-wide Population*	*Data Source*
Historical	**2010**	103,190	2010 US Census[1]
	2015	107,481	BEBR Estimate[2]
	2020	119,760	2020 US Census[1]
	2023	137,837	City of Palm Bay 2045 Comprehensive Plan Table FLU-1
Future	**2030**	146,800	City of Palm Bay Vision 2045 Comprehensive Plan Table FLU-7
	2035	154,300	
	2040	160,900	
	2045	166,848	

1 –2010 and 2020 US Census obtained from University of Florida Bureau of Economic and Business Research US Census publications.
2 –University of Florida Bureau of Economic and Business Research *Florida Estimate of Population 2015*.

4.2.2 Wastewater Service Area Population

The PBUD wastewater service area has 20,773 accounts as of April 2024. Based upon 2.9 persons per household according to the latest U.S. Census data, the estimated current wastewater service area population is approximately 60,241 people.

PBUD provides wastewater services to approximately 43% of the total city-wide population.

4.2.3 Historical Wastewater Flows to Wastewater Treatment Plants

Municipal wastewater flows are conveyed to two (2) wastewater treatment facilities within the city for treatment and disposal. At these locations, the volume of wastewater received is routinely metered and is required to be reported monthly to the FDEP using monthly DMRs. From the data contained in these reports, the following table presents the reported wastewater flows to the treatment facilities:

Table 4-2. Historical Wastewater Flows to the Treatment Plants

Year	*Total System Wastewater Flows*			*NRWRF*	*NRWWTP*
	Annual Average Daily Flow (MGD)	*Annual Maximum Day Flow (MGD)*	*Observed MADF: AADF Peaking Factor*	*Annual Average Daily Flow (MGD)*	*Annual Average Daily Flow (MGD)*
2019	3.83	5.66	1.48	0.92	2.59
2020	3.61	5.68	1.58	0.71	2.82
2021	3.47	5.12	1.50	0.00[1]	3.20
2022	3.82	6.41	1.68	0.50	3.04
2023	4.06	6.73	1.66	0.64	3.19
		Average	**1.58**		

1- NRWRF was out of service in 2021 being upgraded for biological nutrient removal.

The data in the table above shows a generally increasing trend in total system wastewater flows from 2019 through 2023 increasing by 0.23 MGD over the period disregarding the drop in wastewater flow in 2020 and 2021 attributable to the COVID-19 pandemic period. More importantly, we observe the flow increasing towards the 5.2 MGD permitting capacities of the facilities. Also, we see the observed maximum day flows steadily increasing over the period from 5.66 MGD in 2019 to 6.73 MGD in 2023. The observed MADF to AADF peaking factors also have increased over the period and now average 1.58 over the last five (5) years.

4.2.4 Diurnal Flow Pattern at the Wastewater Treatment Plant

Sanitary wastewater flows conveyed to the wastewater treatment plant follow a typical diurnal flow pattern characterized by low flows in the overnight hours and elevated flows during the day with higher peak flows in the morning and afternoon periods. This pattern of wastewater flow follows from the typical residential domestic water use within a home.

Instantaneous Influent flow data in one-minute time increments was obtained from the NRWWTP for the three (3)-day (or 72-hour) period from midnight on Wednesday, October 27th through 12: 59 PM on Friday, October 29th, 2021, as can be seen in the following figure.

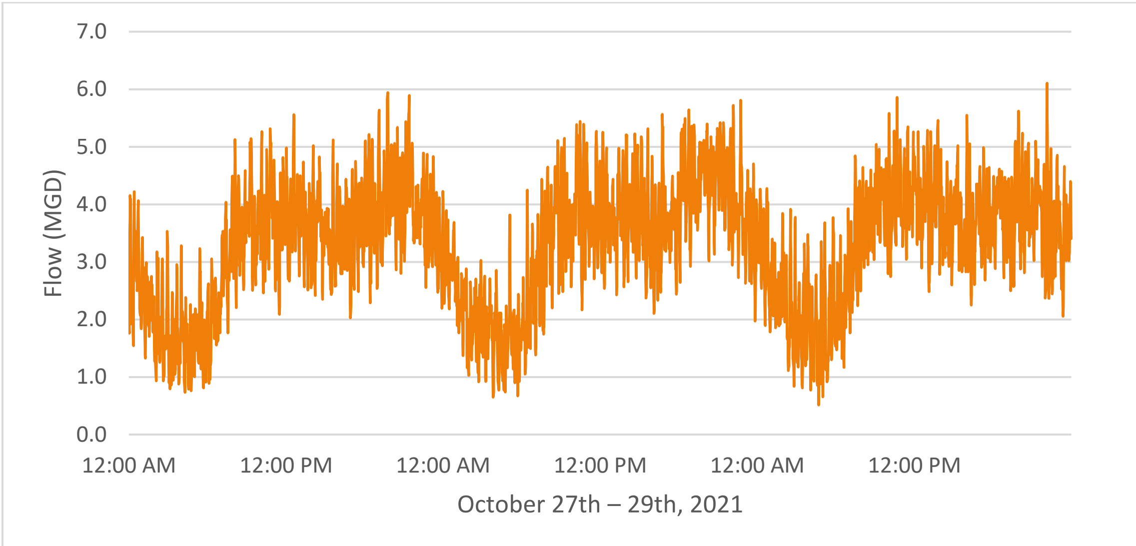


Figure 4-1. NRWWTP Influent Flows for October 27th through 30th 2021

Flows were then averaged across the three (3) days to yield an observed 3-day average flow representative of the diurnal flow at the plant. This observed diurnal curve and the recorded average daily flow can be seen in **Figure 4-2**.

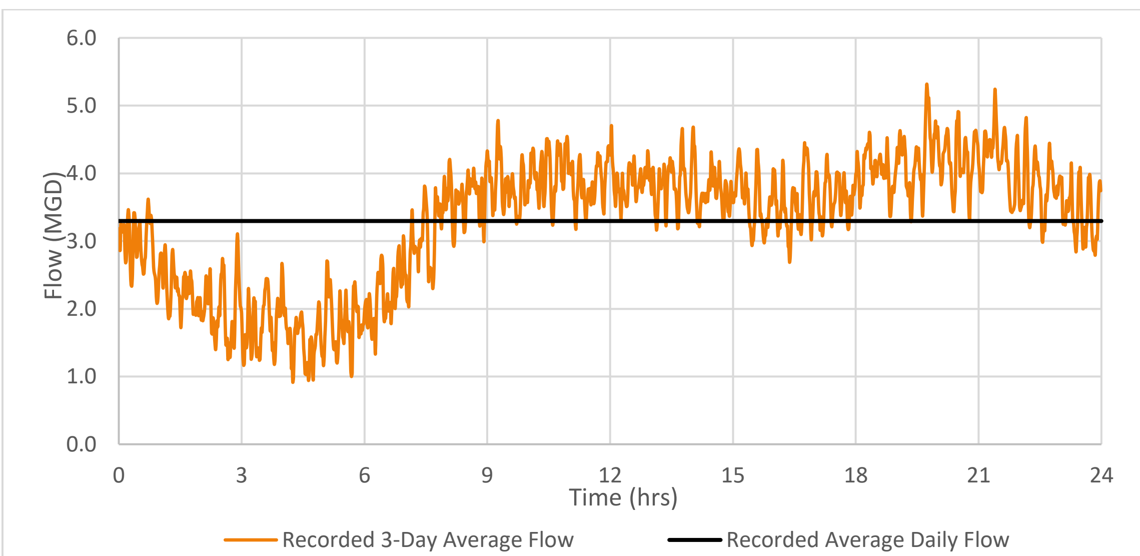


Figure 4-2. Observed Averaged Diurnal Flow Pattern at NRWWTP

Average daily wastewater flows equated to approximately 2,300 gpm or 3.30 MGD. Peak flows were observed to be approximately 4.58 MGD. The observed peak hour peaking factor for this period was observed to be 1.39 or (4.58/3.30).

The diurnal pattern is much flatter than in previous years, likely due to the pandemic and socioeconomic factors that resulted in more people in their homes during the day. Rather than two (2) distinct morning and evening peaks with a midday valley between, the data shows a relative plateau throughout the day and softening of the two (2) peaks.

4.2.5 Analysis of Existing Infiltration & Inflow

Extraneous water from infiltration/inflow (I&I) sources reduces the capacity and capability of sewer systems and treatment facilities to transport and treat domestic wastewater. Infiltration occurs when groundwater infiltrates existing sewer lines through defective pipes, pipe joints, connections, or manholes due to material and joint degradation and deterioration. Inflow normally occurs when rainfall enters the sewer system through direct connections such as roof leaders, yard drains, catch basins, sump pumps, manhole covers, and frame seals or indirect connections with storm sewers. The elimination of infiltration/inflow by sewer system rehabilitation and an ongoing operation and maintenance program to identify these areas is essential to protect the enormous investment in sewers and wastewater treatment facilities.

4.2.5.1 Infiltration Analysis

In the Brevard County area, the seasonal high groundwater elevation generally occurs from June through November when the heavy seasonal precipitation events generally occur. The area groundwater levels are heavily influenced by the seasonal water fluctuation of the Indian River Lagoon. The water level in the lagoon can seasonally vary by about 1 to 2 feet. When the groundwater is elevated, infiltration tends to become greater due to additional defects in the sewer lines.

Infiltration is normally assessed by analyzing the low nighttime wastewater flows (from midnight to 6 am) during average day dry weather flow conditions (without precipitation) during high seasonal groundwater conditions. Infiltration can be assessed on a system-wide or lift station-specific collection system area if the appropriate data is available.

During the calibration period previously described in **Section** 4.2.4, the observed flows to the treatment plant during the overnight hours were generally about 1.5 MGD. It is difficult to assess the degree of infiltration without additional data to be used for comparison.

Another method of qualitatively assessing infiltration is by comparing the per capita wastewater flow with the portable water flow. The calculated per capita flow of 67 gpd/cap (or

4.06 MGD divided by the estimated service area population of 60,240) is slightly higher than the calculated potable water demand of 58 gpd/cap per Section 4.2.3 of the 2024 City of Palm Bay Water Master Plan. This would suggest about 9 gpd/cap or 500,00 gpd of wastewater flow on a system-wide basis may be attributable to excess wastewater flow or infiltration.

The US Environmental Protection Agency (USEPA) defines excessive infiltration as greater than 1,500 gallons per day per inch of diameter per mile of pipe (gpd/idm) (EPA, 2014). The City of Palm Bay has 228 miles of 8-inch diameter sewer (as shown in **Table 3-1**) or 1,824 idm. Palm Bay's calculated infiltration rate is 500,000 gpd divided by 1,824 idm or 274 gpd/idm or only 18% of the USEPA's excessive infiltration rate. Therefore Palm Bay's observed infiltration rate would not be considered excessive by EPA's standard.

4.2.5.2 Inflow Analysis

Inflow is normally assessed by analyzing the correlation between the measured precipitation from storm events and the measured sanitary flows within the system. Generally, a sanitary collection system will be observed to experience elevated wastewater flows during significant wet weather events. The challenge to making this correlation is the availability of reliable precipitation data over the entire collection system.

For Palm Bay, two National Weather Service regional precipitation gauges are in the region one located at the Melbourne airport and the other gage located in West Melbourne. Neither regional precipitation gauge is located within the City of Palm Bay sanitary collection system and in some cases the record precipitation data from these two gauges is very different for the same storm.

An analysis was completed for sixty calendar days in 2023 with measured precipitation attempting to correlate measured precipitation with elevated wastewater flows. The data suggests a casual correlation such as on Nov 17, 2023, with the measured precipitation was 4.5 inches and the ADF was 6.9 MGD or 2.84 MGD above the 2023 AADF of 4.06 MGD. However, the correlation was not observed on June 2, 2023, with 3.0 inches of measured precipitation occurring with the ADF being 4.6 MGD on that day. It was generally observed, elevated wastewater flows were observed within the collection system on the handful of days with measured precipitation greater than about 2.5 to 3.0 inches of precipitation.

There was insufficient information to determine the significance of inflow on a lift station basis.

4.3 Projection of Future Wastewater Flows

In 2021, the City Growth Management and Utilities Department has provided coordinated information on the planned and known developments within the wastewater service area for the ranges of planning horizon conditions including 0-5 years, 6-10 years, and greater than 10 years. The listing of development, their estimated number of equivalent residential connections (ERC), their estimated total wastewater flows, and the total estimated wastewater flow per planning period are shown in **Table 4-3**.

The total wastewater flows shown in the table have been calculated based upon the Palm Bay Utilities definition of average day wastewater flow per ERC to be 210 gpd (Palm Bay Utilities Department Policies, Procedures, and Standards Handbook Chapter 1.02).

Table 4-3. Future Developments and Wastewater Flow

ID	*Development[1]*	*Type*	*Total Estimated ERC*	*Total Wastewater (gpd)[2]*	*Total Wastewater Flows (gpd)*		
					0-5 Year	*6-10 Year*	*> 10 Year*
A	**Palm Vista (Lennar)**	Residential, Mixed	4,000	840,000	84,000	378,000	378,000
B	**Palm Vista Everlands**	Residential, Mixed	162	34,020	34,020		
C	**SJRWMD Property**	Single Family Residential	552	115,920	11,592	46,368	57,960
		Multi-Family Residential	324	68,040		68,040	
D	**St Johns Preserve**	Residential, Mixed	620	130,200	52,080	52,080	26,040
E	**Fred Poppe Park RV Campground**	Commercial/RV	45	9,450	9,450		
F	**Lennar South**	Residential, Mixed	352	73,920		73,920	
G	**Three Forks**	Mixed Use	814	170,940			170,940
H	**Malabar Estates**	Single Family Residential	77	16,170		16,170	
I	**Chapparal**	Single Family Residential	602	126,420	75,852	50,568	
		Multi-Family Residential	75	15,750		15,750	
J	**Brentwood Phase 3**	Single Family Residential	97	20,370	20,370		
K	**Sanibel Cove**	Single Family Residential	50	10,500	10,500		

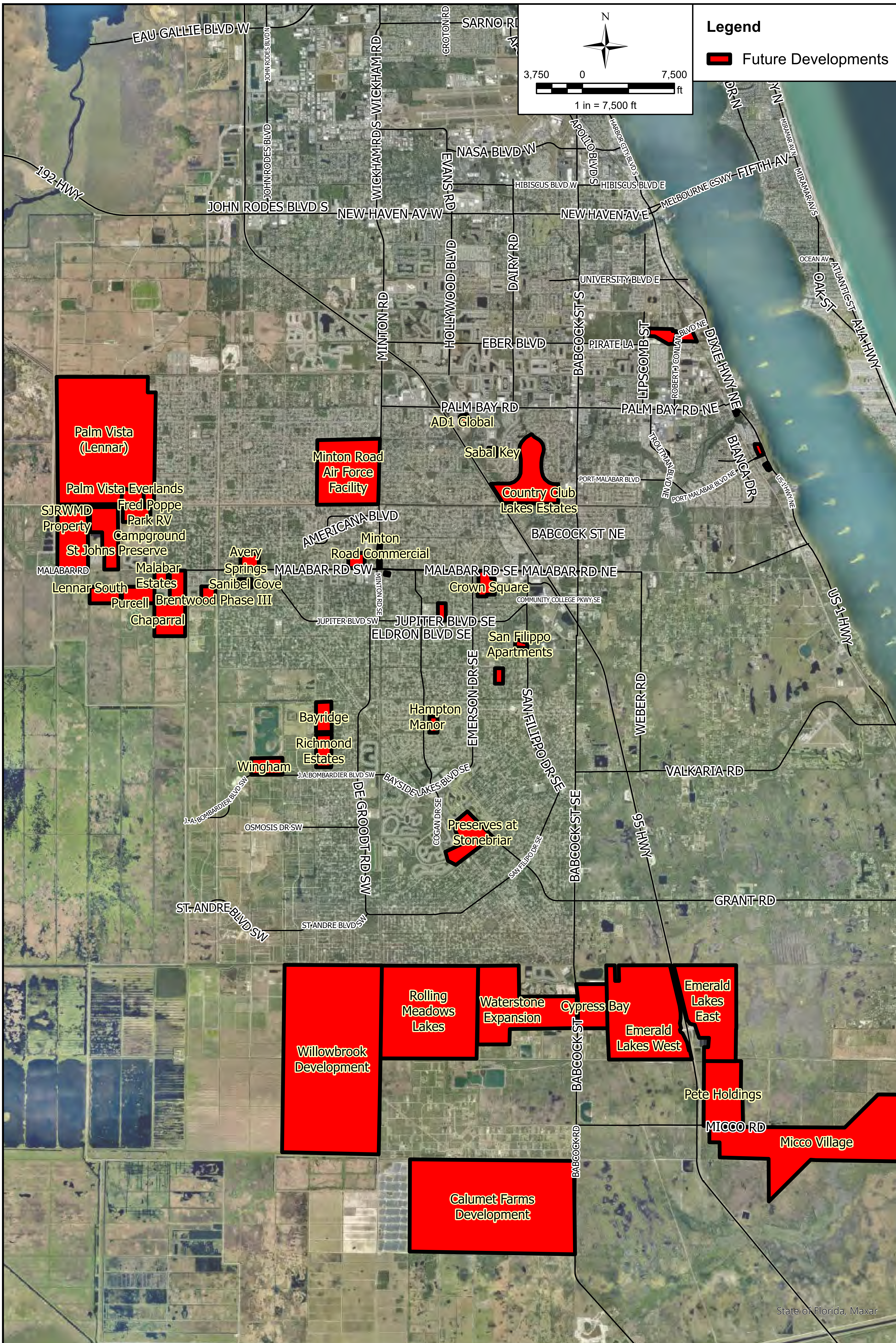
ID	Development[1]	Type	Total Estimated ERC	Total Wastewater (gpd)[2]	Total Wastewater Flows (gpd)		
					0-5 Year	6-10 Year	> 10 Year
L	**Avery Springs**	Single Family Residential	140	29,400	29,400		
M	**Minton Road Airforce Facility**	Mixed-Use	650	136,500		13,650	122,850
N	**Health First Wellness Village**	Mixed Use	100	21,000	21,000		
O	**Minton Road Commercial**	Commercial	77	16,170	16,170		
P	**City Hall Expansion**	Municipal	15	3,150	3,150		
Q	**AD1 Global**	Mixed Use Commercial	82	17,220	17,220		
R	**Sabal Key**	Single Family Residential	40	8,400	8,400		
S	**Country Club Lakes Estates I-IV (LS-107)**	Single Family Residential	199	41,790	41,790		
S	**Reserve at County Club Lakes Estates**	Single Family Residential	154	32,340	32,340		
		Multi-Family Residential	46	9,660	9,660		
T	**Westshore Apartments**	Multi-Family Residential	212	44,520	44,520		
U	**Northshore (Aqua Apartments) (Private LS)**	Residential	325	68,250	68,250		
		Commercial	56	11,760	11,760		
V	**Clearmont Trace**	Multi-Family Residential	28	5,880	5,880		
W	**Pelican Harbor Marina**	Commercial	75	15,750	15,750		
X	**Eztopeliz**	Mixed-Use / Multi-Family Residential	415	87,150		65,363	21,788
W	**Tropical Arms Apartments**	Residential	84	17,640	17,640		
Z	**Twin Lakes (Malabar)**	Residential	16	3,360	3,360		
BB	**Joe Daddy Golf Course Property**	Multi-Family Residential	176	36,960	36,960		
		Commercial	60	12,600	12,600		
CC	**Crown Square**	Multi-Family Residential	216	45,360	45,360		
		Potential Building Space	40	8,400	8,400		
DD	**San Filippo Apartments**	Residential	172	36,120	36,120		
EE	**Gulfport Key**	Single Family Residential	77	16,170	16,170		
F	**Bayridge (LS-108)**	Single Family Residential	143	30,030	30,030		
GG	**Richmond Estates**	Single Family Residential	149	31,290	31,290		
HH	**Wingham**	Residential, mixed	500	105,000		52,500	52,500

ID	Development[1]	Type	Total Estimated ERC	Total Wastewater (gpd)[2]	Total Wastewater Flows (gpd)		
					0-5 Year	6-10 Year	> 10 Year
II	**Hampton Manor (Private LS)**	Assisted Living Facility	7	1,470	1,470		
		Multi-Family Residential	65	13,650	13,650		
JJ	**Eagle Crest**	Single Family Residential	108	22,680	11,340	11,340	
KK	**Preserves at Stonebriar (LS-106)**	Single Family Residential	329	69,090	69,090		
LL	**Rolling Meadows**		2339	491,190	98,238	196,476	196,476
MM	**Waterstone Phase II**		1061	222,810	222,810		
MM	**Waterstone/Cypress Bay West**		1352	283,920	283,920		
NN	**Cypress Bay (LS-109)**		593	124,530	124,530		
OO	**Emerald Lakes - West of I-95**	Residential, Mixed	3,775	792,750	237,825	317,100	237,825
PP	**Emerald Lakes - East of I-95**	Residential, Mixed	2,179	457,590	91,518	183,036	183,036
QQ	**Pete Holdings (Jeff Lee)**	Residential, Mixed	1966	412,860		206,430	206,430
RR	**Micco Village**	Mixed-Use	600	126,000		50,400	75,600
	Calumet Farms		3304	693,840			693,840
	Willowbrook		6000	1,260,000			1,260,000
Total Wastewater Flow (gpd)				**7,496,000**	**2.015,000**	**1,797,000**	**3,683,000**

1 - Developments, Residential Units, and demands provided by Palm Bay Utilities on March 2021

2 - Residential wastewater demand based on 210 gpd/ERC

The locations of the proposed developments can be found in the following figure.



Z:\PROJECTS\Palm Bay Utilities\PBU006 Wastewater Master Plan 2020\GIS\GIS PBU006\PBU006_WW_MP.aprx

INFRASTRUCTURE SOLUTION SERVICES

Melbourne | Sarasota | Panama City Beach

Future Development Locations
Wastewater Master Plan
City of Palm Bay Utilities Department

PROJ. NO.	PBU006
DATE:	JUL 2024

FIGURE NO.
4-3

The total estimated wastewater flows for the known developments over the next twenty (20) years have been estimated to be 7.5 MGD. The following table presents a summary of the current and future wastewater flows over the planning period.

Table 4-4. Historical and Projected Future Systemwide Wastewater Flows

	Year	Ave Daily Wastewater Flow (MGD)		
		Existing Service Areas	New Development Areas	Total
Historical	2019	3.83	NA	3.83
	2020	3.61	NA	3.61
	2021	3.47	NA	3.47
Future	Five-Year	3.5	2.0	5.5
	Ten-Year	3.5	3.8	7.3
	Twenty-Year	3.5	7.5	11.0

4.4 Conclusion

In conclusion, the existing city-wide and wastewater service area populations were reviewed for the purpose of and to make predictions for the future five-, ten-, and twenty-year planning horizons.

According to the April 2024 City's GIS data, there are 73,826 parcels within the City of which 27,334 are vacant or approximately 37%. Of the 46,492 developed parcels, about 36% or 16,885 parcels are connected to central sewer system. The remaining developed parcels not connected to central sewer are served by conventional or nutrient reducing type OSTDS.

The total estimated annual average day wastewater flow from the known future developments is approximately 7.5 MGD. The total system-wide annual average day wastewater from at the twenty-year planning horizon is 11.0 MGD.

Section 5 - Hydraulic Modeling of the Wastewater Collection System

5.1 Introduction

Section 5 of the City of Palm Bay Wastewater Master Plan describes the development and calibration of the wastewater collection system hydraulic model. This model serves as the basis for developing an understanding of the current and future wastewater system infrastructure needs. This section will include the following:

a) Update and use the wastewater collection system model to evaluate the performance of the existing system and evaluate future improvements.
b) Verify the collection system model including the pipes, lift stations, and connectivity.
c) Expand the model to include all gravity sewers 10-in in diameter and larger to provide a more refined modeling of the system performance.
d) Update the model based on GIS and/or development plans to reflect any changes to the system since the previous master plan.
e) Calibrate the model based on actual flow, pressure, and pump run-time data for the system.
f) Develop model simulations for three (3) planning horizons (five-, ten-, and twenty-year).
g) Identify and evaluate improvements in the collection system required to provide service in each of the planning horizons.
h) Model both for the average daily flow (ADF) and maximum average daily flow (MADF) design conditions.

5.2 Previous Wastewater Models

The most recently completed wastewater collection system hydraulic model for the City of Palm Bay was completed in 2017 as part of the Wastewater Master Plan (Wade Trim, 2017). The model primarily simulated the pressurized sanitary force main system including lift stations and force mains. Gravity sewers were only included for connectivity of where force mains discharged into manholes conveying gravity flows to a downstream lift station.

Also, the previous hydraulic model did not represent any of the more than 120 private lift stations in the city. However, these flows were modeled as a constant base flow input with the diurnal flow pattern used in the model.

The previous model was developed using Bentley's SewerGEMS version V8i software package. The model was used to evaluate the existing conditions and proposed future growth in the city's service area using the five-, ten- and twenty-year planning periods.

5.3 Model Development

A major point of emphasis in the development of this hydraulic model was to give the City a refreshed modeling framework representation that will allow the City to leverage its GIS capabilities to update and evolve the model representation of the system. To do this, ISS created a completely new model from scratch using the City's GIS database providing unique identifiers (typically asset ID or AID), elevations, and pertinent characteristics necessary for the model computations. Components of the previous model were evaluated, updated, and incorporated as appropriate. In some cases, missing data required field survey data, City staff input, and approximation based on the best available data.

This fresh start approach is a departure from previous rounds of existing model updates and prevents the compounding of modeling artifacts and inconsistencies accumulated through rounds of revisions. Significant time and attention were devoted to establishing a model framework that integrates with City GIS and data management methods to prevent this model effort from becoming a snapshot analysis. The modeling structure allowed it to serve as a living document, easily updatable and manipulated as the status and needs of the City evolve. It allows for analysis at varying scales, from system-wide master planning to service area-specific design projects, through the ability to include or exclude elements as desired.

It is a priority for ISS to deliver a modeling framework that is practical for the City's needs and that can be readily utilized in real time, rather than solely providing planning analysis every several years. This hydraulic model is designed to serve this role and provide the City with continuing benefits beyond the scope of this master planning exercise.

5.3.1 Modeling Software

The hydraulic model of the City's wastewater collection system was developed in Bentley's OpenFlows SewerGEMS CONNECT Edition Update 3 software package consistent with prior modeling efforts and familiarity by City staff. The model was developed using the ModelBuilder tool in SewerGEMS allowing the model components to be linked to the GIS data directly. Additional GIS information was required in some cases to provide for the construction of the model; however, the asset ID, or other unique ID, was used in the City GIS where available to provide the ability to compare the original City GIS files with the GIS database used in SewerGEMS. Additionally, the LoadBuilder tool was used to import water billing data as the basis for the spatial distribution of sanitary loading in the model.

The SewerGEMS software provides four (4) numerical solvers to simulate water levels and flows in the system. The computational solver chosen for simulations in this study was the GVF-Convex solver due to the numerous lift stations resulting in a complex system of both pumped and gravity flow.

The model simulations are set up with a duration of 48 hours with the first 24 hours representing average day conditions and the second 24 hours representing either the average day flow (ADF scenarios) or maximum day flow design conditions (MDF scenarios). The purpose of the first 24 hours is to establish appropriate initial conditions for the design condition and to stabilize the modeling framework allowing for appropriate representative conditions of the wastewater collection and forcemain system to be analyzed in the subsequent 24-hour modeling period.

5.3.2 Model Build

The model build was comprised mainly of city-provided GIS datasets last provided in April 2024. In some cases, data was carried over from the previous model build, such as lift station pump performance curves. Where data was deficient or suspect, requests were made to the City, and the data was provided. The result was a digital model that closely matched real-world conditions.

5.3.2.1 Sanitary Flow Sources

Sanitary flows were imported into the model using the City's water billing data and the customer account GIS data. The wastewater customers were brought into SewerGEMS as property connections allowing for easy updates of the sanitary baseflow. The customer location ID is unique to each property address, so this GIS field is used as the Property Connection ID in SewerGEMS. The sanitary flows for each property connection were connected to the nearest manhole or gravity main using the LoadBuilder tool. This automated tool is accurate for the majority of the property connections but is dependent on the gravity mains included in the model. Manual adjustment was required to ensure the proper connection point.

5.3.2.2 Sanitary Gravity Mains

By pipe length, 1.03 million linear feet of the 1.2 million linear feet (86%) of gravity mains within the GIS were included in the gravity sewer model. A breakdown of the gravity mains included in the model by pipe size is shown in **Table 5-1**.

Table 5-1. Modeled Gravity Mains by Pipe Diameter

Gravity Main Diameter	Pipe Length (linear feet)	Percent of Total
6	4,649	0.45
8	1,000,163	96.85
10	20,302	1.97
12	2,187	0.21
15	3,051	0.30
18	2,108	0.20
21	265	0.03
Total	**1,032,725**	

Similarly, approximately 86% (4,444 of the 5,147) manholes were included in the model. Import into SewerGEMS required gravity mains to have upstream and downstream inverts unless it was the same as the bottom invert of the manhole. In numerous instances, upstream gravity mains were higher than the manhole invert thus requiring invert elevations to be assigned to the gravity main GIS data. A GIS python script was written to read the manhole GIS data to populate these inverted elevations. Manual verification was then required to ensure the proper elevations were assigned to the gravity main.

To decrease the heavy computational demand of generating hydraulic profiles and modeling flow through the extensive gravity network, a system network was developed that excluded all gravity except that which is essential for connectivity and moved tributary area meter loads to their downstream lift stations. This arrangement complements the full gravity model in that it reduces model runtimes by approximately 95% while still retaining high accuracy at the system level. With the inclusion of all gravity components and the large number of lift stations in the system, the SewerGEMS calculation engine often struggled to converge in portions of significant flow change and resulted in model runtimes of nearly an hour. Much of this computational effort is dedicated to the generation of gravity system graphical output profiling and similar processes that are not typically utilized at the system-wide master planning level. The development of a complimentary minimal-gravity model addresses the cumbersome nature of this gravity-inclusive model and allows for a modeling framework that can be utilized by the City for the majority of planning endeavors at runtimes of a few minutes. However, the retention of the gravity network in the gravity-inclusive framework allows for the model to remain useful when evaluating a smaller section of the system.

5.3.2.3 City Lift Stations

Point locations for the City-owned lift stations are provided from the City's GIS database. The force main leaving the lift stations coincides with the point representing the lift station so it was moved to add the pumps and discharge force main in the model. The elevations provided in the lift station data sheets (rim, pump on/of, inflow inverts, pump invert, high alarm, etc.) were used in the model. Pump definitions were copied over from the prior modeling files and updated, where necessary, based on the pump curves provided in the lift station data sheets.

5.3.2.4 Private Lift Stations

Information for the more than 120 private lift stations connected to the City's wastewater collection system was limited to available digital records maintained for newer developments otherwise supplemented using a typical lift station design. Most of the private lift stations are smaller stations serving commercial developments where gravity sewer is not available. The private lift stations are not evaluated for performance in this evaluation; however, they can impact the force main system. Additionally, the model can be used to determine private lift stations that may be impacted by the drop in force main system pressures when the South Regional WRF is in operation.

A standard lift station design used to populate the private lift stations assumes a total depth of 12 feet. This depth is based on assuming the upstream manhole is approximately 6 feet deep and the high-level alarm is then 7 feet below the land surface. The gravity main invert entering the wet well varies based on the length of the gravity main between the manhole and the wet well. Pipe slope was assumed to be 0.4% (minimum design slope for 8-inch gravity). Missing land surface elevations were obtained using the Brevard County digital elevation model (DEM) with 1-ft contours. In general, the minimum water elevation in the wet wells was 1 foot (6 inches for the pump invert and 6 inches of minimum submergence). The control volume was set to 1 foot and the depth between the pump on elevations was 1 foot. The wet well diameters were set to 4 feet for stations with relatively small inflows. Larger private lift stations with inflows greater than 20,000 gpd were set to 6 feet.

Most of the private wet well information in the model is not critical to the model as the operation of the wet wells is not being evaluated. However, for some of the stations, the pump flow rates, and discharge pressures may have an impact. Initially, the pumps were assigned a 100-gpm design flow rate and a total dynamic head (TDH) equivalent to the average force main pressure where the lift station discharges. Discharge pressure was taken from initial model runs and the previous modeling efforts. Stations with significantly larger daily loads were then evaluated individually and pumps were increased proportionally to these loads. The pump design operating point becomes a model input that will be evaluated to identify critical or potentially critical private lift stations that may require further investigation.

5.3.2.5 Force Mains

Nearly all of the force mains shown as active in the City's GIS are represented in the hydraulic model. Overall, nearly 500,000 lf of force mains were included in the model compared to 523,000 lf of active force mains in the City GIS. A breakdown of the force mains included in the model by pipe size is shown in **Table 5-2**.

Table 5-2. Modeled Force Mains by Pipe Diameter

Force Main Diameter	*Pipe Length (linear feet)*	*Percent of Total*
2	11,687	2.34%
3	15,480	3.09%
4	95,005	18.98%
6	79,766	15.94%

Force Main Diameter	***Pipe Length (linear feet)***	***Percent of Total***
8	102,644	20.51%
10	39,393	7.87%
12	80,999	16.19%
14	588	0.12%
16	55,930	11.18%
18	237	0.05%
20	18,726	3.74%
Total	**500,455**	

The force mains included in the model are identified by the Asset ID (AID) field for syncing between GIS and the model. However, the force mains linework in GIS had to be split in numerous places for manifolding force mains to properly connect in the model. For instances where a force main was split in GIS, the AID naming was maintained with a letter (A, B, C, etc.) added to the end of the AID. Future syncing between the model and original City GIS would require modification to the GIS or a one-to-many join between the City GIS and model GIS.

5.3.2.6 Modeling Boundary Conditions

Boundary conditions for the model consist of the two (2) existing wastewater treatment facilities that are each modeled as free outfalls. The discharge force main for the NRWWTP rises to an invert elevation of 33 feet (NAVD29) before turning through the headworks wall and down into the headworks channel.

The NRWRF discharge force main rises to the bottom of the headworks channel and discharges at an elevation of 34.5 feet (NAVD29). This configuration at the NRWRF does allow for wastewater to flow back if no lift stations are in operation however the available wastewater that could reverse flow is minimal since the overflow weir downstream of the screen would prevent this from occurring. Since the model uses the GVF-Convex solver, the force main feeding the NRWRF outfall is modeled with a check valve rather than a weir structure to prevent reversal of flow in the simulations.

The South Regional WRF is also included in the phasing horizons as this plant is expected to come online soon.

5.4 Sanitary Flow Loadings

There are no combined sewers in the City's wastewater collection system, so determination of wet-weather flows was not required. System flow contributions from I&I were considered during calibration and added as necessary to match the flows, stages, or pump run times.

5.4.1 Dry-Weather Sanitary Flows

The sanitary flow loads used in the model are compiled from the water billing records provided by the City. Monthly water use for the City's wastewater customers was obtained for the years 2017 through 2020. Due to changes in potable water usage during the pandemic due to COVID-19, water billing data from 2020 was not used except for new accounts established in 2020. All other sanitary flow loads were calculated by averaging the 2018 and 2019 water billing data. If the average water billing data showed zero water use in the 2018 and 2019 average, then the average 2019 and 2020 water usage was used. For the water billing data obtained, only 256 of the 48,627 accounts used the 2019/2020 water billing data.

5.4.2 Peaking Factors

The hydraulic analysis is conducted under both average day and max day conditions, so the max day peaking factor must be determined to properly increase flows. A max day peaking factor of 1.8 was used in previous modeling efforts. However, recent inflow data suggests the currently observed max day peaking factor is lower than the historical value. The 1.8 max day peaking factor was used in this model to remain conservative and consistent with previous efforts.

The observed diurnal flow pattern at the NRWWTP was previously described in **Section 4.2**. The observed diurnal peak hour ratio of 1.39 was determined for the three (3)-day observation period by dividing the largest one (1) hour running average flow during the 72-hour observation period (4.58 MGD) by the average observed flow (3.30 MGD). Multiplying the max day and diurnal peak hour factors yields an annual peak hour factor of 2.50. This value is equal to the new development annual peak hour factor utilized in the previous master plan and slightly lower than the existing development annual peak hour factor (2.67) utilized in the same master plan. The 2.67 annual peak hour factor was used in this model to remain conservative and consistent with previous efforts.

5.5 Model Calibration and Verification

Once all system elements were incorporated into the modeling framework, numerous iterative rounds of model calibration were conducted to best match model outputs to recorded measurements. This calibration process encompassed three (3) main categories in order of significance: flow calibration, pressure calibration, and lift station pump cycling. Field data, including pressure readings at 19 air release valve (ARV) locations and SCADA-recorded pump runtimes at 19 lift stations throughout the system, was collected from October 27th to the 29th of 2021. This three (3)-day window serves as the calibration period.

5.5.1 Calibration Criteria

Calibration serves to tune the hydraulic model to the observed behaviors of the existing system, producing analysis results with a degree of confidence acceptable to the model user for the task at hand. Despite the quantitative nature of much of this modeling exercise, the model calibration process lies in the art and engineering judgment to which this objective science is complemented. In the United States and throughout the academic literature, no universal or definitive metrics exist for which to deem a sanitary sewer hydraulic model calibrated. This is largely due to the expansive range of model complexities, accuracy of input data, and intended applications of such models. In the United Kingdom, calibration standards including 5% flow deviations in trunk mains and pressure deviations within 15% of maximum system-wide headloss have been proposed, as described by Ormsbee and Lingireddy for the American Water Works Association (Ormsbee and Lingireddy, 1997). Though, even these metrics are primarily directed towards water distribution systems without the added complexity of numerous manifolded lift stations generating intermittent pumped flows. Ultimately, as described in Haestad Methods, site-specific considerations and the intended use of the model drive a determination of when calibration has been achieved (Walski et al., 2003).

For this analysis, calibration criteria were selected to be system flows within 1% of observed values and individual pressure readings within 3 pounds per square inch (psi) of modeled values. These criteria were generated through a consideration of the network complexity, accuracy and quantity of field measurements, and system-wide master planning scope of analysis. As this model is subsequently utilized for additional analyses at smaller scales, additional data collection and calibration for service areas of interest can be performed and integrated into the system-wide model to address those needs. For city-wide master planning, this level of model performance is adequate to generate results and drive planning efforts with a high degree of confidence.

5.5.2 System Flow Calibration

Sanitary flow data were generated from water billing data as described in **Section 5.4**. Wastewater flows were initially assumed to be 80% of the metered water demands. Then both global and temporal factor adjustment was performed to approximate flow contributions for inflow and infiltration and match total flow volumes, as well as match the diurnal flow pattern observed at the NRWWTP during the calibration period. Following this exercise, the modeled average daily flow was 3.33 MGD. This falls within 1% of the recorded average daily flow of 3.30 MGD during the calibration period. Additionally, the modeled flows at the treatment plant closely match the observed diurnal curve. **Figure 5-1** below illustrates how the nature and magnitude of the system flows comparing the modeled flows with the recorded flows during the calibration period.

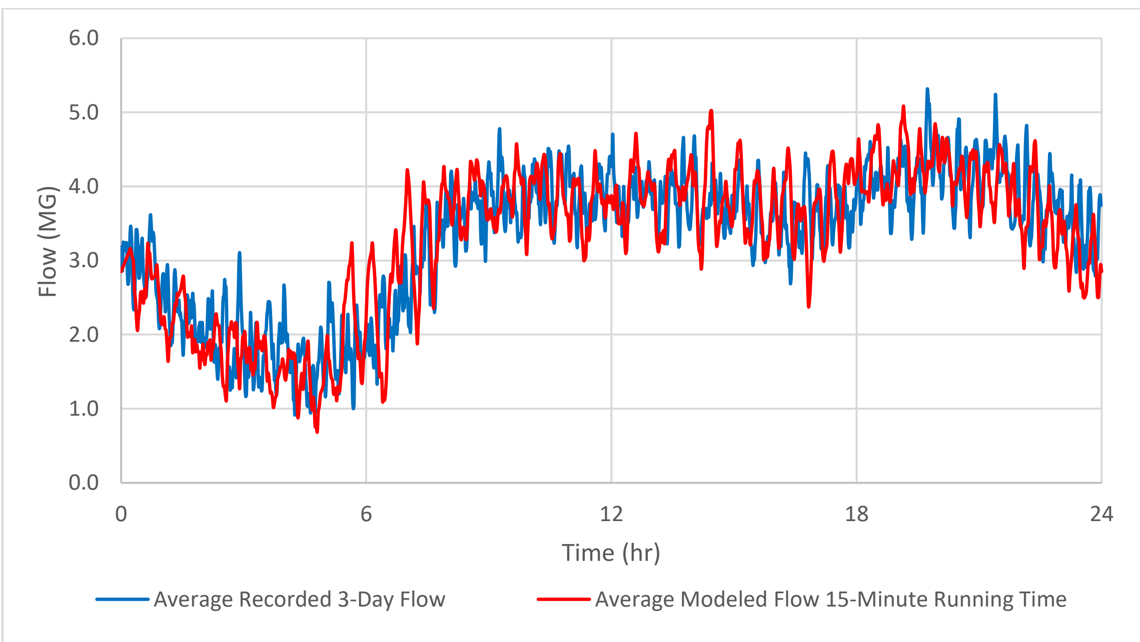
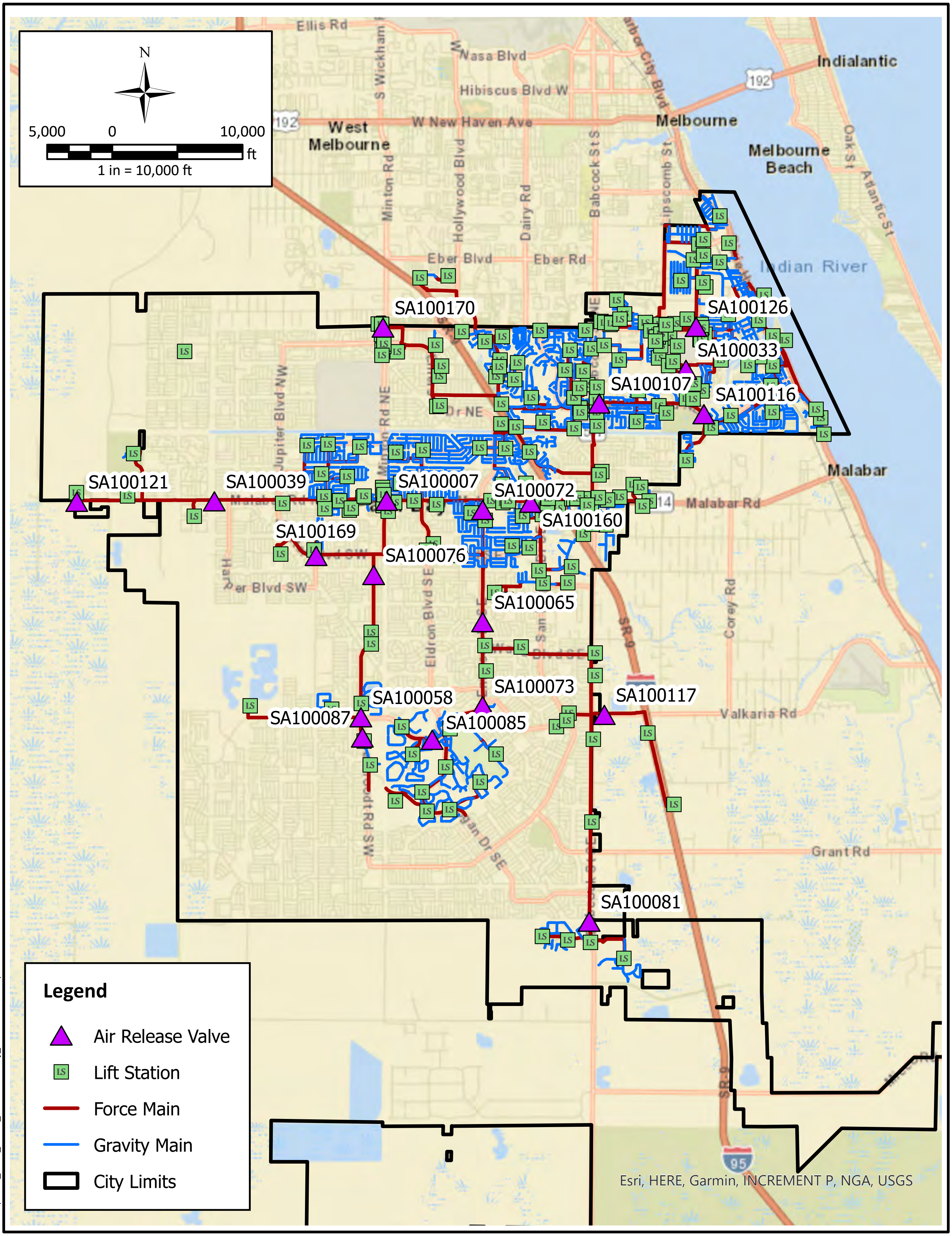


Figure 5-1. Comparison of Model Diurnal Flow Pattern with Actual Recorded Flow

5.5.3 System Pressure Calibration

During the calibration period, instantaneous pressure readings were field measured at 19 ARV locations, once in the morning and once in the afternoon. A map of these ARV locations is provided in **Figure 5-2**.



C:\Users\kkarcher\Desktop\KEK_Local_Sewer_Model\PalmBay_2021WWModel.aprx

INFRASTRUCTURE SOLUTION SERVICES
Melbourne | Sarasota | Panama City Beach

Calibration Air Release Valves Locations
Wastewater Master Plan
City of Palm Bay Utilities Department

PROJ. NO.: **PBU006**
DATE: **JUL 2024**

FIGURE NO. **5-2**

Once system flows were calibrated, pipe roughness was adjusted to calibrate pressures throughout the system to best match these observed pressures. Pipe material and age were imported from GIS with each pipe during model development. These variables were used to assign C-factor roughness coefficients to force mains. Iterative rounds of adjustments were performed to generate a C-factor schedule that best matched observed pressures throughout the system. **Table 5-3** shows the calibrated force main C-factor schedule. These C-factors were used for all subsequent model representations.

Table 5-3. Force Main C-Factor Schedule

Pipe Age (Years Old)	***Pipe Materials***			
	Cast Iron	***Asbestos Cement***	***Ductile Iron***	***PVC***
0-20	115	130	140	140
20-40	110	125	140	140
40-60	105	120	130	130
60+	100	115	130	130

Morning and afternoon manual pressure readings were collected at each of the ARV locations, spread across the three (3)-day calibration periods. Snapshot measurements like these do not fully characterize the nature of the force main, as pressures can fluctuate with pump cycling. To account for these fluctuations, C-factor adjustments were performed to capture recorded values within the minimum and maximum modeled values for the respective periods. Based on the field data time stamps, the AM period was established as 8 am-11 am and the PM period was established as 12 pm-3 pm. **Figures 5-3 and 5-4** show the field measurements as well as minimum and maximum modeled pressures during these periods.

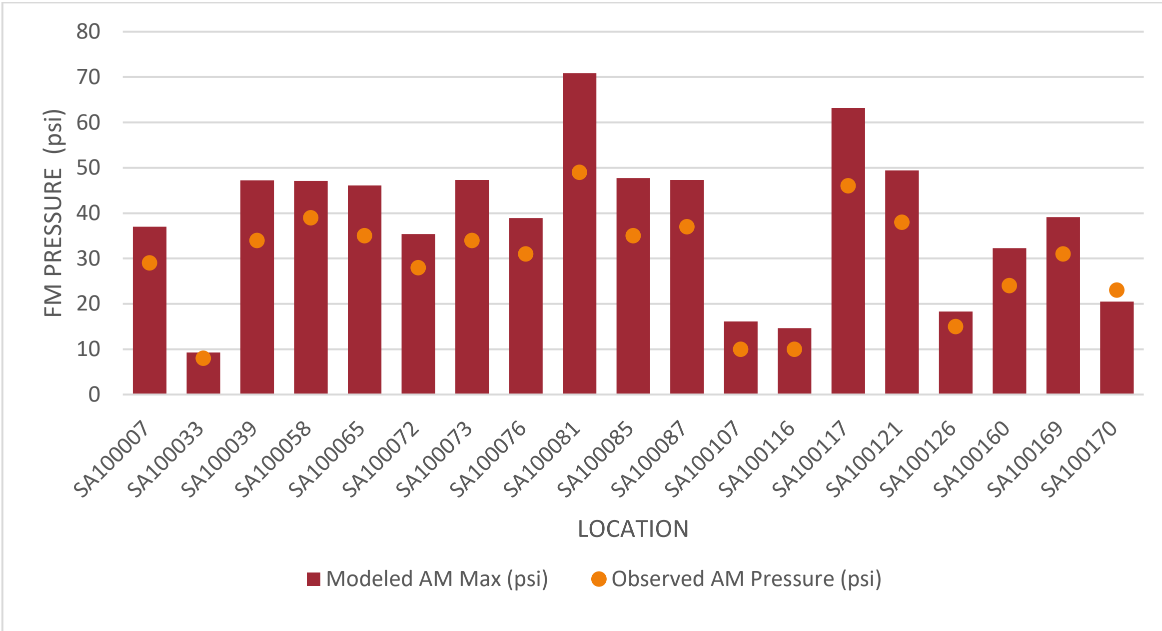


Figure 5-3. Comparison of Observed and Modeled Force Main Pressures (AM)

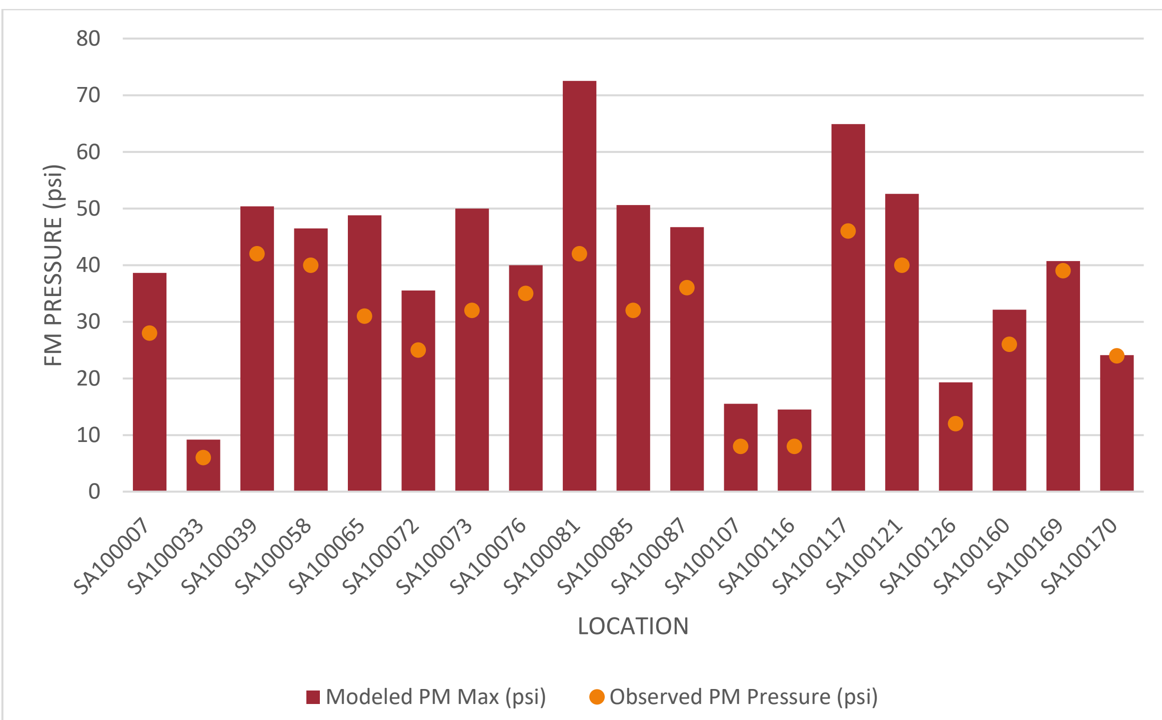


Figure 5-4. Comparison of Observed and Modeled Force Main Pressures (AM)

All locations saw modeled pressures bracket observed pressures except for the location within the plant and the location at the far northwest extremity of the system. These variations are less than 3 psi which is reasonable given the accuracy of the pressure gauges and the degree of uncertainty for element elevations brought into the model from GIS.

5.5.4 Lift Station Pump Cycling

Finally, 19 lift stations across the system were selected to compare pump cycling. The number of pump starts was compared between lift station SCADA reports and the observed modeled pump cycles. The number of pump starts is primarily affected by the flows into the wet well and the physical characteristics of the wetwell (dimensions, pump on/off elevations, etc.). Some variation was observed which is likely due to uneven inflow and infiltration in different areas. I&I was addressed globally in this model to capture the overall nature of flows in the system rather than assessing each gravity service area individually, as this was not feasible. **Table 5-4** shows the observed and modeled pump cycles. No adjustments were made to the force main network from this pump cycle analysis, though it did initiate field investigations of several lift stations to correct and update information in the GIS and model.

Table 5-4. Lift Station Pump Cycles

Lift Station	*Field Recorded Pump Cycles*				*Modeled Pump Cycles*
	10/27/2021	*10/28/2021*	*10/29/2021*	*Average*	
2	108	104	102	105	81
16	60	62	60	61	138
18	16	18	17	17	35
30	33	30	24	29	65
34	67	67	67	67	57
45	102	101	102	102	174
47	107	108	112	109	136
52	77	73	78	76	76
58	110	110	115	112	119
60	22	20	23	22	124

Lift Station	Field Recorded Pump Cycles				Modeled Pump Cycles
	10/27/2021	10/28/2021	10/29/2021	Average	
63	20	19	19	19	61
65	14	19	15	16	14
74	24	23	22	23	18
75	42	38	36	39	41
76	13	14	14	14	29
85	31	31	27	30	55
87	29	28	30	29	80
95	22	21	28	24	19
97	33	29	32	31	47

5.6 Summary

A newly created hydraulic model was built from City GIS and lift station data. Data evaluation and correction were performed throughout the system as best as reasonably possible. Model layouts were developed both including and excluding the majority of the gravity system to allow for both efficient system-wide analysis and area-specific investigation.

Wastewater flows were developed from water billing data and adjusted to match observed treatment plant flow data within 1%. A diurnal pattern was created to capture recent temporal shifts due to the pandemic. This diurnal pattern closely captures the nature of sanitary loadings throughout the day. Pipe roughness was adjusted in the model according to material and age, yielding pressures representative of observed ranges at locations throughout the system. The hydraulic model has been adequately calibrated for its intended system-wide master planning use. This allows for the model to be a more useful tool at the City's disposal for a wider range of project needs. Subsequent memos will describe the use of this model to evaluate existing and current conditions throughout the wastewater network.

Section 6 - Evaluation of Existing Wastewater Collection System

6.1 Introduction

Section 6 of the City of Palm Bay Wastewater Water Master Plan made use of the calibrated wastewater collection system hydraulic model to evaluate the current existing condition infrastructure needs of the system:

a) Evaluate the performance of the existing system using the updated wastewater collection system model.
b) Evaluate the gravity sewer trunk system (10-in in diameter and larger) to identify areas that may be experiencing surcharging and pipes that are over or near capacity during peak flows.
c) Evaluate lift stations to identify any that are nearing capacity.
d) Evaluate force mains to identify any that are experiencing excessive velocities.
e) Identify upgrades to the existing system needed to meet current service requirements.

Another substantial purpose of this analysis was to evaluate the impacts on the wastewater collection system of bringing the South Regional Water Reclamation Facility (SRWRF) online and evaluating the recently completed Regional Lift Station No. 1 (RLS01). The SRWRF is an additional treatment plant currently under construction in the southern portion of the city. This facility will receive flows that are currently conveyed over 12 miles from the south extremes of the city to the North Regional treatment plants located on Clearmont St in the north, as well as future flows from anticipated development in the southern portion of the city for future planning horizons. Upon connection, the SRWRF is expected to significantly reduce pressures in this southern region of the system and have a notable impact on lift station performance.

RLS01 is a large repump station completed in 2023 along Malabar Rd in the western portion of the city. This station receives pumped flows from the upstream local lift stations furthest west along Malabar Rd and is designed to accommodate future flows from anticipated development in this same area at future planning horizons. The operation of RLS01 significantly reduces force main pressures in the upstream lift stations, as they pump at a minimal head condition to a free discharge in the wet well rather than a long run to the treatment plant in the east of the city.

The submersible pumps at RLS01 are controlled using variable frequency drives (VFD). The VFDs allow the discharge of the pumps to be controlled or throttled, limiting the downstream force main pressures, and not adversely impacting lift stations along Malabar Rd that pump into the force main downstream from RLS01.

These are significant components of the Palm Bay wastewater collection system which are completed, RLS01, or will shortly be completed, SRWRF, prior to the five-year planning horizon. For these reasons, the analysis of the impact of the SRWRF and RLS01 on the system was evaluated under a separate "Near-Term" design condition modeling scenario.

6.2 Evaluation Criteria

Consistent with regulatory requirements and previous City of Palm Bay Wastewater Master Plans, the criteria used to evaluate the existing wastewater collection system include the following:

a) Modeled system flows should not exceed permitted or hydraulic capacities at any of the treatment plants.
b) Gravity lines should not be surcharged and should under no circumstances surcharge to the extent that any manholes flood to grade.
c) Wet wells should be designed to prevent gravity line surcharging and excessive pump cycling.
d) Pumps should be capable of providing enough head to discharge into force mains at all times without generating high head conditions that may exclude other pumps from discharging.
e) Pumps should typically operate reasonably within their pump curve, avoiding shutoff and runout conditions.
f) Force main velocities should be at a minimum of two (2) fps to ensure scouring and prevent deposition of solids without exceeding five (5) fps and resulting in significant headloss.
g) Force main pressures should be less than 50 psi, with pressures below 30 psi preferred.

6.3 Existing Conditions Wastewater Collection System Evaluation

This evaluation of existing conditions serves to assess the performance of the city-wide wastewater collection system as it currently operates.

6.3.1 Treatment Plant Capacity

The City currently operates two (2) treatment plants at adjacent locations on Clearmont St in the northeast of the city. Both facilities are fed by a common incoming force main along Clearmont St, allowing for the balancing of influent flows between the plants. Influent force mains for both plants branch off from the trunk main along Clearmont St at approximately the same location, while the NRWWTP has an additional influent force main that branches off from the Clearmont St trunk main and runs along the northern boundary of the plant. This influent force main is separate from the southern influent force main and enters the headworks independently.

The NRWWTP has a permitted capacity of 4.0 MGD on an average annual daily flow (AADF) basis and the NRWRF has a permitted capacity of 1.2 MGD on an AADF basis. The hydraulic capacities of these facilities are 8.0 and 2.5 MGD, respectively.

A summary of flows to the two (2) treatment plants is provided in the table below.

Table 6-1. Existing Conditions Modeled Treatment Plant Flows

Treatment Plant	*Modeled Average Daily Flow (MGD)*	*Annual Average Daily Flow Permitted Capacity (MGD)*	*Modeled Max Day Peak Hour Flow (MGD)*	*Peak Hourly Flow Hydraulic Capacity (MGD)*
NRWWTP	2.63	4.0[1]	4.80	8.0[2]
NRWRF	0.78	1.2[1]	2.99	2.5[3]
Total	**3.40**	**5.2**	**7.79**	**10.5**

1) From State of Florida Domestic Wastewater Facility Permit #FLA103357
2) From Sheet G-3: Hydraulic Profile in Port Malabar Wastewater Treatment Plant Expansion to 4.0 MGD, 1985 sheet set
3) From Sheet G-5: Hydraulic Profile in Nutrient Removal Facilities Permit Set, 2019 sheet set

The existing conditions modeled flows do not exceed the permitted capacity for either of the facilities under AADF conditions. The NRWWTP has an additional 1.37 MGD of capacity and the NRWRF has an additional 0.42 MGD of capacity. Under max day peak hour conditions, the NRWWTP does not receive flows over the hydraulic capacity of the plant. However, under max day peak hour conditions, the NRWRF receives flows over its hydraulic capacity by 0.49 MGD. The combined hydraulic capacity of the two (2) plants is 2.71 MGD greater than the max day peak hour flows, though flow controls are necessary to direct flows towards the NRWWTP and away from the NRWRF during periods of peak flows. Possible alternatives include directional valving along

Clearmont St. Providing some degree of positive flow control to prevent exceeding the hydraulic capacity of the NRWRF under peak flow conditions is necessary.

6.3.2 Gravity System Performance

Gravity sewer surcharging conditions can be divided into two (2) primary categories. The following section addresses surcharging immediately downstream of a force main discharge into the gravity system. **Section 6.3.3.1** addresses surcharging that occurs directly upstream of a lift station as a result of lift station operational bands.

6.3.2.1 Surcharge Gravity Downstream of Force Main Connections

Under the average day condition, surcharging occurs along Palm Bay Rd east of the intersection of Lakewood Dr. as well as north along Lakewood Dr. Lift Station No. LS60 and LS61 both discharge into the same manhole at the north of Lakewood Dr and two (2) force mains from five (5) private lift stations discharge into the same manhole at the south of Lakewood Dr. near the intersection of Palm Bay Rd. During periods of high flows, these lift stations pump simultaneously more than the capacity of these 8-in gravity lines, causing them to surcharge. This surcharging condition is illustrated in **Figure 6-1**.

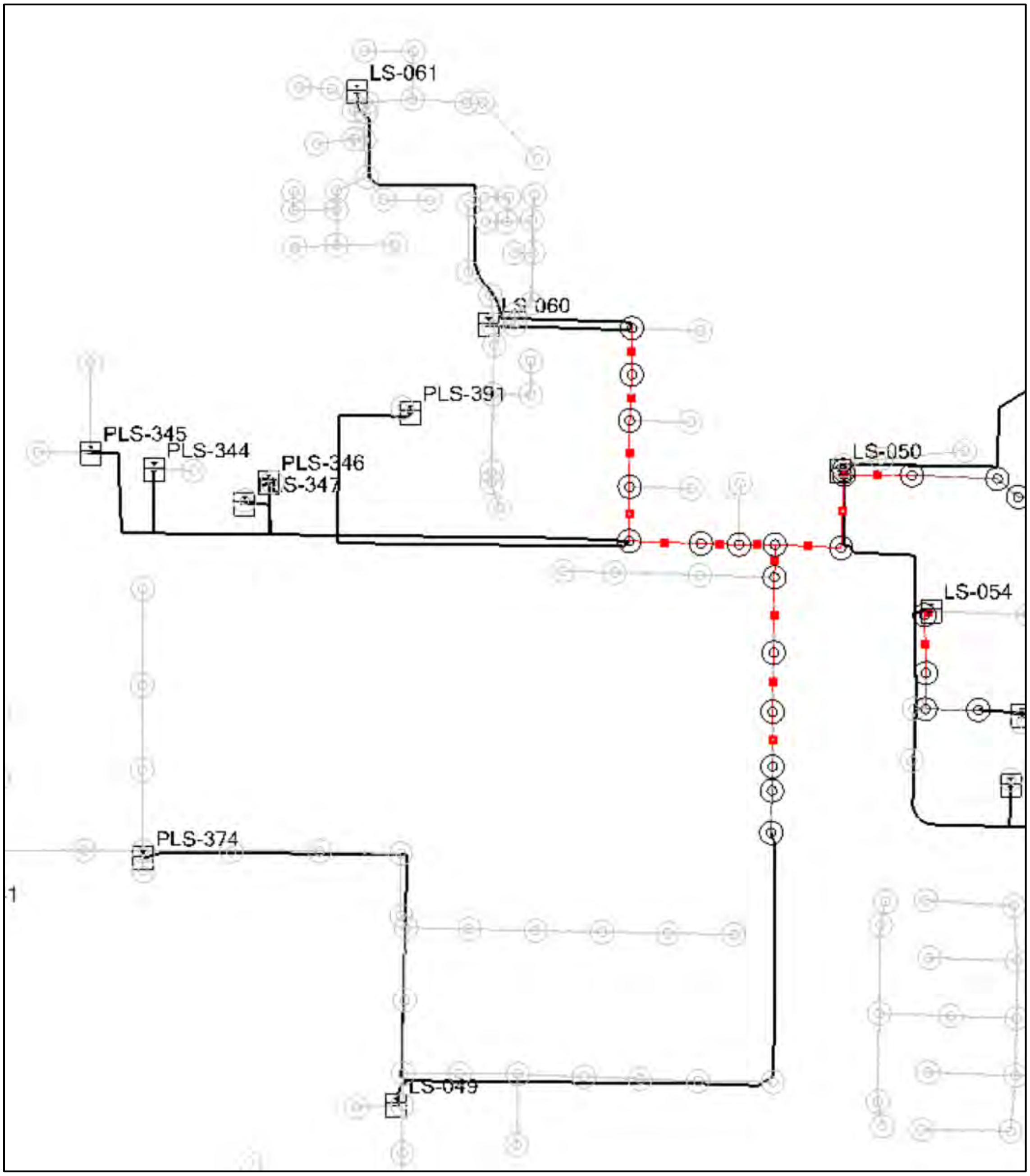


Figure 6-1. Gravity Surcharging along Palm Bay Road

Additionally, the gravity line receiving pumped flows from LS07 surcharges from the receiving manhole down two (2) additional segments to the third manhole. This line begins as an 8-in before reducing to a 6-in which may be contributing to its inability to pass the pumped flows.

The same surcharging conditions observed under the average day condition are also observed under the max day condition, spreading farther down the gravity system in these issue areas. The gravity section upstream of LS50 between LS60/LS61, the private lift stations along Malabar Rd, and the discharge of LS49 is nearly completely surcharged at times of peak flows.

The same condition was observed to occur within the gravity section upstream of LS13 between the discharges of LS07, LS17, LS21, and PLS341. This surcharging is illustrated in the following figure.

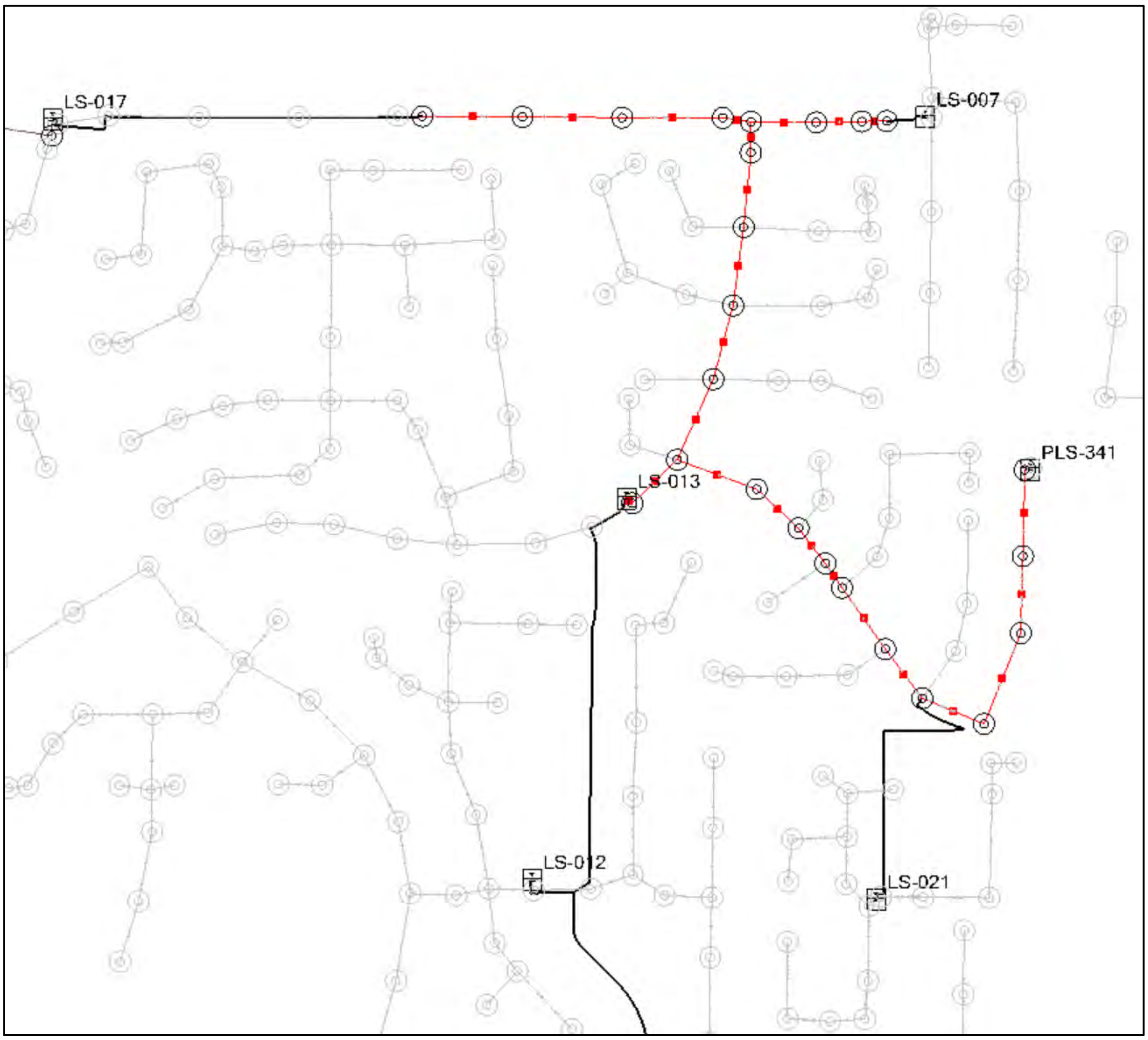


Figure 6-2. Gravity Surcharging Upstream of LS13

6.3.3 Lift Station Performance

Lift stations were evaluated across three (3) metrics: adherence to Utilities Department Standards, pump sizing, and general physical condition.

6.3.3.1 Deviations from Utilities Department Design Standards

Upon review of the lift station data information provided by the City, ISS found the operation of many lift stations deviating from the Utilities Department Design Standards as found in the City of Palm Bay Utilities Department Policies, Procedures and Standards Handbook, January 2014. The analysis found the stations deviate from standards concerning the following parameters:

- Operating Bands - No more than 3 ft is to be provided as the operating band between pump off and lead pump on elevations;
- Clearance between the Wet Well Bottom and Lowest Gravity Sewer Invert - Requires at least 5 ft between the bottom of the wet well and the lowest gravity invert entering the station; and
- Pump Operating Levels -Operating levels are to be set such that the lead pump, lag pump, and high alarm elevations all fall below the lowest gravity invert into the station.

The pump operating float positions are of particular note because many stations operate in a continual state of surcharging the upstream gravity sewer as a result of the pump operating elevations. Due to multiple factors including physical pump dimensions and depth constraints in the wet wells, many stations utilize pump-off elevations that are higher than the influent gravity sewer inverts, permanently surcharging these lines. From the elevations provided in the lift station data sheets, 52 stations operate in this state of continuous surcharge while 87 stations surcharge the lowest gravity influent line before lag pumps turn on.

All but 3 stations surcharge the lowest gravity influent line before the high-level alarm is triggered, though the high-level alarm elevation is beneath the rim elevation of the lowest manhole in each gravity tributary area, per the GIS data provided by the City. If the high-level alarm is raised above the rim elevation of a manhole in the tributary area, as is illustrated by elevation “A” in **Figure 6-3**, the station becomes blind to flooding at that manhole. The rim elevation of the lowest manhole in the tributary gravity network, as illustrated by elevation “B” should be considered when raising high-level alarm elevations to ensure alarms are triggered before issues occur in the upstream collection system.

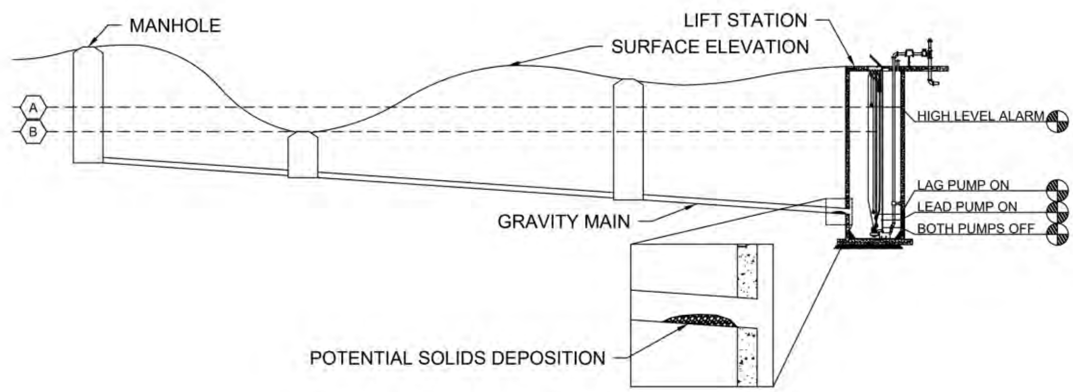


Figure 6-3. High-Level Alarm Impacts on Upstream Manhole Flooding

The widespread surcharged conditions on the gravity sewers upstream of lift stations contribute to solids deposition and operational issues in the system, as shown above. It is also compounded in areas where pumped flows are discharged to the gravity network to be repumped, such as upstream of LS13 and LS50. Field investigation may be warranted at these repump stations to determine whether the pumps-off float can be lowered to allow the influent gravity lines to periodically drain into the wet well. Alternatively, periodic pump downs or jetting may be required to flush out accumulated solids at these stations.

A summary of lift stations that deviate from City standards is presented. **Section 6.7**.

6.3.3.2 Pump Sizing

Under average day conditions, no lift stations experience lag pumps turning on at any point during the simulation and no stations violate a high-level alarm. All flows under average day conditions can be conveyed using a single-duty pump at each lift station as desired. LS45 is the only lift station out of the 107 active lift stations that experiences a cycle time of less than five (5) minutes, resulting in pumps starting more than six (6) times per hour under alternating operation. This station is either overloaded or misrepresented in the data information provided by the City. **Table 6-2** below shows this station with excessive pump starts.

Table 6-2. Lift Stations with Excessive Pump Starts in Existing Average Day Scenario

Lift Station	*Average Cycles per Hour*	*Average Time between Alternating Pump Starts (min)*
LS45	21.4	2.8

Conversely, 7 lift stations experience cycle times of more than four (4) hours, which may result in septic conditions causing odor issues. These lift stations with excessive times between pump starts are presented below in **Table 6-3**.

Table 6-3. Lift Stations with Excessive Retention Times in Existing Average Day Scenario

Lift Station	Average Cycles per Day	Average Time between Alternating Pump Starts (hr)
LS24	6	4.0
LS37	5	4.8
LS55	4	6.0
LS59	4	6.0
LS94	5	4.8
LS103	1	24.0
LS105	2	12.0

Additionally, several lift stations operate to the left of their curves near their shutoff head for a significant portion of their pumping events. 18 lift stations operate at least 25% of their pumping events within 15% of their shutoff head. The pumps at these stations are likely undersized for the pressures they are experiencing in their receiving force mains. **Table 6-4** shows these stations operating near their shutoff heads.

Table 6-4. Lift Stations Operating Near Shutoff Head in Existing Average Day Scenario

Lift Station	Percentage of Pumping Time within 15% of Shutoff Head
LS10	100%
LS30	37%
LS31	100%
LS33	100%
LS34	34%
LS35	41%

Lift Station	Percentage of Pumping Time within 15% of Shutoff Head
LS39	35%
LS40	69%
LS44	100%
LS46	100%
LS49	35%
LS51	100%
LS56	100%
LS70	26%
LS76	30%
LS86	100%
LS92	35%
LS100	60%

Under max day conditions, 15 lift stations experience lag pumps turning on at some point during the simulation. This indicates that these stations may have pumps that are undersized for the flows they are receiving. LS27 violates its high-level alarm but the water level in the wet well never reaches within ten (10) feet of the rim elevation. LS100 violates its high-level alarm and floods to grade. The City is currently performing a drawdown on LS100 to clarify pump information that is believed to be incorrect. The pump curve will be updated following this investigation and is expected to rectify this issue. These lift stations with lag pumps operating on the max day are presented below in **Table 6-5**.

Table 6-5. Lift Stations with Lag Pumps Operating in Existing Max Day Scenario

Lift Stations	LS13, LS14, LS25, LS27, LS31, LS38, LS70, LS73, LS82, LS83, LS84, LS85, LS87, LS92, LS100

As was the case in the average day scenario, LS45 is the only lift station that experiences a cycle time of less than five (5) minutes. Cycle time decreases under the increased flows of the max day, as is expected. **Table 6-6** below shows this station with excessive pump starts.

Table 6-6. Lift Stations with Excessive Pump Starts in Existing Max Day Scenario

Lift Station	*Average Cycles per Hour*	*Average Time between Alternating Pump Starts (min)*
LS45	36.6	1.6

As expected, even more, lift stations operate to the left of their curves near their shutoff head for a significant portion of their pumping events under the max day condition. 44 lift stations operate at least 25% of their pumping events within 15% of their shutoff head. The pumps at these stations are likely undersized for the pressures they are experiencing in their receiving force mains. **Table 6-7** below shows these stations operating near their shutoff heads.

Table 6-7. Lift Stations Operating Near Shutoff Head in Existing Max Day Scenario

Lift Station	*Percentage of Pumping Time within 15% of Shutoff Head*	*Lift Station*	*Percentage of Pumping Time within 15% of Shutoff Head*
LS10	100%	**LS70**	91%
LS12	70%	**LS71**	73%
LS13	66%	**LS72**	70%
LS14	25%	**LS73**	80%
LS16	45%	**LS74**	76%
LS23	42%	**LS75**	77%
LS25	90%	**LS76**	91%
LS26	69%	**LS77**	72%
LS30	56%	**LS78**	59%
LS31	100%	**LS79**	38%
LS33	100%	**LS80**	84%
LS34	57%	**LS81**	56%
LS35	77%	**LS82**	90%
LS38	77%	**LS83**	89%
LS40	30%	**LS84**	90%
LS44	100%	**LS85**	90%
LS46	100%	**LS86**	100%
LS49	63%	**LS87**	85%
LS51	100%	**LS92**	94%
LS56	100%	**LS94**	87%
LS68	87%	**LS100**	98%
LS69	65%	**LS102**	75%

6.3.3.3 Physical Condition Concerns

Several lift stations were noted to have condition concerns when inspected, as described in the lift station data provided by the City. A summary of notable concerns is provided in **Section 6.7**.

6.3.4 Force Main Velocities

6.3.4.1 Low Velocities

The existing conditions' peak hourly flow maximum force main velocities are within the 2 to 5-foot per second (fps) target range for the majority of the system. Several force mains at the extremities of the system in the south and west of the city experience low velocities less than the desired scouring velocity of 2 fps. These lines are sized to accommodate anticipated development in these regions and will experience increased velocities as this development transpires and connects to the network. Until that occurs, force mains with low velocities will experience the potential for solids deposition and accumulation. Approximately 80,600 LF of force main experience maximum velocities less than 2 fps under the max day condition. This comprises approximately 17% of the total force main network by length.

6.3.4.2 High Velocities

There are also several force mains that experience maximum velocities greater than the desired 5 fps. This occurs when sections of the force main are downsized between larger lines at either end. Notable examples include:

- Babcock St south of Waco Blvd;
- Emerson Dr south of Malabar Rd; and
- Malabar Rd and Babcock St just east of the I-95 crossing.

Approximately 72,300 linear feet (LF) of force main experience maximum velocities greater than 5 fps under the max day design condition. This comprises approximately 15% of the total force main network by length. High velocities are also observed in several discharge force mains where a single lift station enters a manifolded force main and in the influent lines to the treatment plants. **Table 6-8** presents the lift stations with high discharge velocities.

Table 6-8. Lift Stations with High Discharge Velocities in Existing Max Day Scenario

Lift Stations	LS23, LS32, LS52, LS69, LS71, LS73, LS75, LS77, LS97, LS102, LS105, LS108

There is little variation in maximum velocities between average and max day conditions for much of the system as the maximum velocity is predominantly controlled by pump size and occurs during a period of minimal head. A notable exception is the 20-in force main along Clearmont St south of the facilities that convey flows from the majority of the city to the treatment plants. This force main sees an increase in maximum velocity from the average day to the max day as flows from 88 public and 86 private lift stations are funneled through this line. Under this max day condition, the 14-in NRWWTP influent line and the 16-in NRWRF influent line see velocities exceeding 5 fps 44% and 4% of the time, respectively.

When considering the directional flow options discussed in **Section 6.3.1**, it is important to consider that valving along Clearmont St would direct additional peak flows through the existing 14-in-inNRWWTP influent line, thus further increasing velocities. Conversely, bringing the 12-in influent force main along the north of the NRWWTP property back online would accommodate some of this flow and likely alleviate some of the increased velocities in the existing 14-in NRWWTP influent line. For this reason, returning the 12-in influent force main along the north of the NRWWTP property to service is recommended as a CIP in the five-year planning horizon.

Figures depicting the existing force main velocities for the existing conditions' average day and max day design scenarios are provided in **Figures 6-4 and 6-5**, respectively.

6.3.5 Force Main Pressures

Under the average day condition, force main maximum pressures generally increase from the lowest values in the northeast of the city towards higher values in the southwest through the system. The I-95 crossing and subsequent turn north along Babcock St, which conveys all flows from the south and west of the city, serve as a distinct pressure divide. Nearly all pressures northeast and downstream of this point, near the two (2) treatment plants, experience maximum pressures of less than 30 psi.

Maximum pressures then increase moving south and west, with Jupiter Blvd essentially serving as the north/south 50-psi pressure divide. Maximum pressures exceeding 50 psi are observed sparingly in the westernmost section of Malabar Rd and with more frequency moving south through areas along Degroodt Rd, Emerson Dr, and Babcock St west of I-95. These observations apply to the manifolded system that comprises the majority of the city-wide network. Smaller pressure systems discharging to gravity for subsequent repumping are scattered throughout the city and generally experience very low pressures as they free discharge into manholes.

The same general trends observed under the average day condition are also observed under the max day condition. There is little variation in maximum pressures for the northeast and southern regions of the city, though slight increases are observed. The primary observed difference under the max day condition is the migration of the 50-psi pressure divide to include all the system west and south of the intersection of Malabar Rd and Emerson Dr. The section of force main along Malabar Rd west of Emerson Dr, as well as the neighborhoods north and south, sees maximum pressures increase from the mid-40 psi range to mid-50 psi range. The majority of the system south of Jupiter Blvd sees maximum pressures exceeding 60 psi.

Figures depicting the existing conditions and maximum pressures for the average day and max day design scenarios are provided in **Figures 6-4 and 6-5** respectively.

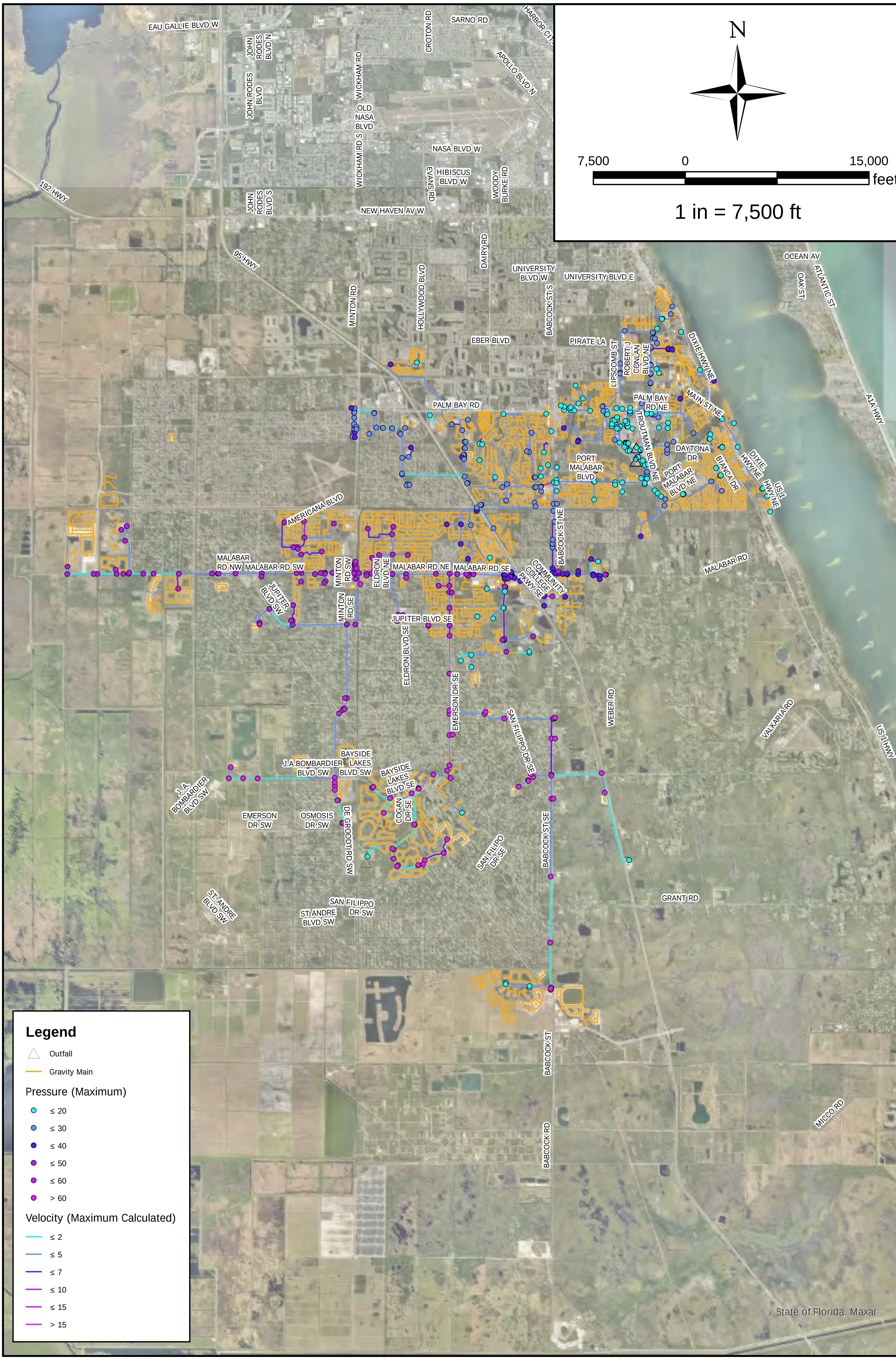


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FIGURE NO.
6-4

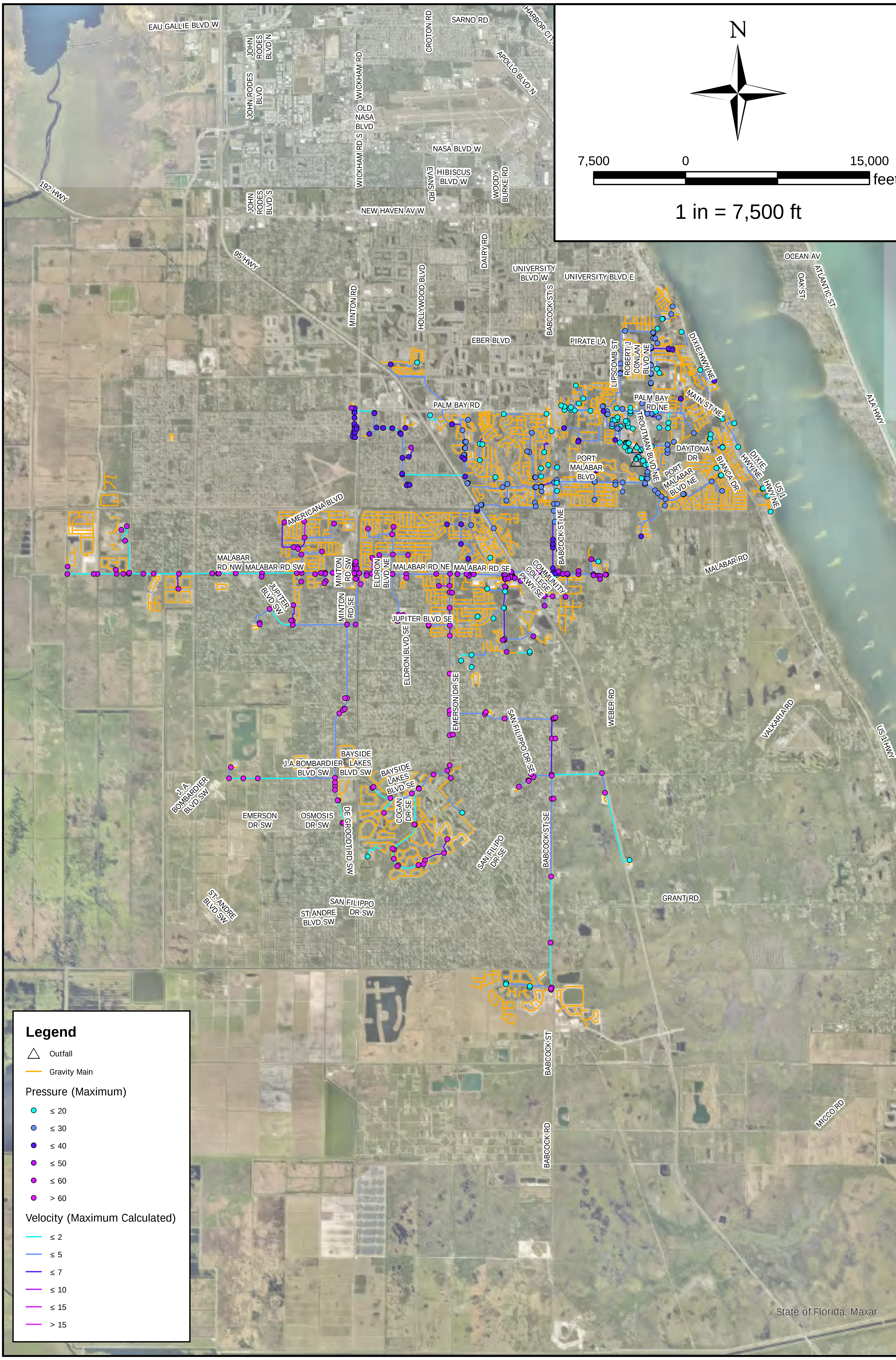

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FIGURE NO.

6-5

6.4 Near Future Conditions System Evaluation

This evaluation of existing conditions serves to assess the performance of the city-wide wastewater collection system as it will operate in the near future prior to the five-year planning horizon. This phase includes the addition of the SRWRF in the south of the city near Bayside Lakes and RLS No 1 in the west of the city along Malabar Road. This design scenario is intended to evaluate the systemwide impacts of bringing these two (2) significant operational elements online without any additional improvements.

6.4.1 Treatment Plant Capacity

The NRWWTP and NRWRF are discussed above in **Section 6.3.1** and remain unchanged in the near future scenario.

The SRWRF is currently under construction and expected to be completed by the fall of 2025. When the initial phase of construction is completed, the plant will have an initial treatment capacity of 1.0 MGD AADF and a peak hydraulic capacity of 3.0 MGD.

A summary of these flows is provided in the table below.

Table 6-9. Near Future Conditions Modeled Treatment Plant Flows

Treatment Plant	*Modeled Average Daily Flow (MGD)*	*Annual Average Daily Flow Permitted Capacity (MGD)*	*Modeled Max Day Peak Hour Flow (MGD)*	*Peak Hourly Flow Hydraulic Capacity (MGD)*
NRWWTP	2.36	4.0[1]	4.92	8.0[2]
NRWRF	0.59	1.2[1]	1.50	2.5[3]
SRWRF	0.49	1.0[4]	1.25	2.0[5]
Total	**3.43**	**6.2**	**7.69**	**12.5**

1. From State of Florida Domestic Wastewater Facility Permit #FLA103357
2. From Sheet G-3: Hydraulic Profile in Port Malabar Wastewater Treatment Plant Expansion to 4.0 MGD, 1985 sheet set
3. From Sheet G-5: Hydraulic Profile in Nutrient Removal Facilities Permit Set, 2019 sheet set
4. From State of Florida Domestic Wastewater Facility Permit #FLA693782
5. From Sheet G-4: Hydraulic Profile in South Regional Water Reclamation Facility Bid Set, 2019 sheet set

Modeled flows do not exceed the permitted capacity for any of the facilities under AADF conditions in the near future scenario. The NRWWTP has an additional 1.80 MGD of capacity, the NRWRF has an additional 0.53 MGD of capacity, and the SRWRF has an additional 0.52 MGD of capacity. Under max day peak hour conditions, the NRWWTP and the SRWRF do not receive flows over their hydraulic capacities. However, under max day peak hour conditions, the NRWRF still receives flows over its hydraulic capacity by 0.66 MGD. The combined hydraulic capacity of the two (2) northern plants is 3.8 MGD greater than the max day peak hour flows, though flow controls are necessary to direct flows towards the NRWWTP and away from the NRWRF during periods of peak flows. As discussed above, possible alternatives include adding throttling valves along Clearmont St to prevent hydraulic overloading the NRWRF under peak flow conditions.

6.4.2 Gravity System Performance

Surcharging in the near future condition is very similar to that observed in the existing condition, as the primary issue areas are in the central northern region of the city. This area is not significantly impacted by the addition of the SRWRF or RLS01 due to the distance from these facilities.

6.4.3 Lift Station Performance

Lift stations were evaluated across three (3) metrics: standard compliance, pump sizing, and condition.

6.4.3.1 Deviations from Design Standards

Apart from the newly completed RLS01, all lift stations are the same in both the existing conditions and near-future scenarios. Thus, the deviations from design standards are the same as previously described.

6.4.3.2 Pump Sizing

Under average day conditions, no lift stations experience lag pumps turning on at any point during the simulation and no stations violate a high-level alarm. Lift stations experiencing excessive pump starts and retention times are the same as during the existing average day conditions as previously described.

Fourteen lift stations, four less than during the existing average day, operate at least 25% of their pumping events within 15% of their shutoff head. The four (4) lift stations that improved (LS70, LS76, LS92, and LS100) are all near either the SRWRF or RLS01, indicating the benefit these elements have on the system. **Table 6-10** below shows these stations operating near their shutoff heads.

Table 6-10. Lift Stations Operating Near Shutoff Head in Near Future Conditions Average Day Scenario

Lift Station	*Percentage of Pumping Time within 15% of Shutoff Head*
LS10	100%
LS30	37%
LS31	100%
LS33	100%
LS34	34%
LS35	41%
LS39	35%
LS40	69%
LS44	100%
LS46	100%
LS49	35%
LS51	100%
LS56	100%
LS86	100%

Under max day conditions, LS13 and LS14 are the only lift stations that experience lag pumps turning on during the simulation, 13 less than during the existing max day, and neither station violates a high-level alarm. With the addition of the SRWRF, several of the stations in the southern region of the city that require lag pump operation under existing conditions no longer require lag pump operation under near-future conditions. As is the case in all prior scenarios, LS45 is the only lift station that experiences a cycle time of less than five (5) minutes. On the near future max day, 20 lift stations operate at least 25% of their pumping events within 15% of their shutoff head. This is 6 more stations than the average day under the same near-future condition. However, this is a more than 50% reduction from the comparable max day of the existing condition, for which 44 lift stations are operating in this way. This demonstrates the positive influence the SRWRF has on reducing pressure for pumps in the southern region of the city. **Table 6-11** below shows these stations operating near their shutoff heads.

Table 6-11. Lift Stations Operating Near Shutoff Head in Near Future Conditions Max Day Scenario

Lift Station	*Percentage of Pumping Time within 15% of Shutoff Head*
LS10	100%

Lift Station	*Percentage of Pumping Time within 15% of Shutoff Head*
LS12	36%
LS13	33%
LS14	25%
LS25	37%
LS26	39%
LS30	56%
LS31	100%
LS33	100%
LS34	57%
LS35	77%
LS40	30%
LS44	100%
LS46	100%
LS49	63%
LS51	100%
LS56	100%
LS76	31%
LS86	100%
LS92	35%

6.4.3.3 Condition Concerns

Condition concerns for the near future scenario are the same as for the existing conditions scenario previously described.

6.4.4 Force Main Velocities

6.4.4.1 Low Velocities

The near future conditions' peak hourly flow maximum velocities are generally similar to the existing scenario, with the majority of the system within the 2 to 5 fps target range. Velocities less than the desired scouring velocity of 2 fps are still observed in the south and west of the city, though to a lesser extent than under the existing conditions. Approximately 57,800 LF of force main experience maximum velocities less than 2 fps under the max day condition. This comprises approximately 12% of the total force main network by length, a decrease of approximately 5% compared to the existing conditions.

6.4.4.2 High Velocities

There are still some force mains that experience maximum velocities greater than the desired 5 fps. These locations are the same as previously described. However, these velocities generally decrease slightly, especially for a portion of Emerson Dr. Approximately 77,700 LF of force main experience maximum velocities greater than 5 fps under the max day condition. This comprises approximately 16% of the total force main network by length.

This slight 1% increase over the existing conditions is predominantly due to increased velocities in the 12-in force main along Bayside Lakes Blvd before the transition to a 16-in force main on Cogan Dr. This line now conveys considerable flows from the south of the city to the SRWRF. Velocities throughout Bayside Lakes are generally higher than under the existing conditions, bringing some sections within the desired range and some sections above the desired range.

Lift stations with high discharge velocities are similar to those of the existing conditions, with the addition of LS68, LS82, LS98, and RLS01. In bringing RLS01 online, the stations upstream, including LS98, now see a very low head condition, subjecting these pumps to runout conditions. Each station to the west of RLS01 should be investigated to determine the suitability of the existing pumps under this new discharge condition. A similar effort should be conducted in the Bayside Lakes area, including LS82, as the addition of the SRWRF has significantly reduced pressures in the region. Pumps in these stations that now experience much lower discharge pressures may also be at risk of runout.

Variation between average and max day conditions mirrors that observed under the existing conditions. The 20-in force main along Clearmont St and influent lines to both the NRWWTP and NRWRF experience maximum velocities greater than 5 fps. Under this max day condition, the 14-in NRWWTP influent line and the 16-in NRWRF influent line see velocities exceeding 5 fps 22% and 1% of the time, respectively. This is a 50% reduction in the frequency of such occurrences at the NRWWTP compared to the existing conditions. However, these high velocities still occur frequently, and returning the 12-in influent force main along the north of the NRWWTP property to service is still recommended as a CIP in the five-year planning horizon.

Figures depicting the near future conditions maximum velocities for the average day and max day design scenarios are provided in **Figures 6-6 and 6-7**, respectively.

6.4.5 Force Main Pressures

The northeast of the city to the east of the I-95 crossing experiences similar maximum pressures to the existing conditions, with the majority of this area not exceeding 30 psi. This is consistent for both average and max day scenarios, with the area near the intersection of Minton Rd and Palm Bay Rd increasing to above 30 psi under the max day scenario. Force mains discharging to gravity systems throughout the city continue to see low maximum pressures, as was observed in the existing conditions.

RLS01 reduces pressures in the force main west of the station to below 20 psi under both average and max day scenarios as this section is free to discharge into the wet well. However, maximum pressures along Malabar Rd to the east of the station, as well as within developments north and south along this path, are increased to above 60 psi as a result of the significant pumping condition at RLS01. To reduce this high-pressure impact on the downstream system, it is recommended to monitor downstream pressures while initially throttling the VFDs. The total capacity of the large pumps at this station will not be required until further development occurs in this area and a reduction of the output should be performed in the meantime to limit negative downstream effects.

Maximum pressures over 50 psi are still observed south along Degroodt Rd and Babcock St south of Valkaria Rd, as is observed in the existing conditions. However, the Bayside Lakes area and force main running south along Emerson Dr see a significant reduction in maximum pressures with the operation of the SRWRF. The run length for these areas is significantly reduced, yielding lower pressures. High pressures in the southern regions of the city along Degroodt Rd. and Babcock St. would likely be alleviated significantly if a connection to the SRWRF was constructed. Alternatives for such improvements will be considered in the future planning horizons to increase system performance.

Figures depicting the near future conditions and maximum pressures for the average day and max day design scenarios are provided in **Figures 6-6 and 6-7**, respectively.

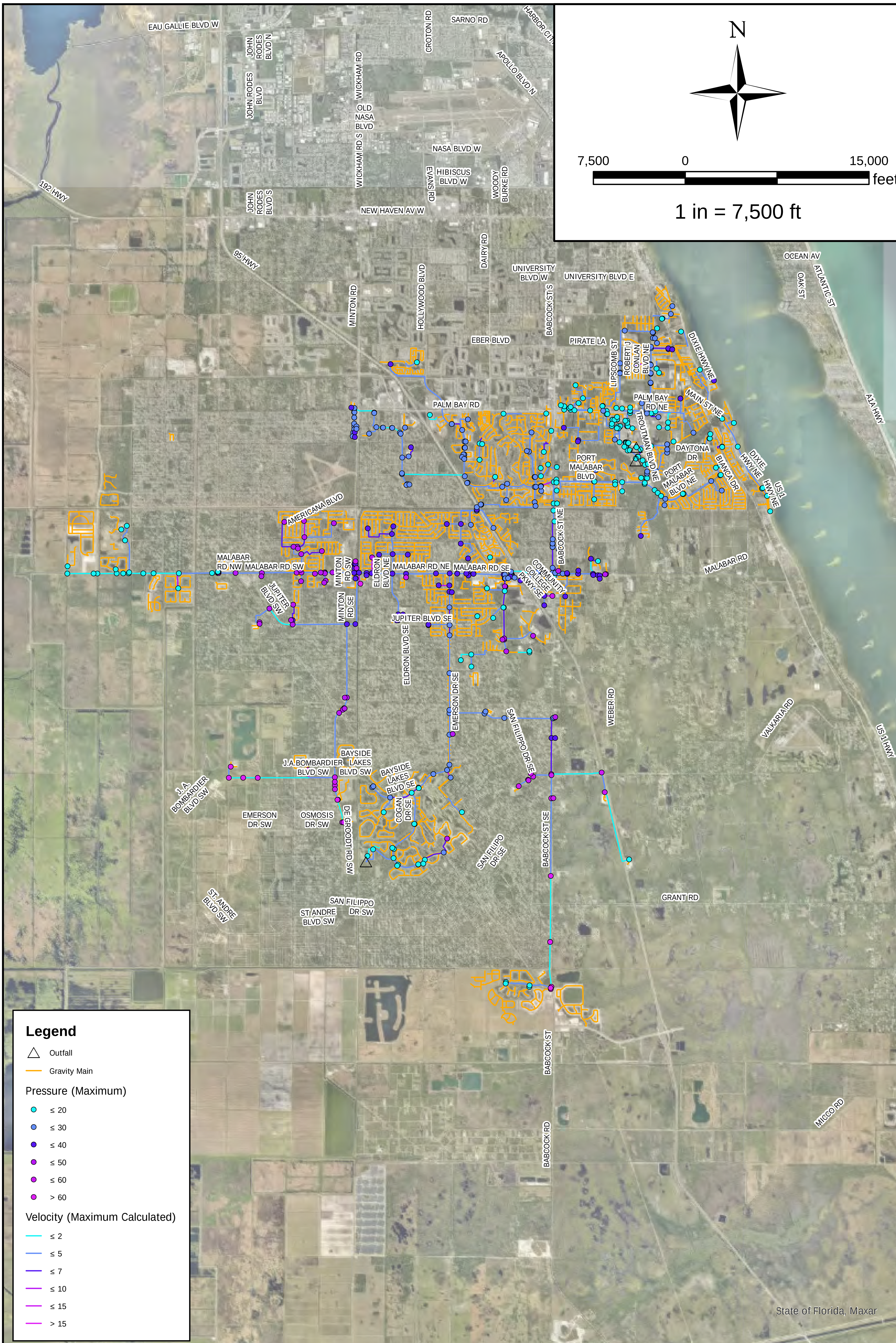

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FIGURE NO.
6-6

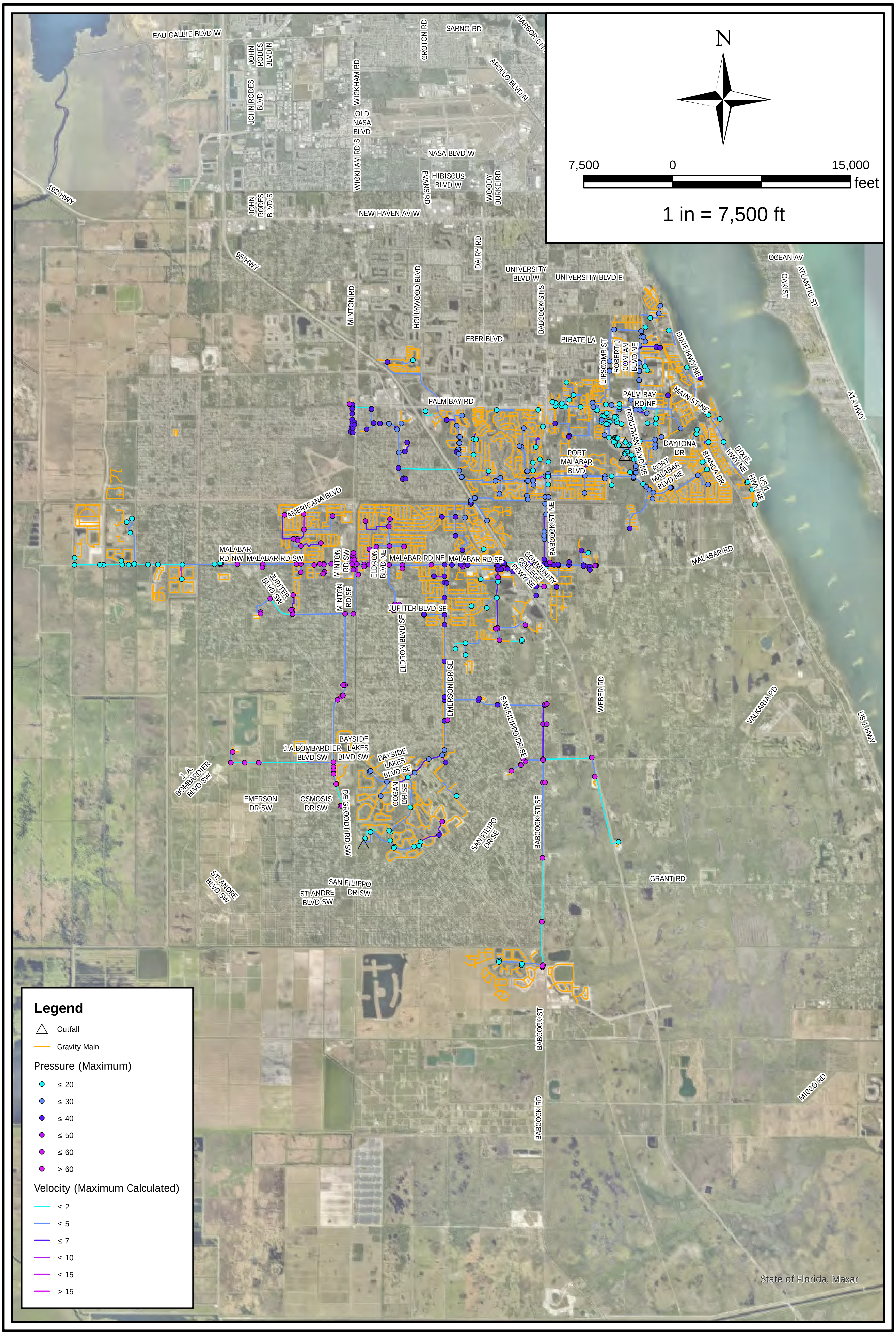

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FIGURE NO.
6-7

6.4.6 Impacts of SRWRF and RLS01

The addition of the SRWRF significantly reduced maximum pressures in the Bayside Lakes and Emerson Dr regions throughout the south of the city. It also reduces the flow conveyed to the Malabar Rd force main, alleviating pressures at this central junction just west of the I-95 crossing. The addition of this plant is critical to the long-term performance of the system in the southern reaches of the city, especially considering the anticipated continued growth in this region.

The addition of RLS01 reduces pressures in the westernmost stretch of the force main along Malabar Road. However, if the pumps are not throttled appropriately using VFDs, high pressures will be generated in the force main extending east from the station and may cause issues. These issues include stations along this route being unable to pump into the existing force main. Attention to the proper operational control of the RLS01 using the VFDs to throttle the pumps limiting the downstream force main pressures is imperative to the integrity of the arterial system spanning the center of the city.

6.5 Capital Improvement Needs

This evaluation of the near future condition identifies future improvement needs beyond the addition of the SRWRF and RLS01. Flow control is necessary between the two (2) northern treatment plants to prevent the NRWRF from exceeding its hydraulic capacity under peak flow conditions. It is recommended to return the 12-in influent force main along the north of the NRWWTP property to service and to install flow controls on the force main along Clearmont St. Both efforts are included as five-year CIPs.

Additionally, pumps that are operating near their shutoff head or runout condition should be adjusted to allow for improved performance.

6.6 Observations and Recommendations

At the present day, the City's wastewater treatment system has both permitted and hydraulic capacity between the NRWWTP and the NRWRF, though flow controls are necessary to direct flows towards the NRWWTP during peak hour flows. The addition of the SRWRF in the near future adds additional capacity, though flow controls are still necessary between the two (2) north plants.

Some gravity surcharging exists, predominantly in the central northern section of the city as well as in the influent gravity lines entering lift stations. The latter is due to operating levels in many lift stations being set to either permanently or intermittently surcharge these influents under routine operation. Excessive and insufficient pump cycling are not significant issues, with only a small number of stations outside of desired ranges. However, pumps operating far left on their curves near shutoff heads are more common throughout the system and warrant further investigation. Several of these stations are in the southern region of the city and will be improved when the SRWRF becomes operational, though many others are scattered throughout the system.

Maximum force main velocities are generally within the desired 2 to 5 fps range throughout the city, though areas exist that are both higher and lower. The influent force mains feeding the NRWWTP and NRWRF both experience high velocities, especially with the northern NRWWTP influent line out of service. Pressures are generally higher than desired throughout southern and western portions of the city, though most of the northeastern region operates at reasonable pressures. The SRWRF alleviates pressures in the south of the city in Bayside Lakes and north towards Malabar Rd, though has limited impact on southern areas along Degroodt Rd and Babcock St. RLS01 alleviates pressures in the westernmost stretch of Malabar Rd, though may increase pressures locally to the east of the station if the VFDs are not throttled appropriately.

Considering the anticipated growth in the south region of the city, the SRWRF will be critical to the continued performance of the system. The central section of Malabar Rd west of the I-95 crossing maintains a high-pressure zone and is likely to be exacerbated by future development in the west region of the city. Future development flows and the physical improvements required to maintain adequate system performance will be evaluated in the following technical memorandum.

6.7 Additional Information

Table 6-12. Lift Stations Deviation from City Standards

Lift Station	Pumps Off to Lead On 36" or Less	Wetwell Bottom to Lowest Gravity Invert 60" or More	Gravity Surcharged at Lead On?	Gravity Surcharged at Lag On?	Gravity Surcharged at High Alarm?
LS01	Violate				
LS02			Violate	Violate	Violate
LS03		Violate			Violate
LS04	Violate				
LS05		Violate		Violate	Violate
LS06		Violate		Violate	Violate
LS07	Violate			Violate	Violate
LS08	Violate			Violate	Violate
LS09			Violate	Violate	Violate
LS10					Violate
LS11		Violate	Violate	Violate	Violate
LS12		Violate	Violate	Violate	Violate
LS13				Violate	Violate
LS14		Violate		Violate	Violate
LS15		Violate		Violate	Violate
LS16		Violate	Violate	Violate	Violate
LS17		Violate		Violate	Violate
LS18		Violate	Violate	Violate	Violate
LS19		Violate			Violate
LS20	Violate			Violate	Violate
LS21		Violate	Violate	Violate	Violate
LS22		Violate	Violate	Violate	Violate
LS23	Violate		Violate	Violate	Violate
LS24		Violate		Violate	Violate
LS25		Violate		Violate	Violate
LS26		Violate	Violate	Violate	Violate
LS27		Violate		Violate	Violate
LS28					Violate
LS29		Violate	Violate	Violate	Violate
LS30				Violate	Violate
LS31		Violate			Violate
LS32				Violate	Violate
LS33		Violate	Violate	Violate	Violate
LS34		Violate	Violate	Violate	Violate
LS35		Violate	Violate	Violate	Violate
LS36		Violate	Violate	Violate	Violate
LS37					Violate
LS38	Violate	Violate	Violate	Violate	Violate
LS39	Violate		Violate	Violate	Violate
LS40				Violate	Violate
LS41	Violate	Violate	Violate	Violate	Violate
LS42			Violate	Violate	Violate
LS43				Violate	Violate
LS44		Violate		Violate	Violate
LS45		Violate	Violate	Violate	Violate
LS46					Violate
LS47		Violate		Violate	Violate
LS48					Violate
LS49		Violate	Violate	Violate	Violate
LS50	Violate				Violate

Lift Stations Deviation from City Standards

Lift Station	Pumps Off to Lead On 36" or Less	Wetwell Bottom to Lowest Gravity Invert 60" or More	Gravity Surcharged at Lead On?	Gravity Surcharged at Lag On?	Gravity Surcharged at High Alarm?
LS51		Violate	Violate	Violate	Violate
LS52		Violate	Violate	Violate	Violate
LS54		Violate	Violate	Violate	Violate
LS55		Violate			Violate
LS56					Violate
LS57		Violate			Violate
LS58		Violate	Violate	Violate	Violate
LS59	Violate			Violate	Violate
LS60		Violate		Violate	Violate
LS61			Violate	Violate	Violate
LS62					Violate
LS63		Violate	Violate	Violate	Violate
LS64		Violate		Violate	Violate
LS65		Violate		Violate	Violate
LS66				Violate	Violate
LS67					Violate
LS68		Violate		Violate	Violate
LS69			Violate	Violate	Violate
LS70				Violate	Violate
LS71	Violate		Violate	Violate	Violate
LS72		Violate	Violate	Violate	Violate
LS73		Violate	Violate	Violate	Violate
LS74		Violate	Violate	Violate	Violate
LS75		Violate	Violate	Violate	Violate
LS76				Violate	Violate
LS77			Violate	Violate	Violate
LS78			Violate	Violate	Violate
LS79	Violate		Violate	Violate	Violate
LS80			Violate	Violate	Violate
LS81	Violate		Violate	Violate	Violate
LS82				Violate	Violate
LS83			Violate	Violate	Violate
LS84	Violate		Violate	Violate	Violate
LS85		Violate		Violate	Violate
LS86		Violate		Violate	Violate
LS87			Violate	Violate	Violate
LS88				Violate	Violate
LS89		Violate	Violate	Violate	Violate
LS90				Violate	Violate
LS91		Violate	Violate	Violate	Violate
LS92		Violate	Violate	Violate	Violate
LS93			Violate	Violate	Violate
LS94					Violate
LS95				Violate	Violate
LS96	Violate	Violate		Violate	Violate
LS97		Violate	Violate	Violate	Violate
LS98	Violate				Violate
LS99	Violate		Violate	Violate	Violate
LS100	Violate		Violate	Violate	Violate
LS101				Violate	Violate
LS102		Violate	Violate	Violate	Violate
LS103		Violate	Violate	Violate	Violate
LS104			Violate	Violate	Violate
LS105					Violate
LS106				Violate	Violate
LS107		Violate	Violate	Violate	Violate
LS108					

Table 6-13. Lift Station Physical Condition Concerns

Lift Station	*Lift Station Condition Issues (as Reported by the City)*
LS-001	• Lift station being replaced. The replacement station is currently under construction.
LS-010	• The lift station has no isolation valve located outside of the station • Ductile piping from the wet well to the dry pit showing signs of rust and deterioration
LS-012	• Rehabilitation of station needed. Wet Well/Dry Well configuration
LS-013	• Rehabilitation of station needed. Wet Well/Dry Well configuration
LS-015	• Old station. • The station currently has no isolation valve present • Improve station access
LS-024	• Pipes, gravel valve pit, and manifold needing replacement. • No present isolation valve for the station • Panel needs replacement
LS-025	• Wet well piping is rusted • Valve pit needs replacement • Needs water meter can is needed in the building • No isolation valve present • Power panel/ cap panel needs replacement • No electrical isolation knife present
LS-026	• Station should be considered for major overhaul • Valve pit should be considered for rehabilitation
LS-027	• Portions of concrete found on wet well lid and wet well walls are failing
LS-028	• Station should be considered for rehabilitation • Valve pit needs replacement • Pipe within wet well is rusted • Panel/pedestals needs replacement
LS-029	• Station should be considered for rehabilitation • Valve pit needs replacement • Pipe within wet well is rusted
LS-030	• Station should be considered for rehabilitation • Valve pit needs replacement • Pipe within wet well is rusted • Station has considerable heavy methane gas located within wet well
LS-031	• Station should be considered for rehabilitation • Valve pit needs replacement • Pipes within wet well is rusted
LS-033	• Station requires rehabilitation • Control panel needs replacement • Piping needs replacement • Valve pit needs replacement • New electrical disconnect should be considered
LS-036	• Station should be considered for rehabilitation • Valve pit needs replacement • Pipes within station are rusting/rusted
LS-046	• Station should be considered for rehabilitation

Lift Station	*Lift Station Condition Issues (as Reported by the City)*
	• Valve pit needs replacement
LS-060	• Check valve arm missing
LS-061	• The discharge pipe has a repair clamp located within the wet well and valve pit • Pump pedestals need replacement
LS-066	• No potable water located at the station
LS-083	• Station currently only has one functioning sewage pump
LS-091	• Back flow leaking
LS-099	• Valve pit failing from sample water discharge • Valves for the station do not fully close • Wet well discharge pipes are currently rusting from sample water discharge
LS-104	• Station should be considered for rehabilitation
NRLS-001	• Station should be considered for rehabilitation • Station currently has one functioning pump

Section 7 - Five-Year Future Conditions Wastewater Collection System Needs Evaluation

7.1 Introduction

Section 7 of the City of Palm Bay Wastewater Water Master Plan makes use of the wastewater collection system hydraulic model to evaluate the future condition infrastructure needs of the system at the five-year planning horizon as described below:

a) Evaluate the performance of the wastewater collection system model in each of the three (3) planning horizons (five-, ten-, and twenty-year).
b) Evaluate the gravity sewer trunk system (10-in in diameter and larger) to identify areas that may be experiencing surcharging and pipes that are over or near capacity during peak flows.
c) Evaluate lift stations to identify any that are nearing capacity.
d) Evaluate force mains to identify any that are experiencing excessive velocities and identify and size gravity sewer, lift stations, and force mains necessary to serve future development.
e) Identify upgrades to the existing system needed to meet projected wastewater flows.

7.2 Model Development

Refer to **Section 5** for additional information describing the modeling framework and model calibration.

7.3 Five-Year Future Conditions Wastewater Flows

The City identified a number of anticipated future developments that will contribute sanitary flows to the wastewater collection system. Projected ERU counts and phasing were provided for each development. Thirty-three of these future developments are expected to contribute flows for the five-year planning horizon.

Additionally, multiple septic-to-sewer project areas are anticipated to be completed and contribute flows under the five-year planning horizon. The City also provided information for existing properties in each lift station service area that have yet to connect to the sanitary system.

Flows for these properties were added in the five-year planning horizon as part of the newly adopted mandatory connection ordinance.

Wastewater flow from a total of 9,959 ERCs was added in the five-year planning horizon. **Table 7-1** presents the projected future development wastewater flows and **Figure 7-1** shows the future development locations.

Table 7-1. Five-Year Future Conditions Wastewater Flows

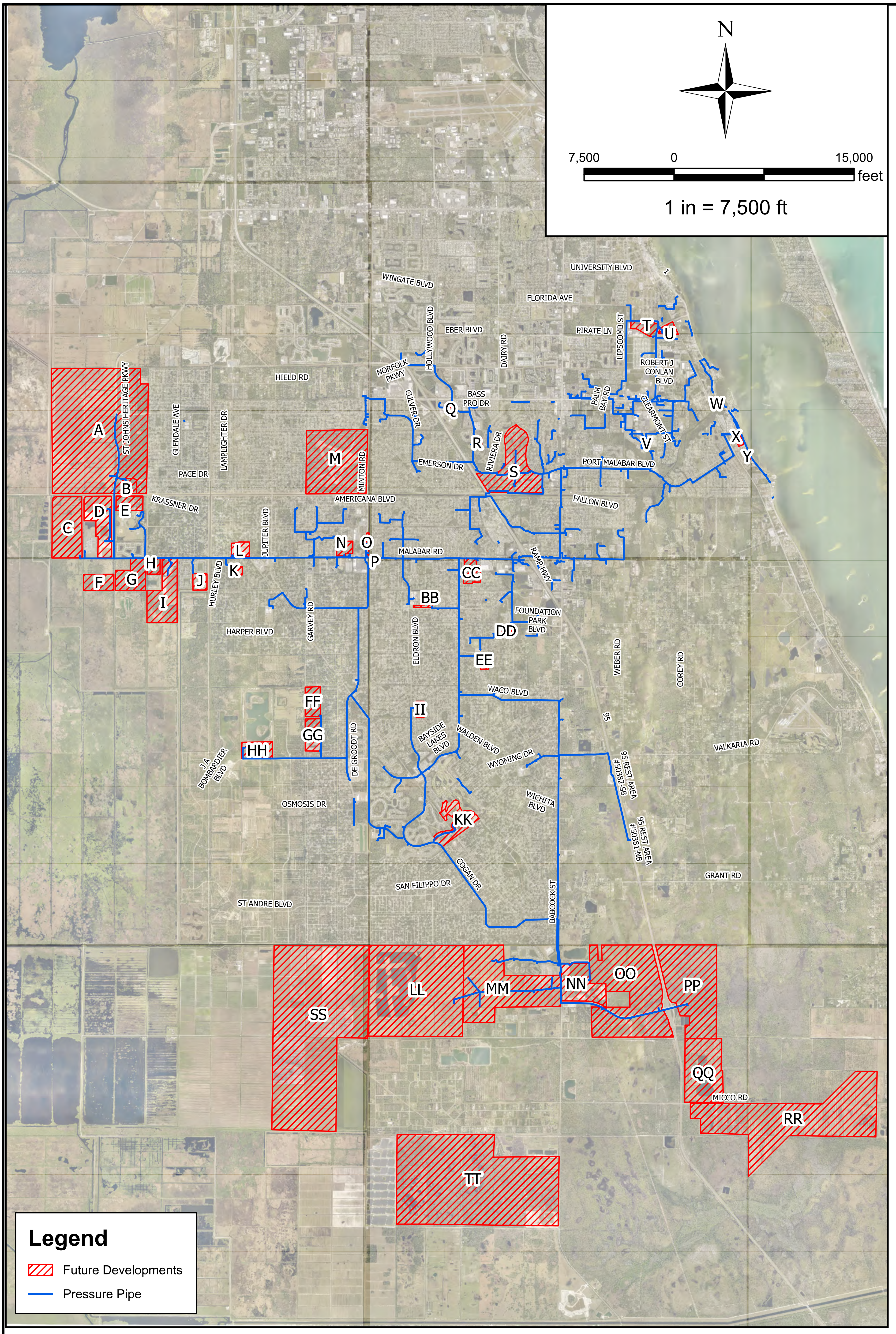
ID	Development[1] Name	Development Type	Five-Year Future Conditions Wastewater Flows)	
			Equivalent Residential Connection	Wastewater Flows (gpd)
A	**Palm Vista (Lennar)**	Residential, Mixed	400	84,000
B	**Palm Vista Everlands**	Residential, Mixed	162	34,020
C	**SJRWMD Property**	Single Family Residential	55.2	11,592
		Multi-Family Residential	0	
D	**St Johns Preserve**	Residential, Mixed	248	52,080
E	**Fred Poppe Park RV Campground**	Commercial/RV	45	9,450
F	**Lennar South**	Residential, Mixed	0	
G	**Three Forks**	Mixed Use	0	
H	**Malabar Estates**	Single Family Residential	0	
I	**Chapparal**	Single Family Residential	361.2	75,852
		Multi-Family Residential	0	
J	**Brentwood Phase 3**	Single Family Residential	97	20,370
K	**Sanibel Cove**	Single Family Residential	50	10,500
L	**Avery Springs**	Single Family Residential	140	29,400
M	**Minton Road Airforce Facility**	Mixed-Use	0	
N	**Health First Wellness Village**	Mixed Use	100	21,000
O	**Minton Road Commercial**	Commercial	77	16,170
P	**City Hall Expansion**	Municipal	15	3,150
Q	**AD1 Global**	Mixed Use Commercial	82	17,220
R	**Sabal Key**	Single Family Residential	40	8,400
S	**Country Club Lakes Estates I-IV (LS-107)**	Single Family Residential	199	41,790
S	**Reserve at County Club Lakes Estates**	Single Family Residential	154	32,340
		Multi-Family Residential	46	9,660
T	**Westshore Apartments**	Multi-Family Residential	212	44,520
U	**Northshore**	Residential	325	68,250
		Commercial	56	11,760

ID	Development[1] Name	Development Type	Five-Year Future Conditions Wastewater Flows)	
			Equivalent Residential Connection	Wastewater Flows (gpd)
	(Aqua Apartments) (Private LS)			
V	Clearmont Trace	Multi-Family Residential	28	5,880
W	Pelican Harbor Marina	Commercial	75	15,750
X	Eztopeliz	Mixed-Use / Multi-Family Residential	0	
W	Tropical Arms Apartments	Residential	84	17,640
Z	Twin Lakes (Malabar)	Residential	16	3,360
BB	Joe Daddy Golf Course Property	Multi-Family Residential	176	36,960
		Commercial	60	12,600
CC	Crown Square	Multi-Family Residential	216	45,360
		Potential Building Space	40	8,400
DD	San Filippo Apartments	Residential	172	36,120
EE	Gulfport Key	Single Family Residential	77	16,170
FF	Bayridge (LS-108)	Single Family Residential	143	30,030
GG	Richmond Estates	Single Family Residential	149	31,290
HH	Wingham	Residential, mixed	0	
II	Hampton Manor (Private LS)	Assisted Living Facility	7	1,470
		Multi-Family Residential	65	13,650
JJ	Eagle Crest	Single Family Residential	54	11,340
KK	Preserves at Stonebriar (LS-106)	Single Family Residential	329	69,090
LL	Rolling Meadows		467.8	98,238
MM	Waterstone Phase II		1061	222,810
MM	Waterstone/Cypress Bay West		1352	283,920
NN	Cypress Bay (LS-109)		593	124,530
OO	Emerald Lakes - West of I-95	Residential, Mixed	1132.5	237,825
PP	Emerald Lakes - East of I-95	Residential, Mixed	435.8	91,518
QQ	Pete Holdings (Jeff Lee)	Residential, Mixed	0	
RR	Micco Village	Mixed-Use	0	
	Calumet Farms		0	
	Willowbrook		0	
		Total	**9,598**	**2,015,475**

1. Development areas without values shown above have planned development in the ten and twenty-year development horizons. Refer to **Figure** 7-1 for locations of proposed development areas.

It should be noted that these development projections are fluid, have changed continuously throughout this analysis, and will continue to change as the developments evolve. The proposed southern developments, including Ashton Park, significantly impact system requirements in the south of the city. ERC estimates for these developments are expected to be updated soon and will inevitably affect the sizing and orientation of proposed improvements in this area. Considerations for the sensitivity and uncertainty of this issue are discussed in the following sections.

All future development flows were added to their collecting lift stations, just like the existing flows. Many of these proposed developments require additional lift stations that will be added to the City network in the future. These lift stations were represented using the best available data for the stations that have progressed through at least preliminary design. However, many stations have not been designed and were represented with standard lift station designs in accordance with City standards. Pumps were sized based on flow projections and anticipated pressures in the system. The representation of these lift stations will almost certainly change as these developments progress towards completion, though it is important to capture the intermittent pumping nature of the system rather than assigning continuous flows for future developments. This approach will characterize the impacts of these developments at the system-wide scale and will allow for more detailed analysis at the development scale as the design progresses in the future.



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5-Year Future Conditions Development Map
Wastewater Master Plan
City of Palm Bay Utilities Department

PROJ. NO. **PBU006**

DATE: **JUL 2024**

FIGURE NO. **7-1**

7.4 Five-Year Future Wastewater Collection System Conditions Evaluation

7.4.1 Treatment Plant Capacity

A summary of these modeled flows to the treatment plants is provided in the table below.

Table 7-2. Five-Year Future Conditions Modeled Treatment Plant Flows

Treatment Plant	*Modeled Average Daily Flow (MGD)*	*Annual Average Daily Flow Permitted Capacity (MGD)*	*Modeled Max Day Peak Hour Flow (MGD)*	*Peak Hourly Flow Hydraulic Capacity (MGD)*
NRWWTP	3.74	4.0[1]	6.83	8.0[2]
NRWRF	0.69	1.2[1]	1.94	2.5[3]
SRWRF	2.22	3.0[4]	5.56	6.0[4]
Total	**6.65**	**7.2**	**14.34**	**16.5**

1. From State of Florida Domestic Wastewater Facility Permit #FLA103357
2. From Sheet G-3: Hydraulic Profile in Port Malabar Wastewater Treatment Plant Expansion to 4.0 MGD, 1985 sheet set
3. From Sheet G-5: Hydraulic Profile in Nutrient Removal Facilities Permit Set, 2019 sheet set
4. Assumes five-year improvements are completed (SRWRF Phases 1-A, 1-B, and 1-C) so the permitted capacity is 3.0 MGD AADF and the hydraulic capacity of 6.0 MGD PHF.

Modeled flows do not exceed the permitted capacity for either of the northern facilities under AADF conditions. The NRWWTP has an additional 0.26 MGD of capacity and the NRWRF has an additional 0.51 MGD of capacity. The combined hydraulic capacity of the two (2) northern plants is 1.73 MGD greater than the max day peak hour flows, though flow controls are necessary to direct flows towards the NRWWTP and away from the NRWRF during periods of peak flows. This flow control is necessary to prevent hydraulic overloading the NRWRF.

The modeled AADF and PHF to the SRWRF will require the facility to be expanded to 3.0 MGD AADF and 6.0 MGD PHF. This will be accomplished by completing the SFWRF Phase 1B (equipment) and 1C (tankage and equipment) within the five-year planning horizon.

7.4.2 Gravity System Performance

The gravity main surcharging issues identified in **Section 6.3** were addressed with capital improvement needs as described later in **Section 7.5**.

Upsizing is required for segments along Palm Bay Rd downstream of LS07, along Palm Bay Road upstream of LS50, and San Filippo Dr between LS29 and LS27 to adequately pass flows. With the incorporation of these improvements, the gravity system performs adequately under average and maximum day conditions.

However, there are still instances of surcharged gravity lines directly upstream of lift stations scattered throughout the city as a result of overlapping lift station operating bands. It is recommended that these operating bands are investigated and adjusted to minimize this occurrence.

7.4.3 Lift Station Performance

All lift stations are capable of passing max day flows using only the lead pump with the exception of LS13, LS14, and LS34. LS14 is the only lift station that fills to the point of triggering a high-level alarm. Additionally, 32 lift stations operate at least 25% of their pumping events within 15% of their shutoff head. **Table 7-3** below shows these stations operating near their shutoff heads.

Table 7-3. Lift Stations Operating Near Shutoff Head in Five-Year Future Conditions Max Day Scenario

Lift Station	*Percentage of Pumping Time within 15% of Shutoff Head*	*Lift Station*	*Percentage of Pumping Time within 15% of Shutoff Head*
LS08	39%	LS44	100%
LS10	100%	**LS46**	100%
LS12	60%	**LS49**	62%
LS13	100%	**LS51**	100%
LS14	27%	**LS56**	100%
LS16	45%	**LS71**	45%
LS25	66%	**LS72**	51%
LS26	62%	**LS73**	46%
LS30	77%	**LS74**	55%
LS31	100%	**LS75**	61%
LS33	100%	**LS76**	68%
LS34	75%	**LS77**	35%
LS35	100%	**LS78**	32%
LS37	27%	**LS80**	54%
LS38	36%	**LS86**	100%
LS40	39%	**LS92**	29%

Individual pump adjustments were not made at any lift stations for this five-year analysis, except for LS01 and LS05 as described in the most recent design documents for improvements at these sites. Increasing the size of pumps at these underperforming locations is necessary and documented as a capital improvement need in **Section 7.5**.

7.4.4 Force Main Velocities

7.4.4.1 Low Velocities

Maximum force main velocities are generally within the 2 to 5 fps target range throughout the system. Several new force mains constructed to serve five-year anticipated developments including the initial phases of Palm Vista, Rolling Meadows, and Emerald Lakes developments experience low velocities less than the desired scouring velocity of 2 fps. These lines are sized to accommodate the significant additional flows anticipated in the ten-year and twenty-year planning horizons as development progresses.

Force main velocities in the south along Babcock St and Waco Blvd also experience low velocities as a result of the connection with the new line along Cogan Dr. Velocities in these force mains will increase as anticipated development in the southern portion of the city continues.

Approximately 117,000 LF of force main experiences maximum velocities less than 2 fps under the max day condition. This comprises approximately 20% of the total force main network by length.

7.4.4.2 High Velocities

Approximately 37,000 LF of force main experience maximum velocities greater than 5 fps under the max day condition. This comprises approximately 6% of the total force main network by length. This occurs where sections of force main are downsized between larger lines at either end including near Emerson Dr south of Malabar Rd and just east of the I-95 crossing. Pressures in these areas are alleviated due to improvements elsewhere in the system so upsizing these lines is not necessary at this phase. Additionally, high velocities observed in the discharge force mains of several smaller and private lift stations occur infrequently and do not constitute critical issues at this stage.

Figures depicting the five-year conditions force main velocities for the average day and max day design scenarios are provided in **Figures 7-2 and 7-3**, respectively.

7.4.5 Force Main Pressures

Force main maximum pressures are below 50 psi throughout the system. Notable exceptions include the following force main segments:

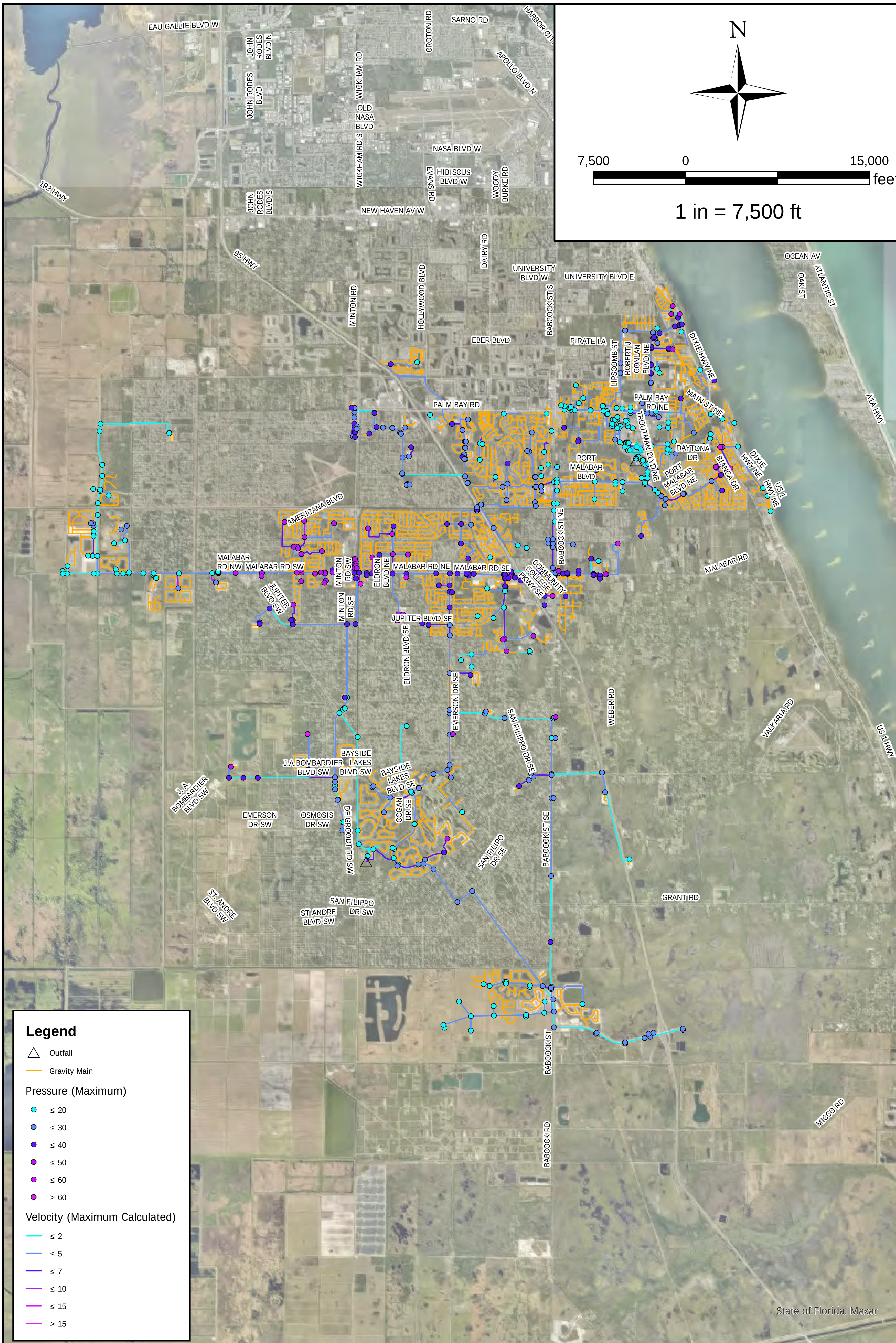
- J.A. Bombardier Blvd and Gaynor Dr
- Directly downstream of the reconstructed LS05
- Malabar Rd east of RLS01.

The 6-in FM along J.A. Bombardier Blvd and the 4-in FM serving Richmond Estates/Bayridge along Gaynor Dr experience high force main pressures. This area will be addressed via the construction of a new City lift station in the vicinity of Degroot Rd SW and Osmosis Dr. The existing Degroot Rd force main will be redirected to the south to discharge into the new proposed lift station.

Additionally, the RLS01 pumps are not modeled as VFDs in this analysis which contributes to elevated pressures downstream along Malabar Rd and in the developments north and south. These pumps will be adjusted once the City provides updated pump curves and control logic for these VFDs, which may reduce pressures in what is now the highest-pressure region of the system.

Maximum pressures are marginally higher throughout the city during the max day scenario than they are during the average day scenario, though the same spatial trends are observed. Pressures in the northeast of the city remain low, as do pressures upstream of RLS01 in the west. Pressures in the new developments in the south of the city are low as a result of the construction of the new force main along Cogan Dr and tie-in to the existing force main along Babcock St. This connection also significantly alleviates pressures in the Babcock St force main that were very high in the near future condition.

Figures depicting the five-year conditions maximum pressures for the average day and max day design scenarios are provided in **Figures 7-2 and 7-3**, respectively.



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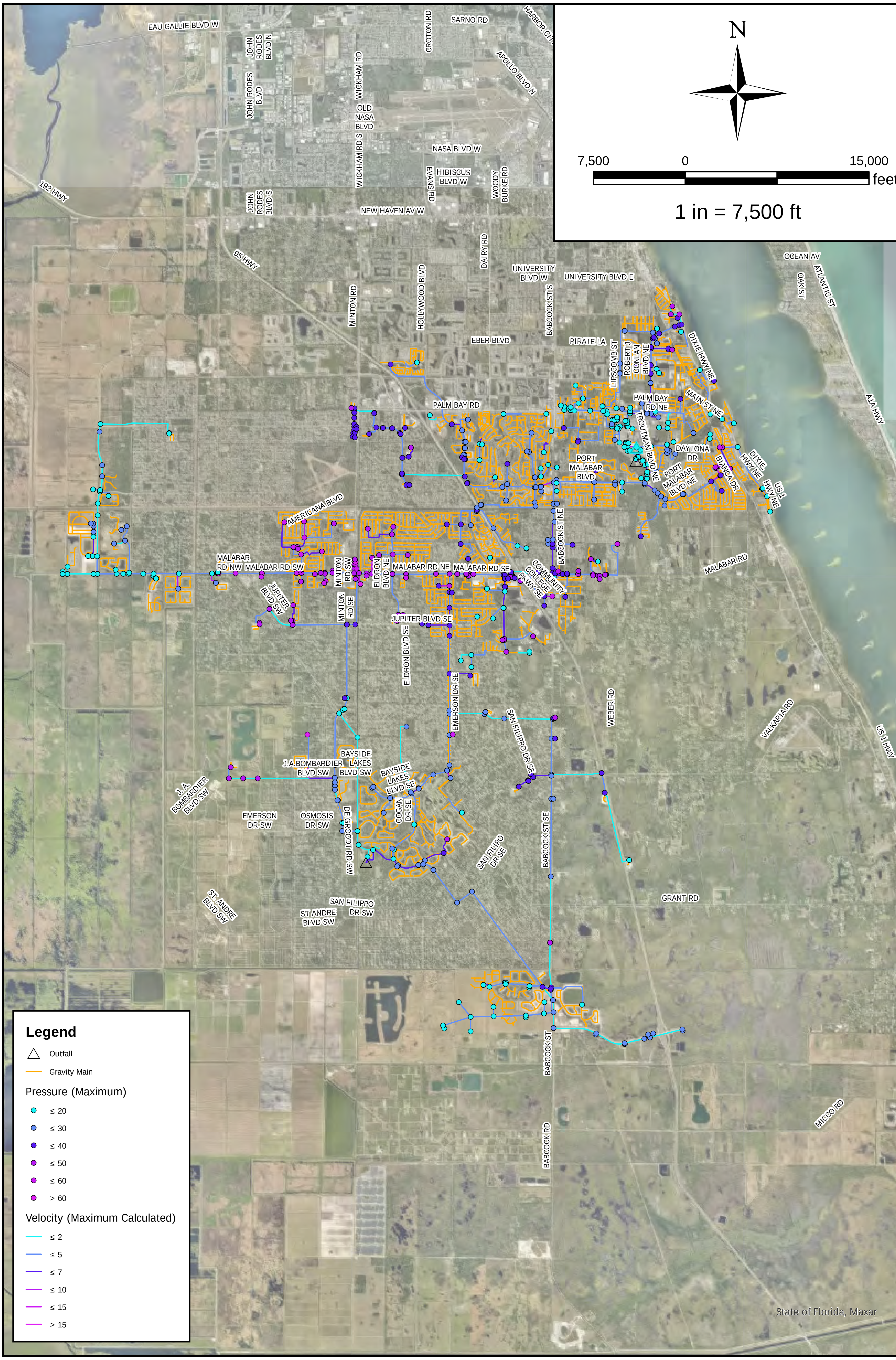
5-Year Conditions
Average Day Maximum Values
Wastewater Master Plan
City of Palm Bay Utilities Department

PROJ. NO. **PBU006**

DATE: **JUL 2024**

FIGURE NO. **7-2**



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5-Year Conditions
Maximum Day Maximum Values
Wastewater Master Plan
City of Palm Bay Utilities Department

PROJ. NO.
PBU006

DATE:
JUL 2024

FIGURE NO.
7-3

7.5 Five-Year Future Conditions Septic-to-Sewer Conversions

The Brevard County region boarding along the IRL has recognized the importance of taking the necessary actions needed to improve the water quality in the IRL. The City has been a participant in the SOIRL program to regionally fund through sale tax revenue projects to improve the IRL water quality. The SOIRL program provides funding for projects based on the cost-effectiveness of removing nitrogen from IRL. The City has planned, designed, and completed several SOIRL grant-funded projects including multiple stormwater improvements and the BNR improvement project at the NRWRF. In addition, the City has received SOIRL grant funding for two septic-to-sewer projects further described below in **Section 7.5.1**.

Furthermore, the FDEP through the IRL BMAP has determined the need to take action to further limit the discharge of nutrients (nitrogen and phosphorus) for the OSTDS effluent. The FDEP has issued a Final Order requiring the City to submit an OSTDS Remediation Plan containing the following information:

1. An inventory of the OSTDS within the local government's jurisdiction or service area based on the best information available;
2. An estimate of future growth in new OSTDS over the next 20 years in the local government's jurisdiction or service area;
3. An inventory of OSTDS that are expected to be eliminated over the next 20 years through connection to central sewer lines of a domestic wastewater facility or other distributed wastewater system with additional nutrient reduction;
4. Identification of deadlines and interim milestones for the planning, design, and construction of new/extended central sewer lines and replacement of OSTDS by connection to the new/extended lines;
5. The estimated costs associated with the projects in item 4) above;
6. For OSTDS that are not expected to be eliminated over the next 20 years through connection to central sewer lines, an estimate of the number of these OSTDS that will require upgrading to enhanced nutrient-reducing OSTDS or participating in a distributed wastewater treatment system with additional nutrient reduction within the local government's jurisdiction, to meet the water quality objectives of the BMAP;
7. The estimated costs associated with upgrading to enhanced nutrient-reducing OSTDS that are identified in section 6); and,
8. Any other cost-effective and financially feasible projects necessary to achieve the nutrient load reductions for OSTDS to meet the water quality objectives of the BMAP with estimated costs, timelines, and locational information.

The City's OSTDS Remediation Plan contains the current approach being undertaken by the City to implement the BMAP-required septic-to-sewer projects as funding is available to meet the state legislature-mandated requirements contained within the Indian River Protection Program (Section 373.469 FS) for all OSTDS within the IRL BMAP to be connected to central sewer or upgraded to enhanced nutrient removal OSTDS type by July 1, 2030.

Refer to **Section 2.6.1** for more information regarding the OSTDS Remediation Plan.

The following is a detailed description of the phased septic-to-sewer conversion projects being included in the OSTDS Remediation Plan which the City would undertake within the five-year planning horizon if the necessary combination of state financial support can be assembled through a combination of state appropriations, grants, and other funding sources.

7.5.1 Septic to Sewer Conversion Area A

The Utilities Department has received local Brevard County SOIRL grant funding to connect a limited number of parcels to central sewer based upon their proximity to the water bodies and reduced TN loadings. The City has received SOIRL grant funding for $2.6 million for wastewater collection system improvement to implement septic-to-sewer conversions for this area.

Project Area A is located east of Troutman Blvd, north of Port Malabar Blvd, and bordered by Turkey Creek. The area is comprised primarily of residential parcels and has access to potable water provided by the City but is not currently connected to the City's sanitary sewer system. The City has received a Save Our Indian River Lagoon (SOIRL) grant for $3.06 million for wastewater collection system improvement to implement septic-to-sewer conversions for this area (SOIRL Project 2016-39).

Table 7-4 provides proposed connections for each subarea within Area A. This includes the proposed number of connections for each phase, the average daily flow associated with the number of proposed connections, design flow, the number of proposed manholes, the proposed length of gravity piping and force main, and approximate lift station depth.

Table 7-4. Phase A Septic to Sewer Conversion Subarea Information

Phase A Subarea	*Connections*	*ADF (GPD)*	*Design Flow (GPM)*	*Number of Manholes*	*Length of Gravity Pipe (ft)*	*Length of Force Main (ft)*
A-1	76	20,800	60	21	2,866	1,433
A-2	23	4,830	15	7	1,356	201
Total	**99**	**25,630**		**28**	**4,222**	**1,634**

City staff have concerns regarding the feasibility of proceeding with the project. The City will be required to acquire two privately owned parcels to locate the proposed lift station sites. In addition, the recent escalation in construction costs may cause the City to require additional funding from grants or state appropriations for the project to be deemed financially feasible. The currently available SOIRL grant funding is not sufficient to fully fund the projected construction costs or the additional City utility-related fees for sewer connections estimated at $5,670 and the private side lateral costs estimated at $4,500 for each connection.

7.5.2 Septic to Sewer Conversion Area B

Project Area B is located east of I-95 and north of Malabar Road. The area is comprised primarily of single-family residential parcels having access to potable water provided by the City of Palm Bay; however, it is not connected to the City of Palm Bay sanitary sewer collection system at this time. A limited portion of this project area was previously identified by the SOIRL program to be eligible for grant funding in the amount of $9.9 million (SOIRL Project No. 2016-046).

Table 7-5 provides proposed connections for each subarea within Area B. This project area is divided into 14 gravity sewer subareas with a new gravity sewer collection system, lift station, and force main to tie into the existing system force mains. The table provides the proposed number of connections for each subarea, the average daily flow associated with the number of proposed connections, lift station design flow, the number of proposed manholes, and proposed lengths of gravity sewer main and force main.

Table 7-5. Phase B Septic to Sewer Conversion Subarea Information

Phase B Subarea	*Connections*	*ADF (GPD)*	*Design Flow (GPM)*	*Number of Manholes*	*Length of Gravity Pipe (ft)*	*Length of Force Main (ft)*
B-1	113	23,730	70	20	6,800	600
B-2	97	20,370	60	23	7,100	2,700
B-3	194	40,740	120	43	12,300	1,100
B-4	117	24,570	80	20	7,300	0
B-5	134	28,140	80	28	8,700	2,100
B-6	143	30,030	90	21	7,100	3,000
B-7	142	29,820	80	28	8,200	1,500
B-8	100	21,000	70	16	5,400	1,000
B-9	182	38,220	110	33	11,100	1,800
B-10	143	30,030	90	30	9,500	1,500
B-11	165	34,650	100	37	11,300	900
B-12	139	29,190	90	26	8,500	2,100
B-13	81	17,010	50	19	5,100	1,400
B-14	57	11,970	40	16	4,800	700
Total	**1,807**	**379,470**		**360**	**113,200**	**20,400**

Each Area B subarea requires a conventional sanitary lift station constructed to standards established by the City's Utilities Department. Each station will require the City's acquisition of private property to locate the proposed lift station. Typically, property acquisition of the lift station site is a challenge to making a septic-to-sewer project technically feasible when a new lift station is required. These challenges may include the following issues:

- Availability of a vacant site centrally located in the subarea,
- Willingness of the adjacent property owners to be adjacent to a lift station,
- Size or topography of the property, and

- Willingness of the property owner to sell their property to the City for a fair price.

The following table shows the proposed lift station sites needed and their status for the Phase B septic-to-sewer conversion projects.

Table 7-6. Phase B Septic to Sewer Conversion Subarea Lift Station Site

Phase B Subarea	*Proposed Lift Station Location*	*Parcel Owner*[1]	*Private Ownership*	*Vacant*
B-1	543 Picasso Ave NE	Darband Homes LLC	YES	YES
B-2	582 Homestead Ave NE	Gottfried, Michael S	YES	YES
B-3	1518 Nebraska St NE	Webb, Ruth E	YES	YES
B-4	1622 Charles Blvd NE	Carol Ann NEHS Revocable Living Trust	YES	YES
B-5	1621 Sutschek St NE	Vynckier, Dider	YES	YES
B-6	1864 Brookside St NE	Johnson, Jay D	YES	YES
B-7	473 Deacon Ave NE	Dang, Tu Vuong	YES	YES
B-8	443 Heather Ave NE	Hartmut Malluche Family Trust	YES	YES
B-9	327 Harvey Ave NE	Maronda Homes LLC of Florida	YES	YES
B-10	Corner of Fallon Blvd NE & Karney Ave NE (no address)	Truong, Quy T; Truong, Hau D	YES	YES
B-11	567 Bounty Ave NE	Bregenzer, Nicholas; Bryer Leanne	YES	YES
B-12	2240 Fallon Blvd NE	Bezanilla, Carlo; Bezanilla, Mauro; Bezanilla, Gloria	YES	YES
B-13	2201 Macedo Rd NE	Hutchinson, Olive; Hutchinson, Sarah	YES	YES
B-14	Oaklyn St NE (no address)	City of Palm Bay	NO	YES

1 – Property ownership data obtained in April 2024.

Before any engineering design work can begin, property acquisition for these sites must commence and the property must be acquired. The identification of alternate lift station sites or alternate sanitary collection system designs may be needed if it is determined any of these proposed lift station sites become unavailable.

7.5.3 Septic to Sewer Conversion Area C

Project Area C is located west of I-95 and north of Malabar Road. The area is comprised of primarily single-family residential parcels having access to potable water provided by the City of Palm Bay water system however, is not connected to the Palm Bay sewer.

The proposed project will provide 395 service connections through the construction of a gravity sewer system. This project area is divided into two (2) subareas each including a new gravity sewer collection system, lift station, and force main to tie into the existing system force mains.

Table 7-7 provides proposed connections for each subarea within Area C. This includes the proposed number of connections for each subarea, the average daily flow associated with the number of proposed connections, design flow, the number of proposed manholes, the proposed lengths of gravity pipe and force main, and approximate lift station depth.

Table 7-7. Phase C Septic-to-Sewer Conversion Subarea Information

Phase C Subareas	Connections	ADF (GPD)	Design Flow (GPM)	Number of Manholes	Length of Gravity Pipe (ft)	Length of Force Main (ft)
C-1	208	43,680	130	40	13,080	1,600
C-2	187	39,270	110	45	15,711	1,500
Total	**395**	**82,950**		**85**	**28,791**	**3,100**

Each Area C subarea requires a conventional sanitary lift station constructed to the City's Utilities Department standards. Each station will require the acquisition of property to site the proposed lift station. The following table shows the proposed lift station site needed and its status for the Phase C projects.

Table 7-8. Phase C Septic to Sewer Conversion Subarea Lift Station Site

Phase B Subarea	Proposed Lift Station Location	Parcel Owner[1]	Private Ownership	Vacant
C-1	197 Biltmore Ave NE	Wassef, Antoun	YES	YES
C-2	Corner of Jettie St NE & Exmore Ct NE	Regency Construction of S Florida Inc	YES	YES

1 – Property ownership data obtained in April 2024.

Before any engineering design work can begin, property acquisition for these sites must commence. The identification of alternate lift station sites or alternate sanitary collection system design may be needed if it is determined any of these proposed lift station sites become unavailable.

7.6 Five-Year Future Conditions Wastewater Collection System Capital Improvement Needs

Several capital improvement needs are identified in this five-year planning horizon to maintain the integrity and optimal operation of the wastewater collection system. These needs are identified below in **Table 7-9** with the circumstances that trigger each need. Improvements span all system components including treatment plants, gravity collection system, and force main network. A map showing the location of these five-year capital improvement needs is provided in **Figure 7-6**.

Table 7-9. Five-Year Future Conditions Wastewater Collection System Capital Improvements Needs

Five-Year Capital Improvements Needs	***Trigger***
CIP No. 1: NOT USED	NA
CIP No. 2: Install and Operate Flow Controls between NRWWTP and NRWRF	Currently Needed
CIP No. 3: Replace 444 LF of 6-in Gravity Main with 8-in Gravity Main Downstream of LS07	Currently Needed
CIP No. 4: Construct 1,093 LF of 10” PVC Sanitary FM leaving PLS-391 to LS-50	Currently Needed

Five-Year Capital Improvements Needs	***Trigger***
CIP No. 5: Construct 850 LF 6" PVC Sanitary FM from LS-56 until 20" FM across from Clearmont St	Currently Needed
CIP No. 6: Replace 443 LF of 8-in gravity main with 12-in along San Filippo Dr	Currently Needed
CIP No. 7: Evaluate Lift Station Operating Bands	Currently Needed
CIP No. 8: Upsize Pumps at Underperforming Lift Stations	As needed
CIP No. 9: NOT USED	NA
CIP No. 10: LS05 Replacement and Modified Discharge Force main	Currently Needed
CIP No. 11: Replace 2,900 LF of 8-in AC FM with 12-in PVC FM along Port Malabar Blvd and Canal	LS05 replacement
CIP No. 12: Replace 3,340 LF of 12-in AC FM with 12-in PVC FM along Port Malabar Blvd	LS05 replacement
CIP No. 13: Construct 11,240 LF of 20-in FM along FPL Easement from Osmosis Dr to Degroodt Rd	Currently Needed
CIP No. 14: NOT USED	NA
CIP No. 15: Construct 5,860 LF of 24-in FM along Babcock St from proposed Waterstone tie-in to proposed Cogan Dr tie-in with connection to existing Babcock St FM	Southern Developments
CIP No. 16: Construct 9,040 LF of 12-in FM from Waterstone development to proposed Babcock St FM	Waterstone or Rolling Meadows Developments
CIP No. 17: Construct 1,290 LF of 20-in FM along Babcock St from St Johns Heritage Pkwy to proposed Waterstone tie-in	Emerald Lakes
CIP No. 18: Construct 3,570 LF of 16-in FM along St Johns Heritage Pkwy from Babcock St to Emerald Lakes	Emerald Lakes
CIP No. 19: Construct 7,370 LF of 12-in FM along St Johns Heritage Pkwy within Emerald Lakes	Emerald Lakes
CIP No. 20: Increase permitted capacity of SRWRF to at least 3.0 MGD AADF/ 6.0 MGD PHF	Rule 62-600.405, F.A.C.
CIP No. 23: SOIRL Septic to Sewer Conversion Area A	BMAP Requirements and Availability of Project Funding
CIP No. 24: Septic to Sewer Conversion Area B Phases 1 through 5	BMAP Requirements and Availability of Project Funding
CIP No. 25: Septic to Sewer Conversion Area B Phases 6 through 9	BMAP Requirements and Availability of Project Funding
CIP No. 26: Septic to Sewer Conversion Area B Phases 10 through 14	BMAP Requirements and Availability of Project Funding
CIP No. 27: Septic to Sewer Conversion Area C	BMAP Requirements and Availability of Project Funding
CIP No. 28: Construct 6,189 LF of 3-in FM along Emerson Dr from Discover Elementary School west to St Johns Heritage Pkwy FM	School Board Action to Abandon Septic System

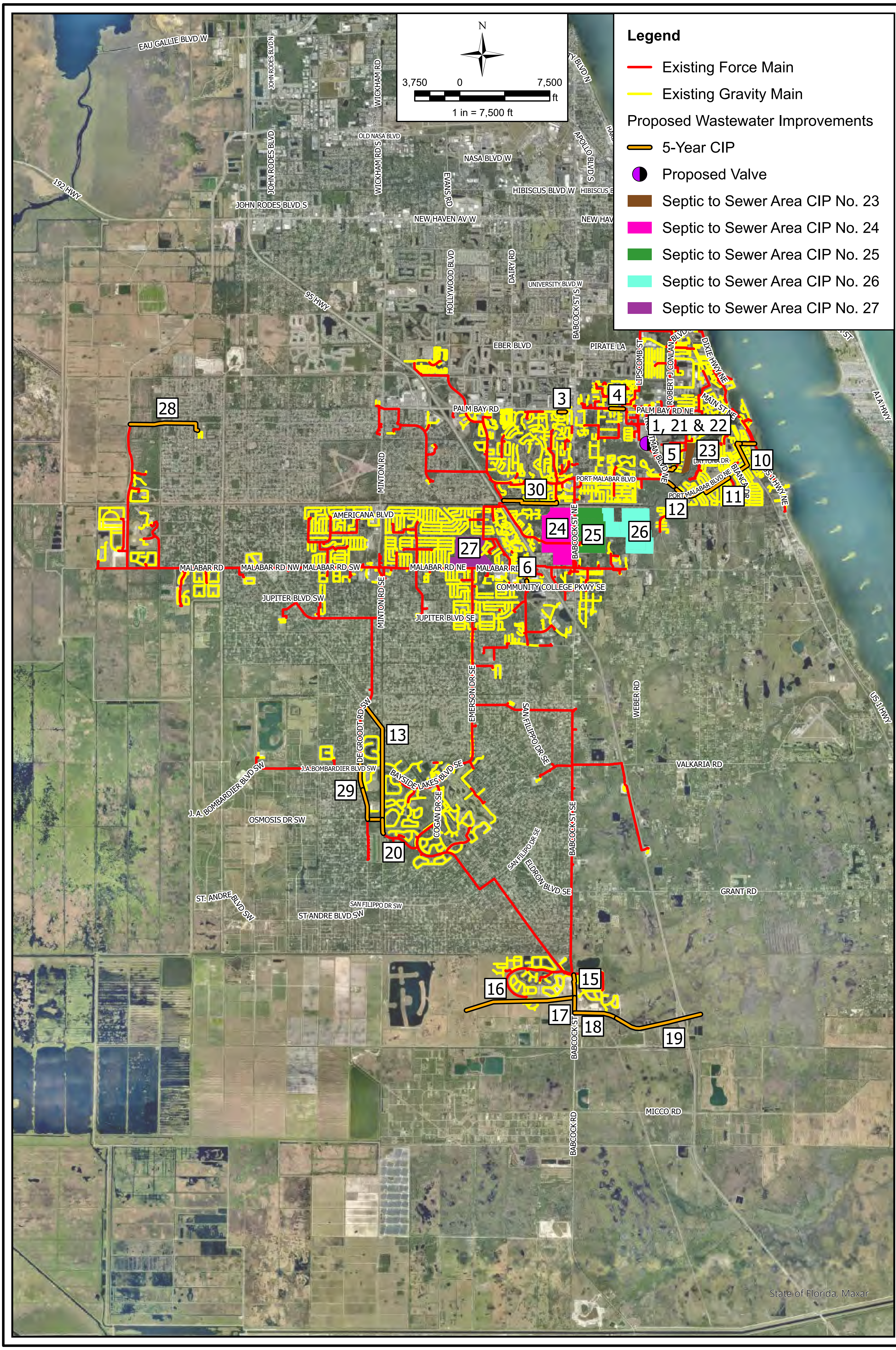
Five-Year Capital Improvements Needs	***Trigger***
CIP No. 29. Construction of 3,680 LF of New 8-in PVC FM and 1050 LF of New 20-in PVC FM from Lift Station 67 to existing FM north of SRWTP.	Currently Needed
CIP No. 30: Replace 8" AC Sanitary FM with 8" PVC Sanitary FM from LS-36 to LS-09	Condition of FM

The following is a summary of the proposed capital improvement wastewater collection system needs including a general description of improvements and the purpose for improvement.

- **5-Year CIP No. 1 – NOT USED**
- **5-Year CIP No. 2 – Install and Operate Flow Controls between NRWWTP and NRWRF:** Install flow controls to limit NRWRF flows to a maximum of 1700 gpm (2.45 MGD). This prevents hydraulic overloading of the plant and reduces the change of overflows.
- **5-Year CIP No. 3 – Replace 6-in Gravity Main with 8-in Gravity Main Downstream of LS07:** Upsize gravity line receiving LS07 pumped flows to prevent surcharging.
- **5-Year CIP No. 4 – Construct 10" PVC Sanitary FM leaving PLS-391 to LS-50**: Redirect flows from 3 City-owned and 6 private lift stations directly to LS 50 to eliminate surcharging of the existing gravity sewer.
- **5-Year CIP No. 5 – Construct 6" PVC Sanitary FM from LS-56 until 20" FM across from Clearmont St:** Redirect flows from LS56 directly to force main conveying flows directly to NRWWTP.
- **5-Year CIP No. 6 – Gravity Main Replacement along San Filippo Dr:** Upsize gravity line receiving pumped flows upstream of LS27 to prevent surcharging.
- **5-Year CIP No. 7 – Evaluate lift station operating bands:** Investigate whether the lead pump on floats can be lowered at several lift stations. This prevents frequent surcharging of gravity lines feeding these lift stations.
- **5-Year CIP No. 8 – Upsize pumps at underperforming lift stations:** Increase the size of pumps at lift stations operating near their shutoff heads. This increases operational efficiency and reliability during periods of increased flow.
- **5-Year CIP No. 9 – NOT USED**

- **5-Year CIP No. 10 – LS05 Replacement and Modified Discharge Force main:** Project currently at 30% design. This provides increased capacity to accommodate future flows in the service area.
- **5-Year CIP No. 11 – Replace 8-in AC FM with 12-in PVC FM downstream of new LS05:** Upsize and replace existing pipe in poor condition. This increases operational reliability in a pipe of concern as it will experience increased pressures and velocities once LS05 is replaced.
- **5-Year CIP No. 12 – Replace 12-in AC FM with 12-in PVC FM along Port Malabar Blvd:** Replace existing pipe in poor condition. This increases operational reliability in a pipe of concern as it will experience increased pressures and velocities once LS05 is replaced.
- **5-Year CIP No. 13 – 20-in FM Extension along FPL easement:** Force main to alleviate pressures in the west of the city and direct flows to the SRWRF.
- **5-Year CIP No. 14 – NOT USED**
- **5-Year CIP No. 15 – 24-in FM Extension along Babcock St with tie-in:** Force main to provide capacity for development in the south of the city and direct flows to the SRWRF. This tie-in also alleviates pressures in the existing network along Babcock St.
- **5-Year CIP No. 16 – 12-in FM Extension to serve Waterstone and Rolling Meadows:** Force main to provide capacity for Waterstone and Rolling Meadows.
- **5-Year CIP No. 17 – 20-in FM Extension to serve Emerald Lakes:** Force main to provide capacity for Emerald Lakes and additional development.
- **5-Year CIP No. 18 – 16-in FM Extension to serve Emerald Lakes:** Force main to provide capacity for Emerald Lakes and additional development.
- **5-Year CIP No. 19 – 12-in FM Extension to serve Emerald Lakes:** Force main to provide capacity for Emerald Lakes and additional development.
- **5-Year CIP No. 20 – Increase SRWRF Capacity:** Increase permitted capacity of SRWRF to 3 MGD AADF/ 6.0 MGD PHF. This accommodates projected flows and prevents hydraulic failure of the plant.
- **5-Year CIP No. 23 – SOIRL Septic to Sewer Conversion Area A:** Connect 99 existing conventional septic tanks with drain field to central sewer.
- **5-Year CIP No. 24 –Septic to Sewer Conversion Area B Phases 1 through 5:** Connect 655 existing conventional septic tanks with drain field to central sewer.

- **5-Year CIP No. 25 –Septic to Sewer Conversion Area B Phases 6 through 9:** Connect 567 existing conventional septic tanks with drain field to central sewer.
- **5-Year CIP No. 26 –Septic to Sewer Conversion Area B Phases 10 through 14:** Connect 585 existing conventional septic tanks with drain field to central sewer.
- **5-Year CIP No. 27 –Septic to Sewer Conversion Area C:** Connect 395 existing conventional septic tanks with drain field to central sewer
- **5-Year CIP No. 28 –Install 3" FM along Emerson Dr from Discover Elementary School**: Force Main to connect Discovery Elementary School to central sewer and eliminate a conventional septic tank and drain field.
- **5-Year CIP No. 29 – Construction of New FM from Lift Station 67 to existing FM north of SRWTP**: Repurposing of existing 8-in FM from Lift Station 86 to Lift Station 67. Construction of new 8-in FM from Lift Station 67 to the corner of DeGroodt and Osmosis and new 8-in FM from the corner of DeGroodt and Osmosis until cul de sac of Osmosis and connect to SRWRF. Construction of 20-in FM from FPL Easement to existing FM north of SRWRF.
- **5-Year CIP No. 30 – Replace 8" AC Sanitary FM with 8" PVC Sanitary FM from LS-36 to LS-09**: Upsize and replace existing pipe in poor condition. This increases operational reliability.



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5-Year Future Conditions
Capital Improvements Needs Locations
Wastewater Master Plan
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FIGURE NO. **7-4**

7.7 Observations and Recommendations

7.7.1 Observations

The City's wastewater collection system operates adequately under the five-year planning horizon with the implementation of projects to address the five-year capital improvement needs described above in **Table 7-4**.

Significant development necessitates the expansion of the SRWRF to increase its capacity and flow control between the northern plants is necessary to prevent hydraulic failure of the NRWRF. Increased pressures in the central west of the city are alleviated by a new force main along the FPL easement, conveying westerly flows to the SRWRF instead of east along Malabar Rd. New force mains connecting the southern developments to the SRWRF alleviate high pressures in the south of the city.

Limited gravity main replacement in the northern section of the city reduces surcharging in pipes currently operating beyond their capacity. Pump upsizing and operating band adjustments also reduce surcharging upstream of lift stations and promote efficient pumping operations. Throttling of the RLS01 VFDs is important to prevent high pressures along Malabar Rd. Additional improvements will likely be necessary in the southern and western regions of the city as development in these areas continues.

7.7.2 Recommendations

It is recommended that the City implement projects to address the five-year wastewater collection system capital improvement needs as described in this Section.

Section 8 - Ten-Year Future Conditions Wastewater Collection System Needs Evaluation

8.1 Introduction

Section 8 of the City of Palm Bay Wastewater Master Plan used the wastewater system hydraulic model to evaluate the future condition infrastructure needs of the system at the ten-year planning horizon as described below:

a) Evaluate the performance of the wastewater collection system model in each of the three (3) planning horizons (five-, ten-, and twenty-year).
b) Evaluate the gravity sewer trunk system (10-in in diameter and larger) to identify areas that may be experiencing surcharging and pipes that are over or near capacity during peak flows.
c) Evaluate lift stations to identify any that are nearing capacity.
d) Evaluate force mains to identify any that are experiencing excessive velocities and identify and size gravity sewer, lift stations, and force mains necessary to serve future development.
e) Identify upgrades to the existing system needed to meet projected wastewater flows.

8.2 Model Development

Refer to **Section 5** for additional information describing the modeling framework and model calibration.

8.3 Ten-Year Future Conditions Wastewater Flows

The City identified several anticipated future developments that will contribute to sanitary flows to the wastewater collection system. A projected number of ERCs and phasing were provided for each development. Fourteen of these future developments are expected to contribute to wastewater flows for the ten-year planning horizon.

The City also provided information for vacant properties in each lift station service area. It is assumed that these properties will be developed, at which point they will connect to the respective gravity system. These connections were divided evenly between the ten-year and twenty-year planning horizons and flows were assigned accordingly.

Due to pending changes to the Ashton Park development plan, this development was omitted from the analysis at this time. Its addition will likely affect the required improvements.

Wastewater flows from some 8,650 ERCs were added to the ten-year planning horizon. **Table 8-1** below presents the projected future development wastewater flows and **Figure 8-1** shows the future development locations.

Table 8-1. Ten-Year Future Conditions Wastewater Flows

ID	***Development[1] Name***	***Development Type***	***Ten-Year Future Conditions Wastewater Flows)***	
			Equivalent Residential Connection	***Wastewater Flows (gpd)***
A	**Palm Vista (Lennar)**	Residential, Mixed	1,800	378,000
B	**Palm Vista Everlands**	Residential, Mixed	0	
C	**SJRWMD Property**	Single Family Residential	220.8	46,368
		Multi-Family Residential	324	68,040
D	**St Johns Preserve**	Residential, Mixed	248	52,080
E	**Fred Poppe Park RV Campground**	Commercial/RV	0	
F	**Lennar South**	Residential, Mixed	352	73,920
G	**Three Forks**	Mixed Use	0	
H	**Malabar Estates**	Single Family Residential	77	16,170
I	**Chapparal**	Single Family Residential	240.8	50,568
		Multi-Family Residential	75	15,750
J	**Brentwood Phase 3**	Single Family Residential	0	
K	**Sanibel Cove**	Single Family Residential	0	
L	**Avery Springs**	Single Family Residential	0	
M	**Minton Road Airforce Facility**	Mixed-Use	65	13,650
N	**Health First Wellness Village**	Mixed Use	0	
O	**Minton Road Commercial**	Commercial	0	
P	**City Hall Expansion**	Municipal	0	
Q	**AD1 Global**	Mixed Use Commercial	0	
R	**Sabal Key**	Single Family Residential	0	
S	**Country Club Lakes Estates I-IV (LS-107)**	Single Family Residential	0	
S	**Reserve at County Club Lakes Estates**	Single Family Residential	0	
		Multi-Family Residential	0	
T	**Westshore Apartments**	Multi-Family Residential	0	
U	**Northshore**	Residential	0	
		Commercial	0	

ID	Development[1] Name	Development Type	Ten-Year Future Conditions Wastewater Flows)	
			Equivalent Residential Connection	Wastewater Flows (gpd)
	(Aqua Apartments) (Private LS)			
V	Clearmont Trace	Multi-Family Residential	0	
W	Pelican Harbor Marina	Commercial	0	
X	Eztopeliz	Mixed-Use / Multi-Family Residential	311.25	65,363
W	Tropical Arms Apartments	Residential	0	
Z	Twin Lakes (Malabar)	Residential	0	
BB	Joe Daddy Golf Course Property	Multi-Family Residential	0	
		Commercial	0	
CC	Crown Square	Multi-Family Residential	0	
		Potential Building Space	0	
DD	San Filippo Apartments	Residential	0	
EE	Gulfport Key	Single Family Residential	0	
FF	Bayridge (LS-108)	Single Family Residential	0	
GG	Richmond Estates	Single Family Residential	0	
HH	Wingham	Residential, mixed	250	52,500
II	Hampton Manor (Private LS)	Assisted Living Facility	0	
		Multi-Family Residential	0	
JJ	Eagle Crest	Single Family Residential	54	11,340
KK	Preserves at Stonebriar (LS-106)	Single Family Residential	0	
LL	Rolling Meadows		935.6	196,476
MM	Waterstone Phase II		0	
MM	Waterstone/Cypress Bay West		0	
NN	Cypress Bay (LS-109)		0	
OO	Emerald Lakes - West of I-95	Residential, Mixed	1,510	317,100
PP	Emerald Lakes - East of I-95	Residential, Mixed	871.6	183,036
QQ	Pete Holdings (Jeff Lee)	Residential, Mixed	983	206,430
RR	Micco Village	Mixed-Use	240	50,400
	Calumet Farms		0	
	Willowbrook		0	378,000
		Total	**8,558**	**1,797,191**

1. Development areas without values shown above have planned development in the five- and twenty-year development horizons. Refer to **Figure 8-1** for locations of proposed development areas.

It should be noted that these development projections are fluid, have changed continuously throughout this analysis, and will continue to change as the developments evolve. The proposed southern developments, including Ashton Park, significantly impact system requirements in the south of the city. ERC estimates for these developments are expected to be updated soon and will inevitably affect the sizing and orientation of proposed improvements in this area. Considerations for the sensitivity and uncertainty of this issue are discussed in the following sections.

All future development flows were added to their collecting lift stations. Many of these proposed developments require additional lift stations that will be added to the City network in the future. These lift stations were represented using the best available data for the stations that have progressed through at least preliminary design. However, many stations have not been designed and were represented with standard lift station designs in accordance with City standards. Pumps were sized based on flow projections and anticipated pressures in the system.

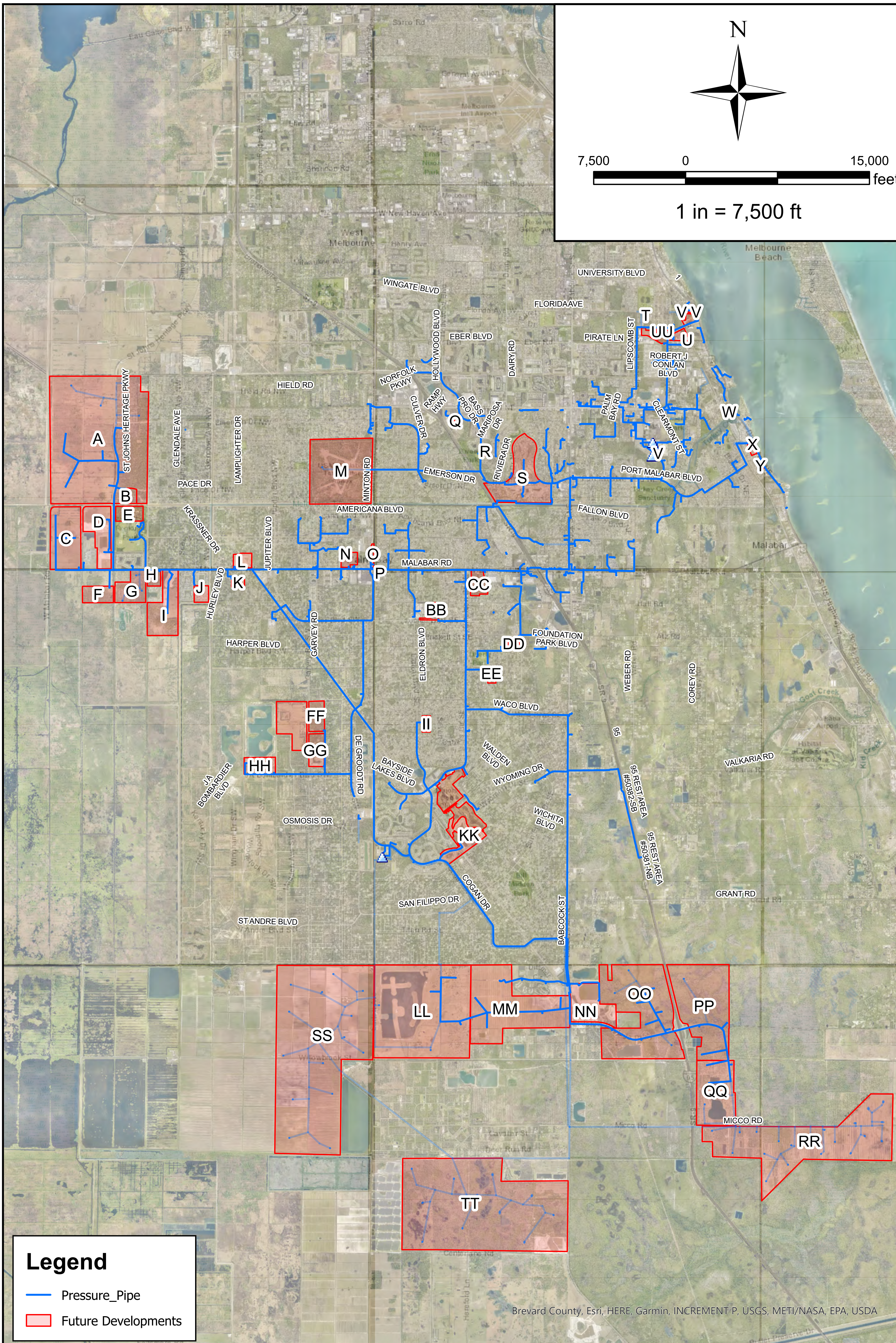

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FIGURE NO. **8-1**

The representation of these lift stations will almost certainly change as these developments progress towards completion, though it is important for modeling purposes to capture the intermittent pumping nature of the system within the hydraulic model rather than using a more simplified approach to model flows for future developments. This approach will characterize the impacts of these developments at the system-wide scale and will allow for more detailed analysis at the development scale as the design progresses in the future.

8.4 Ten-Year Future Wastewater Collection System Conditions Evaluation

This evaluation of future conditions serves to assess the performance of the city-wide wastewater collection system as it operates in the 100-year planning horizon.

8.4.1 Treatment Plant Capacity

A summary of the modeled wastewater flows to each wastewater treatment facility is provided in the table below.

Table 8-2. Ten-Year Future Conditions Modeled Treatment Plant Flows

Treatment Plant	*Modeled Average Daily Flow (MGD)*	*Annual Average Daily Flow Permitted Capacity (MGD)*	*Modeled Max Day Peak Hour Flow (MGD)*	*Peak Hourly Flow Hydraulic Capacity (MGD)*
NRWWTP	3.88	4.0[1]	7.32	8.0[2]
NRWRF	0.75	1.2[1]	1.55	2.5[3]
SRWRF	4.24	5.0[4]	10.2	10.0[5]
Total	**8.87**	**7.2**	**19.1**	**20.5**

1. From State of Florida Domestic Wastewater Facility Permit #FLA103357.
2. From Sheet G-3: Hydraulic Profile in Port Malabar Wastewater Treatment Plant Expansion to 4.0 MGD, 1985 sheet set.
3. From Sheet G-5: Hydraulic Profile in Nutrient Removal Facilities Permit Set, 2019 sheet set.
4. Including 1.0 MGD incremental increase identified as a ten-year capital improvement need.
5. Assuming analogous treatment to retain 2:1 hydraulic: permitted capacity ratio and including 1.0 MGD incremental increase identified.

The combined hydraulic capacity of the two (2) northern plants is 1.63 MGD greater than the max day peak hour flows, though flow controls remain necessary to direct flows towards the NRWWTP and away from the NRWRF during periods of peak flows. This flow control is necessary to prevent hydraulic overloading of the NRWRF as previously described.

To accommodate increased flows in the southern portion of the city and diversion of flows from the western portion of the city, the permitted and hydraulic capacities of the SRWRF must be increased. The SRWRF can be expanded in 1.0 MGD AADF and 2 MGD PH increments. An expansion to a minimum of 5 MGD AADF and 10 MGD PHF will be required for the 10-year planning horizon. Also, as the model suggests the peak flows to the SRWRF may be approaching or exceeding the hydraulic capacity, the next master planning modeling update will need to further evaluate the projected peak flows to the SRWRF.

8.4.2 Gravity System Performance

Gravity's main surcharging issues were previously identified and addressed as capital improvement needs. These improvements rectified the surcharging issues and no additional issues are identified in the ten-year planning horizon.

However, there are still instances of surcharged gravity lines directly upstream of lift stations scattered throughout the city as a result of overlapping lift station operating bands. This is identical to the five-year planning horizon and will persist unless addressed.

8.4.3 Lift Stations Performance

Existing underperforming lift stations were identified and designated for pump upsizing as previously described. No additional existing lift station performance issues were identified in this ten-year planning horizon. Future lift stations were represented as previously described and performed adequately.

8.4.4 Malabar Booster Station 1 (MBS01)

The incorporation of Regional Lift Station 1 (RLS01) repumps lift station on Malabar Rd as previously described. This station becomes incapable of passing the required flows in the ten-year planning horizon.

To adequately convey the additional flows from the west, Malabar Booster Station 1 (MBS01) was incorporated into the model. This station was conceptualized as a four (4)-pump inline booster station configuration as described in the Regional Pump Station No. 1 100% Design Drawing Set prepared by Wade Trim in February 2019 (Wade Trim, 2019). This station would operate as a series of VFD-operated inline booster pumps rather than a conventional master lift station with a wet well. The major difference is that the inline boosters pump would simply increase the force main pressure while the regional lift station dumps the force main to free discharge in the wet well before pumping the flow.

8.4.5 Force Main Velocities

8.4.5.1 Low Velocities

Maximum force main velocities are generally within the 2 to 5-foot-per-second (fps) target range throughout the system. A few new force mains in Pete Holdings and Rolling Meadows Lakes experience low velocities less than the desired scouring velocity of 2 fps. These lines are sized to accommodate the significant additional flows anticipated in the twenty-year planning horizon as development progresses. The same is true for the ends of lines in the west of the city along Malabar Rd and St Johns Heritage Pkwy.

Velocities in the south along Babcock St and Waco Blvd also experience low velocities as a result of the connection with the new line along Cogan Dr. These lines may benefit from being valved on one (1) end, depending on the direction southern development flows are conveyed.

Approximately 106,000 LF of force main experience maximum velocities less than 2 fps under the max day condition. This comprises approximately 16% of the total force main network by length.

8.4.5.2 High Velocities

Approximately 109,000 LF of force main experience maximum velocities greater than 5 fps under the max day condition. This comprises approximately 16% of the total force main network by length. Elevated velocities in downsized pipes connected to larger pipes at either end, in short segments of individual lift station discharge force mains, and in treatment plant influent lines as previously described are not of concern at this stage.

Additional force mains in the northeast of the city occasionally experience elevated velocities, though due to the low pressures in this region, there is not a concern of generating excessive friction losses.

A notable change in the system is the establishment of the low-pressure zone upstream of the pumps along western Malabar Rd (RLS01 in the five-year planning horizon and MBS-01 in the ten-year planning horizon). Under existing conditions, this region experiences high pressures, and lift station pumps are sized accordingly. However, the pressures are significantly reduced when the new discharge condition changes to a free discharge to the wet well for RLS01 or inline booster pump intake for MPS01 which causes the larger existing pumps to run out and pump at very high velocities. It may be advantageous to replace these pumps with smaller pumps upon constructing the booster station to prevent the high discharge velocities observed here.

Additionally, velocities in force mains within Bayside Lakes and along Cogan Dr and Osmosis Dr leading to the SRWRF are elevated due to a combination of increased flows from the southern developments and decreased pressures resulting in existing pumps operating at high discharge velocities, similar to as described above. An evaluation of downsizing some of these existing pumps is warranted and the influence of southern developments will become clearer as these flow projections are updated.

Figures depicting the ten-year planning horizon maximum force main velocities for the average day and max day design scenarios are provided in **Figures 8-2 through 8-3**.

8.4.6 Force Main Pressures

Force main maximum pressures are generally below 50 psi throughout the system under both average day and max day design scenarios. Notable exceptions include:

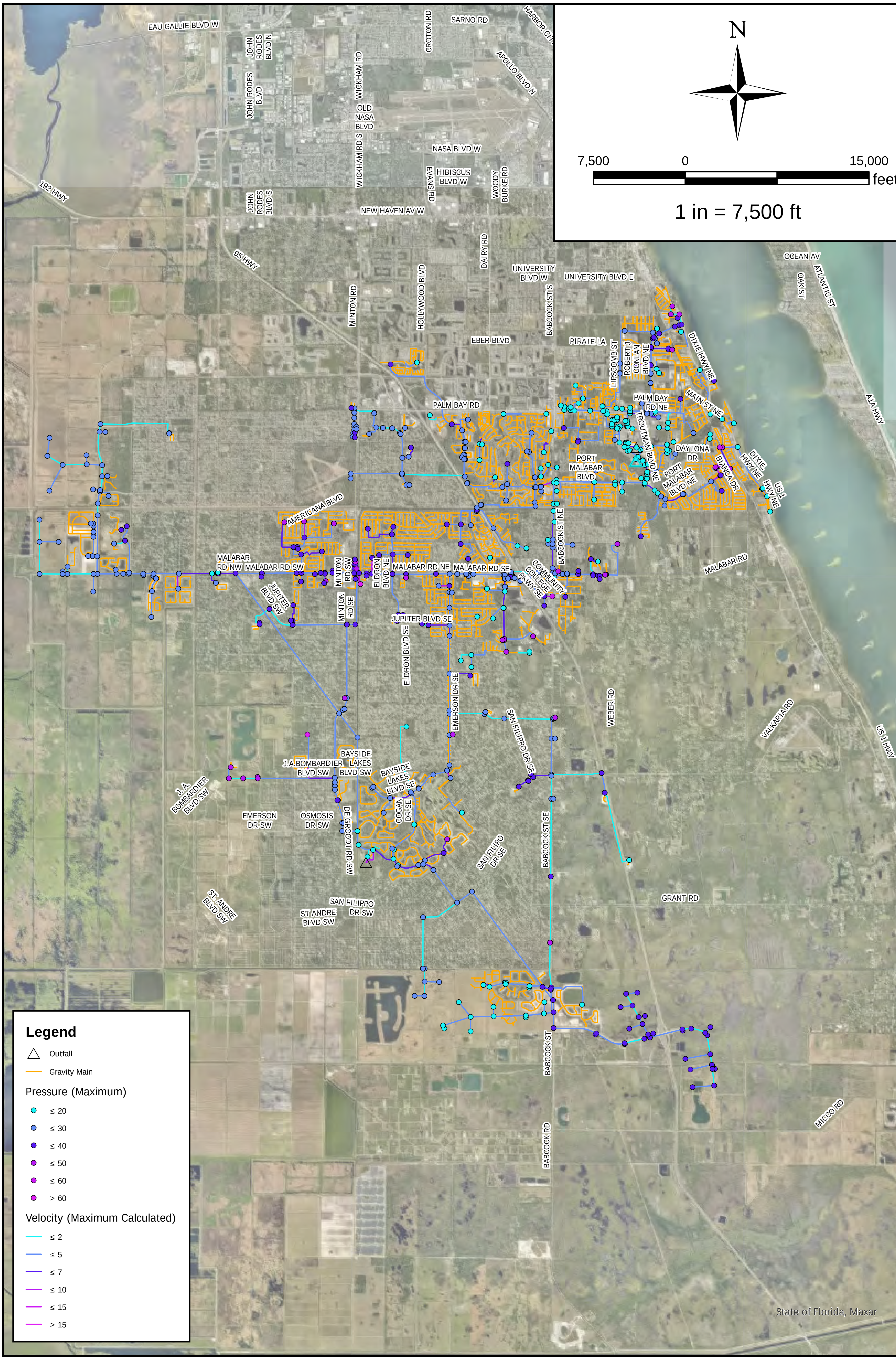
- J.A. Bombardier Blvd and Gaynor Dr; and
- Malabar Rd East of MBS01.

The 6-in FM along J.A. Bombardier Blvd and the 4-in FM serving Richmond Estates/Bayridge along Gaynor Dr experience high pressures, in part due to the large pumps at LS108. This combination of line size and pump size will make it very difficult for pressures in this line to ever reduce significantly and further investigation of reducing pump sizes should be conducted upon construction of the Florida Power & Light (FPL) utilities easement force main.

The significant flow volume conveyed by MBS01 raises pressures along Malabar Rd to the east of the station through Emerson Dr, though not beyond the 50-psi target threshold. If pressures increased above the City’s tolerance, valving could be incorporated to direct flows to the south along the new 20-in force main extension routed through the FPL easement.

Maximum pressures are marginally higher throughout the city during the max day scenario as compared to the average day scenario, though the same spatial trends are observed. Pressures in the northeast of the city remain low, as do pressures upstream of MBS01 in the newly established pressure zone. Pressures in the new developments at the south of the city approach but do not exceed the 50-psi target threshold, though will be highly sensitive to changes in development size and layout.

Figures depicting the ten-year planning horizon maximum pressures for the average day and max day design scenarios, with and without MPS01, are provided in **Figures 8-2 to 8-3**.



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Wastewater Master Plan
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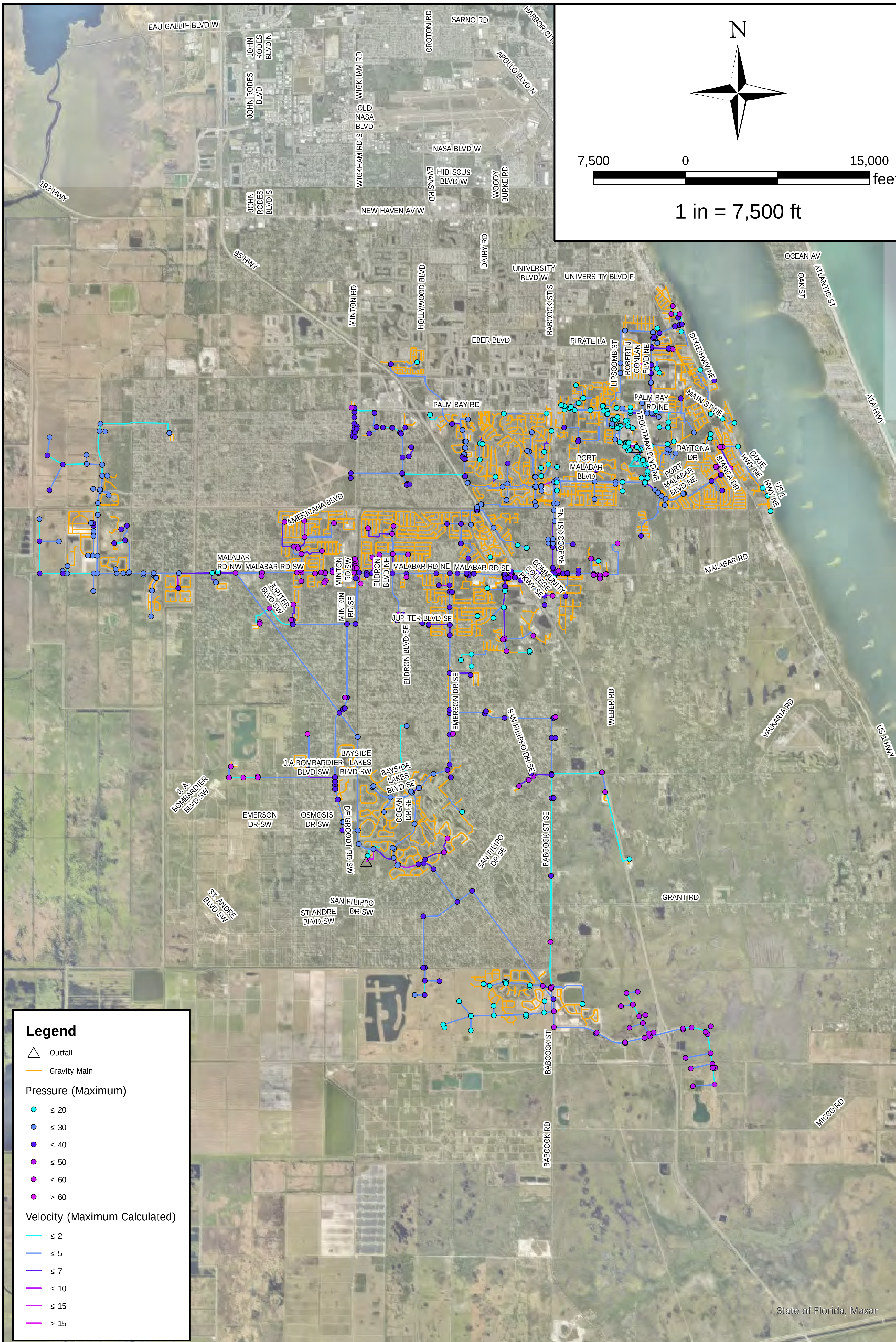
FIGURE NO. **8-2**



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10-Year Conditions
Maximum Day Maximum Values
Wastewater Master Plan
City of Palm Bay Utilities Department

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FIGURE NO.
8-3

8.5 Ten-Year Future Conditions Wastewater Collection System Capital Improvement Needs

Capital improvement needs have been considered for the ten-year time horizon and are included in the ten-year model. **Table 8-3** provides the anticipated capital improvement needs for the ten-year wastewater system improvements. See **Figure 8-6** for locations of proposed capital improvement needs.

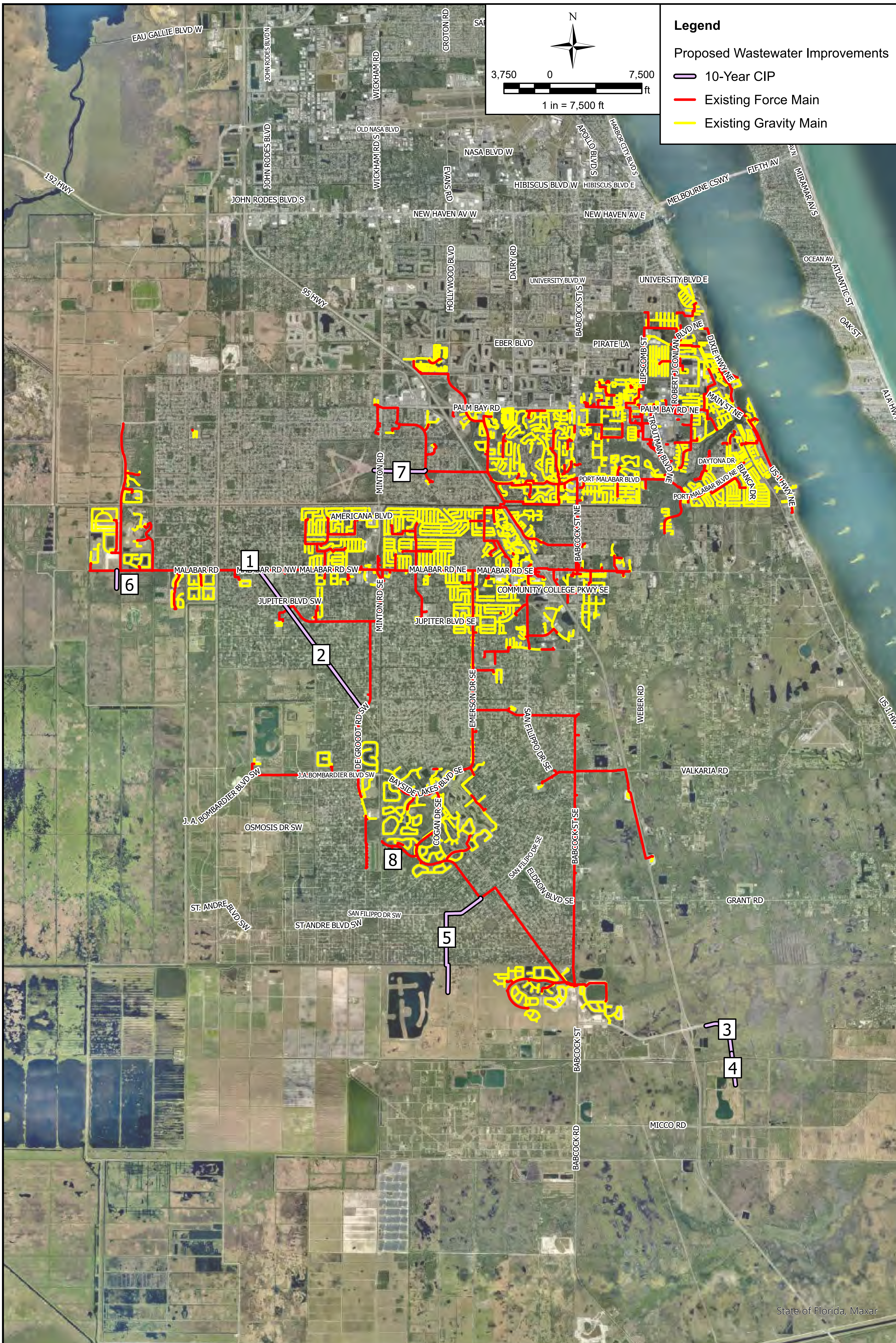
Table 8-3. Ten-Year Future Conditions Wastewater Collection System Capital Improvements Needs

Ten-year Capital Improvements Needs	***Trigger***
CIP No. 1: Construct Malabar Booster Station 1 (MBS01) with four inline booster pumps	Peak Upstream Flows Exceeding 2,800 gpm
CIP No 2: Construct 14,186 LF of 20-in FM along FPL Easement from Degroodt Rd to Malabar Rd	Construction of MBS01
CIP No. 3: Construct 3,895 LF of 16-in FM along St Johns Heritage Pkwy from Emerald Lakes East to Pete Holdings	Connection of Emerald Lakes East or Pete Holdings
CIP No. 4: Construct 2,600 LF of 12-in FM along St Johns Heritage Pkwy within Pete Holdings	Connection of Pete Holdings
CIP No. 5: Construct 9,850 LF of 12-in FM from Rolling Meadows Lakes to Cogan Dr	Connection of Rolling Meadows Lakes
CIP No. 6: Construct 1,442 LF of 8-in FM from Lennar South to Malabar Rd	Connection of Lennar South
CIP No. 7: Construct 4,229 LF of 6-in FM from Minton Road Air Force Facility to existing FM	Connection of Minton Road Air Force Facility
CIP No. 8: Increase permitted and hydraulic capacities of SRWRF to 5 MGD AADF/ 10 MGD PHF	Rule 62-600.405, F.A.C.

The following is a summary of the proposed wastewater collection system capital improvement needs including a general description of improvements and purpose for improvement.

- **10-Year CIP No. 1 – Construct Malabar Booster Station 1 (MBS01) with four (4) inline Booster Pumps:** Significantly larger regional pump station to replace the repumping duties of RLS01. This station will keep pressures low to the west along Malabar Rd while being able to accommodate the increased flows from the upstream proposed developments.

- **10-Year CIP No. 2 – Install 20-in FM Extension along FPL Easement from Degroodt Rd to Malabar Rd:** Force main extension to alleviate pressures in the west of the city and direct flows to the SRWRF. This provides a more direct route to the SRWRF and alleviates pressures generated by MBS01.
- **10-Year CIP No. 3 – Install 16-in FM Extension along St Johns Heritage Pkwy from Emerald Lakes East Future Development to Pete Holdings Future Development:** Force main extension to provide connectivity and capacity for Emerald Lakes East and additional developments to the south and east. This FM extension is required to begin service to these developments.
- **10-Year CIP No. 4 – Install 12-in FM Extension along St Johns Heritage Pkwy within Pete Holdings Future Development:** Force main extension to provide connectivity and capacity for Pete Holdings and additional developments to the south and east. This FM extension is required to begin service to these developments.
- **10-Year CIP No. 5 – Install 12-in FM Extension from Rolling Meadows Lakes Future Development to Cogan Dr:** Force main extension to provide connectivity and capacity for Rolling Meadows Lakes into the proposed FM extension along Cogan Dr. This FM extension is required to continue service to this development.
- **10-Year CIP No. 6 – Install 8-in FM Extension to Serve Lennar South Future Development:** Force main extension to provide connectivity and capacity for Lennar South. This FM extension is required to begin service to this development.
- **10-Year CIP No. 7 – Install 6-in FM Extension to Serve Minton Road Air Force Facility Future Development:** Force main extension to provide connectivity and capacity for Minton Road Air Force Facility. This FM extension is required to begin service to this development.
- **10-Year CIP No. 8 – Increase SRWRF Capacity:** Increase permitted and hydraulic capacities of SRWRF to 5 MGD AADF / 10 MGD PHF, respectively. This accommodates projected flows and should be completed following Florida Administrative Code Section 62-600.



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10-Year Future Conditions
Capital Improvements Needs Locations
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FIGURE NO.
8-4

8.6 Observations and Recommendations

8.6.1 Observations

The City's wastewater collection system operates adequately under the ten-year planning horizon with the implementation of projects to address the ten-year capital improvement needs described in **Table 8-3**.

Significant future development necessitates the expansion of the SRWRF to increase its capacity and flow control between the northern plants remains necessary to prevent hydraulic overloading of the NRWRF. Increased pressures in the central west of the city continue to be alleviated by an extension of the new force main along the FPL easement to Malabar Rd, redirecting flows to the SRWRF from the north regional treatment plants. Additional force mains connecting the southern developments to the SRWRF are required to address flows in the south of the city.

The construction of MBS01 is crucial to accommodating future development flows in the western portion of the city. Additionally, existing pump sizes upstream of MBS01 should be evaluated to prevent pumps from running out, resulting in high velocities and pressures that prevent the system from reaping the fullest benefits of the newly established low-pressure zone.

Line sizes throughout the south of the city become highly sensitive to the size, timing, and lift station orientation preferences of these developments. Further investigation of the Bombardier Blvd force main and pump sizes is also warranted to address high pressures at this extremity of the system.

Additional improvements will likely be necessary in future planning horizons for the southern region of the city as development in these areas continues. This may include the upsizing of lines proposed in this technical memorandum if deemed necessary to accommodate flows at later planning horizons. All capital improvement needs will be evaluated at that time and updated, if necessary, following the upcoming discussion with City staff, and updated Ashton Park flows.

8.6.2 Recommendations

It is recommended that the City implement projects to address the ten-year wastewater collection system capital improvement needs as described above in **Table 8-3.**

Section 9 - Twenty-Year Future Conditions Wastewater Collection System Needs Evaluation

9.1 Introduction

Section 9 of the City of Palm Bay Wastewater Master Plan makes use of the wastewater collection system hydraulic model to evaluate the future condition infrastructure needs of the system at the twenty-year planning horizon as described below:

a) Evaluate the performance of the wastewater collection system model in each of the three (3) planning horizons (five-, ten-, and twenty-year).
b) Evaluate the gravity sewer trunk system (10-in in diameter and larger) to identify areas that may be experiencing surcharging and pipes that are over or near capacity during peak flows.
c) Evaluate lift stations to identify any that are nearing capacity.
d) Evaluate force mains to identify any that are experiencing excessive velocities and identify and size gravity sewer, lift stations, and force mains necessary to serve future development.
e) Identify upgrades to the existing system needed to meet projected wastewater flows.

9.2 Model Development

Refer to **Section 5** for additional information describing the modeling framework and model calibration.

9.3 Twenty-Year Future Conditions Wastewater Flows

The City identified many anticipated future developments that will contribute to sanitary flows to the wastewater collection system. A projected number of ERCs and phasing were provided for each development. Thirteen of these future developments are expected to contribute to wastewater flows for the twenty-year planning horizon.

The City also provided information for vacant properties in each lift station service area. It is assumed that these properties will be developed, at which point they will connect to the respective gravity system. These connections were divided evenly between the ten-year and twenty-year planning horizons and flows were assigned accordingly.

The Ashton Park development was omitted from the analysis at this time, though its addition will likely affect required improvements.

Wastewater flows from some 17,539 ERCs were added in the twenty-year planning horizon as shown in **Table 9-1** below. A graphical depiction of the location of the twenty-year planning horizon future developments can be found in **Figure 9-1**.

Table 9-1. Twenty-Year Future Conditions Wastewater Flows

ID	*Development[1] Name*	*Development Type*	*Twenty-Year Future Conditions Wastewater Flows)*	
			Equivalent Residential Connection	*Wastewater Flows (gpd)*
A	**Palm Vista (Lennar)**	Residential, Mixed	1,800	378,000
B	**Palm Vista Everlands**	Residential, Mixed	0	
C	**SJRWMD Property**	Single Family Residential	276	57,960
		Multi-Family Residential	0	
D	**St Johns Preserve**	Residential, Mixed	124	26,040
E	**Fred Poppe Park RV Campground**	Commercial/RV	0	
F	**Lennar South**	Residential, Mixed	0	
G	**Three Forks**	Mixed Use	814	170,940
H	**Malabar Estates**	Single Family Residential	0	
I	**Chapparal**	Single Family Residential	0	
		Multi-Family Residential	0	
J	**Brentwood Phase 3**	Single Family Residential	0	
K	**Sanibel Cove**	Single Family Residential	0	
L	**Avery Springs**	Single Family Residential	0	
M	**Minton Road Airforce Facility**	Mixed-Use	585	122,850
N	**Health First Wellness Village**	Mixed Use	0	
O	**Minton Road Commercial**	Commercial	0	
P	**City Hall Expansion**	Municipal	0	
Q	**AD1 Global**	Mixed Use Commercial	0	
R	**Sabal Key**	Single Family Residential	0	
S	**Country Club Lakes Estates I-IV (LS-107)**	Single Family Residential	0	
S	**Reserve at County Club Lakes Estates**	Single Family Residential	0	
		Multi-Family Residential	0	
T	**Westshore Apartments**	Multi-Family Residential	0	
U	**Northshore**	Residential	0	
		Commercial	0	

ID	Development[1] Name	Development Type	Twenty-Year Future Conditions Wastewater Flows)	
			Equivalent Residential Connection	Wastewater Flows (gpd)
	(Aqua Apartments) (Private LS)			
V	Clearmont Trace	Multi-Family Residential	0	
W	Pelican Harbor Marina	Commercial	0	
X	Eztopeliz	Mixed-Use / Multi-Family Residential	103.75	21,788
W	Tropical Arms Apartments	Residential	0	
Z	Twin Lakes (Malabar)	Residential	0	
BB	Joe Daddy Golf Course Property	Multi-Family Residential	0	
		Commercial	0	
CC	Crown Square	Multi-Family Residential	0	
		Potential Building Space	0	
DD	San Filippo Apartments	Residential	0	
EE	Gulfport Key	Single Family Residential	0	
FF	Bayridge (LS-108)	Single Family Residential	0	
GG	Richmond Estates	Single Family Residential	0	
HH	Wingham	Residential, mixed	250	52,500
II	Hampton Manor (Private LS)	Assisted Living Facility	0	
		Multi-Family Residential	0	
JJ	Eagle Crest	Single Family Residential	0	
KK	Preserves at Stonebriar (LS-106)	Single Family Residential	0	
LL	Rolling Meadows		935.6	196,476
MM	Waterstone Phase II		0	
MM	Waterstone/Cypress Bay West		0	
NN	Cypress Bay (LS-109)		0	
OO	Emerald Lakes - West of I-95	Residential, Mixed	,1132.5	237,825
PP	Emerald Lakes - East of I-95	Residential, Mixed	871.6	183,036
QQ	Pete Holdings (Jeff Lee)	Residential, Mixed	983	206,430
RR	Micco Village	Mixed-Use	360	75,600
	Calumet Farms		3,304	693,840
	Willowbrook		6,000	1,260,000
		Total	**17,539**	**3,683,285**

1. Development areas without values shown above have planned development in the five- and ten-year development horizons. Refer to **Figure 9-1** for locations of proposed development areas.

It should be noted that these development projections are fluid and will continue to change over time as the developments evolve. The proposed southern development's location within the utility wastewater system and its intensity level significantly impact system requirements in the south of the city. As the scale and timing of these developments evolve, the required wastewater system improvements will need to be adjusted accordingly.

All future development wastewater flows were conveyed to their respective lift stations. Many of these proposed developments require the construction of additional lift stations that will be added to the City network in the future. These lift stations were represented in the wastewater model framework using the best available data for the stations that have progressed through at least preliminary design. However, many stations have not been designed and were represented as standard lift station designs in accordance with City standards. Pumps were sized based on flow projections and anticipated pressures in the system. The modeled representation of these lift stations will almost certainly change as these developments progress toward completion, though it is important for modeling purposes to capture the intermittent pumping nature of the system within the hydraulic model rather than using a more simplified approach to model flows for future developments. This approach will characterize the impacts of these developments at the system-wide scale and will allow for more detailed analysis at the development scale as the design progresses in the future.

9.4 Twenty-Year Future Wastewater Collection System Conditions Evaluation

This evaluation of future conditions serves to assess the performance of the city-wide wastewater collection system as it operates in the twenty-year planning horizon.

9.4.1 Treatment Plant Capacity

A summary of the modeled wastewater flows to each wastewater treatment facility is provided in the table below.

Table 9-2. Twenty-Year Future Conditions Modeled Treatment Plant Flows

Treatment Plant	*Modeled Average Daily Flow (MGD)*	*Annual Average Daily Flow Permitted Capacity (MGD)*	*Modeled Max Day Peak Hour Flow (MGD)*	*Peak Hourly Flow Hydraulic Capacity (MGD)*
NRWWTP	4.23	4.0[1]	7.77	8.0[2]

Treatment Plant	Modeled Average Daily Flow (MGD)	Annual Average Daily Flow Permitted Capacity (MGD)	Modeled Max Day Peak Hour Flow (MGD)	Peak Hourly Flow Hydraulic Capacity (MGD)
NRWRF	0.97	1.2[1]	2.58	2.5[3]
SRWRF	8.09	8.0[4]	18.63	16.0[5]
Total	**13.3**	**10.2**		**25.5**

1. From State of Florida Domestic Wastewater Facility Permit #FLA103357
2. From Sheet G-3: Hydraulic Profile in Port Malabar Wastewater Treatment Plant Expansion to 4.0 MGD, 1985 sheet set
3. From Sheet G-5: Hydraulic Profile in Nutrient Removal Facilities Permit Set, 2019 sheet set
4. Including 1.0 MGD incremental increase identified as a ten-year capital improvement need.
5. Assuming analogous treatment to retain 2:1 hydraulic: permitted capacity ratio and including 1.0 MGD incremental increase identified.

9.4.2 Gravity System Performance

Gravity main surcharging issues were previously identified and addressed as capital improvement needs. These improvements rectified the modeled gravity system surcharging conditions and no additional issues are identified in the twenty-year planning horizon.

However, there are still instances of surcharged gravity lines directly upstream of lift stations scattered throughout the city as a result of -in pump on-in floats set above influent gravity inverts. This is identical to the ten-year planning horizon and will persist unless addressed.

9.4.3 Master Pump Stations

Following a discussion with City staff, flow routing in the southeastern future development area was updated to reflect the intended use of LS-93 as a master lift station for a portion of the developments in this area. This configuration directs all Waterstone and Cypress Bay flows into LS-93 which then discharges into the proposed transmission force main extending through the FPL easement. Other future developments to the east of Babcock St convey flows along St Johns Heritage Pkwy and into the FPL easement force main, though are not repumped at LS-93.

In addition to utilizing LS-93 as a master lift station, the significance and potential benefit of requiring large developments to discharge into the City system from a single master pump station utilizing variable frequency drives (VFDs) was discussed with City staff. As previously described, the high degree of lift station manifolding that exists in the City contributes to the chronic oversizing of pumps, resulting in elevated pressures. The incorporation of master repump stations with VFDs at each of the large future developments will assist in dampening pressure spikes that would be generated by numerous competing manifolded stations. This reduces the size and width of the operating band required on new pumps, which could otherwise make proper pump selection challenging. Of particular emphasis are the anticipated developments in the southeast of the city.

To remain conservative and follow the prior city-wide trend, new stations were modeled as discrete manifolded stations in this analysis, though the incorporation of master pump stations should be assessed as developments approach more refined planning levels.

9.4.4 Force Main Velocities

9.4.4.1 Low Velocities

Maximum force main velocities are generally within the 2 to 5 foot per second (fps) target range throughout the system with only a select few force mains observed to be experiencing velocities less than the desired scouring velocity of 2 fps. These lines are predominantly in the south along Babcock St and Waco Blvd after the rerouted LS93 discharges into the FPL easement force main. The section of this force main from LS-93 to approximately Wyoming Dr may benefit from being valved off but not abandoned as it could be utilized as a bypass in the event of a line break in the southern portion of the city. The remaining section serving smaller lift stations could be maintained by periodically operating both pumps in these lift stations to create scouring events.

Approximately 40,000 LF of force main experience maximum velocities less than 2 fps under the max day condition. This comprises approximately 5% of the total force main network by length.

9.4.4.2 High Velocities

Approximately 103,000 LF of force main experience maximum velocities greater than 5 fps under the max day condition. This comprises approximately 13% of the total force main network by length. Elevated velocities in downsized pipes connected to larger pipes at either end, in short segments of individual lift station discharge force mains, and in treatment plant influent lines are as previously described and are not of engineering significance.

Additional force mains in the northeast of the city occasionally experience elevated velocities, though due to the low pressures in this region, there is not a concern of generating excessive friction losses.

Figures depicting the twenty-year planning horizon maximum force main velocities for the average day and max day design scenarios are provided in **Figures 9-2 and 9-3**.

9.4.5 Force Main Pressures

Force main maximum pressures are generally below 50 psi throughout the system under both average day and max day scenarios. Notable exceptions include:

- J.A. Bombardier Blvd and Gaynor Dr and
- MBS01 Discharge

The significant flow volume conveyed by MBS01 raises pressures in the discharge force main along Malabar Rd to the east of the station. However, as flows are conveyed new 20-in force main extension routed through the FPL easement, pressures remain acceptable and the existing network along Malabar Rd is shielded from the impact of these increased flows.

Maximum pressures are marginally higher throughout the city during the max day scenario as compared to the average day scenario, though the same spatial trends are observed. Pressures in the northeast of the city remain low, as do pressures upstream of MBS01. Pressures in the new developments at the southeast of the city approach but do not exceed the 50-psi target threshold, though will be highly sensitive to changes in development size and layout. Pressures in the new developments at the southwest of the city, serviced by a separate line to the SRWRF, experience notably lower pressures than those in the southeast of the city.

9.5 Twenty-Year Future Conditions Capital Improvement Needs

Several capital improvement needs are identified in this twenty-year planning horizon to maintain the integrity and optimal operation of the wastewater collection system. These needs are identified below in the table below with the circumstances that trigger each need. Improvements span all system components including treatment plants, pump stations, and force main network. A map showing the location of these twenty-year capital improvement needs is shown in **Figure 9-4**.

It is important to note that these improvement needs are very sensitive to the future development projections and lift station orientation preferences, both of which are still fluid. Additionally, Ashton Park is not considered in this analysis. The recommended improvement needs may change as the scale and timing of numerous large future developments continue to change.

Any substantial variations in development projections should prompt an evaluation of these improvements needs to verify they remain applicable.

Table 9-3. Twenty-Year Future Conditions Wastewater Collection System Capital Improvements Needs

Twenty-Year Capital Improvements Needs	***Trigger***
CIP No. 1: Install valve on existing 16-in FM east of intersection of existing 16-in Malabar Rd FM and proposed 20-in FPL powerline easement FM	Malabar Rd FM pressures exceeding 50 psi or hydraulic overloading at NRWWTP/NRWRF
CIP No.2: Construct 16,698 LF of 20" PVC Sanitary FM from SRWRF along DeGroodt and San Filippo to C-37 Canal for Willowbrook Development	Connection of Willowbrook and/or Calumet Farms
CIP No. 3: Construct 9,205 LF of 20-in FM within Willowbrook	Connection of Calumet Farms
CIP No. 4: Construct 14,876 LF of 16-in FM along FPL powerline easement from Calumet Farms to Willowbrook	Connection of Calumet Farms
CIP No. 5: Construct 7,286 LF of 16-in FM along Cogan Dr and Osmosis Dr from CIP No. 5: proposed 20-in FM tie-in at Cogan Dr to SRWRF	Addition of 8,700 total ERCs from Southern Developments
CIP No. 6: Increase permitted and hydraulic capacities of SRWRF to 8 MGD AADF / 16 MGD PHF, respectively	Rule 62-600.405, F.A.C.

The following is a summary of the proposed wastewater collection system capital improvement needs including a general description of improvements and general purpose for improvement.

- **20-Year CIP No. 1 – Install Valve on Malabar Rd FM:** Valve to direct flows from MBS01 through the proposed 20-in FPL powerline easement FM south to the SRWRF. This reduces pressures in the existing 16-in Malabar Rd FM to the east and prevents overloading the NRWWTP and NRWRF.
- **20-Year CIP No. 2 – Install 20-in FM Extension from SRWRF along DeGroodt and San Filippo to C-37 Canal for Willowbrook Development:** Force main extension to provide

connectivity and capacity for Willowbrook and Calumet Farms. This FM extension is required to begin service to these developments.

- **20-Year CIP No. 3 – Install 20-in FM Extension within Willowbrook:** Force main extension to provide connectivity and capacity for Willowbrook and Calumet Farms. This FM extension is required to expand service within Willowbrook and begin service to Calumet Farms.
- **20-Year CIP No. 4 – Install 16-in FM Extension along FPL Powerline Easement from Calumet Farms to Willowbrook:** Force main extension to provide connectivity and capacity for Calumet Farms. This FM extension is required to begin service to this development.
- **20-Year CIP No. 5 – Install 16-in FM Extension along Cogan Dr and Osmosis Dr from Proposed 20-in FM Tie-In at Cogan Dr to SRWRF:** Force main extension alongside existing force main (dual pipe configuration) to provide capacity for Southern Developments. This FM extension is required once total southern development flows reach approximately 8,700 ERCs beyond the existing flow condition.
- **20-Year CIP No. 6 – Increase SRWRF Capacity:** Increase permitted and hydraulic capacities of SRWRF to 8 MGD AADF/16 MGD PHF. This accommodates projected flows and should be completed in accordance with Florida Administrative Code Section 62-600.

9.6 Observations and Recommendations

9.6.1 Observations

The City's wastewater collection system operates adequately under the twenty-year planning horizon with the implementation of projects to address the twenty-year capital improvement needs described in **Table 9 3**.

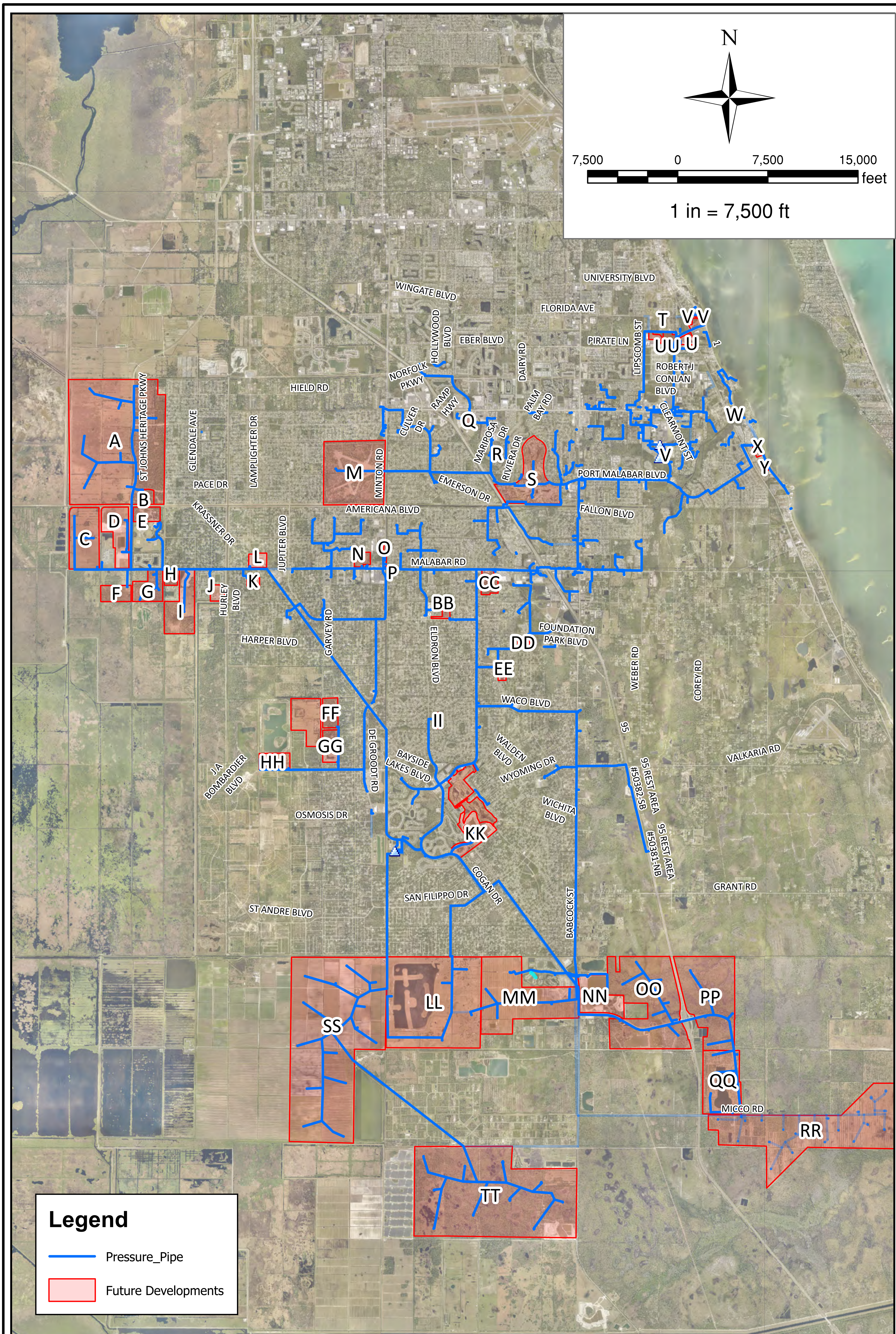
Further development in the southern and western portions of the city continues to necessitate expansion of the SRWRF. A valve installed east of the MBS01 discharge becomes necessary to route flows south to the SRWRF in order to prevent increased pressures downstream along Malabar Rd and to avoid hydraulically overloading the two (2) northern plants, which become susceptible to peak flows in this twenty-year planning horizon. Large-diameter force main extensions are required to serve sizable developments in the southeast and southwest extremities of the City system. The significant flows and long force main distances create a hydraulicly challenging situation for the existing manifold system.

For optimal system performance, large developments should discharge into the City system via large master pump stations operated with VFDs, rather than numerous lift stations being manifolded into the system throughout the development. This will reduce the required operating band of the pumps and limit pressure increases caused by competing stations during peak flow periods. The system becomes especially sensitive to this in the far south of the city.

Additional improvements will likely be necessary in future planning horizons for the southern region of the city as development in these areas continues. This may include the upsizing of lines proposed in this technical memorandum if deemed necessary to accommodate flows at later planning horizons. Additionally, this analysis does not consider the possibility of significant septic-to-sewer conversion efforts throughout much of the city. Considering the sizeable number of properties currently utilizing septic tanks, the impacts of a large-scale conversion effort would be significant and all capital improvement needs would need to be evaluated at that time. The inclusion of Ashton Park flows will also become necessary as this development progresses.

9.6.2 Recommendations

It is recommended that the City implement projects to address the twenty-year wastewater collection system capital improvement needs as described above in **Table 9-3**.



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20-Year Future Conditions Development Locations
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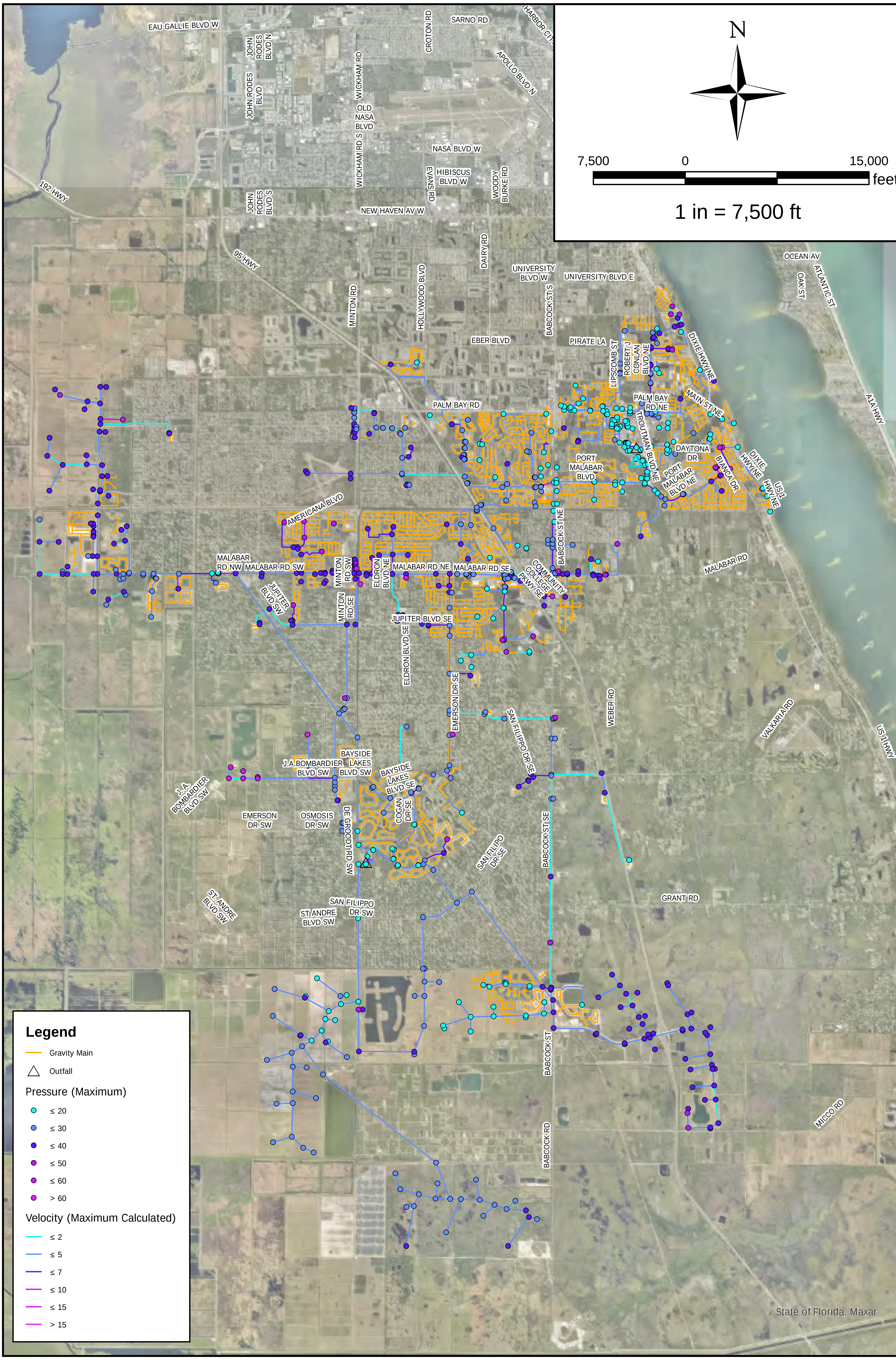
FIGURE NO. **9-1**



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20-Year Conditions
Average Day Maximum Values
Wastewater Master Plan
City of Palm Bay Utilities Department

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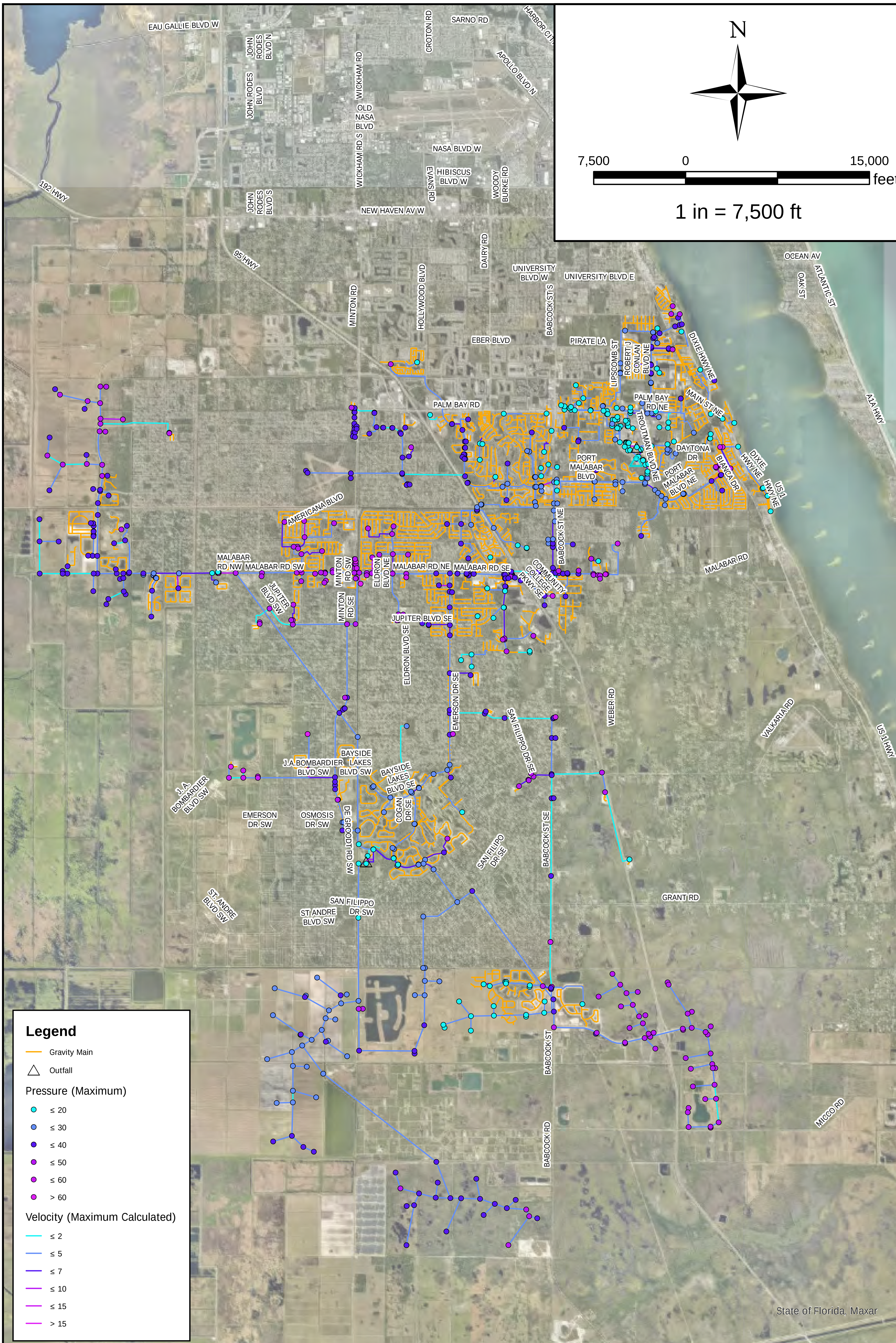
FIGURE NO.
9-2



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20-Year Conditions
Maximum Day Maximum Values
Wastewater Master Plan
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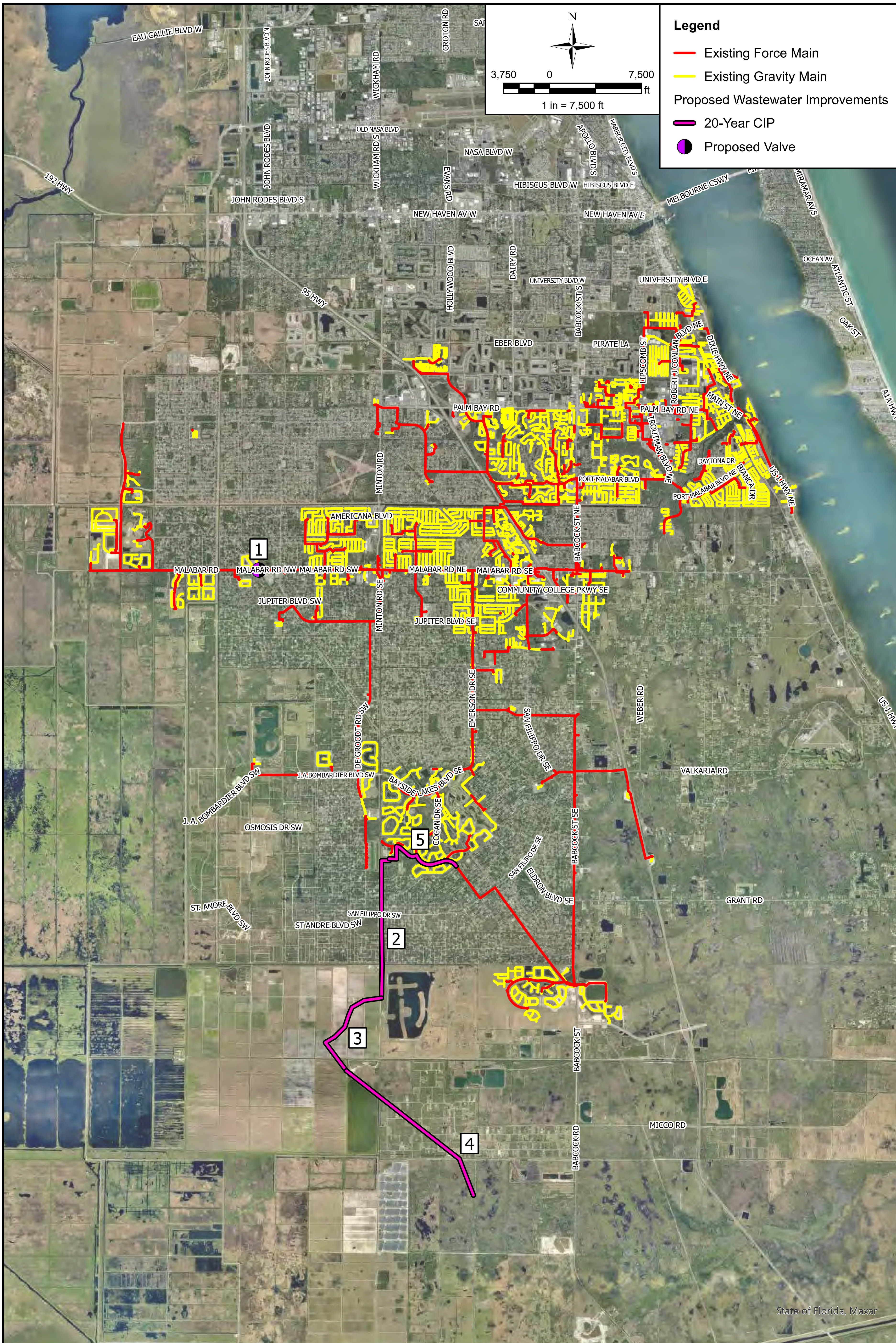
FIGURE NO. **9-3**



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20-Year Future Conditions
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FIGURE NO.
9-4

Section 10 - Existing Conditions Wastewater Treatment Facilities Needs Evaluation

10.1 Introduction

Section 10 of the City of Palm Bay Wastewater Master Plan will evaluate the condition of the existing wastewater treatment facilities including:

a) Review existing plans and records for the wastewater treatment facilities and equipment;
b) Review any existing operational issues or constraints with the WWTP operations staff;
c) Perform a site visit to review the condition and operation of the existing equipment; and
d) Review the hydraulic and treatment capacity of each unit process.

10.2 Approach

ISS staff prepared a general listing of the major treatment processes and equipment within each wastewater treatment facility through our previous knowledge of the City's facilities along with a review of project reports, drawings, and specifications. These listings were able to be confirmed through facility site visits along with interviews with plant operations and maintenance personnel. This information was used to prepare a condition assessment rating for the major treatment processes and equipment that rely upon the industry's typical renewal and replacement intervals. Following this work, a listing of the facilities was developed based upon infrastructure that is either approaching the end of its useful service life or the need to provide additional capacity to meet future needs.

It is important to note assessment of the DIW existing condition is beyond the scope of this project and is therefore left to the others.

10.2.1 Sources of Data

The City has provided ISS with a significant amount of background information regarding the North Regional Utilities wastewater facilities including record drawings of the existing facilities, contract drawings for the most recently completed upgrade projects and the FDEP Wastewater Facilities Operating permit renewal documentation. Through this data and ISS's long-term knowledge of the wastewater facilities, a compilation of the existing equipment and facilities assets has been prepared including the approximate year the asset was placed into service.

Sources of specific facility information include the following:

General Information

- Wastewater Master Plan, Wade Trim, October 2012
- SCADA Master Plan, Wade Trim, February 2015
- Wastewater Master Plan, Wade Trim, October 2017
- Operations and Performance Report, City of Palm Bay Wastewater Facilities, Wade Trim, April 2019
- Capacity Analysis Report, City of Palm Bay Wastewater Facilities, Wade Trim, April 2019
- Domestic Wastewater Facilities Permit Renewal Application Package Wade Trim, April 2019
- Florida Department of Environmental Protection Domestic Wastewater Facilities Permit No. FLA103357 Issued September 13, 2019
- Florida Department of Environmental Protection Wastewater Compliance Inspection Report August 2023.

North Regional Wastewater Treatment Plant

- Port Malabar Sewage Treatment Plant, Arthur Finney and Harold Schmidt Engineers, March 1962
- Aerobic Digester Addition to Sewer Plant Port Malabar Sewage Treatment Plant, August 1966
- Port Malabar Sewage Treatment Plant Expansion to 2.0 MGD, April 1975.
- Phase I Modifications of the Port Malabar Wastewater Treatment Plant Construction Drawings, CH2M Hill, October 1984
- North Regional Utilities Campus Class I Deep Injection Well Acidization, Wade Trim, October 2017
- North Regional Wastewater Treatment R&R Improvements Headworks, Digester, RAS/WAS Pump Station Bid Documents, Wade Trim, Jan 2019
- Deep Injection Well Reservoir Pond Liner Replacement Bid Documents, Wade Trim, May 2018
- Clarifier No 2 Design Bid Documents, Wade Trim, June 2020
- North Regional Wastewater Treatment Plant MCC-1 and Grit Area Improvements, Wade Trim, November 2021

North Regional Water Reclamation Facility

- Wastewater Treatment and Effluent Disposal System Part I 2.0 MGD Wastewater Treatment Plant, Dyer, Riddle, Mills, & Precourt, January 1989

- Water Reclamation Facility Process Air Pipe Replacement Bid Documents, Wade Trim. March 2017
- North Regional Water Reclamation Facility Nutrient Removal Facilities Basis of Design Report, Wade Trim, July 2018
- Reclaimed Water High Service Pump Area Improvements Bid Documents, Wade Trim, August 2019

10.2.2 Site Visits

Site visits were conducted to visually inspect the facility, document the major equipment, and interview the plant staff to determine the general condition of the facility's physical assets. The visual inspection was limited to observable above-grade features of the equipment and overall facilities.

Numerous condition factors were considered during the site visits to most effectively evaluate an asset's performance and expected replacement frequency. While most factors are specific to the type of asset, the following are examples of general condition assessment factors that are common to many water assets:

- Corrosion;
- Unusual Noise, Heat, or Odor when Operating;
- Excessive Vibration;
- Leaking Packing Glands;
- Evidence of Wear;
- Inability to Perform Designed Duty;
- Equipment Nonfunctional or Tagged-out;
- Safety Issues;
- Absence of Leaks; and
- Structural Integrity.

10.2.3 Asset Condition Rating Description

Direct visual observation has been used to assign an asset condition rating. The rating system uses condition ratings from "1 to 5" to reflect the physical state of the asset, from best to worst respectively. A condition rating of "1" implies the asset is nearly as good as a new asset. A condition rating of "5" implies that the asset should be replaced. This system is effective in identifying and expressing asset conditions and assisting in improving overall asset management practices.

Table 10-1. Asset Condition Rating

Asset Ranking	*Description of Condition*	*Maintenance Level*	*Percent of Asset Requiring Repair*	*Condition Fraction*
1	Very Good Condition	Normal Maintenance Required	0%	0.0
2	Minor Defects Only	Minor Maintenance Required	0 to 10%	0.2
3	Moderate Deterioration	Significant Maintenance Required	11 to 20%	0.5
4	Significant Deterioration	Significant Renewal/Upgrade Needed	21 to 49%	0.7
5	Asset Unserviceable	Requires Replacement	50% and above	0.9

1 Adapted from the International Infrastructure Manual
2. Defined as the value of the asset needed to return the assert to a Very Good condition rating
3. Estimate of percentage of the useful life consumed. For example, a condition fraction of 0.2 means 20% of the useful service life has been consumed or 80% of the useful service life remains.

When an asset may be assessed incompletely, such as obstructed portions of submerged equipment, it will be rated based on the response to verbal condition questions that will be answered by plant personnel.

10.2.4 Renewal/Replacement Intervals

The water/wastewater utilities industry have over time developed a range of typical renewal and replacement (R&R) internals for water and wastewater treatment unit processes and equipment. These R&R intervals have been developed by utility plant and maintenance staff based on field data for infrastructure capital asset management services. This information has been used as the basis for determining the remaining useful service of individual unit processes and equipment.

Table 10-2. Estimated Original Useful Life Based on Asset Type

	Asset Type	*Original Useful Service Life (yrs)*
Civil	Site Work	50
	Asphalt Paving	25
Structural	General	50
	Concrete	50
	Fiberglass	25
	Steel	25
	Plastic/RFP	10
	Coatings – High Performance	15
	Coatings – General	10
Mechanical	General	25
	Submersible Pump	15
	Positive Displacement Pump	20
	Blower	30
	Centrifugal Pump	20
	Equipment Motors	15
	Mechanical Gear Box	15
	Valves	30 to 40
	Chemical Feed Equipment	10
	Influent Mechanical Screens	30
	Clarifier Mechanisms	20
	Piping	50
	Belt Filter Press	25
Electrical	Switchgear & Motor Control Center	30
	Generator	30
	Variable Frequency Drives	20
	Elec Valve Actuators	30
Instrumentation	Sensors & Transmitters	15
	Automatic Sampler	20
	Flow Meters	30
Control Systems	PLCs	10
	SCADA	10

In general, most mechanical equipment would be expected to require rebuilding, reconditioning, or overhaul by the original equipment manufacturer at the mid-point of its useful service life. If this work has been delayed or deferred, then the original useful service life may be reduced by as much as 25%.

10.2.5 Remaining Useful Life

An asset's Remaining Useful Life (*RUL*) is defined as the Original Service Life minus the number of years the asset has been in service (calculated from the installation year). The RUL is calculated as follows:

RUL = OUL – Years in Service **(1)**

The calculation of RUL simply allows for the determination of infrastructure that is approaching or has exceeded its useful service and therefore would be expected to need replacement or significant reconditioning.

10.3 North Regional Wastewater Treatment Plant Condition Assessment

10.3.1 Previously Completed Improvement Projects

The City has completed multiple upgrade projects over the past 10 years on the NRWWTP wastewater facilities. The upgraded equipment/assets will be reflected in the age of the equipment and it's condition rating.

The following is a brief listing of the most recent projects at the NRWWTP:

2014 Replacement of six (6) Floating Digester Surface Aerators and Concrete Repairs

2016 Aeration Basin Surface Aerator Replacement

2017 Replacement of Deep Injection Well Pumps

2017 Deep Injection Well Acidization

2019 Deep Injection Well Reservoir Pond Liner Replacement

2020 Wastewater Treatment Plant Renewal and Replacement Improvements. Replacement of Return Activated Sludge/Waste Activated Sludge Pump Station; Replacement of Headworks Mechanical Screen; and Replacement of Circular Digester No. 6 Surface Aerator.

2021 Construct Secondary Clarifier No. 2

2022 Deep Injection Well Mechanical Integrity Testing

2022 Replace Belt Filter Press Progressive Cavity Cake Pump

2023 Replacement of Grit Area Shelter, Grit System Components, Demolition of Headworks Distribution Chamber, and Motor Control Center No. 1.

The completion of these projects greatly impacted the overall general condition of the facility as the projects addressed a large number of specific equipment/component condition issues at the time. Furthermore, these projects decreased the service life of a large amount of critical WWTP infrastructure through the replacement of equipment approaching the end of its useful service life.

10.3.2 Condition Asset Rating

Based upon the asset condition rating methodology described in **Section 10.2**, the following is a summary of the current condition of the NRWWTP assets by process area.

Table 10-3. North Regional Wastewater Treatment Plant Asset Condition Rating Summary

Unit Process	Average Useful Life Remaining (%)	General Condition Assessment	Equipment < 40% Remaining Useful Service Life
Headworks	62%	1 to 2	• Manual Bar Screen • Grit Removal Mechanism • Headworks Structure
Aeration Basin	48%	2	• Inf and Eff Movable Weir Gates • Aeration Basin Structure
Secondary Clarifier No. 1	20%	4	• Clarifier Mechanism • Clarifier Drive & Motor • Scum Beach • Clarifier Weirs & Baffles • Clarifier Structure
Secondary Clarifier No. 2	92%	1	• None
RAS/WAS/SCUM	77%	1	• None
Effluent & DIW	45%	1 to 2	• Standby Effluent Storage Ponds • Standby Effluent Storage Ponds Valves • Pneumatic Tank & Air Compressor
Solids Handling	52%	1 to 2	• BFP Feed Pumps/Motors • RW Booster Pump
Electrical	48%	2 to 3	• Service Entrance Panel
Controls & SCADA	0%	3 to 4	• All Components

A more detailed Asset Condition Rating for all equipment can be found in **Section 10.5**.

As shown in the table above, an asset with a lower percentage of Useful Life Remaining would be expected to be approaching the end of its useful service life, would likely experience additional preventative and corrective maintenance, and should be scheduled for routine replacement in the future. Assets with less than 20% of Useful Life Remaining would be expected to be replaced within the next 5 to 10 years. This is particularly an issue with assets with a shorter useful service life (such as 10 years for control system components) that were not replaced as part of the most recent improvements project. Assets determined to be less than 20% of Useful Life Remaining will serve as the basis for being included in the five-year, ten-year, and twenty-year future needs.

10.3.3 Hydraulic and Treatment Capacity

The hydraulic and/or treatment rated capacity of each unit treatment process has been calculated based on generally accepted industry design standards, Class I reliability requirements, and FDEP rules.

The following table presents a listing of the hydraulic and/or treatment-rated capacity of each unit treatment process of the NRWWTP.

Table 10-4. North Regional Wastewater Treatment Plant Hydraulic and Treatment Capacity Summary

Unit Treatment Process	*Rated Capacity*	*Hydraulic Capacity*	*Treatment Capacity (lbs $_{C}BOD_5$/d)*	*Technical Basis*
Permitted/Design Capacity	**4.0 MGD AADF**	**8 MGD PHF**	**8,340**	**Record Drawings**
Influent Mechanical Screen		8 MGD PHF		Equipment Design Specification
Influent Manual Bypass Screen		8 MGD PHF		Rack Velocity Limitation
Vortex-Induced Grit Removal		20 MGD PHF		Shop Drawings/Product Literature
Aeration Basin			9,000	Organic Loading

Unit Treatment Process	*Rated Capacity*	*Hydraulic Capacity*	*Treatment Capacity (lbs $_{C}BOD_5$/d)*	*Technical Basis*
Surface Aerator			9,500	Aerator Capacity & BOD Loading
Secondary Clarifier		9.5 MGD PHF		Surface Overflow Rate
RAS Pumps	4.0 MGD AADP			RAS at 100% AADF
Deep Injection Well Pumps		10 MGD PHF		Pump Duty Rated Capacity
Deep Injection Well		12.73 MGD Max		Permit Capacity
Aerobic Digesters			10,000	VSS Reduction & Digester SRT
Belt Filter Press			8,500	Equipment Design Specification & Operating Time

10.3.4 Future Regulations

As discussed in **Section 2.6.2**, the NRWWTP may be subject to a future FDEP regulatory requirement to provide biological nutrient removal. If this were to be required, the City would be required to adapt the current biological treatment system into a Modified Ludzach-Ettinger (MLE) configuration with the construction of a new 1.0-million-gallon Anoxic Basin and other related improvements. Such a treatment process modification would be expected to achieve a total nitrogen concentration of less than 10 mg/L and a total phosphorus concentration of less than 6 mg/L through chemical phosphorus removal.

10.3.5 Future Needs

Capital improvement needs related to renewal and replacement of the current assets at the North Regional WWTP have been developed for the five-, ten-, and twenty-year planning horizons as shown below:

Five-Year Improvement Needs

- **CIP No. 22: NRWWTP Square Digester Improvements.** Convert the existing square digesters from surface aeration to coarse bubble aeration with positive displacement aeration blowers. Work includes the following:
  - Remove and dispose of existing surface aerators
  - Power wash/clean tankage, coat tank walls, and perform minor concrete repairs
  - Furnish and install coarse bubble aeration diffuser and stainless steel air piping
  - Furnish and install two duty + one standby positive displacement aeration blowers with VFDs
  - Furnish and install dissolved oxygen or oxidation-reduction potential instrumentation and related control system to control aeration blowers
  - Remove and replace sludge transfer pumps, valves, and piping.

Ten-Year Improvement Needs

No detailed CIPs have been developed for the ten-year planning horizon. However, the future needs of the NRWWTP will include improvements to renewal and replace the following infrastructure:

- Second Clarifier No. 1 Mechanism
- PLC Control Systems Panels
- Belt Filter Press Feed Pumps/Motors
- Belt Filter Press Control System Replacement and BFP Mid-Life Rebuilt
- Lab Building Interior Rehabilitation

Twenty-Year Improvement Needs

None

10.4 North Regional Water Reclamation Facility

10.4.1 Previously Completed Improvement Projects

The City has completed multiple upgrade projects over the past 10 years on the NRWRF wastewater facilities. The upgraded equipment/assets will be reflected in the age of the equipment and it’s condition rating.

The following is a brief listing of the most recent project sat the NRWRF:

2017 Rehabilitation of Ring-Steel Wastewater Process Tanks and Return the Biological System to Service

2018 Process Air Line Replacement

2020 Reclaimed Water High Service Pump Area Improvements

2022 Biological Nutrient Removal Improvements

The completion of these projects greatly impacted the overall general condition of the facility as the projects addressed a large number of specific equipment/component condition issues at the time. Furthermore, these projects decreased the service life of a large amount of critical WRF infrastructure through the replacement of equipment approaching the end of its useful service life.

10.4.2 Condition Asset Rating

Based upon the asset condition rating methodology described in **Section 10.2**, the following is a summary of the current condition of the NRWRF assets by process area.

Table 10-5. North Regional Water Reclamation Facility Asset Condition Rating Summary

Unit Process	Average Useful Life Remaining (%)	General Condition Assessment	Equipment < 40% Remaining Useful Service Life
Headworks	34	2 to 3	• Isolation Plug Valves • Influent Flow Meter • Sampler
Anoxic Basin and Feed Forward Pumps	93	1	• None
Aeration Basin and Secondary Clarifiers	61	2	• Aeration Header Piping & Valves
RAS/WAS	93	1	• None
Aeration	29	3 to 4	• Aeration Blower & Motors
Filtration	18%	2 to 3	• Disk Filters Motors, Chains • Disk Filter Actuated Valves • Disk Filter Control Panel • Upflow Sand Fitler
Chlorine Contact	46%	2 to 3	• Tank Coatings
Effluent Transfer	0%	3	• Eff Transfer Pumps & Motors • 3-Way Plug Valve and Actuator
Substandard Storage	0%	5	• Steel Tank Walls • Tank Coatings
Reclaimed Water Storage	0%	3	• Steel Tank Walls • Tank Dome • Tank Coatings
Reclaimed Water Distribution	73%	1 to 3	• RW Pump No. 3 & Motor
Chemical Feed - Alum	87%	1	• None
Chemical Feed - Bleach	13%	3	• Bulk Storage Tanks • Bulk Tank Structure • Chemical Feed Skids • Feed Skid Structure
Electrical	0%	3	• Main Breaker • Auto Transfer Switch • MCC No 1 • MCC No. 2
Controls & SCADA	0%	3	• Main Control Panel

10.4.3 Hydraulic and Treatment Capacity

The hydraulic and/or treatment-rated capacity of each unit treatment process has been calculated based on generally accepted industry design standards, Class I reliability requirements, and FDEP rules.

The following table presents a listing of the hydraulic and/or treatment-rated capacity of each unit treatment process of the NRWWTP.

Table 10-6. North Regional Water Reclamation Facility Hydraulic and Treatment Capacity Summary

Unit Treatment Process	*Rated Capacity*	*Hydraulic Capacity*	*Treatment Capacity (lbs $_{C}BOD_5$/d)*	*Technical Basis*
Permitted/Design Capacity	**1.2 MGD AADF**	**2.5 MGD PHF**	**2,500**	**WT BNR BODR** **2019 OMPR/CAR**
Influent Manual Screen		7.5 MGD PHF		Channel Approach Velocity
Anoxic Basin		3.6 MGD AADF		Hydraulic Residence Time
Aeration Basin			2,900	Organic Loading
Aeration Blowers			4,000	Blower Capacity
Secondary Clarifier		2.7 MGD PHF		Surface Overflow Rate
Filtration		3.0 MGD PHF		Hydraulic Loading Rate
Chlorine Contact Chamber		2.3 MGD PHF		Contact Time
Effluent Transfer Pumps		2.66 MGD PHF		Pumping Capacity
Substandard Storage		1.5 MG		Tank Capacity
Reclaimed Storage		1.0 MG		Tank Capacity
Reclaimed Water High Service Pumps		2.1 MGD PHF		Pumping Capacity
Chemical Feed Facilities – Bleach		3.6 MGD AADF		Bulk Tank Capacity and Chem Feed Pump Capacity

10.4.4 Future Needs

Capital improvement needs related to renewal and replacement of the current assets at the North Regional WRF have been developed for the five-, ten-, and twenty-year planning horizons as shown below:

Five-Year Improvement Needs

No detailed CIPs have been developed for the five-year planning horizon. However, PBUD has projects budgeted and/or has commenced the engineering design for the following NRWRF needs:

- Replacement of Existing Aeration Blowers
- Removal of the Existing Non-Functional Continuous Flow Sand Filter and Replacement with Third Cloth Media Disc Filter
- Removal and Replacement of the Substandard Effluent Storage Tank

Ten-Year Improvement Needs

No detailed CIPs have been developed for the ten-year planning horizon. However, the future needs of the NRWRF will likely include improvements to renewal and replace the following infrastructure:

- Chlorine Contact Chamber Tank Coatings
- Effluent Transfer Pumps and Motors
- 3-Way Modulation Plug Valve
- Sodium Hypochlorite Bulk Storage and Chemical Feed System
- Plant Process Instrumentation and Control System including turbidity and chlorine residual analyzer
- Electrical System including Main Breaker, Auto Transfer Switch, and MCC

Twenty-Year Improvement Needs

None

10.5 Observations and Recommendations

The existing conditions of the current wastewater treatment facilities have been assessed using an approach that assigned a condition rating to all the major components of each facility. The rating was based on the useful service life remaining of the asset and its general physical condition. From this work, equipment was identified which has less than approximately 40% of its useful life remaining. These components were further grouped into capital improvement needs for renewal and replacement.

10.5.1 Observations

The following observations are based on the condition assessment evaluation of the existing wastewater treatment facilities:

- The NRWWTP is in generally good condition as a results of multiple improvement projects over the previous few years.
- The most urgent needs to be addressed at the NRWWTP include the following:
  - Rehabilitation of the Aerobic Square Digesters
  - Replacement of the Clarifier No. 1 mechanism and related improvements
  - Belt Filter Press Feed Pumps/Motors
  - Belt Filter Press Feed Control System Replacement and BFP Rebuilt
  - Lab Building Interior Rehabilitation
- The NRWRF is in generally good condition after the recently completed BNR improvement project.
- The NRWRF urgent needs have been budgeted by the City and/or are under engineering design including:
  - Replacement of Existing Aeration Blowers
  - Removal of the Existing Non-Functional Continuous Flow Sand Filter and Replacement with Third Cloth Media Disc Filter
  - Removal and Replacement of the Substandard Effluent Storage Tank
- NRWRF needs to be evaluated in the future include the following:
  - Chlorine Contact Chamber Tank Coatings
  - Effluent Transfer Pumps and Motors
  - 3-Way Modulation Plug Valve
  - Sodium Hypochlorite Bulk Storage and Chemical Feed System
  - Plant Process Instrumentation and Control System including turbidity and chlorine residual analyzer
  - Electrical System including Main Breaker, Auto Transfer Switch, and MCC

10.5.2 Recommendations

The following recommendations are based on the evaluation of the existing wastewater treatment plant infrastructure:

- Implement the CIPs identified in this Section to address the needs of the existing wastewater treatment plant infrastructure needs.

10.6 Additional Information

The following presents the details for the condition assessment scoring for the North Regional Wastewater Treatment Plant and the Water Reclamation Facility.

PROCESS	LOCATION	EQUIPMENT	YEAR INSTALLED	ORIGINAL USEFUL LIFE (YRS)	YEARS IN SERVICE	RUL (YRS)	RUL (%)
PRELIMINARY	HEADWORKS	ISOLATION PLUG VALVES	2023	30	1	29	97%
PRELIMINARY	HEADWORKS	INF FLOW METER	2021	30	3	27	90%
PRELIMINARY	HEADWORKS	INF GATES	2020	25	4	21	84%
PRELIMINARY	HEADWORKS	MECHANICAL BAND SCREEN	2020	30	4	26	87%
PRELIMINARY	HEADWORKS	SCREENINGS WASHER AND PRESS	2020	25	4	21	84%
PRELIMINARY	HEADWORKS	MANUAL BAR SCREEN	1988	25	36	-11	0%
PRELIMINARY	HEADWORKS	COMPOSITE SAMPLER	2014	20	10	10	50%
PRELIMINARY	HEADWORKS	CHANNEL WALLS COATINGS	2020	15	4	11	73%
PRELIMINARY	HEADWORKS	GRIT REMOVAL MECHANISM	1988	25	36	-11	0%
PRELIMINARY	HEADWORKS	GRIT PUMP	2023	25	1	24	96%
PRELIMINARY	HEADWORKS	GRIT CLASSIFIER	2014	25	10	15	60%
PRELIMINARY	HEADWORKS	HEADWORKS STRUCTURE	1988	50	36	14	28%
SECONDARY	AERATION BASIN	MOVABLE INF WEIR GATE	1988	25	36	-11	0%
SECONDARY	AERATION BASIN	SURFACE AERATORS	2017	25	7	18	72%
SECONDARY	AERATION BASIN	SURFACE AERATORS MOTOR & GEAR BOX	2017	20	7	13	65%
SECONDARY	AERATION BASIN	SURFACE AERATORS VFDs	2017	20	7	13	65%
SECONDARY	AERATION BASIN	FROTH SPRAY PIPING AND NOZZLES	2017	20	7	13	65%
SECONDARY	AERATION BASIN	DO SENSORS	2017	15	7	8	53%
SECONDARY	AERATION BASIN	EFF BAFFLE	2022	10	2	8	80%
SECONDARY	AERATION BASIN	MOVABLE EFF WEIR GATE	1988	25	36	-11	0%
SECONDARY	AERATION BASIN	AERATION BASIN STRUCTURE	1988	50	36	14	28%
SECONDARY	CLARIFIER NO. 1	CLARIFIER MECHANISM	1988	20	36	-16	0%
SECONDARY	CLARIFIER NO. 1	CLARIFIER MECHANISM DRIVE	2012	15	12	3	20%
SECONDARY	CLARIFIER NO. 1	CLARIFIER BRIDGE	2016	30	8	22	73%
SECONDARY	CLARIFIER NO. 1	SCUM BEACHES	1988	25	36	-11	0%
SECONDARY	CLARIFIER NO. 1	CLARIFIER WEIR PLATE/BAFFLE	1988	25	36	-11	0%
SECONDARY	CLARIFIER NO. 1	CLARIFIER STRUCTURE	1988	50	36	14	28%

PROCESS	LOCATION	EQUIPMENT	YEAR INSTALLED	ORIGINAL USEFUL LIFE (YRS)	YEARS IN SERVICE	RUL (YRS)	RUL (%)
SECONDARY	CLARIFIER NO. 2	CLARIFIER MECHANISM	2022	20	2	18	90%
SECONDARY	CLARIFIER NO. 2	CLARIFIER MECHANISM DRIVE	2022	15	2	13	87%
SECONDARY	CLARIFIER NO. 2	CLARIFIER BRIDGE	2022	30	2	28	93%
SECONDARY	CLARIFIER NO. 2	SCUM BEACHES	2022	25	2	23	92%
SECONDARY	CLARIFIER NO. 2	CLARIFIER WEIR PLATE/BAFFLE	2022	25	2	23	92%
SECONDARY	CLARIFIER NO. 2.	CLARIFIER STRUCTURE	2022	50	2	48	96%
SECONDARY	RAS/WAS/SCUM	SCUM PUMPS	2019	20	5	15	75%
SECONDARY	RAS/WAS/SCUM	RAS PUMPS	2019	20	5	15	75%
SECONDARY	RAS/WAS/SCUM	RAS PUMPS VFDs	2019	20	5	15	75%
SECONDARY	RAS/WAS/SCUM	RAS MAG METER	2019	30	5	25	83%
SECONDARY	RAS/WAS/SCUM	WAS PUMPS	2019	20	5	15	75%
SECONDARY	RAS/WAS/SCUM	WAS PUMPS VFDs	2019	20	5	15	75%
SECONDARY	RAS/WAS/SCUM	WAS FLOW METER	2019	20	5	15	75%
SECONDARY	RAS/WAS/SCUM	RAS PAD STRUCTURE	2019	25	5	20	80%
EFFLUENT	EFF STORAGE	STANDBY EFF STORAGE PONDS	1988	40	36	4	10%
EFFLUENT	EFF STORAGE	STANDBY PONDS FLOW DIVERSION VALVES	1988	30	36	-6	0%
EFFLUENT	EFF POND	STRUCTURE	2018	50	6	44	88%
EFFLUENT	EFF POND	DIW PUMPS	2018	20	6	14	70%
EFFLUENT	EFF POND	DIW PUMPS MOTORS	2018	20	6	14	70%
EFFLUENT	EFF POND	DIW PUMPS VFDs	2018	20	6	14	70%
EFFLUENT	EFF POND	PMEUMATIC TANK	1988	25	36	-11	0%
EFFLUENT	EFF POND	AIR COMPRESSOR	1988	25	36	-11	0%
EFFLUENT	EFF TRANSFER	EFF TRANSFER PUMPS	2012	25	12	13	52%
EFFLUENT	EFF TRANSFER	STRUCTURE	2019	50	5	45	90%

PROCESS	LOCATION	EQUIPMENT	YEAR INSTALLED	ORIGINAL USEFUL LIFE (YRS)	YEARS IN SERVICE	RUL (YRS)	RUL (%)
SOLIDS HANDLING	DIGESTER NO. 1	FLOATING AERATOR & MOTORS	2014	25	10	15	60%
SOLIDS HANDLING	DIGESTER NO. 2	FLOATING AERATOR & MOTORS	2014	20	10	10	50%
SOLIDS HANDLING	DIGESTER NO. 3	FLOATING AERATOR & MOTORS	2014	20	10	10	50%
SOLIDS HANDLING	DIGESTER NO. 4	FLOATING AERATOR & MOTORS	2014	20	10	10	50%
SOLIDS HANDLING	DIGESTER NO. 5	FLOATING AERATOR & MOTORS	2014	20	10	10	50%
SOLIDS HANDLING	DIGESTER NO. 6	FLOATING AERATOR & MOTORS	2016	25	8	17	68%
SOLIDS HANDLING	BELT FILTER PRESS	PROGRESSIVE CAVITY BFP FEED PUMPS/MOTORS	2010	20	14	6	30%
SOLIDS HANDLING	BELT FILTER PRESS	AIR COMPRESSOR	2020	10	4	6	60%
SOLIDS HANDLING	BELT FILTER PRESS	BELT FILTER PRESS	2010	25	14	11	44%
SOLIDS HANDLING	BELT FILTER PRESS	RW BOOSTER PUMP	2010	15	14	1	7%
SOLIDS HANDLING	BELT FILTER PRESS	SLUDGE CAKE PUMP/MOTOR	2022	20	2	18	90%
SOLIDS HANDLING	BELT FILTER PRESS	POLYMER FEED MAKE-UP UNIT	2020	10	4	6	60%
ELECTRICAL	MAINTENANCE BUILDING	SERVICE ENTRANCE PANEL	1985	30	39	-9	0%
ELECTRICAL	MAINTENANCE BUILDING	EMERGENCY GENERATOR	2014	30	10	20	67%
ELECTRICAL	HEADWORKS	MCC-1	2023	30	1	29	97%
ELECTRICAL	HEADWORKS	AERATOR NO. 1 VFD	2017	20	7	13	65%
ELECTRICAL	HEADWORKS	AERATOR NO. 2 VFD	2017	20	7	13	65%
ELECTRICAL	RAS/WAS	MCC-2	TBD				
ELECTRICAL	LAB BUILDING	MCC	TBD				
ELECTRICAL	DIW	MCC	TBD				
ELECTRICAL	BFP	PLC CONTROL PANEL	2010	20	14	6	30%
ELECTRICAL	BFP	BFP FEED PUMP No. 1 VFD	2010	20	14	6	30%
ELECTRICAL	BFP	BFP FEED PUMP No. 2 VFD	2010	20	14	6	30%
CONTROLS	HEADWORKS	RTU PANEL	2003	10	21	0	0%
CONTROLS	BELT FILTER PRESS	PLC PANEL	2010	10	14	0	0%
CONTROLS	RAS/WAS	RTU PANEL	2003	10	21	0	0%
CONTROLS	MAINTENANCE BUILDING	PLC PANEL	2003	10	21	0	0%
CONTROLS	OPERATIONS ROOM	PLC PANEL	2003	10	21	0	0%
CONTROLS	MAINTENANCE BUILDING	MASTER RADIO	2003	10	21	0	0%
CONTROLS	DEEP INJECTION WELL	RTU PANEL					
PRELIMINARY	DRAIN LIFT STATION	SUBMERSIBLE PUMPS	2014	25	10	15	
PRELIMINARY	DRAIN LIFT STATION	STRUCTURE	1988	50	36	14	

PROCESS	LOCATION	EQUIPMENT	YEAR INSTALLED	ORIGINAL USEFUL LIFE (YRS)	YEARS IN SERVICE	RUL (YRS)	RUL (%)
PRELIMINARY	HEADWORKS	ISOLATION PLUG VALVE	1989	30	35	-5	0%
PRELIMINARY	HEADWORKS	INF FLOW METER	1989	30	35	-5	0%
PRELIMINARY	HEADWORKS	MANUAL BAR SCREEN	2015	30	9	21	70%
PRELIMINARY	HEADWORKS	AUTOMATIC SAMPLER	2010	20	14	6	30%
PRELIMINARY	HEADWORKS	STRUCTURE	2016	25	8	17	68%
SECONDARY	ANOXIC BASIN NO. 1	SUBMERSIBLE MIXER	2022	25	2	23	92%
SECONDARY	ANOXIC BASIN NO. 2	SUBMERSIBLE MIXER	2022	25	2	23	92%
SECONDARY	ANOXIC BASIN NO. 1	STRUCTURE	2022	50	2	48	96%
SECONDARY	ANOXIC BASIN NO. 2	STRUCTURE	2022	50	2	48	96%
SECONDARY	FEED FORWARD	FEED FORWARD PUMPS (3)	2022	20	2	18	90%
SECONDARY	FEED FORWARD	FEED FORWARD FLOW METER (2)	2022	30	2	28	93%
SECONDARY	AERATION BASIN NO. 1	IR TELESCOPIC VALVE	2022	25	2	23	92%
SECONDARY	AERATION BASIN NO. 1	STEEL TANK EXTERIOR WALLS	2016	25	8	17	68%
SECONDARY	AERATION BASIN NO. 1	TANK WALL INTERIOR COATINGS	2016	15	8	7	47%
SECONDARY	AERATION BASIN NO. 1	TANK WALL EXTERIOR COATINGS	2016	15	8	7	47%
SECONDARY	AERATION BASIN NO. 1	PERIMETER WALKWAY	2016	25	8	17	68%
SECONDARY	AERATION BASIN NO. 1	AERATION HEADER PIPE	1989	30	35	-5	0%
SECONDARY	AERATION BASIN NO. 1	AERATION DOWNPIPES, VALVES, & DIFFUSERS	2016	25	8	17	68%
SECONDARY	CLARIFER BASIN NO. 1	STEEL TANK INTERIOR WALLS	2016	25	8	17	68%
SECONDARY	CLARIFER BASIN NO. 1	TANK WALL COATINGS	2016	15	8	7	47%
SECONDARY	CLARIFER BASIN NO. 1	CLARIFIER MECHANISM, DRIVE, MOTOR	2016	25	8	17	68%
SECONDARY	CLARIFER BASIN NO. 1	CENTER WALKWAY	2016	25	8	17	68%
SECONDARY	CLARIFER BASIN NO. 1	SCUM TROUGH	2016	25	8	17	68%
SECONDARY	CLARIFER BASIN NO. 1	CLARIFIER WEIR PLATE/BAFFLE	2016	25	8	17	68%
SECONDARY	CLARIFER BASIN NO. 1	CLARIFIER WEIR TROUGH	2016	25	8	17	68%
SECONDARY	CLARIFER BASIN NO. 1	AIR LIFT WAS & SPLITTER BOX	2016	25	8	17	68%
SECONDARY	AEROBIC DIGESTER NO. 1	AERATION DOWNPIPES, VALVES, & DIFFUSERS	2016	25	8	17	68%
SECONDARY	AERATION BASIN NO. 2	IR TELESCOPIC VALVE	2022	25	2	23	92%
SECONDARY	AERATION BASIN NO. 2	STEEL TANK EXTERIOR WALLS	2016	25	8	17	68%
SECONDARY	AERATION BASIN NO. 2	TANK WALL INTERIOR COATINGS	2016	15	8	7	47%
SECONDARY	AERATION BASIN NO. 2	TANK WALL EXTERIOR COATINGS	2016	15	8	7	47%
SECONDARY	AERATION BASIN NO. 2	PERIMETER WALKWAY	2016	25	8	17	68%
SECONDARY	AERATION BASIN NO. 2	AERATION HEADER PIPE	1989	30	35	-5	0%
SECONDARY	AERATION BASIN NO. 2	AERATION DOWNPIPES, VALVES, & DIFFUSERS	2016	25	8	17	68%
SECONDARY	CLARIFER BASIN NO. 2	STEEL TANK INTERIOR WALLS	2016	25	8	17	68%
SECONDARY	CLARIFER BASIN NO. 2	CLARIFIER MECHANISM, DRIVE, MOTOR	2016	15	8	7	47%
SECONDARY	CLARIFER BASIN NO. 2	CENTER WALKWAY	2016	25	8	17	68%
SECONDARY	CLARIFER BASIN NO. 2	SCUM TROUGH	2016	25	8	17	68%
SECONDARY	CLARIFER BASIN NO. 2	CLARIFIER WEIR PLATE/BAFFLE	2016	25	8	17	68%
SECONDARY	CLARIFER BASIN NO. 2	CLARIFIER WEIR TROUGH	2016	25	8	17	68%
SECONDARY	CLARIFER BASIN NO. 2	AIR LIFT WAS & SPLITTER BOX	2016	25	8	17	68%
SECONDARY	AEROBIC DIGESTER NO. 2	AERATION DOWNPIPES, VALVES, & DIFFUSERS	2016	25	8	17	68%

PROCESS	LOCATION	EQUIPMENT	YEAR INSTALLED	ORGIONAL USEFUL LIFE (YRS)	YEARS IN SERVICE	RUL (YRS)	RUL (%)
SECONDARY	ALUM FEED	ALUM BULK STORAGE TANK	2022	20	2	18	90%
SECONDARY	ALUM FEED	CHEMICAL FEED SKID	2022	10	2	8	80%
SECONDARY	ALUM FEED	COVERED STRUCTURE	2022	25	2	23	92%
SECONDARY	RAS/WAS	RAS PUMP NO. 1	2022	20	2	18	90%
SECONDARY	RAS/WAS	RAS PUMP NO. 2	2022	20	2	18	90%
SECONDARY	PROCESS AIR	CENTRIFUGAL BLOWER NO. 1 & MOTOR	1989	25	35	-10	0%
SECONDARY	PROCESS AIR	CENTRIFUGAL BLOWER NO. 2 & MOTOR	1989	25	35	-10	0%
SECONDARY	PROCESS AIR	AIR HEADER PIPE	2018	50	6	44	88%
TERTARRY	DISK FILTER NO. 1	CLOTH MEDIA FILTERS	2018	10	6	4	40%
TERTARRY	DISK FILTER NO. 1	DISC ROTATION CHAIN & MOTOR	2009	15	15	0	0%
TERTARRY	DISK FILTER NO. 1	BACKWASH ACTUATING VALVES	2009	20	15	5	25%
TERTARRY	DISK FILTER NO. 1	BACKWASH PUMP	2009	20	15	5	25%
TERTARRY	DISK FILTER NO. 1	CONTROL PANEL	2009	15	15	0	0%
TERTARRY	DISK FILTER NO. 2	CLOTH MEDIA FILTERS	2018	10	6	4	40%
TERTARRY	DISK FILTER NO. 2	DISC ROTATION CHAIN & MOTOR	2009	15	15	0	0%
TERTARRY	DISK FILTER NO. 2	BACKWASH VALVES	2009	20	15	5	25%
TERTARRY	DISK FILTER NO. 2	BACKWASH PUMP	2009	20	15	5	25%
TERTARRY	DISK FILTER NO. 2	CONTROL PANEL	2009	15	15	0	0%
TERTARRY	UPFLOW SAND FILTER	FILTER MEDIA	1989	15	35	-20	-133%
TERTARRY	UPFLOW SAND FILTER	FILTER INTERNALS	1989	20	35	-15	-75%
TERTARRY	UPFLOW SAND FILTER	AIR COMPRESSOR	1989	25	35	-10	-40%
TERTARRY	FILTERS	FILTER BYPASS CONTROL VALVE	1989	30	35	-5	-17%
TERTARRY	FILTERS	STRUCTURE	1989	50	35	15	30%
TERTARRY	FILTERS	STAIRS AND ELEV WALKWAY	1989	25	35	-10	-40%
TERTARRY	CHLORINE CONTACT	STRUCTURE	1989	50	35	15	30%
TERTARRY	CHLORINE CONTACT	WALL COATINGS		15			
TERTARRY	CHLORINE CONTACT	V-NOTCH WEIR & LEVEL SENSOR	1989	15	35	-20	
TERTARRY	CHLORINE CONTACT	SAMPLE PUMP	2016	20	8	12	60%
TERTARRY	CHLORINE CONTACT	TRC ANALYZER	2016	15	8	7	47%
TERTARRY	CHLORINE CONTACT	TURBIDITY ANALYZER	2016	15	8	7	47%
TERTARRY	HYPOCHLORITE FEED	BLEACH BULK STORAGE TANK	2010	20	14	6	30%
TERTARRY	HYPOCHLORITE FEED	BULK TANK COVERED STRUCTURE	1989	30	35	-5	0%
TERTARRY	HYPOCHLORITE FEED	CHEMICAL FEED SKID	2016	10	8	2	20%
TERTARRY	HYPOCHLORITE FEED	FEED SKID COVERED STRUCTURE	1989	30	35	-5	0%

PROCESS	LOCATION	EQUIPMENT	YEAR INSTALLED	ORGIONAL USEFUL LIFE (YRS)	YEARS IN SERVICE	RUL (YRS)	RUL (%)
EFFLUENT	EFF TRANSFER	EFF TRANSFER PUMP NO. 1 & MOTOR	1989	20	35	-15	0%
EFFLUENT	EFF TRANSFER	EFF TRANSFER PUMP NO. 2 & MOTOR	1989	20	35	-15	0%
EFFLUENT	EFF TRANSFER	3-WAY PLUG VALVE & ACTUATOR	1989	30	35	-5	0%
EFFLUENT	SUBSTANDARD TANK	STEEL TANK EXTERIOR WALLS	1989	30	35	-5	0%
EFFLUENT	SUBSTANDARD TANK	TANK WALL INTERIOR COATINGS	1989	15	35	-20	0%
EFFLUENT	SUBSTANDARD TANK	TANK WALL EXTERIOR COATINGS	1989	10	35	-25	0%
EFFLUENT	RECLAIMED WATER TANK	STEEL TANK EXTERIOR WALLS	1989	30	35	-5	0%
EFFLUENT	RECLAIMED WATER TANK	TANK DOME COVER	1989	30	35	-5	0%
EFFLUENT	RECLAIMED WATER TANK	TANK WALL INTERIOR COATINGS	1989	15	35	-20	0%
EFFLUENT	RECLAIMED WATER TANK	TANK WALL EXTERIOR COATINGS	1989	15	35	-20	0%
EFFLUENT	RECLAIMED WATER DISTRIBUTION	RW HIGH SERVICE PUMP NO. 1 & MOTOR	2020	25	4	21	84%
EFFLUENT	RECLAIMED WATER DISTRIBUTION	RW HIGH SERVICE PUMP NO. 1 VFD	2020	20	4	16	80%
EFFLUENT	RECLAIMED WATER DISTRIBUTION	RW HIGH SERVICE PUMP NO. 2 & MOTOR	2020	25	4	21	84%
EFFLUENT	RECLAIMED WATER DISTRIBUTION	RW HIGH SERVICE PUMP NO. 2 VFD	2020	20	4	16	80%
EFFLUENT	RECLAIMED WATER DISTRIBUTION	RW HIGH SERVICE PUMP NO. 3 & MOTOR	2010	25	14	11	44%
EFFLUENT	RECLAIMED WATER DISTRIBUTION	RW HIGH SERVICE PUMP NO. 3 VFD	2010	20	14	6	30%
EFFLUENT	RECLAIMED WATER DISTRIBUTION	HSP STRAINER	2020	25	4	21	84%
EFFLUENT	RECLAIMED WATER DISTRIBUTION	8-IN FLOW METER	2020	30	4	26	87%
EFFLUENT	RECLAIMED WATER DISTRIBUTION	12-IN FLOW METER	2020	30	4	26	87%
UTILITIES	IN-PLANT LIFT STATION	SUBMERSIBLE PUMPS	1989	20	35	-15	0%
UTILITIES	IN-PLANT LIFT STATION	WET WELL STRUCTURE	1989	50	35	15	30%
UTILITIES	IN-PLANT LIFT STATION	WET WELL COATINGS	1989	15	35	-20	0%
UTILITIES	ELECTRICAL	EMERGENCY GENERATOR	2010	30	14	16	53%
UTILITIES	ELECTRICAL	MAIN BREAKER	1989	30	35	-5	-17%
UTILITIES	ELECTRICAL	AUTO TRANSFER SWITCH	1989	30	35	-5	-17%
UTILITIES	ELECTRICAL	MCC NO. 1	1989	30	35	-5	-17%
UTILITIES	ELECTRICAL	MCC NO. 2	1989	30	35	-5	-17%
UTILITIES	ELECTRICAL	PANEL "P"	1989	30	35	-5	-17%
UTILITIES	ELECTRICAL	PANEL "L"	1989	30	35	-5	-17%
UTILITIES	CONTROLS	MAIN CONTROL PANEL	1989	30	35	-5	-17%

Section 11 - Evaluation of Future Conditions Wastewater Treatment Facilities Needs

11.1 Introduction

Section 11 of the City of Palm Bay Wastewater Master Plan will evaluate and identify the upgrades needed to the wastewater treatment and disposal facilities to serve the future growth needs within the City. This section will provide a listing of the facility upgrades needed in each of the five-year, ten-year, and twenty-year planning horizons.

11.2 Review of Current and Future Projected Wastewater Flows

Sections 7, 8, and 9 of this Wastewater Master Plan presented the details of the hydraulic modeling performed for each of the five-year, ten-year, and twenty-year planning horizons. This work included determining the number of ERCs and the projected sanitary wastewater flows for each planning horizon, including the three design flow conditions. This information as developed in detail in **Sections 7, 8, and 9** is summarized in the following table.

Table 11-1. Projected Future Wastewater Flows by Planning Horizon

Timeframe	*Number of ERCs*	*Average Annual Daily Flow (MGD)*	*Max Day Ave Daily Flow (MGD)*	*Max Day Peak Hour Flow (MGD)*
Current	16,214	3.4	6.1	7.8
5-Year	31,733	6.7	11.5	14.3
10-Year	42,225	8.9	15.6	19.1
20-Year	63,352	13.3	23.5	29.0

The future sanitary wastewater flows are projected to increase from 3.3 to 12.2 MGD on an annual average daily flow basis from the current condition to the twenty-year planning horizon. This is a very significant increase in wastewater flows. This increase will require a significant expansion of PBUD’s wastewater treatment and effluent disposal capacity to meet the future needs of the City.

11.3 Review of Current and Future Wastewater Treatment Capacity Requirements

To meet the wastewater treatment capacity needs for each planning horizon, multiple treatment plant expansions will be needed. As discussed in **Sections 3.3 and 11** of this Master Plan report, the PBUD wastewater system includes multiple treatment facilities including the following:

- NRWWTP with a current permitted treatment capacity of 4.0MGD AADF and a hydraulic capacity of 8.0 MGD PHF.
- NRWRF with a current permitted treatment capacity of 1.2 MGD AADF and a hydraulic capacity of 3.7 MGD PHF.
- SRWRF with a current permitted treatment capacity of 2 MGD AADF and a hydraulic capacity of 6 MGD PHF. Note the initial phase of the facility is currently under construction. This phase will have an installed treatment capacity of 1 MGD AADF and a hydraulic capacity of 3 MGD PHF. The second phase of the facility is being designed.

The FDEP requires the wastewater system to have sufficient permitted treatment capacity to meet the annual average day flows in accordance with Chapter 62-600.200, FAC, and the current FDEP Domestic Wastewater Facilities Permit. Additionally, the FDEP required facilities to begin planning for additional capacity within the maximum three-month average daily flow to reach 80% of the permitted capacity in accordance with Chapter 62-600.405, FAC.

As the future annual average daily wastewater flow exceeds the current wastewater treatment permitted capacity, additional treatment plant capacity will be required to meet the future planning horizon needs. These projected treatment plant capacity needs can be found in the following table.

Table 11-2. Projected Future Wastewater Treatment Capacity Requirements by Planning Horizon

Timeframe	*Annual Average Daily Flow (MGD)*	Wastewater Treatment Plant Capacity (MGD)				Wastewater Treatment Plant Capacity Improvement Needs
		Total	*NRWWTP*	*NRWRF*	*SRWRF*	
Current	3.3	5.2	4.0	1.2	NA	
5-Year	6.7	8.2	4.0	1.2	3.0	• SRWRF to 3 MGD
10-Year	8.9	10.2	4.0	1.2	5.0	• SRWRF to 5 MGD
20-Year	13.3	13.2	4.0	1.2	8.0	• SRWRF to 8 MGD

This analysis assumes that any future wastewater treatment plant expansions will occur at the South Regional Utilities campus site. The site has been master planned for support up to 12 MGD of treatment capacity on the site with four 3.0 MGD treatment blocks. The treatment process design has the flexibility to be expandable in multiple phases of 1.0 MGD increments.

As previously discussed the initial 1.0 MGD of treatment plant capacity is currently under construction. The next 1.0 MGD of treatment plant capacity is currently under design and simply involves furnishing and installing wastewater process equipment within already constructed tankage. At the five-, ten- and twenty-year planning horizons, the expansion of wastewater treatment plant capacity will involve a significant degree of work including the construction of additional concrete tankage, additional buildings to house equipment/electrical gear, yard piping, and wastewater process equipment.

11.4 Review of Current and Future Wastewater Treatment Effluent Criteria Requirements

As described in **Section 2.6.2**, the City has been notified by the FDEP of the need to begin planning efforts for the eventual implementation of reduced nutrient effluent permit limits.

The NRWRF and SRWRF have been designed to provide biological nutrient removal at a level sufficient to satisfy the currently anticipated nitrogen and phosphorus effluent limits. No additional treatment plant upgrades/improvements to provide biological nutrient removal are anticipated in the future at this time.

The NRWWTP does not provide biological nutrient removal. This facility discharges treated secondary effluent to a Class I Deep Injection Well. The zone of discharge is over 2,000 feet below the surface into the low permeability boulder zone of the Oldsmar limestone formation. This discharge of secondary treated effluent under applicable FDEP rules and its current Domestic Wastewater Facilities Permit does not adversely impact the water quality of the groundwater or surface water resources.

If the FDEP were to impose nutrient reduction requirements upon the secondary treated effluent from the NRWWTP, then the City would be required to adapt the current biological treatment system into a Modified Ludzach-Ettinger (MLE) secondary biological treatment configuration. This system would be expected to consistently achieve a total nitrogen-treated effluent concentration of less than 10 mg/L and a total phosphorus-treated effluent concentration of less than 6 mg/L through chemical addition.

The improvements needed to implement the MLE process at a minimum include the following:

- Diversion channel with isolation gates
- One new 1-million-gallon Anoxic Basin (155 ft long by 60 ft wide by 15.5 ft side water depth) with two submersible mixers. The Anoxic Basin would be constructed to the south of the existing Aeration Basin adjacent to the effluent pond. The discharge from the Anoxic Basin would be conveyed by gravity to the Aeration Basin.
- An internal recycle stream bringing nitrate-rich mixed liquor from the Aeration Basin to the front end of the Anoxic Basin would be established using three duty + 1 standby non-clog horizontal centrifuge pumps each rated for 3,700 gpm.
- An alum chemical feed system consisting of two bulk double-walled chemical storage tanks and a duplex chemical feed skid with associated piping and controls.
- Related electrical and control system improvements

- The activated sludge system would need to be controlled by increasing the solids retention time and aeration system as needed to achieve full nitrification or the conversion of ammonia to nitrates.
- The existing 5.1 MG effluent holding ponds used during the FDEP required integrity testing of the Deep Injection Well system every five years and would need to be modified to accommodate the construction of the biological nutrient removal improvements.

Additional design-level engineering analysis will be required to further evaluate the feasibility of these improvements if reduced nutrient effluent permit limits were to be imposed by the FDEP on the discharge of the NRWWTP.

If the City were to anticipate the imposition of even more restrictive nutrient effluent permit limits, then the City may desire to consider and evaluate the complete reconstruction and upgrading of the NRWWTP to the Advanced Wastewater Treatment (AWT) level of effluent permit limits (5 mg/L BOD_5; 5 mg/L TSS, 3 mg/L TN, and 1 mg/L TP) using the MBR treatment technology.

11.5 Review of Current and Future Treated Effluent Disposal Capacity Requirements

As discussed in **Section 3.4,** the NRWWTP and NRWRF utilize either a 12.73 MGD maximum day permitted capacity Class I deep injection well or a 2.3 MGD AADF permitted capacity slow-rate public access reuse system to dispose of treated effluent following the treatment process. As the permitted treatment capacity of the NRWWTP and NRWRF are anticipated to remain unchanged over the next 20 years, these two existing methods of effluent disposal being used at these two facilities are expected to be sufficient.

When the SRWRF becomes operational, the treated effluent will be initially discharged to a 7.06 MGD maximum day permitted capacity Class I deep injection well that is shared with the South Regional Water Treatment Plant for disposal of brine or the byproduct of the reverse osmosis water treatment process.

In the near future, the City has a master plan to design, construct, and place into operation a slow-rate public access reuse system to beneficially dispose of reclaimed water within the Bayside Lakes area. This analysis assumes that infrastructure will be in place starting at the five-year planning horizon for the purpose of disposing of a portion of the reclaimed water quality treated effluent from the SRWRF.

The following table shows the projected future effluent disposal needs for the SRWRF.

Table 11-3. Projected Future Effluent Disposal Needs at the SRWRF by Planning Horizon

Timeframe	*SRWRF*				SRWTP	Total Flow for DIW Disposal (MGD)
	AADF (MGD)	*Max Day ADF (MGD)*	*Assumed Reuse Disposal (MGD)*	*Effluent for DIW Disposal (MGD)*	*Brine Flow for DIW Disposal (MGD)*	
Current	0	0	0	0	1.5	1.5
5-Year	3	5.4	0.5	4.9	2.0	6.9
10-Year	5	9.0	0.75	8.25	2.5	10.75
20-Year	8	14.4	1	13.4	3.5	16.9

As can be seen above, the current 7.06 MGD maximum day permitted capacity Class I deep injection well serving the SRWRF and the SRWTO has sufficient capacity through the five-year planning horizon. In the subsequent planning horizons, significantly more effluent disposal capacity will be required and at least one additional deep injection well will be required, or a significantly higher beneficial reuse disposal capacity will be required.

11.6 Future Needs

Capital improvement needs related to the anticipated future wastewater treatment and effluent disposal requirements have been developed for the five, ten, and twenty-year time planning horizon as shown below:

Five-Year Improvement Needs

- **Expand SRWRF treatment capacity from 1 to 2 MGD.** Improvements include the following:
  - Furnish and install membrane bioreactor-related equipment within previously constructed tankage including submersible mixers, feed-forward pumps, aeration diffusers, permeate pumps, aeration blowers, and submerged membrane units.

- **5-Year CIP No. 20:** Expand SRWRF treatment capacity from 2 to 3 MGD. Improvements include the following:
    - Furnish and install the third rotary drum screen;
    - Construct biological treatment tankage including anaerobic, anoxic, aerobic, and MBR tankage;
    - Furnish and install membrane bioreactor-related equipment including submersible mixers, feed-forward pumps, aeration diffusers, permeate pumps, and submerged membrane units;
    - Furnish and install a fourth Effluent Transfer Pump;
    - Furnish and install third High Service Pump;
    - Furnish and install a second hypochlorite bulk storage tank;
    - Furnish and install yard piping; and
    - Furnish and install related electrical and control system improvements.
- **5-Year CIP No. 21:** Upgrade NRWWTP from secondary treatment to biological nutrient removal effluent through the MLE process

or

- Upgrade NRWWTP to AWT using a 4-stage BNR process.

Ten-year Improvement Needs

- **10-Year CIP No. 8:** Expand SRWRF treatment capacity from 3 to 5 MGD.
- **10-Year CIP No. 9:** Construct a second deep injection well for SRWRF. Improvements include the following:
    - Construct deep injection well casings;
    - Construct wellhead and DIW site pad improvements;
    - Furnish and install yard piping; and
    - Furnish and install related electrical and control system improvements.

Twenty-Year Improvement Needs

- **20-Year CIP No. 6:** Expand SRWRF treatment capacity from 5 to 8 MGD AADF.

11.7 Observations and Recommendations

The future needs of the wastewater treatment facilities have been identified to meet the needs to support future growth within the City and to address any future regulatory requirements. This analysis was performed following the projection of future wastewater flows at each planning horizon. From this work, multiple capital improvement projects were developed for each planning horizon.

11.7.1 Observations

The following observations are based on the future needs assessment of the wastewater treatment facilities and their related infrastructure.

- The future wastewater flows by planning horizon are presented in **Table 11-1**. The projected growth of the City, generally in new development areas and septic-to-sewer connections is expected to increase the number of ERCs being served by the wastewater system from 26,214 currently to 63,350 at the twenty-year planning horizon. Similarly, the projected future wastewater flow increased from 3.4 MGD currently to 13.3 MGD on an AADF basis at the twenty-year planning horizon.
- The projected future wastewater treatment capacity needs at each planning horizon are presented in **Table 11-2.** The expected rated capacities of the NRWWTP and NRWRF are expected to remain at their current capacity of 4.0 MGD AADF and 1.2 MGD AADF respectively into the future.
- All future additional wastewater treatment capacity needs will be accommodated by the multiple-phased expansion of the SRWRF to an anticipated future capacity of 8 MGD AADF.
- BNR improvements at the NRWWTP are a possibility if the FDEP mandates the need for the improvements.
- Additional effluent disposal capacity will be needed at the SRWRF sometime before the ten-year planning horizon. This will likely be an additional DIW and the development of a beneficial reuse disposal capacity.

11.7.2 Recommendations

The following recommendation is based on the future needs of the wastewater treatment facilities infrastructure:

- Implement the CIPs identified in the Section to address the future needs of the wastewater treatment facilities infrastructure.

Section 12 - Capital Improvements Projects

12.1 Introduction

Section 12 of the City of Palm Bay Wastewater Master Plan presents a compilation of the wastewater system capital improvement project for each of the three (3)-planning horizons including This includes the following:

a) Develop a comprehensive assessment of the financial implications associated with the water distribution system model within each of the three (3) planning horizons (five-year, ten-year, and twenty-year).

b) The employed methodology to assess and analyze the costs attributed to the wastewater collection gravity and force main system model for each of the three (3) planning horizons.

c) Categorize the costs for each of the three (3) planning horizons into distinct components, namely construction, engineering, project, and other associated expenses.

d) Define the subsequent steps imperative for the progression of this project, outlining the key actions and milestones necessary for its successful execution.

e) Provide informed recommendations concerning the cost evaluation, offering insights and considerations for the decision-making process if the project proceeds.

12.2 Cost Development

Development of the City's sanitary gravity collection system, lift stations, sanitary force main, and wastewater treatment system infrastructure cost evaluation was primarily completed using the following resources:

- RSMeans 2024
- Florida Department of Transportation (FDOT) Historical Average Cost Reports 2024 (Statewide 12 months)
- South Regional Water Reclamation Schedule of Valves from the December 2020 bid.
- City of Port St Lucie Prineville Deep Injection Well No 2 Bid Tabulation Report for the July 2023 bid.
- City of Palm Bay Projects

- Other similar projects previously completed by Infrastructure Solutions Services

Some of the line items and costs used within these resources are:

- Furnish & Install 8” PVC FM via Open-Cut Trenching with Testing: $150 per Linear foot (L.F)
- Furnish & Install 12” PVC FM via Open-Cut Trenching with Testing: $170 per L.F
- Furnish & Install 16” PVC FM via Open-Cut Trenching with Testing: $190 per L.F
- Furnish & Install 20” PVC FM via Open-Cut Trenching with Testing: $250 per L.F
- Furnish & Install 24” PVC FM via Open-Cut Trenching with Testing: $350 per L.F
- Furnish & Install 8” PVC Gravity Sewer Main via Open-Cut Trenching with Testing: $150 per L.F
- Furnish & Install 12” PVC Gravity Sewer Main via Open-Cut Trenching with Testing: $170 per L.F
- Furnish & Install 16” PVC Gravity Sewer Main via Open-Cut Trenching with Testing: $250 per L.F
- Conduct Demolition of Existing Asphalt Pavement: $30.00 per Square Yard (S.Y)
- Construct Asphalt Pavement (in entirety): $75.00 per S.Y

In addition, estimates of probable costs are Class 5 Order of Magnitude estimates as defined by AACE. This cost estimate has been prepared for guidance in project evaluation and implementation available from the information available at this stage of the estimate. The final costs of the project will depend on actual labor and material costs, competitive market conditions, final project scope, implementation schedule, and other variable conditions. As a result, the final project costs will vary from the estimate presented herein.

Contingency

Contingency for individual projects varied. For most capital improvement projects, a contingency of 25% was utilized consistent with Class 5 Order of Magnitude estimates (conceptualized projects). However, a 20% contingency was used for all South Regional Water Reclamation Facility expansion projects.

Engineering Fee

Engineering fees were determined based on the scope of work associated with each capital improvement project and are in line with standard practices. The Engineering Fee Determination is as follows:

- Line work that was estimated to cost less than $5.0M utilized an engineering fee of 10% of the Construction Cost.
- Line work that was estimated to exceed a cost of $5.0M utilized an engineering fee of 7.5% of the Construction Cost.
- All facilities work for capital improvement projects utilized an engineering fee of 15% of the Construction Cost.

Other costs associated with capital improvement projects include potential land acquisitions and easements. The costs for acquisition and easements were derived by comparing the potential land/easement area required to recent market trends and values for similar-sized areas of land.

12.3 Recommended Capital Improvements Plan Cost Summary

Below are the cost summaries of the three (3) planning horizons (five-year, ten-year, and twenty-year):

Table 12-1.Five-Year Conditions Capital Improvement Project Costs Summary

Five-Year Improvements	*Construction Cost*	*Engineering Cost*	*Other Costs[1]*	*Project Cost*
CIP No. 1: NOT USED	NA	NA	NA	NA
CIP No. 2: Install Flow Controls between NRWWTP and NRWRF	$530,000	$106,000	$0	$636,000
CIP No. 3: Replace 6" Sanitary Gravity Main with 8" Sanitary Gravity Main Downstream of LS-07	$360,000	$36,000	$0	$396,000
CIP No. 4: Construct 10" PVC Sanitary FM Leaving PLS-391 to LS-50	$600,000	$60,000	$0	$660,000
CIP No. 5: Construct 6" PVC Sanitary FM from LS-56 until 20" FM across from Clearmont St	$250,000	$25,000	$0	$275,000
CIP No. 6: Extension of 8" PVC Sanitary FM leaving LS-34 until FM leaving LS-27	$170,000	$17,000	$0	$187,000
CIP No. 8: Upsizing of Pumps at Identified Lift Stations	$5,400,000	$405,000	$0	$5,805,000

Five-Year Improvements	*Construction Cost*	*Engineering Cost*	*Other Costs*[1]	*Project Cost*
CIP No. 10: Replace LS-05 and Modify Discharge Forcemain	$3,100,000	$310,000	$0	$3,410,000
CIP No. 11: Replace 8" AC Sanitary FM with 12" PVC Sanitary FM from Angle St NE (LS01/LS02 FM Connection Point) to Bianca Dr NE (LS04 FM Tie-in Point)	$1,200,000	$120,000	$0	$1,320,000
CIP No. 12: Replace 12" AC Sanitary FM with 12" PVC Sanitary FM along Port Malabar Blvd NE from LS04 Tie-In to Clearmont St NE	$1,600,000	$160,000	$0	$1,785,000
CIP No. 13: Construct 20" PVC Sanitary FM in the FPL Easement from Osmosis Dr SE to Degroodt Rd SE	$4,000,000	$400,000	$0	$4,400,000
CIP No. 15: Construct 24" PVC Sanitary FM along Babcock St from Waterstone Tie-in to Cogan Dr SE Tie-in with Connection to Existing Babcock St FM	$1,300,000	$130,000	$0	$1,430,000
CIP No. 16: Construct 12" PVC Sanitary FM from Waterstone Development to proposed Babcock St FM	$2,500,000	$250,000	$100,000	$2,850,000
CIP No. 17: Construct 20" PVC Sanitary FM along Babcock St from St. Johns Heritage Pkway to proposed Waterstone Tie-in	$600,000	$60,000	$0	$660,000
CIP No. 18: Construct 16" PVC Sanitary FM along St. Johns Heritage Pkwy from Babcock St to Emerald Lakes	$1,200,000	$120,000	$0	$1,320,000
CIP No. 19: Construct 12" PVC Sanitary FM along St. Johns Heritage Pkwy within Emerald Lakes	$2,200,000	$220,000	$75,000	$2,495,000
CIP No. 20: Increased Permitted Capacity of SRWRF to 3 MGD AADF (Phase 1-C)	$14,000,000	$2,800,000	$0	$16,800,000
CIP No. 21: North Regional Wastewater Treatment Plant FDEP Required Nutrient Removal Improvements	$10,200,000	$2,040,000	$0	$12,240,000

Five-Year Improvements	*Construction Cost*	*Engineering Cost*	*Other Costs[1]*	*Project Cost*
CIP No. 22: North Regional Wastewater Treatment Plant Square Digester Improvements	$1,100,000	$220,000	$0	$1,320,000
CIP No. 23: SOIRL Septic to Sewer Conversion Area A	$7,600,000	$1,140,000	$1,009,800	$9,749,800
CIP No. 24: Septic to Sewer Conversion Area B Phases 1 through 5	$33,600,000	$5,040,000	$6,681,000	$45,321,000
CIP No. 25: Septic to Sewer Conversion Area B Phases 6 through 9	$27,300,000	$4,095,000	$7,242,000	$38,637,000
CIP No. 26: Septic to Sewer Conversion Area B Phases 10 through 14	$24,700,000	$3,705,000	$4,508,000	$32,913,000
CIP No. 27: Septic to Sewer Conversion Area C	$21,000,000	$3,150,000	$4,029,000	$28,179,000
CIP No. 28: Install 3" FM along Emerson Dr from Discover Elementary School	$1,900,000	$190,000	$0	$2,090,000
CIP No. 29: Construction of New 8-in PVC and 20-in PVC FM from Lift Station 67 to existing FM north of SRWTP	$1,800,000	$180,000	$0	$1,980,000
CIP No. 30: Replace 8" AC Sanitary FM with 8" PVC Sanitary FM from LS-36 to LS-09	$1,600,000	$160,000	$0	$1,760,000
TOTAL FIVE-YEAR IMPROVEMENTS COST				**$218,762,000**

Table 12-2. Ten-Year Future Conditions Capital Improvements Project Cost Summary

Ten-Year Improvements	*Construction Cost*	*Engineering Cost*	*Other Costs[1]*	*Project Cost*
CIP No. 1: Construct Malabar Booster Station 1 (MBS-01) with Four Inline Booster Pumps	$3,000,000	$300,000	$0	$3,300,000
CIP No. 2: Construct 20" PVC Sanitary FM in FPL Easement from Degroodt Rd to Malabar Rd	$5,700,000	$427,500	$0	$6,127,500
CIP No. 3: Construct 16" PVC Sanitary FM along St. Johns Heritage Pkwy	$1,300,000	$130,000	$0	$1,430,000

Ten-Year Improvements	*Construction Cost*	*Engineering Cost*	*Other Costs[1]*	*Project Cost*
from Emerald Lakes East to Pete Holdings Development				
CIP No. 4: Construct 12" PVC Sanitary FM along St. Johns Heritage Pkwy within Pete Holdings Development	$900,000	$90,000	$0	$990,000
CIP No. 5: Construct 12" PVC Sanitary FM from Rolling Meadows Lakes to Cogan Dr SE	$2,800,000	$280,000	$0	$3,080,000
CIP No. 6: Construct 8" PVC Sanitary FM from Lennar South Development to Malabar Rd	$400,000	$40,000	$0	$440,000
CIP No. 7: Construct 6" PVC Sanitary FM from Minton Road Air Force Facility to Existing FM	$1,100,000	$110,000	$0	$1,210,000
CIP No. 8: Expand South Regional Water Reclamation Facility from 3 MGD to 5 MGD (Phase 2A & B)	$37,000,000	$5,550,000	$0	$42,550,000
CIP No. 9: Construct Second Deep Injection Well for the South Regional WRF	$18,700,000	$2,805,000	$0	$21,505,000
TOTAL TEN-YEAR IMPROVEMENTS COST				**$80,623,500**

Table 12-3. Twenty-Year Future Conditions Capital Improvement Project Cost Summary

Twenty-Year Improvements	*Construction Cost*	*Engineerin g Cost*	*Other Costs*	*Project Cost*
CIP No. 1: Install Valve on Existing 16" FM East of Intersection of Existing 16" Malabar Rd FM and Proposed 20" FPL Powerline Easement FM	$200,000	$20,000	$0	$220,000
CIP No. 2: Construct 20" PVC Sanitary FM along C-37 Canal from Willowbrook Development to SRWRF	$4,500,000	$450,000	$0	$4,950,000
CIP No. 3: Construct 20" PVC Sanitary FM within Willowbrook Development	$3,500,000	$350,000	$0	$3,850,000
CIP No. 4: Construct 16" PVC Sanitary FM along FPL Easement from Calumet	$4,400,000	$440,000	$0	$4,840,000

Twenty-Year Improvements	*Construction Cost*	*Engineering Cost*	*Other Costs*	*Project Cost*
Farms Development to Willowbrook Development				
CIP No. 5: Construct 16" PVC Sanitary FM along Cogan Dr and Osmosis Dr from Proposed 20" FM tie-in at Cogan Dr to SRWRF	$2,100,000	$210,000	$0	$2,310,000
CIP No. 6: Expand South Regional Water Reclamation Facility from 5 MGD to 8 MGD (Phase 2C, 3A, and 3B)	$54,000,000	$8,100,000	$0	$62,100,000
			TOTAL 20-YEAR IMPROVEMENT COST	**$78,270,000**

12.4 Subsequent Steps Imperative for the Progression of Project

In order to facilitate the essential advancement of this project, the PBUD is required to undertake land acquisition and easement acquisition within specified Identification Numbers (IDs) outlined in this project. Additionally, a thorough examination of right-of-way considerations for the majority of proposed improvements and pipe extensions is imperative to ensure the feasibility of construction activities.

12.5 Observations and Recommendations

12.5.1 Observations

The following are a series of discerning observations and prudent recommendations pertinent to the optimal facilitation of this project's successful completion. These insights and guidance are proffered to contribute significantly to the project's seamless execution and the achievement of its defined objectives.

- The future conditions for the three (3) planning horizons (five-year, ten-year, and twenty-year) of the City of Palm Bay's wastewater collection system were modeled and assessed using the City's future GIS wastewater system data and the wastewater modeling program SewerGEMS.
- The GIS for the City's wastewater collections system was used to measure the LF of the proposed pipes in this recommended CIP.
- Currently some projects have not yet been specified in all three (3) planning horizons.

- Estimates of probable costs are Class 5 Order of Magnitude estimates as defined by AACE.

12.5.2 Recommendations

The following recommendations are based on the evaluation of the cost estimate for this CIP.

- Before the implementation of this CIP, the cost estimates must be reevaluated more thoroughly, since Class 5 Order of Magnitude as defined by AACE was used

Section 13 - References

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Calibration of Hydraulic Network Models authored by Lindell Ormsbee and Srinivasa Lingireddy as published in the Journal of the American Water Works Association, Volume 89, No. 2, February 1997, pp 42-50

City of Palm Bay OSTDS Remediation Plan, prepared by Infrastructure Solution Services, July 2024

City of Palm Bay North Regional Water Reclamation Facility Nutrient Removal Facilities Basis of Design Report, Prepared by Wade Trim, July 2018.

City of Palm Bay Utilities Department Policies, Procedures, and Standards Handbook, Jan 2014.

City of Palm Bay Water Master Plan, Prepared by Infrastructure Solution Services, June 2024.

Florida Population: Census Summary 2010, Prepared by University of Florida Bureau of Economic and Business Research, April 2011.

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Florida Estimates of Population 2015, Prepared by University of Florida Bureau of Economic and Business, April 2015.

Quick Guide for Estimating Infiltration and Inflow, United States Environmental Protection Agency Water Infrastructure Outreach, June 2014.

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Palm Bay 2045 Comprehensive Plan, City of Palm Bay Growth Management Department, 2024.

CAPITAL IMPROVEMENT DETAILS