



WATER MASTER PLAN

City of Palm Bay, Florida

June 2024



Prepared by Infrastructure Solution Services



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WATER MASTER PLAN CITY OF PALM BAY UTILITIES DEPARTMENT

JUNE 2024



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ABBREVIATIONS AND TERMINOLOGY

$\mu\text{S}/\text{cm}$ = Microsiemens per Centimeter

AACE = Association for the Advancement of Cost Engineering

AADF = Annual Average Daily Flow

AC = Asbestos Cement

ACP = Asbestos Cement Pipe

ASR = Aquifer Storage and Recovery

AVE = Average

BEBR = University of Florida Bureau of Economic and Business Research

bmp = Below Measuring Point

CaCO_3 = Calcium Carbonate

CIP = Capital Improvement Plan

City = City of Palm Bay

CUP = Consumptive Use Permit

Concen. = Concentration

Dia. = Diameter

DIP = Ductile Iron Pipe

DIW = Deep Injection Well

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

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
HS = High-Service
HSP = High-Service Pump
ID = Identification Numbers
ISS = Infrastructure Solution Services
LF = Linear Feet
MCC = Motor Control Center
MDF = Maximum Daily Flow
MG = Million Gallons
mg/L = Milligrams per Liter
MGD = Million Gallons per Day
MHP = Mobile Home Park
MOR = Monthly Operating Report
NRROWTP = North Regional Reverse Osmosis Water Treatment Plant
NRWTP = North Regional Lime Softening Water Treatment Plant
OUL = Original Useful Life
P.C.U = Platinum-Cobalt Units (Units of Color Measurement)
PBUC = Palm Bay Utility Corporation
PBUD = Palm Bay Utilities Department
pH = Potential of Hydrogen
PHF = Peak Hourly Flow
PLC = Programmable Logic Controller

psi = Pounds per Square Inch

PVC = Polyvinyl Chloride

PWS = Public Water System

R&R = Renewal and Replacement

RFP = Request for Proposal

RO = Reverse Osmosis

RUL = Remaining Useful Life

S.U. = pH Standard Units

SCADA = Supervisory Control and Data Acquisition

SF = Square Feet

SJRWMD = St. Johns River Water Management District

SRO = SRWTP = South Regional Water Treatment Plant

TDH = Total Dynamic Head

TOC = Total Organic Carbon

WM = Water Main

WTP = Water Treatment Plant

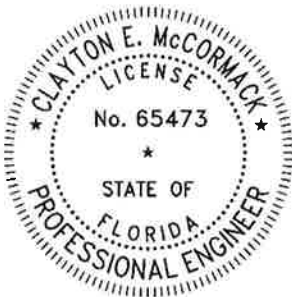
CERTIFICATION

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



A handwritten signature in blue ink, appearing to read "Clayton E. McCormack", written over a horizontal line.

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June 21, 2024

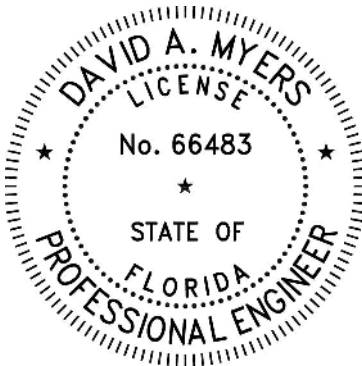
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David A. Myers, PE
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June 24, 2024

Section 1 - Executive Summary

The City of Palm Bay (City) expects continued growth over the next twenty (20) years, resulting in an increase in potable water demand. To meet the demand and to continue to provide safe, high-quality potable water, the City intends to expand and modify its existing water supply, treatment, pumping, storage facilities, and distribution system.

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 production well capacity, treatment capacity, storage capacity, high-service pumping capacity, remote water booster pumping capacity, and distribution and transmission conveyance capacity. This Water Master Plan only includes facility improvements related to capacity and does not address improvements associated with renewal and replacement of facilities, equipment, finished water quality, and/or treatment techniques unless otherwise described.

The source of water for the City's public water supply is groundwater withdrawn from the surficial and Floridan aquifers. These groundwater sources are treated at three (3) water treatment facilities: the North Regional Water Treatment Plant (NRWTP), the North Regional Reverse Osmosis Water Treatment Plant (NRROWTP), and the South Regional Water Treatment Plant (SRWTP). Treated finished water from these plants is pumped into the water distribution consisting of some 681 miles of potable water mains ranging in size from 2-inches to 36-inches in diameter.

As part of this Water Master Plan, a new hydraulic model representation of the existing water distribution was developed using the City's most current and updated geographic information system (GIS) database of the water distribution infrastructure (i.e., pumps, water mains, and water meters). Water demands from all individual water meter billing data were incorporated into the model. The model was calibrated to pressure and water flow data collected from the water distribution system. The model was used to evaluate the existing water distribution under three steady state design conditions and an extended period simulation for several criteria including:

- Water Pressure,
- Pipe Velocity,
- Fire Flow,

- High-Service Distribution Pumping Capacity,
- Water Treatment Plant Capacity,
- Water Well Capacity, and
- Water System Storage Capacity.

The hydraulic model was used as a tool to evaluate the water distribution 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 water service area for the three-planning horizons. The listing of development, their estimated number of equivalent residential connections (ERC), and the total water demand for each planning period was provided. The water demand 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 water 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 the Master Plan to also incorporate an evaluation of the current condition of the water treatment plants (WTPs). This was assessed by assigning an asset condition rating (1 to 5 scale) to all the equipment and facilities at the two (2) WTPs 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 identified through this work was developed into capital improvement projects as previously described.

The future WTP capacity needs were developed by comparing the operational and rated capacity of each WTP facility against the total modeled water demands at each of the five-year, ten-year, and twenty-year planning horizons. A series of water supply, water treatment, system storage, and high-service distribution pumping infrastructure improvement needs at each planning horizon were identified and developed into capital improvement projects.

The results of all the Water Master Plan evaluations indicated that the City's projected increase in water demand will require significant expansion and investments into the City's water system over the

next twenty-year planning horizon. The following table provides a summary of the projected water demands over the next twenty (20) years.

Table 1-1. Projected Future Water Demands by Planning Horizon

Timeframe	Number of ERCs	Average Annual Daily Demand (MGD)	Maximum Day Demand (MGD)	Peak Hour Demand (MGD)
Current	32,676	7.2	9.7	16.8
Five-Year	42,404	9.5	12.4	20.8
Ten-Year	51,157	12.2	17.8	28.0
Twenty-Year	69,111	17.6	22.2	40.0

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

Table 1-2. Projected Capacity Expansion by Facility Type

Timeframe	Wellfield Capacity (MGD)	Treatment Capacity (MGD)	High-Service Pumping Capacity (MGD)	System Storage (MG)	Water Distribution Mains (Miles)
Current	14	10	28.9	7.5	681
Five-Year	16	13.5	30.4	7.5	699
Ten-Year	23.7	20	32.1	9.0	724
Twenty-Year	32.4	24	41.6	11.0	736
Total Increase	18.4	14	12.7	3.5	55

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

- Add one (1) additional Floridan aquifer groundwater supply well for SRWTP. (Five Year CIP No. 24: \$1,870,000)
- Expand SRWTP treatment capacity from an existing treatment capacity of six (6) million gallons per day (MGD) to a future 8 MGD. (Five Year CIP No. 26: \$2,875,000)
- Upgrade one (1) SRWTP High-Service Distribution Pumps. (Five Year CIP No. 25: \$575,000)

- Install of 16-inch/24-inch water transmission main in the Florida Power & Light (FPL) corridor from Paigo Street SE to Babcock Street. (Five Year CIP No. 1: \$9,675,000)
- Replace the existing 8-inch water main with a 12-inch water main on US-1 from Anglers Drive SE to the Breezy Palm RV Park. Five Year (CIP No. 8: \$2,860,000)
- Installation of 16-inch water transmission main along St Johns Heritage Parkway east of Babcock Street. (Five Year CIP No. 13: \$5,390,000)
- Install of 16-inch water transmission main along St Johns Heritage Parkway west of Babcock Street. (Five Year CIP No. 15: \$9,030,000)

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

- Construct the South Booster Station with a 1.5 MG ground storage tank and high-service distribution pumping. (Ten Year CIP No: 13: \$7,975,000)
- Expand NRROWTP to 3.33 MGD. (Ten Year CIP No: 23: \$59,192,000)
- Expand SRWTP from a treatment capacity of 8 to 10 MGD. (Ten Year CIP No: 21: \$3,450,000)
- Upgrade one (1) SRWTP high-service distribution pumps. (Ten Year CIP No: 20: \$575,000)
- Replace existing 6-inch/10-inch watermain with 12-inch watermain on US 1 from Pospsis Ave NE to south of University Blvd. (Ten Year CIP No: 5: \$7,955,000)
- Install 16-inch water main along St Johns Heritage Parkway alignment from St Andre Blvd south looping east Babcock Street. (Ten Year CIP No: 3: \$9,742,500)

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

- Expand NRROWTP treatment capacity from 3.33 to 10 MGD. (Twenty-Year CIP No. 18: \$58,574,000)
- Expand SRWTP treatment capacity from 10 to 14 MGD to include an additional 2.0 MG ground storage tank, additional high-service distribution pumping, and two (2) additional Floridan aquifer groundwater supply wells. (Twenty-Year CIP No. 19: \$40,250,000)
- Replace the existing 8-inch water main with a 12-inch water main along Palm Bay Road from Babcock Street NE to Clearmont Street NE. (Twenty-Year CIP No. 3: \$4,840,000)
- Replace the existing 12-inch water main with a 16-inch water main along Emerson Drive from Nash Repump Station to the west of Minton Drive. (Twenty-Year CIP No. 6: \$6,450,000)

- Replace the existing 10-inch water main with a 12-inch watermain along Conlan Blvd NE from Palm Bay Road to US-1. (Twenty-Year CIP No. 10: \$5,940,000)

Other general recommended improvements based on the system evaluation include the following:

- Looping dead-end water lines to improve fire protection, system redundancy, pressure equalization, and minimize water quality deterioration.
- Replace undersized water mains to meet pipe velocity criteria or improve fire protection and water distribution throughout the community.
- Begin a phased replacement of older asbestos cement (AC) water lines in the northeast sections of the city.

The planning level total estimated cost of the recommended improvements over the twenty-year planning horizon is approximately \$395.8 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

Time-Frame	Well Capacity	Treatment Capacity	High-Service Pump Capacity	Storage Capacity	Distribution Mains	TOTAL
Five-Year	\$1,870,000	\$11,385,000	\$575,000	\$0	\$46,858,000	\$60,688,000
Ten-Year	\$1,955,000	\$78,742,000	\$6,050,000	\$2,500,000	\$79,500,000	\$168,747,000
Twenty-Year	\$0	\$98,824,000	\$3,105,000	\$0	\$64,410,000	\$166,339,000
TOTAL	\$3,825,000	\$188,951,000	\$9,730,000	\$2,500,000	\$190,768,000	\$395,774,000

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Section 2 - Background

2.1 Goals and Objectives

The City of Palm Bay expects continued growth over the next 20 years, resulting in an increase in potable water demand. To meet the demand and to continue to provide safe, high-quality potable water, the City intends to expand and modify its existing water supply, treatment, pumping, and storage facilities as well as its distribution system.

The goal of this Water 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 include the following:

- Groundwater Production Well Capacity,
- Treatment Capacity,
- Water Storage Capacity,
- High-Service Pumping Capacity,
- Water Booster Pumping Capacity, and
- Distribution and Transmission Water Main Conveyance Capacity.

This Water Master Plan generally considers facility and water transmission/distribution system improvements related to increased capacity needs. Improvements associated with the facility renewal and replacement improvements are limited to addressing needs at the water treatment plants. Source water, finished water quality and/or water treatment process improvements are being addressed by others on behalf of the Utility.

In addition to identifying future capital improvement needs, the water distribution hydraulic model developed as part of this Master Plan is anticipated to be used for multiple purposes in the future including the following:

- 1) Develop Water Main Flushing Programs,
- 2) Identify Water Quality Issues in the Water Distribution System,
- 3) Formulate Strategies to Mitigate the Impacts of Outages,
- 4) Determine Needs for Specific, Isolated Service Requests, and

5) Conceptualize Water System Infrastructure Needs.

2.2 City of Palm Bay Description

The City of Palm Bay (City) is located in southern Brevard County along Florida’s East Coast. The City is bordered by the Cities of Melbourne and West Melbourne to the north, the Towns of Malabar and Grant-Valkaria and the Indian River Lagoon 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, 2024). The median household income was \$55,542 and the median home value of \$214,832 in 2024. (*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%

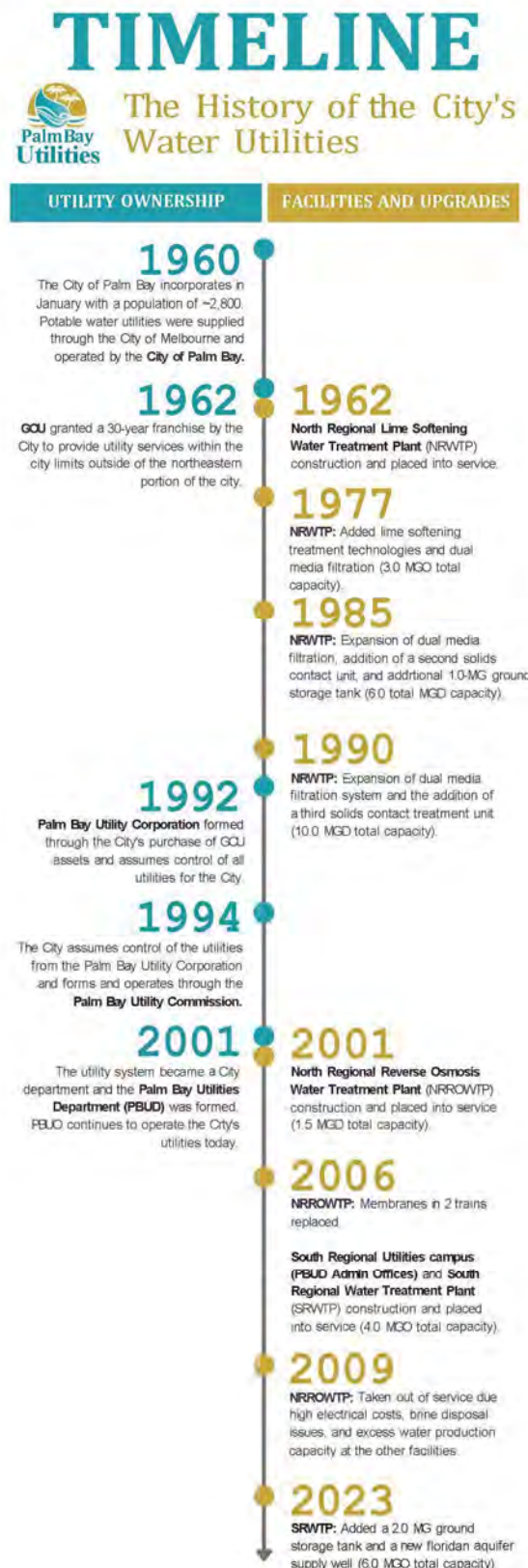
1) Taken from Palm Bay 2045 Comprehensive Plan Table FLU-6.

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 (*City of Palm Bay 2045 Comprehensive Plan, Section 2, 2024*).

2.3 Utility System History

The potable water 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. At the time, potable water was supplied to the City through two (2) interconnections with Melbourne.

In 1962, GDU was granted a franchise by the City of Palm Bay for 30 years to provide utility services within the city limits outside of the northeastern portion of the city. In 1992, at the end of the 30-year franchise agreement, the City purchased the assets of GDU and formed the Palm Bay Utility Corporation (PBUC). The two (2) water distribution systems were interconnected and PBUC began production, treatment, distribution, operation, and maintenance of the utility systems for Palm Bay. PBUC



transferred the utility system to the City in 1994, and the Palm Bay Utilities Commission began control of the system. In 2001, the utility system became a City department and the Palm Bay Utilities Department (PBUD) was formed.

The North Regional Lime Softening Water Treatment Plant (NRWTP) was originally constructed in 1962 by GDU to provide essential municipal water storage and distribution services within the GDU service area. Lime softening treatment with dual media filtration was added in 1977 providing a total production capacity of 3.0 MGD. In 1985, the plant was expanded to a total production capacity of 6.0 MGD with the expansion of the dual media filtration, a second solids contact lime softening unit, and a 1.0-million-gallon ground storage tank (GST). In 1990, the plant was further expanded to a total production capacity of 10.0 MGD with the expansion of the dual media filtration system and the addition of a third solids contact lime softening treatment unit.

The North Regional Reverse Osmosis Water Treatment Plant (NRROWTP) was constructed and placed into service in 2001. The NRROWTP has a capacity of 1.5 MGD and was designed with an ultimate expansion capacity of 3.0 to 4.5 MGD. The reverse osmosis membranes in two of the trains were replaced in 2006. The City has not operated the system since 2009 due to high electrical operating costs, brine disposal issues, and excess water production capacity at the other treatment facilities.

In response to the expected significant growth within the city, the South Regional Water Treatment Plant (SRWTP) was constructed and placed into service in 2006. The plant was originally constructed with a permitted capacity of 4.0 MGD and was recently expanded to bring the permitted capacity to 6 MGD.

The SRWTP is collocated with the PBUD administrative offices on the South Regional Utilities Campus located on Osmosis Dr in south Palm Bay.

2.4 Water Distribution Service Area Description

The PBUD owns and operates the potable water transmission and distribution system within the city limits of the City of Palm Bay and the town limits of the Town of Malabar, and it supplies water to surrounding areas, including a very small portion of the Grant-Valkaria in the southeast and small portions of unincorporated Brevard County in the northwest south of Malabar Rd. 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.

Water is available in most of the northern part of the city, particularly north of Malabar Road. A large portion of homes within the southern and western parts of the city are not connected to the city water system and use private wells for potable water service. A figure showing the parcels serviced by the City is shown in **Figure 2-2**.

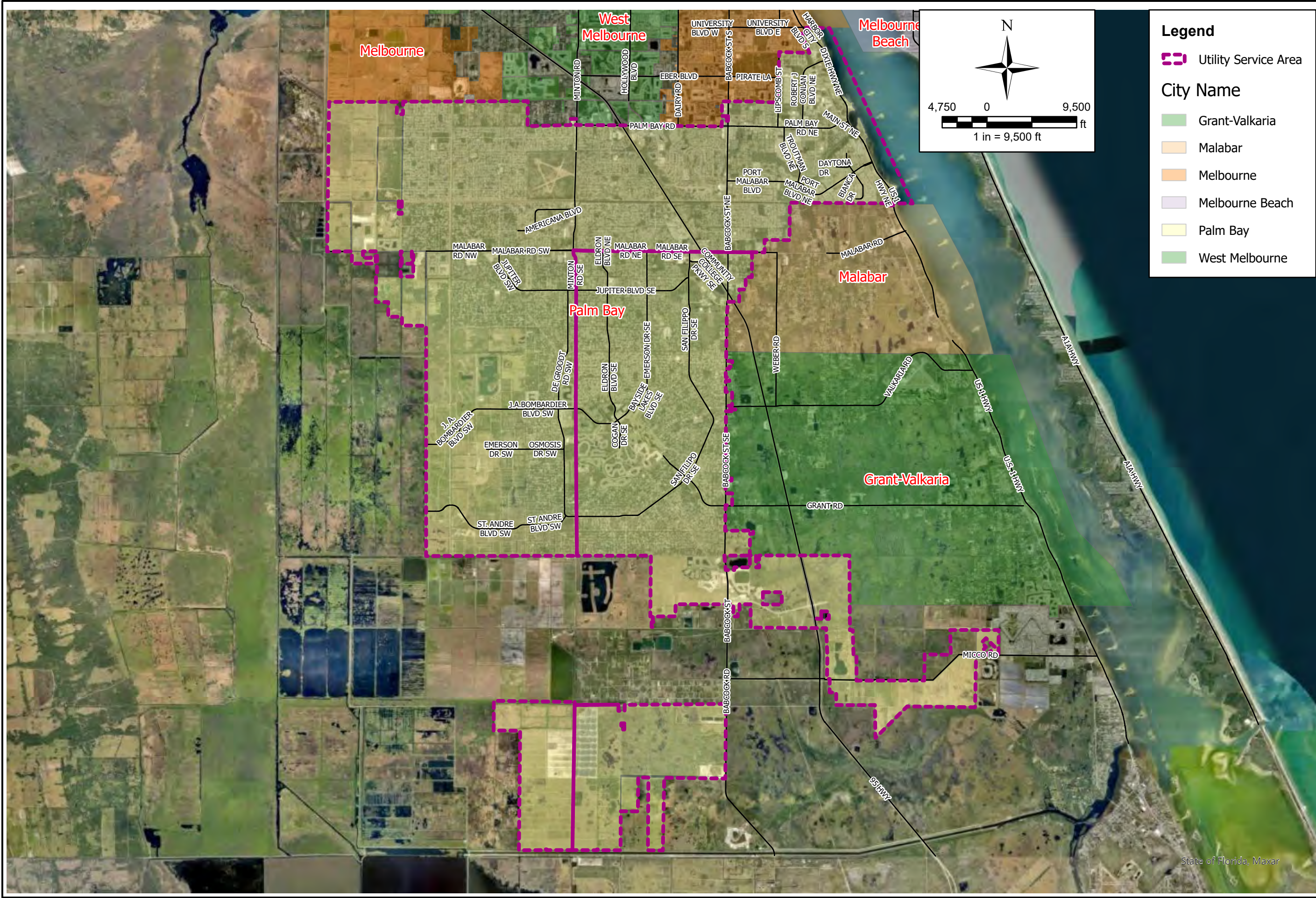
At the end of 2023, the City of Palm Bay had approximately 42,000 service connections. This is an additional 9,600 connections or a 23% increase from the 32,380 in 2016 stated in the previous 2017 City of Palm Bay Water Master Plan.

In case of an emergency, the City of Palm Bay and the City of Melbourne share two (2) interconnections for the bulk sale or purchase of water. The two (2) interconnects are 12-inches in diameter and equipped with 6-inch flow meters. The interconnections are located at Florida Avenue and Monroe Street, and Babcock Street at the northern city limits, respectively.

In 2010, the Cities of Palm Bay and West Melbourne jointly agreed to install two 16-inch water mains across Palm Bay Road, west of Hollywood Road, to provide an emergency interconnection between the communities.

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Utility Service Area
Water Master Plan
City of Palm Bay Utilities Department

PROJECT NO.:
PBU009
DATE:
JUN 2024
FIGURE NO.
2-1

City of Palm Bay
Utilities Service Boundary

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2.5 Previous Water Master Plans

Their most recent City of Palm Bay Water Master Plan report was prepared in October 2017 by Wade Trim (Wade Trim, 2017). At that time, the previous hydraulic model of the water system was updated and calibrated to accurately simulate the water 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 water system demands incorporating the new development areas known at the time.

The following table presents the 2017 Water Master Plan projected water demand characteristics for the annual average, maximum day, and peak hour design flow conditions for each of the planning horizon scenarios.

Table 2-2. 2017 Water Master Plan Projected Twenty-Year Water Demand

Timeframe	Average Annual Daily Demand (MGD)	Maximum Day Demand (MGD)	Peak Hour Demand (MGD)
2017	6.31	9.21	15.14
Five-Year	8.69	13.56	20.86
Ten-Year	11.71	17.10	28.10
Twenty-Year	14.61	21.33	35.06

The results of the evaluations indicated the City's projected increase in water demand required the expansion of the following facilities over the twenty-year plan as shown in the following table.

Table 2-3. 2017 Water Master Plan Projected Capacity Expansion by Facility Type

Timeframe	Wellfield Capacity (MGD)	Treatment Capacity (MGD)	High-Service Pumping Capacity (MGD)	System Storage (MG)	Water Distribution Mains (Miles)
2017	20.31	15.5	20.6	5.5	650
Five-Year	2.54	2	4	2	19.5
Ten-Year	6.07	4	8	1.5	19.5

Timeframe	Wellfield Capacity (MGD)	Treatment Capacity (MGD)	High-Service Pumping Capacity (MGD)	System Storage (MG)	Water Distribution Mains (Miles)
Twenty-Year	1.00	1.5	4	1	12.2
Total Increase	9.61	7.5	16	4.5	51.1
TOTAL	29.92	23.0	36.6	10.0	701.1

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

- Expansion of the SRWTP from an existing treatment capacity of 4.0 (MGD) to a future capacity of 6.0 MGD. This will also require the addition of a new Floridan supply well for the SRWTP.
- Addition of a second 2.0 (MG) ground storage tank at the SRWTP. This will also require additional high-service pumps.
- Installation of a 24-inch transmission water main along Cogan Drive between Babcock Street SE and Paigo Street SE.
- Replacement of existing water main along US-1 with new 12-inch pipe.

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

- Expansion of the SRWTP from a treatment capacity of 6.0 MGD to 10.0 MGD. This expansion also will require the addition of two (2) new Floridan supply wells for the SRWTP.
- Addition of a new Floridan supply well for the NRROWTP.
- Addition of a second 1.5 MG ground storage tank at the Nash Repump Station. This expansion also will require the replacement of high-service pumps at the tank.
- Installation of a 16-inch transmission main along San Filippo Drive and DeGroodt Road.
- Installation of a 16-inch transmission main within the Florida Power and Light (FPL) easement between Malabar Road and Cogan Drive.

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

- Installation of a 1.0 MG ground storage tank and associated high-service pumps near the Babcock Street and Davis Lane intersection.
- Replacement of numerous water lines along Palm Bay Road, US-1, Port Malabar Road, Conlan/Northview/Florida/Kingswood, Culver, and Clearmont with new 12-inch pipe.

- Replacement of existing water main along Emerson Drive with new 16-inch pipe.
- Replacement of existing water main from the NRWTP with new 24-inch pipe.

Other general recommended improvements based on the system evaluations include:

- Looping dead-end water lines to improve fire protection, system redundancy, pressure equalization, and minimize water quality deterioration.
- Replacing undersized water main to meet pipe velocity criteria or improve fire protection and water distribution throughout the community.

The total estimated cost of the recommended improvements over the twenty-year period is approximately \$82.83 million (2017 dollars). The following table summarizes the projected improvement costs at the time for each planning period.

Table 2-4. 2017 Water Master Plan Projected Improvement Cost by Planning Horizon

Timeframe	Wellfield Capacity	Treatment Capacity	High-Service Pumping Capacity	System Storage Capacity	Additional Water Distribution Mains	TOTAL
Five-Year	\$550,000	\$14,410,000	\$880,000	\$1,870,000	\$12,026,000	\$29,736,000
Ten-Year	\$1,650,000	\$19,800,000	\$440,000	\$1,320,000	\$11,882,000	\$35,092,000
Twenty-Year	\$550,000	\$9,900,000	\$330,000	\$990,000	\$6,230,000	\$18,000,000
TOTAL	\$2,750,000	\$44,110,000	\$1,650,000	\$4,180,000	\$30,138,000	\$82,828,000

2.5.1 Water System Improvements Completed Since 2017 Water Master Plan

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

- Five-Year CIP No. 1: 24" WM Loop on Cogan (Paigo to Babcock)
- Five -Year CIP No. 13: 16" WM Extension on Emerson (St Johns Heritage Parkway to W of Amador) for Palm Vista Development
- Five -Year CIP No 14: 16" WM Loop on St Johns Heritage Parkway (Emerson to Malabar Rd) for Palm Vista and Palmer Developments
- Five -Year CIP No 15: 8" WM Extension S of Malabar Rd for Chaparral Development

- Five -Year CIP No 26: South Regional WTP Expansion from 4 MGD to 6 MGD Capacity
- Five-Year CIP No 27: Additional 2.0 MG Ground Storage Tank at South Regional WTP
- Five-Year CIP No. 28: Additional High-Service Pumping at South Regional WTP
- Five-Year CIP No. 29: One New Floridan Aquifer Groundwater Supply Well for South Regional WTP

Section 3 -Description of Water System Infrastructure

3.1 Introduction

Section 3 of the City of Palm Bay Water Master Plan describes the city's water system infrastructure, including the water supply wells, WTPs, and water distribution system. The Section will also describes the regulatory requirements for the water system.

3.2 Regulatory

3.2.1 *FDEP Community Water Supply Regulatory Requirements*

The Florida Department of Environmental Protection (FDEP) regulates the City of Palm Bay municipal potable water production and distribution system through the Source and Drinking Water Program. The authority to regulate public water systems is derived from Chapter 403, Part VI, Florida Statutes, and by delegation of the federal program from the U.S. Environmental Protection Agency (EPA).

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

Chapter 62-550 FAC	Drinking Water Standards, Monitoring, and Reporting
Chapter 62-555 FAC	Permitting and Construction of Public Water Systems
Chapter 62-602 FAC	Drinking Water and Domestic Wastewater Treatment Plant Operators
Chapter 62-602 FAC	Drinking Water and Domestic Wastewater Treatment Plant Operators

The City of Palm Bay water system is classified by the FDEP as a Public Water System (PWS) and is identified by the FDEP as PWS No. 3050442.

3.2.2 *SJRWMD Consumptive Use Permit*

The St. Johns River Water Management District (SJRWMD) regulates the withdrawal of groundwater through the Consumptive Use Permitting (CUP) Program. The current Consumptive Use Permit (Number 202) was issued to the City on May 18, 2010 and expires on May 17, 2029.

According to the permit, by the Year 2029, the Ccity can withdraw a total annual volume of approximately 6,194 million gallons per year, or an average daily withdrawal of 16.97 MGD, from the surficial and Floridan aquifers, combined.

The CUP places a limit on the annual groundwater withdrawal from the surficial aquifer to 1,715.5 million gallons per year, or an annual average daily withdrawal of 4.70 MGD. The permitted annual withdrawal from the Floridan aquifer increases incrementally each year through 2029 when the annual permitted withdrawal is 4,478 million gallons per year, or approximately 12.27 MGD.

Specific wells have additional withdrawal limitations, such as Well No. RO1 serving the NRROWTP reverse osmosis (RO) process and Well No. F-1 serving as a blending well for the NRWTP lime softening process. These wells are limited to a maximum daily withdrawal of 0.7 MGD and 0.43 MGD, respectively.

According to the SJRWMD staff report for the 2010 CUP renewal, the withdrawal allocations permitted generally are expected to be sustainable over the term of the permit, provided the conditions of the permit are met. A total of forty-two (42) active wells, including thirty-five (35) surficial aquifer water wells and seven (7) Floridan Aquifer wells, are permitted under the CUP. In addition, the CUP also provides for three (3) future surficial wells and nine (9) future Floridan wells.

The following table summarizes the permitted withdrawal allocations listed in the permit.

Table 3-1. Consumptive Use Permit Groundwater Withdrawal Permitted Allocations

Year	Surficial Aquifer Withdrawal		Floridan Aquifer Withdrawal		Total Permitted Withdrawals	
	Max Annual Flow (MG)	Annual Average Daily Flow (MGD)	Max Annual Flow (MG)	Annual Average Daily Flow (MGD)	Max Annual Flow (MG)	Annual Average Daily Flow (MGD)
2022	1715.5	4.70	3674.7	10.07	5390.2	14.77
2023	1715.5	4.70	3868.1	10.60	5583.6	15.30
2024	1715.5	4.70	4061.4	11.13	5776.9	15.83
2025	1715.5	4.70	4254.7	11.66	5970.2	16.36
2026	1715.5	4.70	4310.6	11.81	6026.1	16.51
2027	1715.5	4.70	4366.5	11.96	6.82.0	16.66
2028	1715.5	4.70	4422.4	12.12	6137.9	16.82
2029	1715.5	4.70	4478.3	12.27	6193.8	16.97

Taken from Condition 12 St Johns River Water Management District Consumptive Use Permit No. 202 Issued to the City of Palm Bay, May 2010.

3.3 Water Supply Wells

The source of the potable water supply for the City of Palm Bay is the shallow surficial aquifer groundwater for the NRWTP lime softening process. The deeper Floridan Aquifer brackish groundwater is the water source for the NRROWTP and SRWTP reverse osmosis treatment processes.

3.3.1 Surficial Aquifer Groundwater Supply Wells

The raw water source for the North Regional Water Treatment Plant (NRWTP) is a series of thirty-five (35) active surficial aquifer groundwater wells. These wells possess a casing diameter ranging from 6-inches to 12-inches and have a total depth ranging from 85 ft to 137 ft. The details and locations of these wells can be found in **Section 3.6**.

In addition to the surficial aquifer groundwater wells, the NRWTP can utilize the groundwater from the F-1 Floridan Aquifer well with lower chlorides during peak water demand to be blended up to approximately 5% with groundwater from other surficial wells.

The total rated pumping capacity of NRWTP Surficial Aquifer groundwater wells is approximately 6,700 gpm or 9.68 MGD.

According to the City's CUP, the permitting annual average daily groundwater withdrawal from the surficial wells is limited to 4.70 MGD or approximately 49% of the rated well capacity. The historical surficial aquifer groundwater withdrawals are shown in the table below:

Table 3-2. Surficial Aquifer Groundwater Withdraws

Year	Annual Ave Daily Flow Actual Withdraw (MGD)	Annual Ave Daily Flow Permitted Withdraw (MGD)	Annual Ave Daily Flow Under Permitted Withdraw (MGD)
2019	2.94	4.7	1.76
2020	3.43	4.7	1.27
2021	3.31	4.7	1.39
2022	3.16	4.7	1.54
2023	3.54	4.7	1.16

The water quality of the surficial aquifer water supply wells is suitable for conventional lime softening treatment. However, many of the surficial aquifer groundwater water wells are exhibiting increasing concentrations of naturally occurring organic matter (characterized by total organic carbon

[TOC]) and chlorides. WTP staff are constrained to carefully select certain groups of wells to operate at a given time so that proper finished water standards can be maintained. For example, the CUP limits the operation of any surficial wells if the chloride level exceeds 300 mg/L. If this condition occurs, the operation of the well has to be discontinued until the chloride level decreases to below 250 mg/L.

The following table summarizes the water quality of the surficial aquifer wells providing the source water for the NRWTP.

Table 3-3. North Regional Lime Softening WTP Surficial Aquifer Water Quality

Parameter	Units	Historical Ave ^{1,2}	Historical Range ^{1,2}
pH	S.U.	7.2	6.8 to 7.4
Alkalinity	mg/L as CaCO ₃	280	33 to 482
Total Hardness	mg/L as CaCO ₃	398	33 to 482
Iron	mg/L	0.77	0.19 to 3.2
Color	P.C.U	42	0 to 356
Chlorides	mg/L	185	146 to 282
Total Organic Carbon	mg/L	6.4	2.8 to 10
Ammonia	mg/L	1.4	0.8 to 5.2

¹Taken from Table 3-1 North Regional Water Treatment Plant Upgrades Preliminary Design Investigations, Tetra Tech, October 2022

²TOC and ammonia data taken from Stage 2 Disinfection By-Product Minimization Support Task A – Source Water Quality Characterization, Wade Trim, Dec 2013.

3.3.2 Floridan Aquifer Groundwater Supply Wells

3.3.2.1 North Regional Reverse Osmosis Water Treatment Plant Supply Wells

The source water for the North Regional Reverse Osmosis Water Treatment Plant (NRROWTP) is a series of three (3) brackish Floridan Aquifer groundwater wells. The details and locations of these wells can be found in **Section 3.6**.

These wells' total rated pumping capacity is approximately 1,400 gpm or 2.0 MGD.

According to the City's CUP, the permitting annual average daily groundwater withdrawal from the NRROWTP Floridan Aquifer wells is limited to 0.70 MGD for RO-1 and 0.43 MGD for F-1.

The NRROWTP Floridan Aquifer groundwater wells have not been used since approximately 2009 when the reserve osmosis water treatment facilities were taken off-line.

The following table summarizes the water quality of the Floridan Aquifer wells providing the source water for the NRROWTP.

Table 3-4. North Regional Reverse Osmosis WTP Floridan Aquifer Water Quality

Parameter	Units	Supply Well RO-1 Historical Ave (Range) ¹	Supply Well RO-2 Historical Ave (Range) ¹
pH	S.U.	7.4 (7.1 to 7.6)	7.4 (7.1 to 7.7)
Chlorides	mg/L	2,840 (2,444 to 3,058)	975 (849 to 1,062)
Sodium	mg/L	1,675 (1,600 to 1,750)	432 (419 to 446)
Calcium	mg/L as CaCO ₃	166.5 (166 to 167)	104 (99.6 to 107)
Sulfate	mg/L	368 (347 to 391)	149.5 (149 to 150)
Alkalinity	mg/L as CoCO ₃	135.5 (134 to 137)	133 (131 to 135)
Total Dissolved Solids	mg/L	4,870 (4,640 to 5,100)	1,800 (1,760 to 1,840)
Specific Conductivity	μS/cm	9,325 (8,900 to 9,890)	3,278 (3,170 to 3,370)

Taken from Table 3-1 North Regional Water Treatment Plant Upgrades Preliminary Design Investigations, Tetra Tech, October 2022.

3.3.2.2 South Regional Reverse Osmosis Water Treatment Plant Supply Wells

The raw water source for the South Regional Water Treatment Plant (SRWTP) is a series of three (3) active and one (1) newly constructed brackish Floridan Aquifer groundwater wells. The details and locations of these wells can be found in **Section 3.6**.

The total rated pumping capacity of these wells is approximately 7,000 gpm or 10 MGD.

According to the City's CUP, the permitting annual average daily groundwater withdrawal from all Floridian Aquifer groundwater wells is limited to 10.6 MGD in 2023 increasing to 12.27 MGD in 2029. This limitation is inclusive of all Floridian Aquifer groundwater wells.

The historical Floridian Aquifer groundwater withdrawals are shown in the table below:

Table 3-5. Floridian Aquifer Groundwater Withdraws

Year	Annual Ave Daily Flow SRWTP Actual Withdraw (MGD)	Annual Ave Daily Flow NRROWTP Actual Withdraw (MGD)	Annual Ave Daily Flow Total Actual Withdraw (MGD)	Annual Ave Daily Flow Permitted Withdraw (MGD)
2019	4.56	0.0	4.56	8.77
2020	4.44	0.0	4.44	9.01
2021	4.91	0.0	4.91	9.54
2022	4.81	0.0	4.81	10.07
2023	5.00	0.0	5.00	10.60

As can be seen in the table above, the two RO water treatment plants are being operated will within the CUP groundwater withdrawal limitations. The City has significant flexibility to withdraw additional brackish Floridian Aquifer groundwater to meet the needs of the City in the future to accommodate future growth and additional water demands.

The following table summarizes the water quality of the Floridian Aquifer groundwater providing the source water for the SRWTP.

Table 3-6. South Regional Reverse Osmosis WTP Floridian Aquifer Water Quality

Parameter	Units	Concentration ¹
pH	S.U.	7.8
Chlorides	mg/L	790
Sodium	mg/L	389
Calcium	mg/L	124
Sulfate	mg/L	198
Alkalinity	mg/L as CoCO ₃	167
Total Hardness	mg/L as CoCO ₃	615

Parameter	Units	Concentration ¹
Total Dissolved Solids	mg/L	1,800

¹ Taken from City of Palm Bay South Regional Water Treatment Plant Expansion 4 MGD to 6 MGD Technical Specifications Section 11250 1.01 C 1, Tetra Tech, June 2020.

3.4 Water Treatment Plants

3.4.1 North Regional Lime Softening Water Treatment Plant

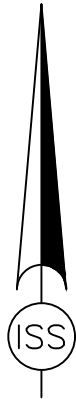
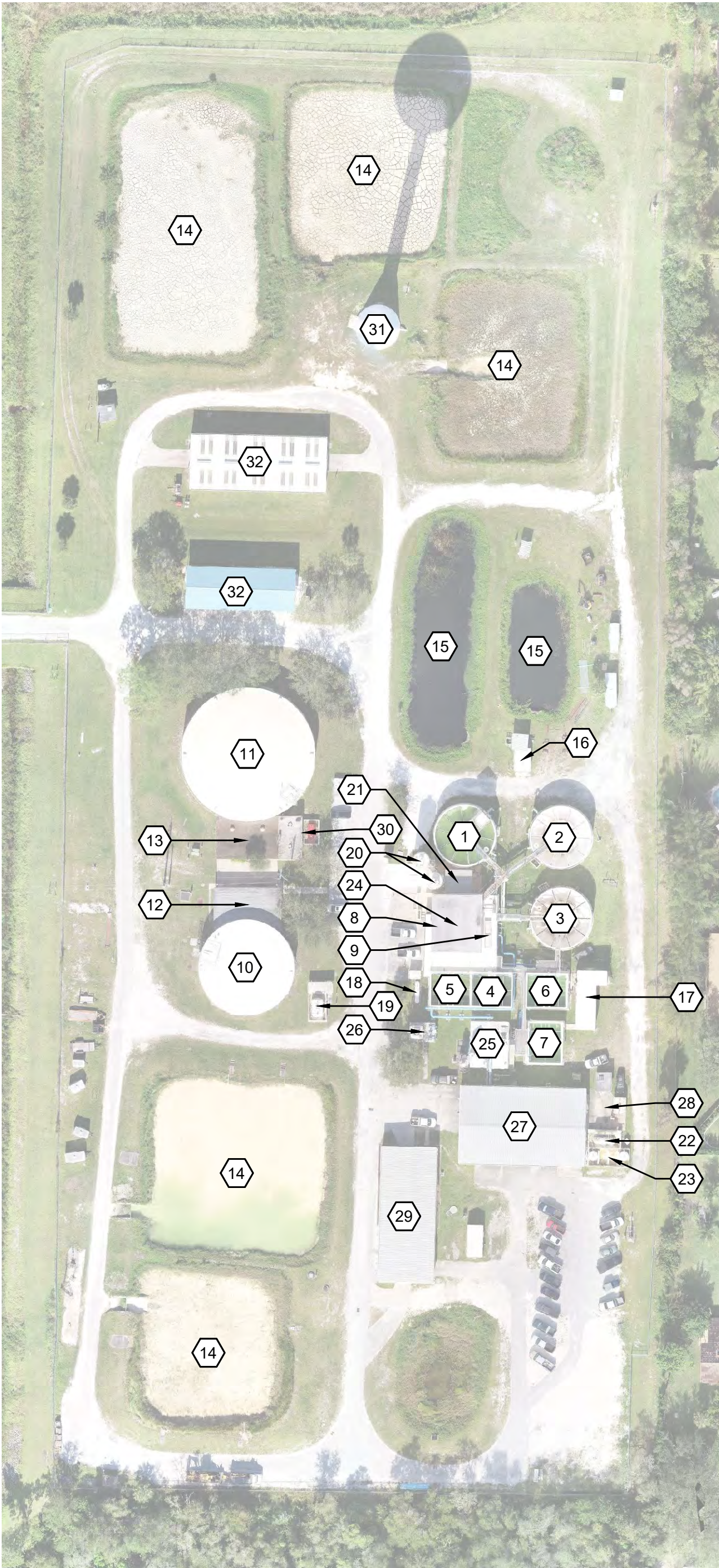
The NRWTP is located on the North Regional Utilities Campus at 1105 Clearmont Street NE, Palm Bay, FL. The facility is operated as a component of community FDEP Public Water System No. 305442. The NRWTP is classified by the FDEP as a Category I, Class A facility. The plant is operated 24 hours per day by a staff consisting of one (1) Chief Operator, seven (7), Certified Operators, and one (1) Trainee.

The NRWTP utilizes the following unit treatment processes:

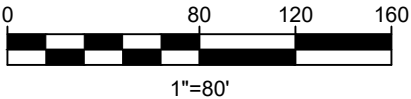
- Cascade Aeration,
- Enhanced Lime Softening,
- Dual Media Sand Filtration,
- Transfer Pumping,
- Sodium Hypochlorite Disinfection,
- Chemical Feed and Storage Facilities,
- Ground Storage Tanks,
- High-Service Pumps,
- Forced draft aeration,
- Standby Power, and
- Instrumentation and Control Systems.

Refer to **Figure 3-1** for an overview of the NRWTP facilities. **Figure 3-2** is a process flow schematic for the NRWTP.

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GRAPHIC SCALE



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

FIG 3-1

PROJECT NO.	PBU009	PROJ. MGR.	CEM
DATE	06/20/24	DRAWN BY	MSC
SCALE	1" = 80'	CHECK BY	CEM
SHEET NO.			

DRAWING TITLE:	SITE PLAN
	PALM BAY NORTH REGIONAL WATER TREATMENT PLANT
CLIENT:	CITY OF PALM BAY UTILITIES DEPARTMENT

**INFRASTRUCTURE
SOLUTION SERVICES**

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

NO.	DATE:		DESCRIPTION	
			REVISIONS	

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The following table provides a description of the existing unit treatment processes at the NRWTP:

Table 3-7. North Regional Lime Softening WTP Unit Treatment Process Description

Unit Process	Description
Aerators	<ul style="list-style-type: none"> • Lime Softening Treatment Unit No. 1 : One 3,500 gpm Cascade Aerator
Solids Contact Treatment Units	<ul style="list-style-type: none"> • Three 44 ft diameter, 16 ft side water depth Solids Contact Clarifier rated at a maximum 1.75 gpm/sf loading rate.
Dual Media Filters	<ul style="list-style-type: none"> • Three duty + 1 standby dual media gravity filters (18 in anthracite, 12 in sand, 12 in gravel) with 576 SF each
Clear Well and Transfer Pumps	<ul style="list-style-type: none"> • One 50,000-gallon Clear Well • Three duty + standby vertical turbine Transfer/Backwash Pumps rated for 3,720 gpm @ 36 ft TDH, 60 HP
Ground Storage Tanks	<ul style="list-style-type: none"> • One 70 ft dia, 17.5 ft SWD 500,000-gallon Ground Storage Tank (South) • One 100 ft dia, 17.5 ft SWD 1,000,000-gallon Ground Storage Tank (North)
High-Service Pumps	<ul style="list-style-type: none"> • Pump Building No. 1 (South): Pump No. 1 – 500 gpm @ 175 ft TDH, 50 HP Constant Speed Split Case Centrifugal; Pump Nos. 2 and 3 – 900 gpm @ 175 ft TDH, 60 HP Constant Speed Split Case Centrifugal • Pump Building No. 2 (North): Pump No. 4,5,and7 – 1,700 gpm @ 185 ft TDH, 100 HP Constant Speed Split Case Centrifugal; Pump No. 6 – 1,700 gpm @ 185 ft TDH, 100 HP Variable Speed Split Case Centrifugal
Lime Feed System	<ul style="list-style-type: none"> • Two 11 ft dia, 34 ft eave height, 1930 CF, 50-ton nominal capacity quicklime storage silos • Two 50 to 1,000 lbs/hr capacity lime slaker • Two 300 gal Lime Slurry Tanks • Three 5 HP Lime Slurry Hose Pumps rated at 20 gpm each
Polymer Feed System	<ul style="list-style-type: none"> • One neat Polymer Feed Pump • One 120-gallon Polymer Batch Tank with Tank Mixer • Triplex diaphragm type polymer metering pump skid rated at 10 gph each
Acid Feed System	<ul style="list-style-type: none"> • Two 2,000-gallon Sulfuric Acid bulk storage tanks • One 150-gallon Sulfuric Acid day tank • One triplex chemical metering pump skid
Phosphate Feed System	<ul style="list-style-type: none"> • One 130-gallon phosphate solution tank • One duplex chemical metering pump skid rated at 13 gph

Unit Process	Description
Hypochlorite Feed System	<ul style="list-style-type: none"> Three 8 ft 6 in dia. by 10 ft 3 in HD Linear Polyethylene 2,500-gallon Double Walled Bulk Hypochlorite Storage Tanks Two Triplex Chemical Metering Pump Skids
Ammonia Feed System	<ul style="list-style-type: none"> One 1,000-gallon horizontal anhydrous ammonia gas bulk storage tank Two 100 lbs/day direct feed type ammoniators with 10:1 turndown
Fluoride Feed System	<ul style="list-style-type: none"> One 5,000-gallon Hydrofluosilic Acid bulk storage tank One 100-gallon Hydrofluosilic Acid day tank One duplex chemical metering skids rated at 1.3 gph each
Backwash Washwater Recovery Pond	<ul style="list-style-type: none"> Save-All Backwash Recovery Pond No. 1 - 50 ft wide by 150 ft long by 7.5 ft deep, 424,000-gallon capacity Save-All Backwash Recovery Pond No. 2 - 35 ft wide by 100 ft long by 4 ft deep, 105,000-gallon capacity One 7.5 HP Solids Handling Washwater Return Pump
Spent Lime Drying Beds	<ul style="list-style-type: none"> Drying Bed No. 1 – 115 ft long by 120 ft wide by 3 ft deep (41,400 CF) Drying Bed No. 2 – 140 ft long by 130 ft wide by 3 ft deep (54,600 CF) Drying Bed No. 3 – 115 ft long by 200 ft wide by 3 ft deep (69,000 CF) Drying Bed No. 4 – 220 ft long by 125 ft wide by 3 ft deep (82,500 CF) Drying Bed No. 5 – 115 ft long by 140 ft wide by 3 ft deep (48,300 CF) One 7.5 HP Solids Handling Sludge Pump Three Filtrate Pump Stations with one 0.5 HP submersible sump pump each
Plant Facilities	<ul style="list-style-type: none"> One 1.25 MW Standby Diesel Generator Air Compressor Operations Office Plant Wide SCADA System

Finished water is stored in two (2) on-site prestressed ground storage tanks (500,000-gallon and 1,000,000-gallon capacity) and one (1) on-site welded steel elevated storage tank (500,000-gallon capacity). The elevated tank "floats" on the system with no control valves regulating flow into or out of the tank. The elevated tank helps offset high demands during peak periods and provides emergency fire flows.

Residuals from the treatment process include filter backwash and spent lime sludge. When the filters are backwashed, the wash water is directed to a Backwash Washwater Recovery Pond (Pond No. 1 – 424,000 gallon; Pond No. 2 – 105,000 gallon). The washwater after being settled in the pond is recovered and returned to the treatment process. The spent lime sludge from the solids contract treatment units is

conveyed to one (1) of five (5) drying beds. The dried spent lime is hauled off-site for beneficial land application.

3.4.1.1 North Regional Reverse Osmosis Water Treatment Plant

The NRROWTP also located at is located at 1105 Clearmont Street NE, Palm Bay, FL. on the North Regional Utilities Campus was placed into service in 2001. The NRROWTP has a capacity of 1.5 MGD and was designed with an ultimate expansion capacity of 3.0 to 4.5 MGD. The existing 1.5 MGD capacity is provided by three (3) 0.5 MGD RO trains designed to operate at 70% recovery. The membranes in two (2) of the trains were replaced in 2006.

The City has not operated the system since 2009 due to high electrical costs, brine disposal issues, and excess water production capacity at the other facilities.

The following table describes the existing unit treatment processes at the NRROWTP:

Table 3-8. North Regional Reverse Osmosis WTP Unit Treatment Process Description

Unit Process	Description
RO Pretreatment	<ul style="list-style-type: none"> Four raw water vertical RO pretreatment cartridge filters rated at 264 gpm each
RO Pretreatment	<ul style="list-style-type: none"> Two raw water vertical bypass cartridge filters rated at 139 gpm each
High-Pressure Pumps	<ul style="list-style-type: none"> Three 125 HP vertical turbine high pressure RO Feed Pumps rated at 465 gpm each
RO Treatment	<ul style="list-style-type: none"> Three 2 stage RO system each rated at 0.5 MGD each with 12 vessels in first state and 6 vessels in second stage
RO Posttreatment	<ul style="list-style-type: none"> Two force draft degasifiers with 5 HP blowers
Clear Well	<ul style="list-style-type: none"> One 68,000 gal Clearwell
Odor Control	<ul style="list-style-type: none"> Two odor control scrubber towers with recirculation pumps
Antiscalent Feed System	<ul style="list-style-type: none"> One 540 gal bulk tank Two chemical feed pumps
Caustic Feed System	<ul style="list-style-type: none"> One 4,000 gal horizontal bulk storage tank One day tank Two chemical metering pumps

Figure 3-3 is an overview of NRROWTP layout and **Figure 3-4** is the Process Flow Schematic.

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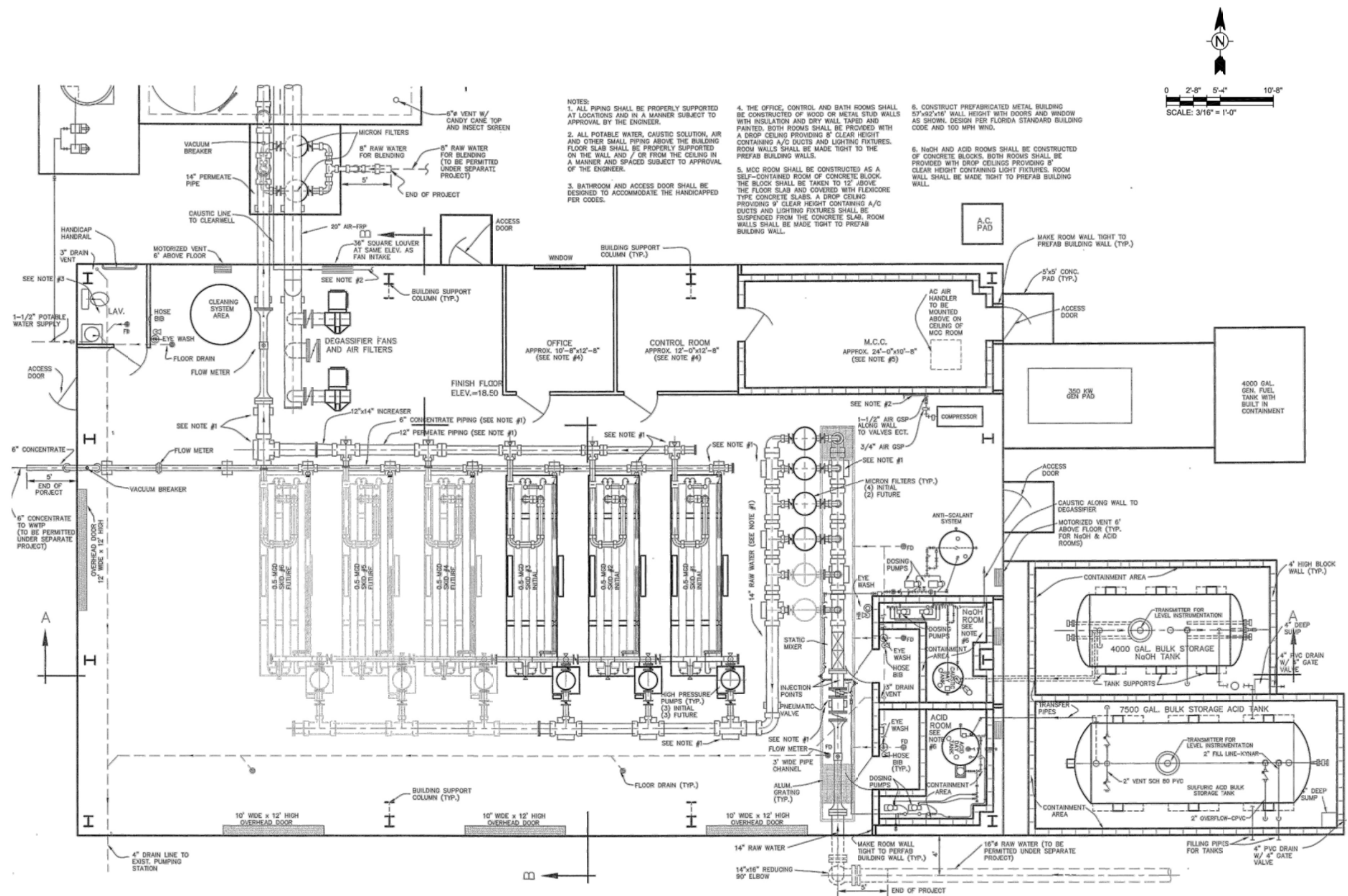


FIG 3-4. ADAPTED FROM CITY OF PALM BAY NORTH REGIONAL WATER TREATMENT PLANT UPGRADES PRELIMINARY DESIGN INVESTIGATIONS, FIGURE 2-4, PREPARED BY TETRA TECH, OCT 2020

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OVERVIEW OF NORTH REGIONAL REVERSE OSMOSIS WATER TREATMENT PLANT FACILITIES

CLIENT: CITY OF PALM BAY UTILITIES DEPARTMENT

PROJECT NO.:	PROJ. MGR.:
PBU009	CEM
DATE:	DRWN. BY:
06/2024	JFN
SCALE:	CHKD. BY:
N.T.S.	CEM
SHEET NO.	

FIG 3-3

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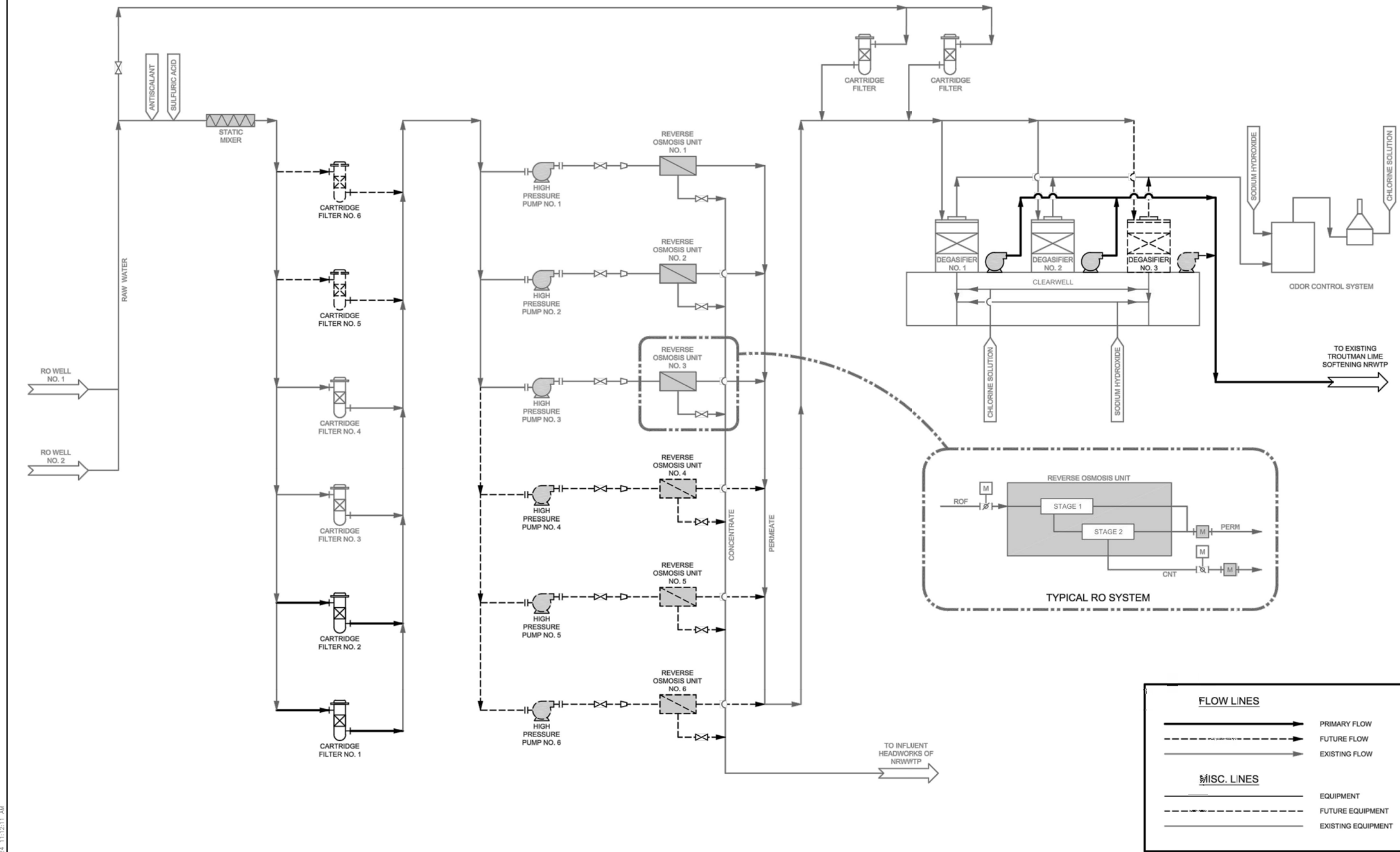


FIG 3-3. ADAPTED FROM CITY OF PALM BAY NORTH REGIONAL WATER TREATMENT PLANT UPGRADES PRELIMINARY DESIGN INVESTIGATIONS, FIGURE 2-3, PREPARED BY TETRA TECH, OCT 2020

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REVISIONS	
NO.	DESCRIPTION

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

CLIENT:
CITY OF PALM BAY UTILITIES DEPARTMENT

PROJECT NO.: PBU009	PROJ. MGR.: CEM
DATE: 06/2024	DRWN. BY: JFN
SCALE: N.T.S.	CHKD. BY: CEM
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FIG 3-4

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3.4.2 South Regional Reverse Osmosis Water Treatment Plant

The SRWTP is located at 250 Osmosis Drive SE, Building B, Palm Bay, FL 32909. The SRWTP 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: one (1) Chief Operator, five (5) Certified Operators, and one (1) Trainee.

The SRWTP was constructed and placed into service in 2006. The plant currently has a permitted capacity of 6 MGD. The plant is expandable to 10 MGD, using the existing building footprint, and to 20 MGD ultimately if new process buildings are constructed. Refer to **Figure 3-5** for an overview of the SRWTP facilities.

The SRWTP includes the following:

- Micron Filtration,
- High-Pressure Pumping,
- Two-Stage Reverse Osmosis Treatment Trains,
- Degasifiers and Odor Control,
- Chlorine Disinfection,
- Chemical Feed and Storage Equipment,
- Transfer Pumping,
- Two (2) Ground Storage Tanks,
- High-Service Pumps,
- Standby Power, and
- Instrumentation and Control Systems

The SRWTP is equipped with a raw water bypass used to blend raw water with the RO permeate water. The blend ratio is approximately 14.3% or 1.5 MGD based on the current plant capacity of 6 MGD. The byproduct of the RO treatment process (RO concentrate or brine) is conveyed to the deep injection well (DIW) for disposal. The rated capacity of the deep injection well is 7.06 MGD.

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The following table is a detailed listing of all unit treatment processes and major equipment currently in service at the SRWTP.

Table 3-9. South Regional Reverse Osmosis WTP Unit Treatment Process Description

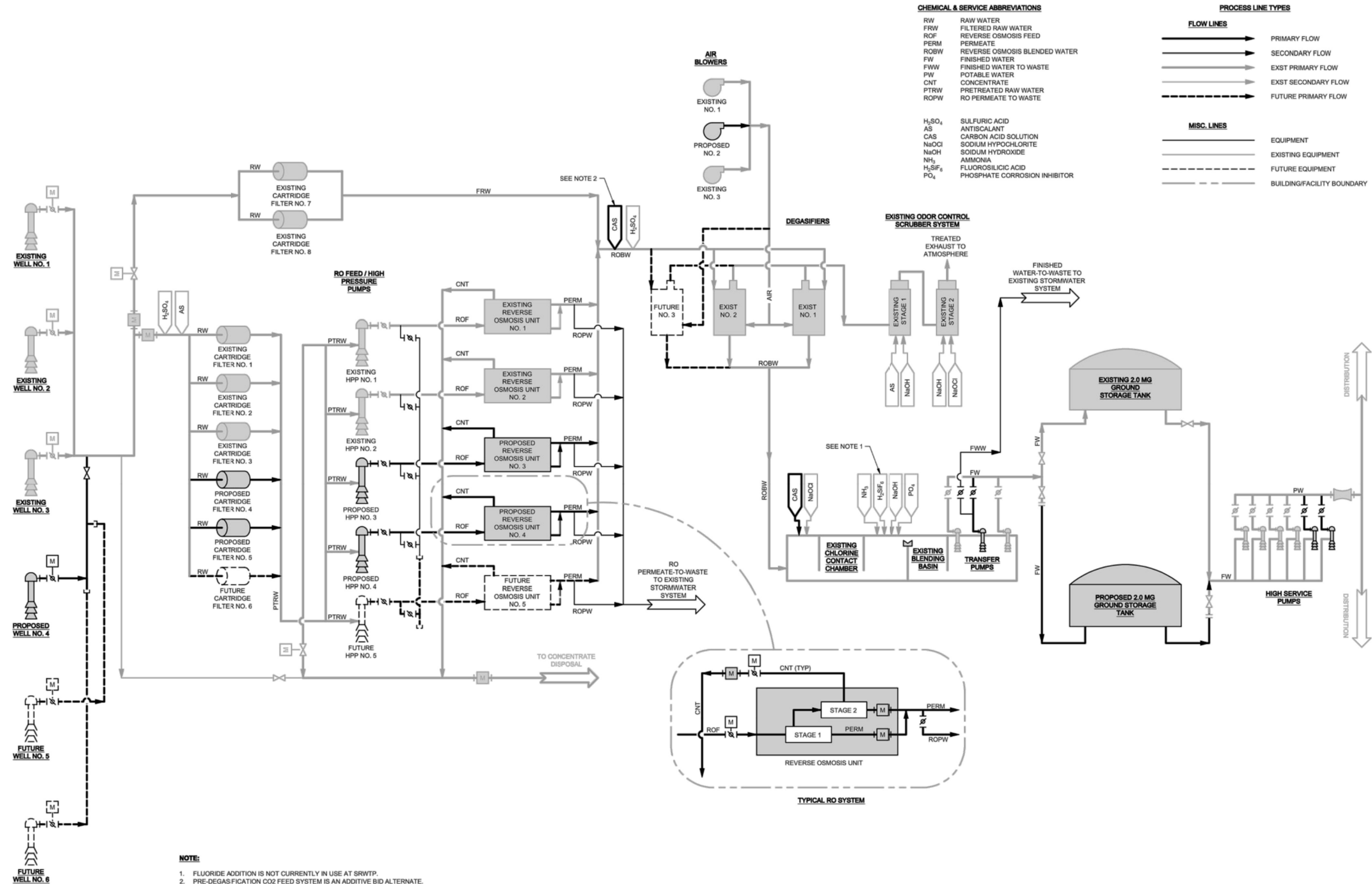
Unit Process	Description
RO Pretreatment	<ul style="list-style-type: none"> Four duty + one standby 32 in dia feed water horizontal RO pretreatment cartridge filters rated at 1,500 gpm each, 90% removal of 5 micron
RO Pretreatment	<ul style="list-style-type: none"> One duty + one standby 30 in dia feed water horizontal bypass pretreatment cartridge filters rated at 1,100 gpm each, 90% removal of 5 micron
High Pressure Pumps	<ul style="list-style-type: none"> Three duty + one standby 250 HP vertical turbine High Pressure Pumps rated at 1,500 gpm @ 450 ft TDH
RO Treatment	<ul style="list-style-type: none"> Four duty Reverse Osmosis treatment skids arranged in two stages (Stage 1: 26 vessels; Stage 2: 13 vessels) rated at 1.75 MGD each, 80% recovery
RO Posttreatment	<ul style="list-style-type: none"> Three 15,000 scfm 40 HP centrifugal fans Two 12 ft dia by 16 ft tall forced draft type degasifiers rated 5 MGD each, 96% removal of 3.0 mg/L sulfides with One two-stage wet chemical odor control scrubber
Chlorine Contact Chamber	<ul style="list-style-type: none"> Two Parallel Three Pass 104,350 gal Chlorine Contact Chamber rated at 15 min contact time 10 MGD
Transfer Pumps	<ul style="list-style-type: none"> Two duty + 1 standby 50 HP vertical turbine type Transfer Pumps rated at 2,300 gpm @ 32 ft TDH
Ground Storage Tanks	<ul style="list-style-type: none"> Two 2.0 million gallon ground storage tank
High-Service Pumps	<ul style="list-style-type: none"> Three duty + 1 standby 125 HP vertical turbine type High-Service Pumps rated at 2,222 gpm @ 162 ft TDH Two duty 60 HP vertical turbine type High-Service Pumps rated at 1,111 gpm @ 162 ft TDH
Sulfuric Acid	<ul style="list-style-type: none"> One 7,500 gal horizontal coated carbon steel Sulfuric Acid bulk storage tank One 500 gal vertical Sulfuric Acid day tank One duty + 1 standby diaphragm Sulfuric Acid chemical metering pumps rated at 6.0 gph each
Antiscalant	<ul style="list-style-type: none"> One 1,200 gal horizontal FRP Antiscalant bulk storage tank One 200 gal vertical Antiscalant day tank One duty + 1 standby diaphragm Antiscalant chemical metering pumps rated at 1 gph each.

Unit Process	Description
Sodium Hypochlorite	<ul style="list-style-type: none"> Two 6,000 gal vertical HDLPE Sodium Hypochlorite bulk storage tanks One 1,500 gal vertical HDLPE Sodium Hypochlorite day tank One duty + one standby hydraulic piston diaphragm Sodium Hypochlorite chemical feed pumps rated at 33 gph for primary disinfection One duty + one standby hydraulic piston diaphragm Sodium Hypochlorite chemical feed pumps rated at 19 gph for wet scrubber
Ammonia	<ul style="list-style-type: none"> One 1,000 gal horizontal steel gaseous ammonia bulk storage tanks One duty + one standby direct feed ammoniators rated at 200 lbs/d each
Caustic Soda (Sodium Hydroxide)	<ul style="list-style-type: none"> One 15,000 gal horizontal FRP Caustic Soda bulk storage tanks One 1,000 gal vertical PE Caustic Soda day tank One duty + one standby mechanical diaphragm Caustic Soda chemical feed pumps rated at 11 gph for pH control of Finished Water One duty + one standby electromechanical diaphragm Caustic Soda chemical feed pumps rated at 3.7 gph for Odor Control
Hydrofluorosilic Acid	<ul style="list-style-type: none"> One 5,300 gal horizontal Hydrofluosilicic Acid bulk storage tank One 110 gal vertical day tank One duty + one standby electromagnetic diaphragm Hydrofluosilicic Acid feed pumps rated at 1.5 gph
Phosphate Inhibitor	<ul style="list-style-type: none"> One 200 gal vertical PE day tank One duty + one standby electromagnetic diaphragm Phosphate Inhibitor feed pumps rated at 2.7 gph
Carbon Dioxide	<ul style="list-style-type: none"> One duty carbon dioxide storage and feed system with one 100,000 lbs (50 ton) liquid carbon dioxide refrigerated storage tank, one 240 lbs/hr electric vaporizer, one 4kW vapor heater, pressure regulators, 120 lbs/hr solution feed panel, one carbonic acid solution feed panel, solution diffusers, and related components.
Concentrate Disposal	<ul style="list-style-type: none"> One 5.0 MG lined storage pond One Class I deep injection well One duty + One standby 20 HP vertical in-line turbine type Concentrate Pump rated at 694 gpm @ 68 ft TDH.

Figure 3-6 is the process flow schematic for the SRWTP.

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**SOUTH REGIONAL REVERSE OSMOSIS
WATER TREATMENT PLANT
PROCESS FLOW SCHEMATIC**

CITY OF PALM BAY UTILITIES DEPARTMENT

PROJECT NO.: PBU009	PROJ. MGR.: CEM
DATE: 06/2024	DRWN. BY: JFN
SCALE: N.T.S.	CHKD. BY: CEM
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FIG 3-6

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3.4.3 Aquifer Storage and Recovery

In 1988, the City constructed an Aquifer Storage and Recovery (ASR) well that extends into the upper portion of the Floridan Aquifer and is equipped with a 1.0 MGD vertical turbine pump. The purpose of the ASR is to store excess potable water from the NRWTP for use during periods of peak demand. Water withdrawn from the ASR is pumped into the distribution system following chlorination. If necessary, the recovered water may be pumped to the NRWTP through piping modifications and valves that were added after the initial construction. The storage capacity of the well is approximately 100 million gallons.

The ASR well is located on the same site as surficial production Well No. RW-15, approximately 600 feet northeast of Sandy Pines Drive.

The CUP issued by the SJRWMD in 2010 for the water supply system requires that injection and recovery flow data for the ASR be maintained and submitted to the SJRWMD. The following table summarizes the historical injected and recovered volumes for the ASR well.

Table 3-10. ASR Well Injection and Recovery Volumes

Year	Injection Volume (MG)	Recovered Volume (MG)	Estimated Storage Volume (MG)
2018	15.092	4.122	94.871
2019	20.097	12.784	93.062
2020	15.439	24.234	84.309
2021	10.42	13.007	74.776
2022	4.812	7.155	65.144
2023	2.734	2.837	56.826

3.5 Water Distribution System

The PBUD water distribution system consists of ground and elevated water storage tanks, high-service water pumps, and water distribution water mains.

3.5.1 Water System Storage Tanks

The PBUD water system includes five (5) groundwater storage tanks and one (1) elevated water storage tank. The total water storage capacity of 7.5 MG. A summary of the water storage facilities is provided below.

Table 3-11. Water Storage Tanks

Tank Location	Tank Type	Construction	Inside Diameter (ft)	Side Water Depth (ft)	Storage Capacity (MG)	Year Constructed
North Regional WTP Tank No. 1	Ground	Pre-Stressed Concrete	70	17.4	0.5	1962
North Regional WTP Tank No. 2	Ground	Pre-Stressed Concrete	99	17.5	1.0	1985
North Regional WTP	Elevated	Welded Steel	50	37.5	0.5	1971
North Repump Station	Ground	Pre-Stressed Concrete	125	16.0	1.5	1987
South Regional WTP Tank No. 1	Ground	Pre-Stressed Concrete	100	34.0	2.0	2006
South Regional WTP Tank No. 2	Ground	Pre-Stressed Concrete	100	35.5	2.0	2023

The 0.5 MG welded steel elevated tank located on the NRWTP site maintains a maximum water level of 163 feet above land surface. This elevated tank “floats” on the system with no control valves regulating flow in or out of the tank. The elevated tank serves to maintain pressure in the system, help offset high water demands during peak periods, and supplies emergency fire flows.

3.5.2 High-Service Pumping

The water distribution system is pressurized by a series of high-service water system distribution pumps located at the NRWTP, SRWTP, and Nash Repump Station. Water pressure within the water distribution system is normally maintained between 50 and 70 (psi). Emergency auxiliary electrical power is supplied to the high-service pumps at each facility using diesel-powered emergency backup generators.

Seven (7) high-service water distribution pumps are located at the NRWTP. The total high-service pumping capacity at the NRWTP is approximately 9,100 gallons per minute (gpm) with a firm capacity (i.e., with the largest pump out of service) of 7,400 gpm.

The Nash Repump Station is located west of Interstate 95 in Port Malabar Unit 45. The Nash Repump Station includes four (4) high-service water distribution pumps and a standby diesel-powered emergency generator. The Nash Repump Station is used to maintain normal operating pressures and boosting pressure in the north and northwest areas of the system (west of I-95) during peak demand periods. The station also serves the function of supplying commercial fire flow demands to the northwest section of the City, particularly the area of Minton Road south of Palm Bay Road and Emerson Drive west of Minton Road. A 1.5 MG ground storage tank located at the Nash Repump Station is filled during the overnight hours. The repump station is typically manually operated during the early morning hours and late afternoon/early evening hours when demand is the greatest and pressure drops. A chlorine booster system is installed at the Nash Repump Station to maintain chlorine residuals in the distribution system. The total high-service pumping rate for the repump station is 3,750 gpm with a firm capacity of 2,500 gpm.

The SRWTP includes two (2) small-capacity high-service water pumps rated at 1,100 gpm each and four (4) high-capacity high-service distribution pumps rated at 2,200 gpm each. All high-service pumps can be powered by an emergency diesel generator. The total combined high-service pumping capacity at the SRWTP is 11,000 gpm with a firm capacity of 8,800 gpm.

PBUD staff primarily utilize the SRWTP high-service pumps, equipped with variable frequency drives, to regulate system pressure and ensure precise control of the water distribution system. The high-service water distribution pumps at NRWTP and Nash Repump Station are manually operated by staff providing coarse control of the water distribution system pressure in response to the daily diurnal demand pattern.

The following table presents the details of the high-service water distribution pumps supplying potable water into the water distribution system.

Table 3-12. High-Service Water Distribution Pump Inventory

Facility	Pump ID	Pump Make and Model	Pump Type	Design Capacity ¹ (gpm)	Design TDH (ft)	Pump Motor (HP)	Pump Operation	Year Installed
North Regional WTP	1	Peerless 3AE14	Split Case Centrifugal	500	175	50	Constant	2021
	2	Peerless 4AE10		900	175	60	Constant	2021
	3	Peerless 4AE10		900	175	60	Constant	2021
	4	Peerless 6AE14G		1,700	185	100	Constant	2021
	5	Peerless 6AE14G		1,700	185	100	Constant	2021
	6	Peerless 6AE14G		1,700	185	100	Variable	2021
	7	Peerless 6AE14G		1,700	185	100	Constant	2021
	Firm			7,400				
	Total			9,100				
Nash Repump Station	1	American Marsh 3x4x15	Split Case Centrifugal	625	140	40	Constant	1987
	2	American Marsh 3x4x15		625	140	40	Constant	1987
	3	Allis Chalmers 8x6x12L Series 8000		1,250	140	75	Constant	1987
	4	Allis Chalmers 8x6x12L Series 8000		1,250	140	72	Constant	1987
	Firm			2,500				
	Total			3,750				
South Regional WTP	1	RuhnRPumpen 12C-135	Vertical Turbine	1,100	162	60	Variable	2005
	2	RuhnRPumpen 12C-135		1,100	162	60	Variable	2005
	3	RuhnRPumpen 13C-200		2,200	162	125	Variable	2005
	4	RuhnRPumpen 13C-200		2,200	162	125	Variable	2005
	5	Trillium Flowway15DKL		2,200	162	125	Variable	2023
	6	Trillium Flowway15DKL		2,200	162	125	Variable	2023
	Firm			8,800				
	Total			11,000				
	GRAND TOTAL FIRM HIGH-SERVICE PUMPING CAPACITY			18,700	26.9 MGD			
	GRNAD TOTAL HIGH-SERVICE PUMPING CAPACITY			23,850	34.3 MGD			
ASR Well		Goulds Submersible 7THC-4 Stage	Submersible	700	200	50	Constant	TBD

(1) Pumping capacity listed is the rated capacity which does not incorporate pump age and efficiency

3.5.3 Water Main Distribution Piping

The City's water distribution system comprises approximately 650 miles of water main piping ranging in size from 2 to 36-inches in diameter with larger diameter piping closer to the treatment facilities and smaller diameter piping farther away from the treatment facilities. Most residential areas in the City are served by 6-inch or 8-inch diameter water mains. In the area east of I-95, 2-inch to 6-inch water mains are common. This is the oldest area of the City with some water mains installed prior to 1975.

The pipe materials that make up the water distribution mains consist of polyvinyl chloride (PVC), ductile iron (DI), asbestos cement (AC), polyethylene (PE), and high-density polyethylene (HDPE) pipe. A summary of the City's active water main pipes is shown in the table below.

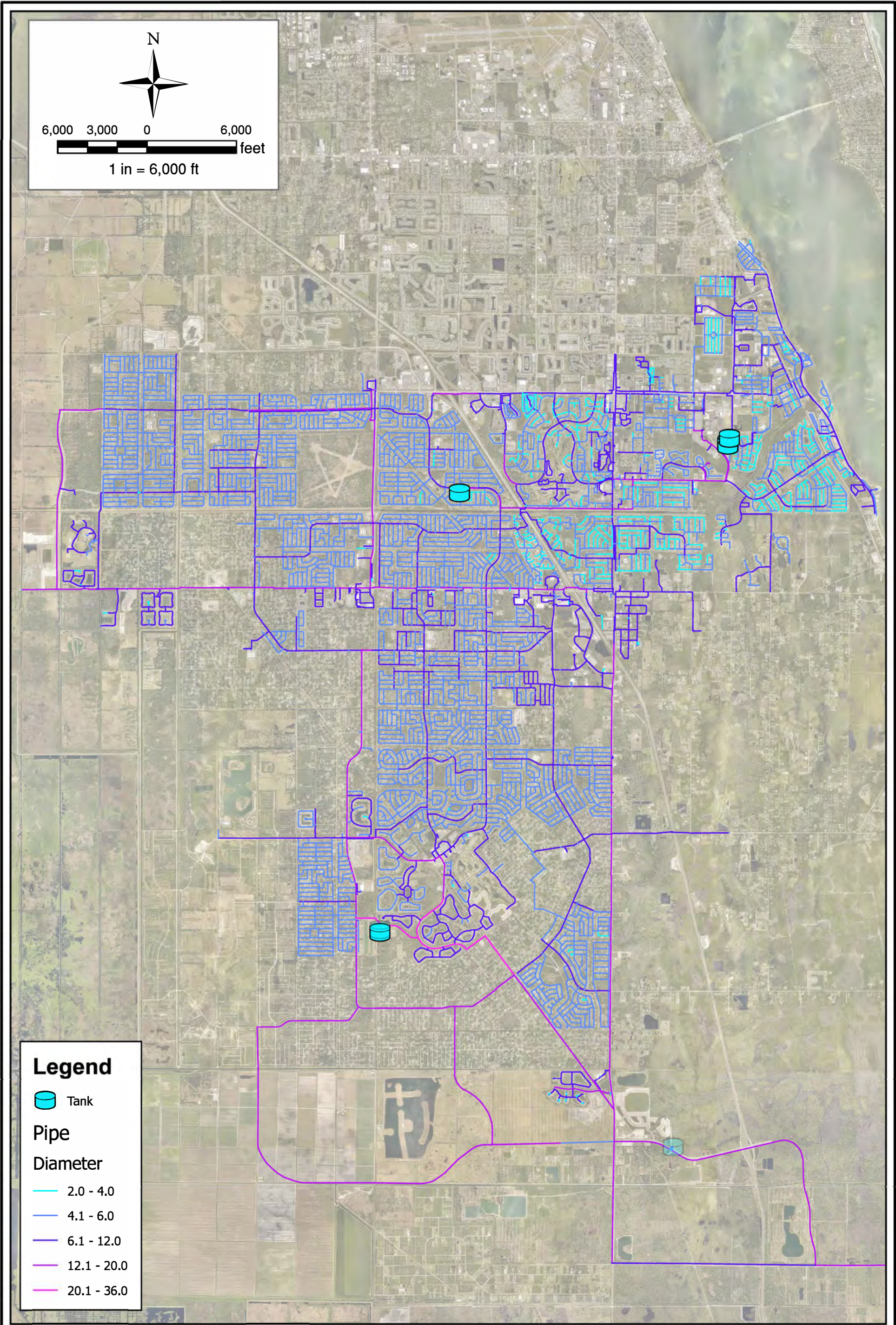
Table 3-13. Water Distribution System Pipe Inventory

Water Main Pipe Diameter	Water Main Pipe Length						Percent of System
	PVC (ft)	AC (ft)	DI (ft))	HDPE (ft)	PE (ft)	Total (ft)	
2-inch	43,683	2,139	611	0	77	46,510	1.29%
3-inch	18,332	0	0	0	0	18,332	0.51%
4-inch	170,817	46,563	187	0	0	217,567	6.05%
6-inch	2,028,135	57,257	4,794	10,318	5,309	2,105,813	58.55%
8-inch	575,579	11,389	6,356	1,301	1,308	595,933	16.57%
10-inch	73,214	20,256	532	640	0	94,642	2.63%
12-inch	304,878	12,998	3,901	1,109	766	323,653	9.00%
14-inch	0	0	0	2,086	0	2,086	0.06%
16-inch	67,620	1,894	69,113	4,708	0	143,334	3.99%
18-inch	0	0	0	1,665	0	1,665	0.05%
20-inch	23,745	78	10,794,	0	0	34,617	0.96%
24-inch	0	0	11,761	0	0	11,761	0.33%
Total	3,306,812	152,574	108,048	21,827	7,460	3,596,721	
Percent of System	91.94%	4.24%	3.00%	0.61%	0.21%		

The following figures show the City's water main pipe sizes and materials.

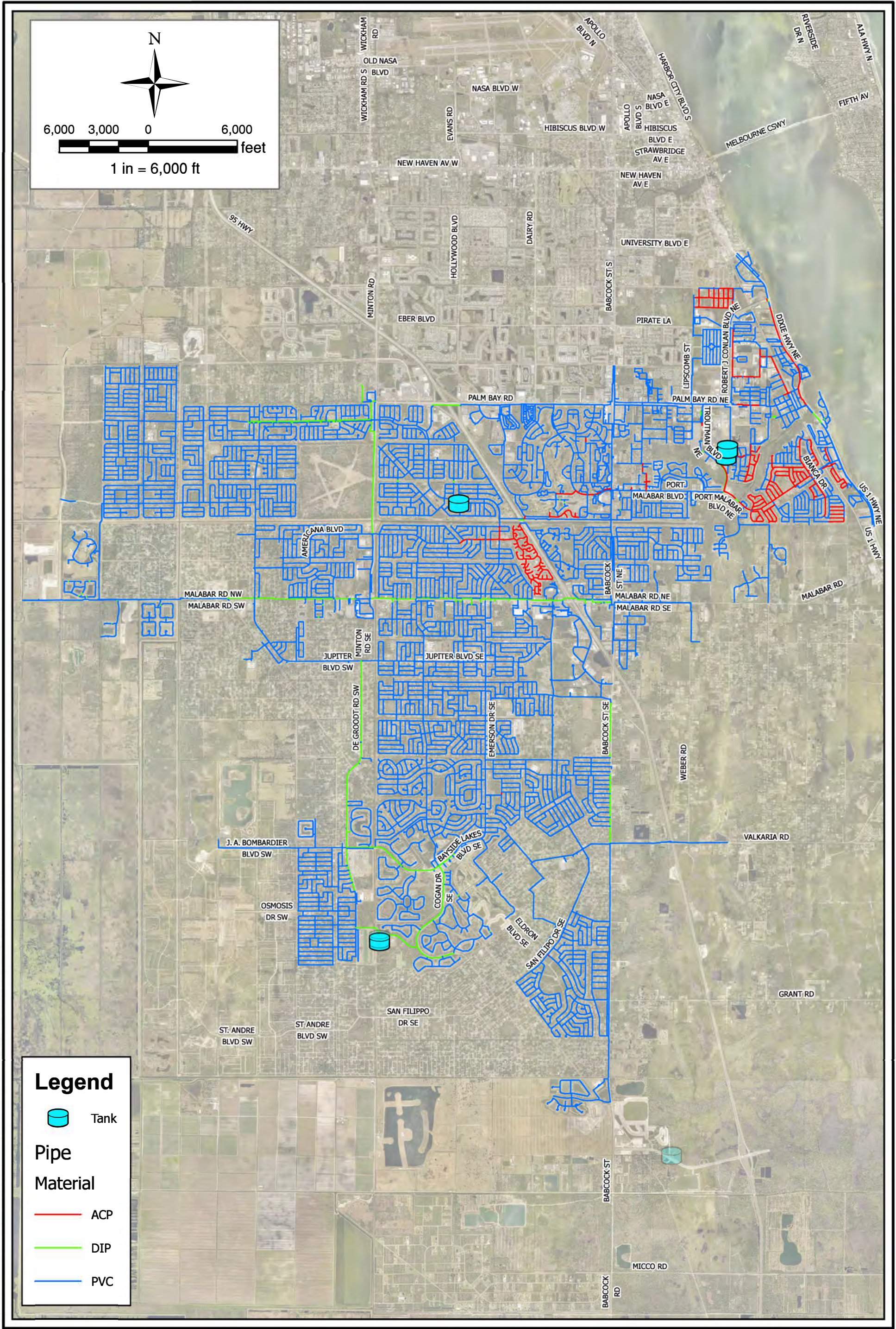
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3.6 Additional Information

3.6.1 North Regional Surficial and Floridan Aquifer Groundwater Supply Wells Details

The section presents the details and the location of the NRWTP surficial and NRROWTP Floridan aquifer groundwater supply wells. The data contained in the following tables was taken from report titled City of Palm Bay Well Condition Survey prepared by Ardaman & Associates, Inc dated Oct 2018.

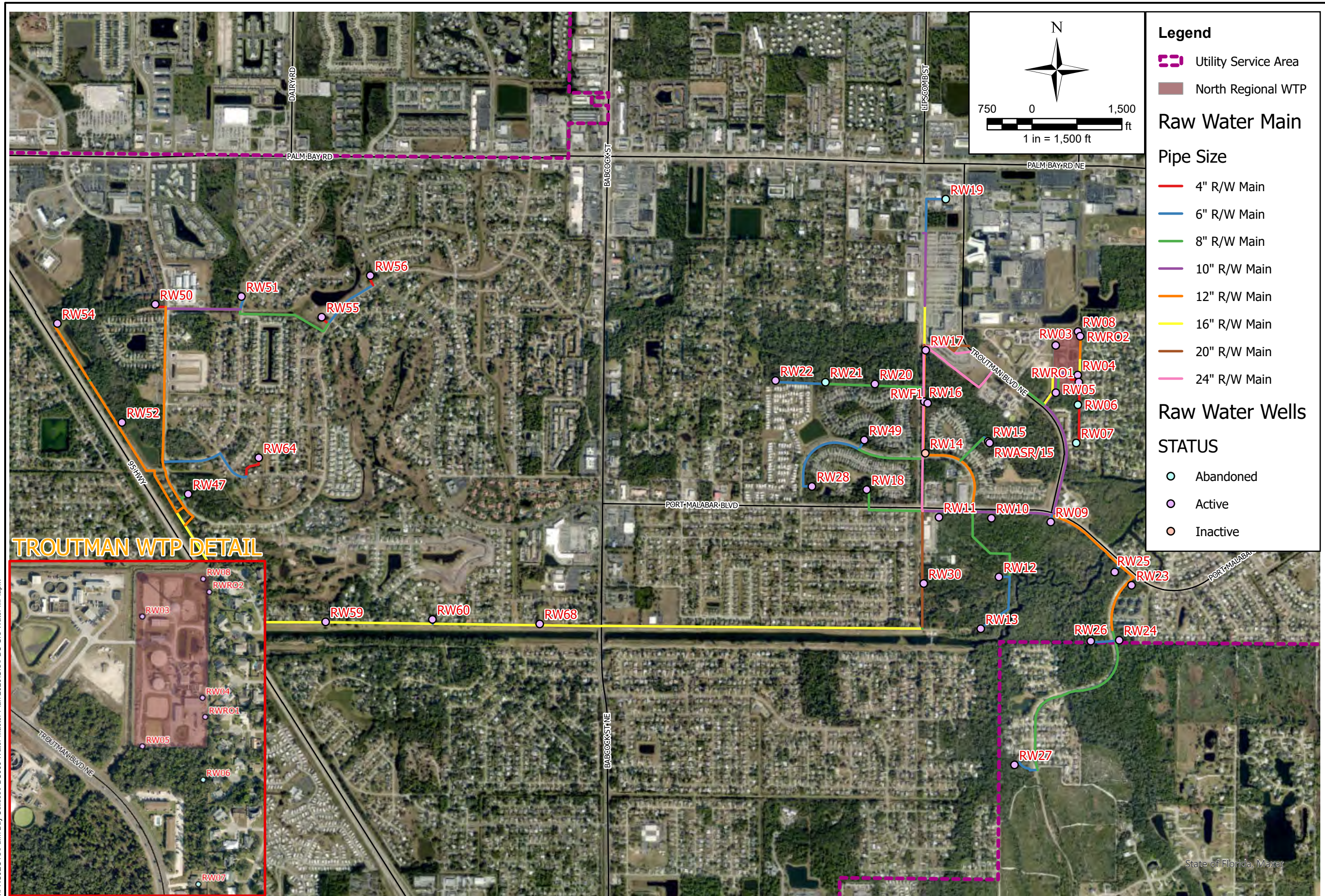
Table 3-14. North Regional Lime Softening WTP Surficial Aquifer Groundwater Supply Wells Details

Well ID	Status	Casing Dia (in)	Total Depth (ft)	Casing Depth (ft)	Screen Length (ft)	Pump Size (HP)	Rated Pumping Capacity (gpm)	Current Pumping Capacity (gpm)	Current Chlorides Concen. (mg/L)	Year Drilled
RW-3	Active	8	85	70	15	5	150	137	177	1964
RW-4	Active	8	85	52	33	7.5	150	165	473	1964
RW-5	Active	8	80	52	28	5	175	166	375	1964
RW-8	Active	8	100	50	50	7.5	150	192	223	1969
RW-9	Active	8	100	70	30	15	160	186	382	1972
RW-10	Active	8	106	70	36	20	255	250	270	1973
RW-11	Active	8	104	76	28	20	275	112	169	1973
RW-12	Active	8	100	74	26	15	255	216	138	1975
RW-13	Active	8	115	70	45	15	250	188	279	1975
RW-14	Active	8	97	80	17	20	150	122	161	1975
RW-15	Active	8	185	62	132	20	250	114	191	1975
RW-16	Active	8	108	90	18	20	250	82	180	1975
RW-17	Active	8	106	73	33	20	400	0	165	1975
RW-18	Active	8	100	71	29	15	250	141	187	1975
RW-20	Active	10	87	68	19	15	275	193	311	1983
RW-22	Active	10	101	77	24	15	185	90	263	1983
RW-23	Active	10	104	60	44	15	250	207	295	1987
RW-24	Active	10	93	60	33	10	200	146	171	1987
RW-25	Active	10	102	70	50	15	200	191	363	1989
RW-26	Active	10	105	60	45	15	200	120	266	1988
RW-27	Active	10	115	55	60	15	250	80	142	1989
RW-28	Active	10	115	61	54	10	200	181	413	1987

Well ID	Status	Casing Dia (in)	Total Depth (ft)	Casing Depth (ft)	Screen Length (ft)	Pump Size (HP)	Rated Pumping Capacity (gpm)	Current Pumping Capacity (gpm)	Current Chlorides Concn. (mg/L)	Year Drilled
RW-30	Active	12	88	59	29	20	310	196	160	1993
RW-47	Active	10	98	62	36	20	305	83	150	1987
RW-49	Active	10	98	60	38	10	200	154	219	1987
RW-50	Active	12	85	62	23	15	160	122	256	1993
RW-51	Active	12	90	58	32	15	140	100	238	1993
RW-52	Active	10	98	56	42	20	350	111	127	1987
RW-54	Active	10	88	56	32	15	175	117	173	1987
RW-55	Active	12	88	68	20	15	180	114	162	1993
RW-56	Active	12	100	70	30	15	200	87	225	1993
RW-59	Active	6	137	60	77	15	250	104	184	1989
RW-60	Active	6	105	62	43	15	170	46	188	1989
RW-64	Active	12	100	68	32	15	200	91	145	1993
RW-68	Active	12	83	63	20	10	250	86	211	1993
RW-2B	Abandoned	8	100	70	30	NA	NA	NA	NA	NA
RW-6	Abandoned	8	80	50	30	NA	NA	NA	NA	1969
RW-7	Abandoned	8	95	55	40	NA	NA	NA	NA	1969
RW-19	Abandoned	8	90	90	NA	NA	NA	NA	NA	NA
RW-21	Abandoned	10	80	65	15	NA	NA	NA	NA	1983

Table 3-15. North Regional Reverse Osmosis WTP Floridan Aquifer Groundwater Supply Wells Details

Well ID	Status	Casing Dia (in)	Total Depth (ft)	Casing Depth (ft)	Open Hole (ft)	Pump Size (HP)	Rated Pumping Capacity (gpm)	Current Pumping Capacity (gpm)	Year Drilled
F-1	Active	12	450	295	155	25	700	700	1986
RO-1	Active	16	850	350	500	30	700	747	1999
RO-2	Active	16	850	350	500	30	700	747	1999
RO-3	Proposed	20	850	350	500	TBD	TBD	NA	NA
RO-4	Proposed	20	850	350	500	TBD	TBD	NA	NA



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3.6.2 South Regional Floridan Aquifer Groundwater Supply Wells Details

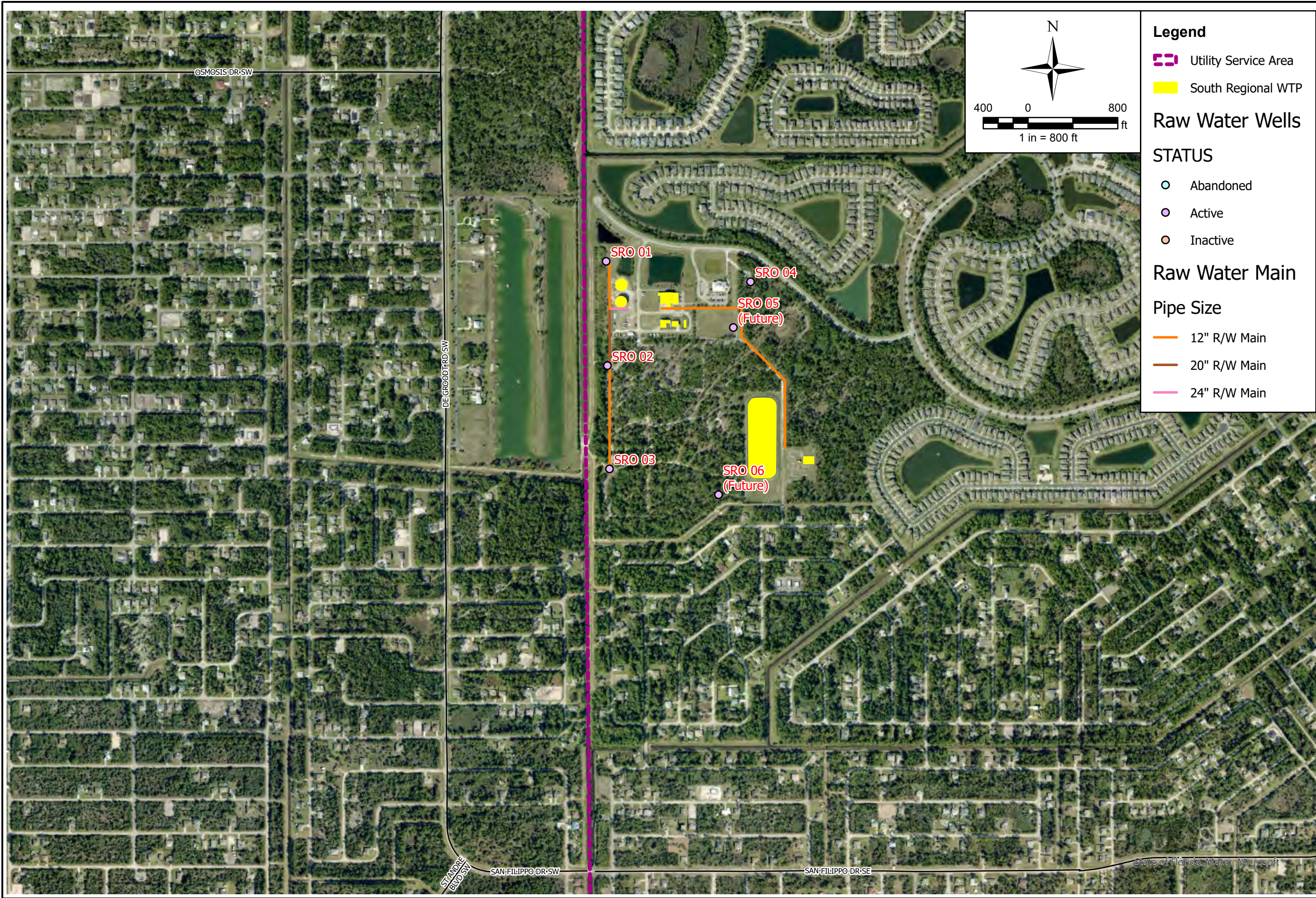
The section presents the details and the location of the SRWTP Floridan aquifer groundwater supply wells. The data contained in the following tables was taken from report titled City of Palm Bay Well Condition Survey prepared by Ardaman & Associates, Inc dated Oct 2018.

Table 3-16. South Regional Reverse Osmosis WTP Floridan Aquifer Groundwater Supply Wells Details

Well ID	Status	Casing Dia (in)	Total Depth (ft)	Casing Depth (ft)	Open Hole (ft)	Pump Size (HP)	Rated Pumping Capacity (gpm)	Current Pumping Capacity (gpm)	Year Drilled
SRO-1	Active	20	850	300	550	100	1,760	1,544	2002
SRO-2	Active	20	850	350	500	100	1,760	1,856	2002
SRO-3	Active	20	850	350	505	100	1,760	2,046	2002
SRO-4	Active	24	850	320	530	100	1,750	1,976	2021
SRO-5	Proposed	24	850	350	500	NA	NA	NA	NA
SRO-6	Proposed	24	850	350	500	NA	NA	NA	NA
SRO-7	Proposed	24	850	350	500	NA	NA	NA	NA
SRO-8	Proposed	24	850	350	500	NA	NA	NA	NA
SRO-9	Proposed	24	850	350	500	NA	NA	NA	NA
SRO-10	Proposed	24	850	350	500	NA	NA	NA	NA
SRO-11	Proposed	24	850	350	500	NA	NA	NA	NA

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Legend

- Utility Service Area
- South Regional WTP

Raw Water Wells

STATUS

- Abandoned
- Active
- Inactive

Raw Water Main

Pipe Size

- 12 inch R/W Main
- 20 inch R/W Main
- 24 inch R/W Main

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Section 4 -Analysis and Projection of Population and Water Demands

4.1 Introduction

Section 4 of the City of Palm Bay Water Master Plan reviews and analyzes the existing and future population projections. The analysis evaluates:

- Population projections and potable water demand to parcels,
- Water production data from water treatment facilities, and
- The theoretical levels of existing water loss in the system.

This Section contains projections of the future water system population necessary to estimate the future water demands.

- The master plan will estimate the future water demands based on the proposed development and future land use.
- The projection of future water demands will be reviewed.
- The master plan will develop water demands for three (3) planning horizons (five-, ten-, twenty-year).

4.2 Determination of Existing Water Demands

The ISS Team collected data from various sources for the analysis, including the following: City of Palm Bay, FDEP, and the University of Florida Bureau of Economic and Business Research (BEBR). The data obtained from these sources include historical water billing data, WTP Monthly Operating Reports (MORs), population estimates, and other types of data that will directly impact the analysis of existing water demand flows.

4.2.1 City-Wide Population

The City of Palm Bay has experienced significant population growth over the last ten (10) years, increasing in population 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. The following table shows the historical and future projected population for Palm Bay.

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

	Year	City Wide Population	Data Source
Historical	2010	103,190	US 2010 Census
	2015	107,481	BEER Estimate
	2020	119,760	US 2020 Census
	2022	127,256	City of Palm Bay 2045 Comprehensive Plan Table FLU-1
Future	2025	137,879	City of Palm Bay 2045 Comprehensive Plan Table FLU-7
	2030	146,800	
	2035	154,300	
	2040	160,900	
	2045	166,848	

4.2.2 Water Service Area Population

The PBUD furnished the historical number of water service accounts for the period 2016 through current. From the number of water service accounts, an estimate of the population served by the system was calculated based on the U.S. Census data figure of 2.9 persons per household for the city, as shown in the following table:

Table 4-2. Historical Number of Water Service Accounts and Water Service Population

Year	Number of Service Accounts (Dec)	Estimated Population on Water Service
2016	31,347	90,900
2017	31,722	92,000
2018	32,380	93,900
2019	33,245	96,400

Year	Number of Service Accounts (Dec)	Estimated Population on Water Service
2020	34,277	99,400
2021	36,027	104,500
2022	38,329	111,150
2023	42,009	121,800

The estimated population within the water service area was calculated to be approximately 90,900 in 2016 increasing to 121,800 in 2023, an increase of 30,900 or 25% over the 7 years with an average growth of approximately 3.6% per year.

4.2.3 Historical Metered Water Demands

The water billing data, provided by the PBUD, was analyzed to determine the actual metered water usage from 2016 through 2021. Data was collected from the direct billing data, tabulated, summarized, and compared to the other data sets for identifying trends, potential problems with the data sets, etc. The water billing data analysis of monthly consumption for the previously mentioned date range is shown in the table below.

Table 4-3. Historical Metered Water Service Demands

Year	Ave Monthly Demand (MG)	Max Monthly Demand (MG)	Ave Daily Demand (MGD)	Annual Change (%)	Ave Daily Demand per Account ¹ (gpd)	Ave Daily Demand per Cap ² (gpd)
2016	164.5	192.0	5.41	-	172.5	59.5
2017	167.6	205.1	5.51	1.9	173.7	59.9
2018	167.5	194.1	5.51	0.1	170.0	58.6
2019	167.3	199.3	5.50	0.1	165.4	57.1
2020	177.9	209.5	5.85	6.3	170.6	58.9
2021	184.1	217.1	6.05	3.5	168.0	57.9

1- Based upon the number of accounts shown in Table 4-2.

2- Based upon the U.S. Census data figure of 2.9 persons per household.

4.2.4 Historical Water Production from Water Treatment Plants

The City of Palm Bay treats produces potable water at three (3) WTPs within the city. At these locations, the amount of water produced is routinely metered and is required to be reported on a monthly basis to the FDEP using Monthly Operating Reports (MOR). From the data contained within the MORs, the following table presents system-wide water production from the WTPs:

Table 4-4. Historical System-Wide WTP Water Production Flows

Year	Ave Monthly Production (MG)	Max Monthly Production (MG)	Annual Average Daily Production (MGD)	Annual Change (%)	Maximum Day Daily Production (MGD)
2016	202.7	220.7	6.66	-	NA
2017	196.5	213.4	6.46	-3.1	NA
2018	198.8	218.4	6.53	2.0	NA
2019	202.2	214.1	6.70	1.5	7.63
2020	216.0	229.1	7.15	5.6	8.43
2021	219.5	232.7	7.23	1.8	8.68
2022	220.1	235.4	7.22	4.9	8.11
2023	230.1	245.4	7.59	7.2	8.90

As can be seen in the table above, the water system has been experiencing a gradual but consistent increasing water production over the past seven years averaging a 2.84 % annual increase. The largest single-year increase occurred between 2022 to 2023 with an annualized 7.2 % increase

From the historical system-wide water production data, the water distribution design flow characteristics of the water distribution system can be calculated. These characteristics are related to the design flow conditions such as the annual average daily flow (AADF), maximum month average daily flow (Max Month ADF), or maximum day average daily flow (Max Day ADF). Calculation of the historical design flow peaking factors is useful in projecting future design condition flows within the water distribution system. The following table presents the observed flow peaking factors calculated from the historical system-wide flow data.

Table 4-5. Historical System-Wide Observed Water Demand Flow Peaking Factors

Year	Annual ADF (MGD)	Max Month ADF (MGD)	Max Day ADF (MGD)	Max Month ADF:AADF	Max Day ADF:AADF
2019	6.70	6.92	7.64	1.03	1.14
2020	7.15	7.54	8.43	1.05	1.18
2021	7.23	7.96	8.68	1.10	1.20
2022	7.22	7.59	8.11	1.05	1.12
2023	7.59	8.18	8.90	1.17	1.17
AVERAGE				1.06	1.16
RANGE				1.03 to 1.17	1.12 to 1.20

From this data, the observed maximum month ADF is 6% higher than the AADF. Similarly, the observed maximum day ADF is 16% higher than the AADF. The observed peaking factors are significantly lower than expected. The previous 2012 and 2017 Master Plan used a max day peaking factor of 1.46 (Wade Trim, 2012 & Wade Trim, 2017). It would appear the observed max day peak flows have significantly decreased over the years due to a number of contributing factors such as a large customer base, use of reclaimed or groundwater irrigation in new residential developments, and landscape watering restrictions.

It is recommended that the previous peaking factors of 1.46 for max day and 2.40 for peak hour be used for city-wide utility planning purposes for consistency with the prior Water Master Plans.

4.2.5 Estimate of System-Wide Water Loss

From the data presented previously within this Section, an estimate can be made of the approximate water loss on a system-wide basis. System water loss is calculated as the difference between the total volume of water produced at the WTPs and the total volume of metered water at the connection. The net loss of water can be attributed to several factors, including known and unknown causes. For example, thirty-eight (38) automatic flushing stations are located throughout the system to improve

potable water quality and maintain chlorine residuals. These devices are operated based upon timers and staff can estimate the volume of water flushed from the system at each location. The reported volume of water flushed at these locations ranges from approximately 250 to 85,000 gpd each or approximately 433,000 gpd total on a system-wide basis. The balance of the water loss within the system occurs from other unknown or unquantified sources such as firefighting, water main breaks, or leaks. The following table presents the calculated water loss on a system-wide basis.

Table 4-6. Calculated System Wide Water Loss

	A	B	C	A-B-C
Year	Total Ave Water Produced (MG/Month)	Total Ave Water Billed MG/Month)	Known Water Loss	Unknown Water Loss
			Estimated Flushed Water (MG/Month)	Calculated Water Loss (MG/Month)
2019	203.4	167.3	13.0	23.1
2020	215.7	177.9	13.0	24.8
2021	219.5	184.1	13.0	22.4

The calculated water loss represents finished potable water produced by the utility, but not metered therefore represents lost revenue to the system. The amount of apparent water loss appears reasonable given industry standards but should be regularly monitored by PBUD for any irregularities. It is recommended for the Department to utilize industry resources such as the American Water Works Association (AWWA) Manual of Practice No. M36 and related water loss audit software version 6.0 to monitor system wide water loss and to track the PBUD’s calculated water loss against industry benchmarks.

4.2.6 Discussion

The time period of 2019 through 2021 represents a period of increased water use within the city that may be attributed to several compounding factors including the COVID-19 pandemic and the increased activity level of development. A noticeable increase in water demand was seen in the billing data for 2020 and later in 2021 as compared to the typical 5.5 MGD from 2016-2019 to a higher 5.85 and 6.05 MGD. This is equivalent to a 6.3% increase in demand from 2019 to 2020 and an additional 3.5% from

2020 to 2021. The typical increase in the number of water billing accounts was an average of 1.7% from 2016-2019 and rose to 2.7% and 4.8% in 2020 and 2021 respectively which could have indicated that the increased demand was solely due to the increase in the number of units being connected to the system. Additional analysis showed that the consumption per equivalent residential connection (ERC) values were either stable or declining (typical of demand growing in concert with or slower than the total number of ERCs) but the year 2020 saw a spike in consumption per ERC which is more in line with the theory that COVID-19 increased the water consumption city-wide from lockdown era at-home increased water usage, increased cleaning protocols, and other related factors. With the combination of factors, the city saw its total number of ERCs grow from approximately 30,730 locations to approximately 36,030 from the beginning of 2016 to 2021 and experienced growth in demand from 5.41 MGD in 2016 to 6.05 MGD in 2021.

4.3 Projection of Future Population and Water Demands

In 2021, The City of Palm Bay Growth Management and Utilities Department provided coordinated information on the planned and known future developments within the water 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 ERCs, the total water demand, and the total demand per planning period are shown below in **Table 4-7**. The total water demand shown in the table has been calculated based upon the Palm Bay Utilities definition of average day water demand per ERC to be 225 gpd (*Palm Bay Utilities Department Policies, Procedures, and Standards Handbook*, Chapter 1.02).

Table 4-7. Future Developments and Water Demand

ID	Development ¹	Type	Total Estimated ERC	Water Demand (gpd)			
				Total ²	0-5 Year	6-10 Year	> 10 Year
A	Palm Vista (Lennar)	Residential, Mixed	4,000	900,000	90,000	405,000	405,000
B	Palm Vista Everlands	Residential, Mixed	162	36,450	36,450		
C	SJRWMD Property	Single Family Residential	552	124,200	12,420	49,680	62,100
		Multi-Family Residential	324	72,900		72,900	
D	St Johns Preserve	Residential, Mixed	620	139,500	55,800	55,800	27,900

ID	Development ¹	Type	Total Estimated ERC	Water Demand (gpd)			
				Total ²	0-5 Year	6-10 Year	> 10 Year
E	Fred Poppe Park RV Campground	Commercial/ RV	45	10,125	10,125		
F	Lennar South	Residential, Mixed	352	79,200		79,200	
G	Three Forks	Mixed Use	814	183,150			183,150
H	Malabar Estates	Single Family Residential	77	17,325		17,325	
I	Chapparral	Single Family Residential	602	135,450	81,270	54,180	
		Multi-Family Residential	75	16,875		16,875	
J	Brentwood Phase 3	Single Family Residential	97	21,825	21,825		
K	Sanibel Cove	Single Family Residential	50	11,250	11,250		
L	Avery Springs	Single Family Residential	140	31,500	31,500		
M	Minton Road Airforce Facility	Mixed use	650	146,250		14,625	131,625
N	Health First Wellness Village	Mixed Use	100	22,500	22,500		
O	Minton Road Commercial	Commercial	77	17,325	17,325		
P	City Hall Expansion	Municipal	15	3,375	3,375		
Q	AD1 Global	Mixed Use Commercial	82	18,450	18,450		
R	Sabal Key	Single Family Residential	40	9,000	9,000		
S	Country Club Lakes Estates I-IV	Single Family Residential	199	44,775	44,775		
S	Reserve at County Club Lakes Estates	Single Family Residential	154	34,650	34,650		
		Multi-Family Residential	46	10,350	10,350		
T	Westshore Apartments	Multi-Family Residential	212	47,700	47,700		
U	Northshore (Aqua Apartments)	Residential	325	73,125	73,125		
		Commercial	56	12,600	12,600		
V	Clearmont Trace	Multi-Family Residential	28	6,300	6,300		
W	Pelican Harbor Marina	Commercial	75	16,875	16,875		

ID	Development ¹	Type	Total Estimated ERC	Water Demand (gpd)			
				Total ²	0-5 Year	6-10 Year	> 10 Year
X	Eztopeliz	Mixed use / Multi-Family Residential	415	93,375		70,031	23,344
W	Tropical Arms Apartments	Residential	84	18,900	18,900		
Z	Twin Lakes (Malabar)	Residential	16	3,600	3,600		
AA	Malabar, Town of	Residential, Mixed	650	146,250	29,250	43,875	73,125
BB	Joe Daddy Golf Course Property	Multi-Family Residential	176	39,600	39,600		
		Commercial	60	13,500	13,500		
CC	Crown Square	Multi-Family Residential	216	48,600	48,600		
		Potential Building Space	40	9,000	9,000		
DD	San Filippo Apartments	Residential	172	38,700	38,700		
EE	Gulfport Key	Single Family Residential	77	17,325	17,325		
FF	Bayridge	Single Family Residential	143	32,175	32,175		
GG	Richmond Estates	Single Family Residential	149	33,525	33,525		
HH	Wingham	Residential, mixed	500	112,500		56,250	56,250
II	Hampton Manor	Assisted Living Facility	7	1,575	1,575		
		Multi-Family Residential	65	14,625	14,625		
JJ	Eagle Crest	Single Family Residential	108	24,300	12,150	12,150	
KK	Preserves at Stonebriar	Single Family Residential	329	74,025	74,025		
LL	Rolling Meadows		2339	526,275	105,255	210,510	210,510
MM	Waterstone Phase II		1061	238,725	238,725		
MM	Waterstone/Cypress Bay West		1352	304,200	304,200		
NN	Cypress Bay		593	133,425	133,425		
OO	Emerald Lakes - West of I-95	Residential, Mixed	3,775	849,375	254,813	339,750	254,813
PP	Emerald Lakes - East of I-95	Residential, Mixed	2,179	490,275	98,055	196,110	196,110

ID	Development ¹	Type	Total Estimated ERC	Water Demand (gpd)			
				Total ²	0-5 Year	6-10 Year	> 10 Year
QQ	Pete Holdings		1966	442,350		221,175	221,175
QQ	Pete Holdings (Jeff Lee)	Residential, Mixed					
RR	Micco Village	Mixed use	600	135,000		54,000	81,000
	Calumet Farms		3304	743,400			743,400
	Willowbrook		6000	1,350,000			1,350,000
Total Demand (gpd)				8,178,000	2,189,000	1,969,000	4,020,000

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

2 - Residential water demand based on 225 gpd/ERC

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

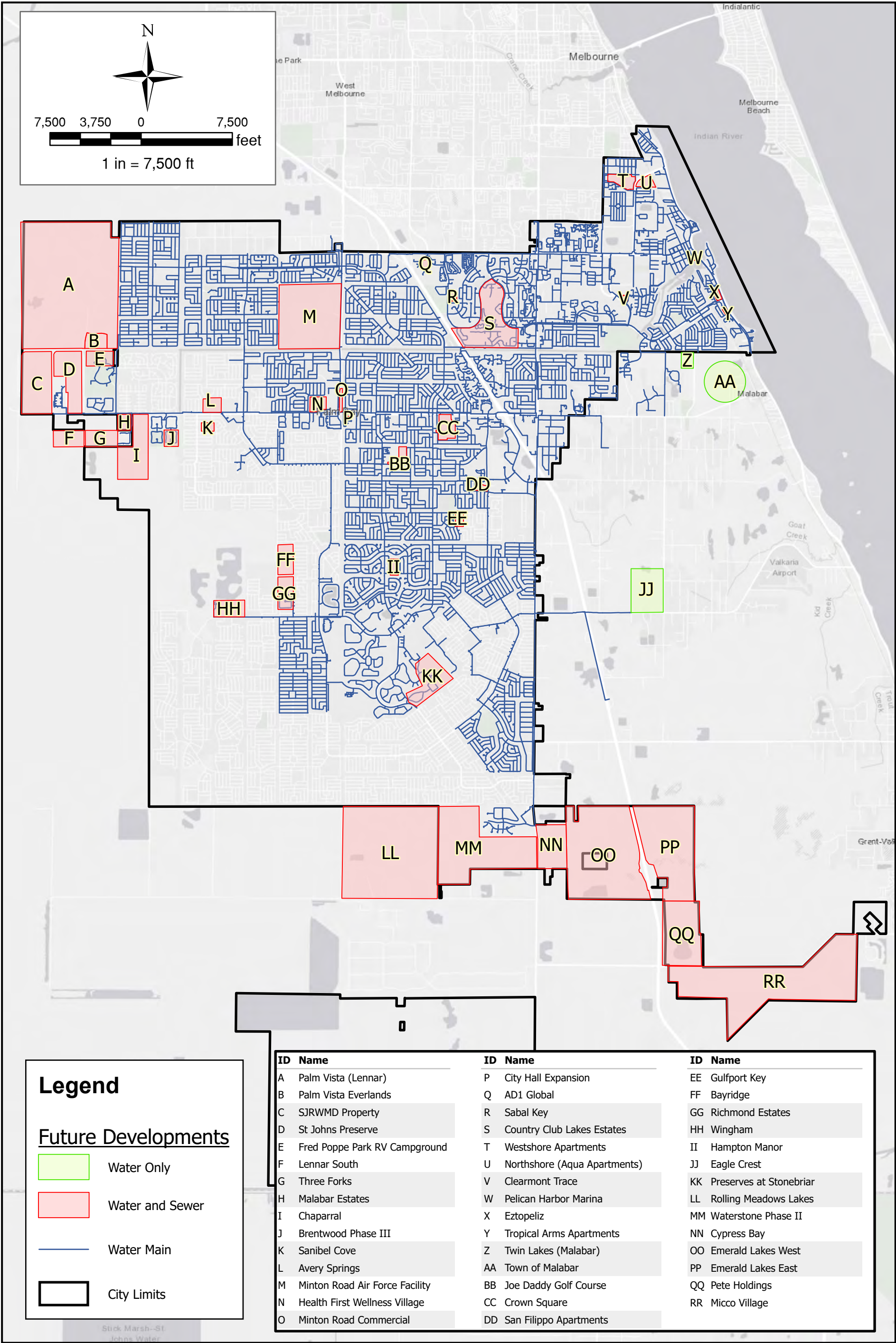
The total estimated demand for known developments over the next twenty (20) years has been estimated to be 8.18 MGD. The following table presents a summary of the current and future water system demands over the planning period.

Table 4-8. Historical and Projected Future Water Demands

	Year	Ave Daily Water Demand (MGD)		
		Existing Service Areas	New Development Areas	Total
Historical	2016	5.41		5.41
	2017	5.51		5.51
	2018	5.51		5.51
	2019	5.50		5.5
	2020	5.85		5.85
	2021	6.05		6.05
Future	Five-Year	6.05	2.19	8.24
	Ten-Year	6.05	4.16	10.21
	Twenty-Year	6.05	8.18	14.23

1 - Future Ave Daily Water Production includes the current estimated total water loss of 16.7% of water production based upon analysis presented in **Section 4.2.5**.

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4.4 Conclusion

In conclusion, the review and analysis of existing population projections and water demands for the entire City water system and the estimation of the future population projections and water demands for the five-, ten-, and twenty-year planning horizons were performed using the appropriate data required to make a full reporting of what the City has experienced in the last five (5) years in terms of demand and growth and to make predictions for the next planning periods. There are 73,826 parcels in the City's GIS, with 27,334 vacant. Of these, 35,703 parcels are within the water service area. At the end of 2021, the PBUD had 36,027 water service accounts serving an estimated population of 104,500.

A noticeable increase in water demand was seen in the billing data for 2020 and later in 2021 as compared to the typical 5.5 MGD from 2016-2019 to a higher 5.85 and 6.05 MGD. This is equivalent to a 6.3% increase in demand from 2019 to 2020 and an additional 3.5% from 2020 to 2021.

The total estimated annual average day water demand from the known future developments is approximately 8.18 MGD gallons. The total system average day demand in the twenty-year planning horizon is estimated to be 14.2 MGD.

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Section 5 -Hydraulic Modeling of the Water Transmission/Distribution System

5.1 Introduction

Section 5 of the City of Palm Bay Water Master Plan requires the development and calibration of the water transmission /distribution system hydraulic model. This model serves as the basis for developing an understanding of the current and future water system infrastructure needs. This section will include the following:

- a) Update and use the water distribution system model to evaluate the performance of the existing system and future improvements.
- b) Verify the distribution system model including the pipes, pump stations, storage facilities, and connectivity.
- c) Update the model based on GIS and/or development plans to reflect any changes to the system since the previous master plan.
- d) Calibrate the model based on actual flow, pressure, and fire hydrant test data for the system.
- e) Develop model simulations for three (3) planning horizons (five-, ten-, twenty-year).
- f) Identify and evaluate improvements in the transmission and distribution system required to provide service in each of the planning horizons.
- g) Model steady-state scenarios for the average daily flow (ADF), maximum daily flow (MDF), and peak hourly flow (PHF) conditions and model extended period simulations for 24 hours.
- h) Conduct a fire-flow analysis across the system under MDF conditions. Fire-Flow evaluated for hydraulic conditions only.

The previous water transmission and distribution system model for the City of Palm Bay was completed in 2017 as part of the prior water master plan efforts. In the 2017 update, the City's GIS data was used to make small adjustments in representation of the system. Otherwise, the version of the model developed in 2017 was very similar to the version previously developed. The hydraulic water system model was used as a tool to develop a series of water system improvements needed due to the anticipated growth in the City's service area using the five-, ten-, and twenty-year planning horizons.

5.2 Model Development

Rather than using the previous water system models as the basis, the water system hydraulic model developed for this Water Master Plan involves taking a fresh approach to building the water system model representation entirely from the City's current GIS data of the water system. The City's GIS database provided unique identifiers (typically asset ID or AID), elevations, and pertinent characteristics necessary for the model computations. In some cases, missing data was required from additional field investigations, City staff input, and approximation based on the best available data.

5.2.1 Modeling Software

The hydraulic model of the City's water transmission and distribution system was developed in Bentley OpenFlows WaterGEMS® 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 WaterGEMS allowing the model components to be linked to data available in GIS. 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 WaterGEMS. Additionally, the LoadBuilder tool was used to import water billing data as the basis for the spatial distribution of demand loading in the model.

The model simulations are run using a 48-hour time duration with the first 24-hour time period representing average day conditions and the second 24-hour time period representing either average day conditions (ADF scenarios) or maximum day conditions (MDF scenarios). The purpose of the first 24-hour time period is to establish appropriate initial modeling conditions including storage tank water levels for the design condition being analyzed.

5.2.2 Model Network

The model network was created from the City's GIS data. In some instances, data from the previous model (*e.g.* high-service distribution pump curves, storage tank dimensions, etc.) was exported from the prior model and imported into the new model. This information was then updated, where necessary, following discussions with City staff.

5.2.2.1 Water Demand Sources

Water demand was imported into the model using the City's water billing data and the customer account GIS data. The water customers were brought into WaterGEMS as "Customer Meters" that allow for easy update of the base demand if necessary. This feature in WaterGEMS is relatively new and can be

used with the ModelBuilder syncing option. The demand for each customer meter is assigned to the nearest water main or pressure junction using the LoadBuilder tool. This tool automates the meter connection process and is accurate for most of the customer meters, though is dependent on the water mains included in the model. The connections were then inspected, and manual adjustments were made to ensure an accurate representation of the system connections. Customer meter elevations were determined by projecting Brevard County Lidar data across the service area. A Python script was written in ArcGIS Pro to assign the elevation of the lidar raster data to the meter at each location.

The link between the customer meter and the water distribution system is a WaterGEMS lateral. These laterals are representations of the actual lateral connection between the customer and the pressure network established for connectivity and demand assignment. Flows within these laterals are not modeled. When connecting to a water main, a WaterGEMS tap is created, and the customer meter demand is split proportionately between the two (2) end nodes of the pipe. The water meter number is unique to each meter, so this GIS field is used as the Customer Meter ID in WaterGEMS.

5.2.2.2 Water Mains

The scope of this effort modeled water mains 6 inches and larger. However, most of the water mains provided in the City GIS were imported into the model for ease of model development and to maintain connectivity throughout the system. Abandoned water mains were not included and water mains within subdivisions and beyond water meters were omitted when feasible. Some water mains initially excluded from the model were later added back to limit the inaccurate linking between the customer meters and the pressure network. A manual evaluation of the water mains representation was conducted to rectify linework irregularities and ensure representative connectivity in the system.

Of the 8,258 water mains within the GIS, 7,140 were included in the model or 86%. By pipe length, 3.29 million linear feet of the 3.49 million linear feet (86%) were included in the model. A breakdown of the water mains included in the model by pipe size is shown below in **Table 5-1**.

Table 5-1. Modeled Water Mains by Pipe Diameter

Pipe Diameter (in)	Pipe Length (feet)	Percent of Total (%)
2	35,987	78.3
3	15,252	84.8

Pipe Diameter (in)	Pipe Length (feet)	Percent of Total (%)
4	199,685	93.7
6	2,029,031	96.9
8	471,219	87.2
10	72,947	85.5
12	292,225	93.7
14	1,490	100.0
16	129,727	99.5
20	33,372	96.5
24	10,810	89.0
Total	3,291,745	94.4%

5.2.2.3 Water Pump Stations

Pump performance characteristics were imported from the prior model and updated using the most recent record drawings and other City-provided documentation. Pump curves were verified for each of the high-service water distribution pumps and the associated yard piping was represented in the model according to the City provided record drawings. Water storage tank dimensions and elevation characteristics were taken from the previous model and verified with City staff and/or record drawings.

5.2.2.4 Model Boundary Conditions

Boundary conditions for the model consist of the two (2) existing water treatment facilities, the NRWTP in the northeast section of the city and the SRWTP in the southwest section of the city. The plants are operated jointly, with the SRWTP generating a relatively consistent system pressure and the NRWTP varying output as required to meet water demand throughout the city. The Nash Repump Station, located in the central north section of the city is utilized to maintain adequate pressures throughout the northwest portion of the system during peak demand though is not a source of water generation.

5.3 Water Demands

City-wide water demands primarily consisted of residential and commercial metered flows within the service area. Water loss, including hydrant flushing and other service-related activities, is accounted for through calibration and validation of the hydraulic model.

5.3.1 Water Demand Data Sources

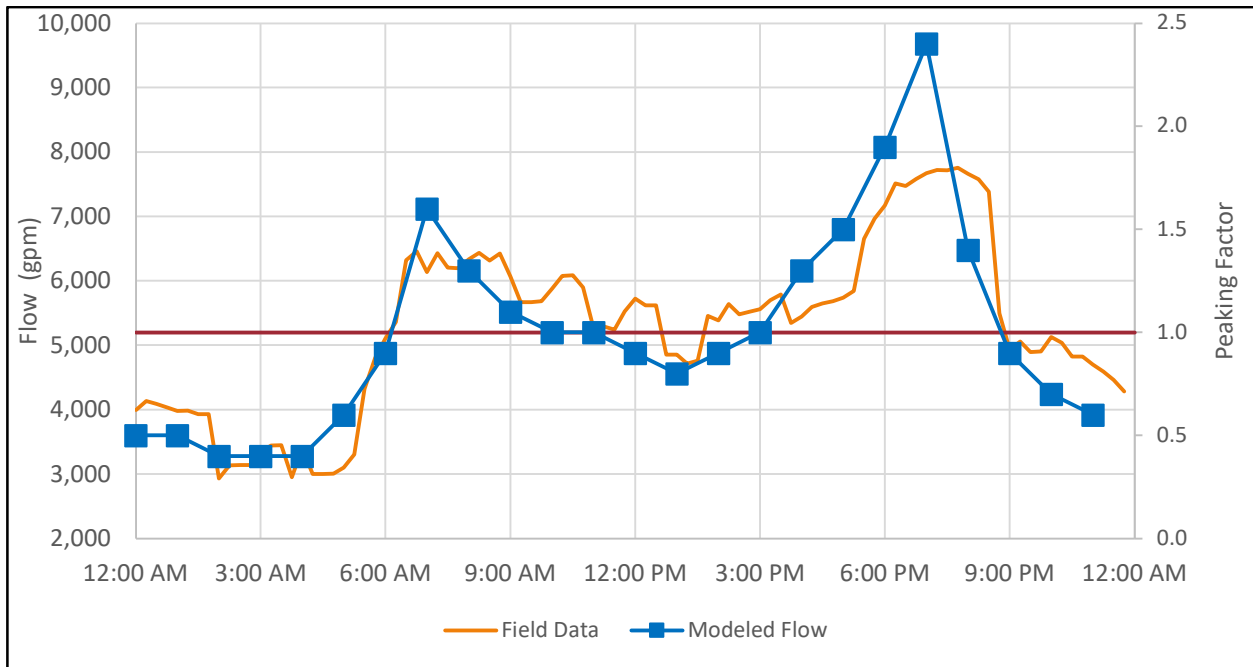
The water demands used in the model are compiled from the water billing records provided by the City. Monthly water use for the City's water customers was obtained for the years 2017 through 2021. Due to changes in flow during the pandemic due to COVID-19, billing data from 2020 and 2021 was not used except for new accounts established after 2020. All other water demands were calculated by averaging the 2018 and 2019 billing data. If the average billing data showed zero use in the 2018 and 2019 average, then the average 2019 through 2021 water usage was used. For the billing data obtained, only 256 of the 48,627 accounts used the 2019/2020 billing data.

In addition to the water billing data, the city-provided water flushing data was represented in the model at their respective device location. Flows from the 38 flushing devices are significant with daily flows as much as 804,000 gpd in a single month based on the data provided (October 2019 through September 2020). Overall, the water flushing accounts for 433,000 gpd on an annual basis with the largest device flushing 86,000 gpd on an annual basis.

5.3.2 Diurnal Flow Patterns

A diurnal water demand flow pattern was developed using the field data collected on October 4 and October 5, 2021. Flow meter measured water flows into the system from the NRWTP and SRWTP were recorded in 15-minute increments while flow from the Nash Repump Station was recorded every hour. The resulting flows into the system averaged about 5,200 gpm or 7.5 MGD. Peak flows occurring in the early evening hours (6:00 – 8:00 pm) were around 7,800 gpm. On October 4, peak flows above 7,000 gpm occurred in the early morning hours and early afternoon hours. The metered flow patterns collected during the calibration period are shown in **Figure 5-1**.

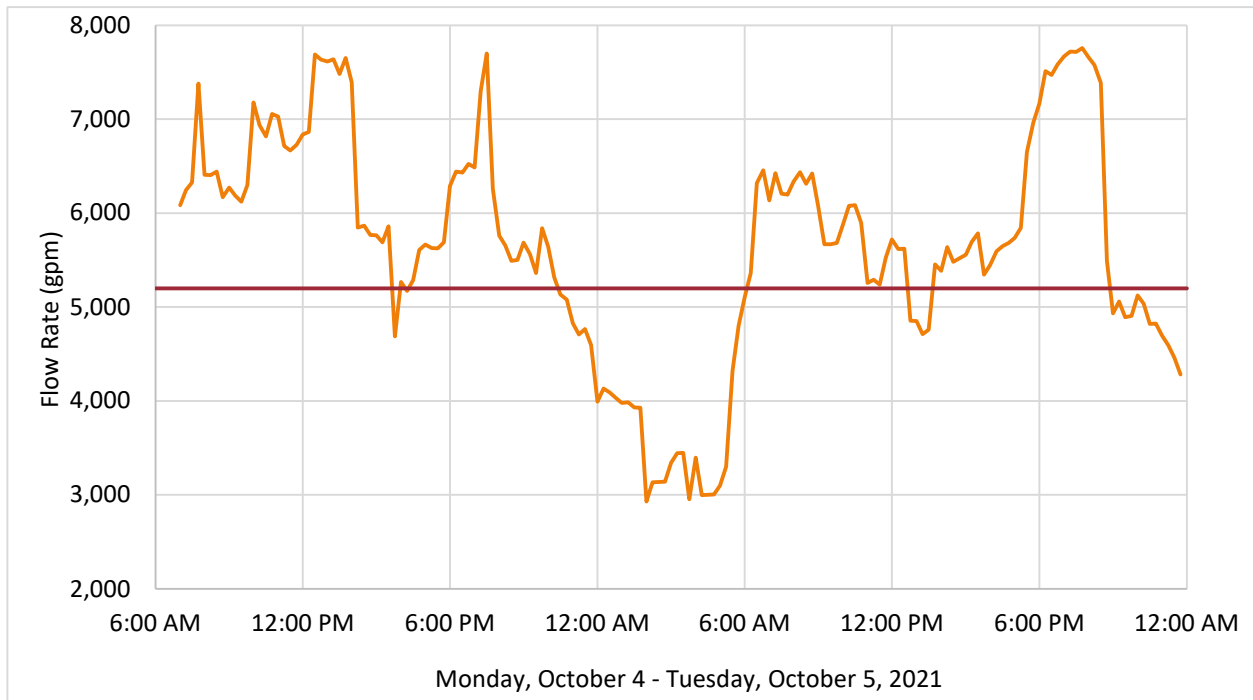
Figure 5-1. System-Wide Water Flows during Calibration Period



This demand pattern was determined to be appropriate for use in the calibration simulation; however, it is not necessarily representative of the peak hour flow that would likely occur during the year. Using an average daily flow of 5,200 gpm, the peak hour factor observed during the October 4/5 calibration period is only 1.5. Published peak hour rates are between 2.0 and 3.0 with a typical value of 2.5. Similarly, the City has used a peak hour factor of 2.4 in prior master plans and modeling evaluations. Since the observed data is limited, a peak hour factor of 2.4 is used for evaluation purposes consistent with the approach taken in previous Water Master Plans.

The design diurnal flow curve used in the model was developed based on the pattern shown for October 5, 2021 adjusted to obtain a 2.4 peak hour factor. The diurnal curve used as the basis in all model simulations except the calibration effort is shown on **Figure 5-2** superimposed with the flows collected during calibration.

Figure 5-2. Design Diurnal Flow Curve



Note: Design diurnal flow curve developed based on the October 5, 2021 observed water system flows.

5.4 Model Calibration

Calibration of the water model consisted of using the field data of flow, pressure, and elevation data recorded in 15- or 60-minute increments to compare to the model results over the same time period. Time-based calibration data included the following:

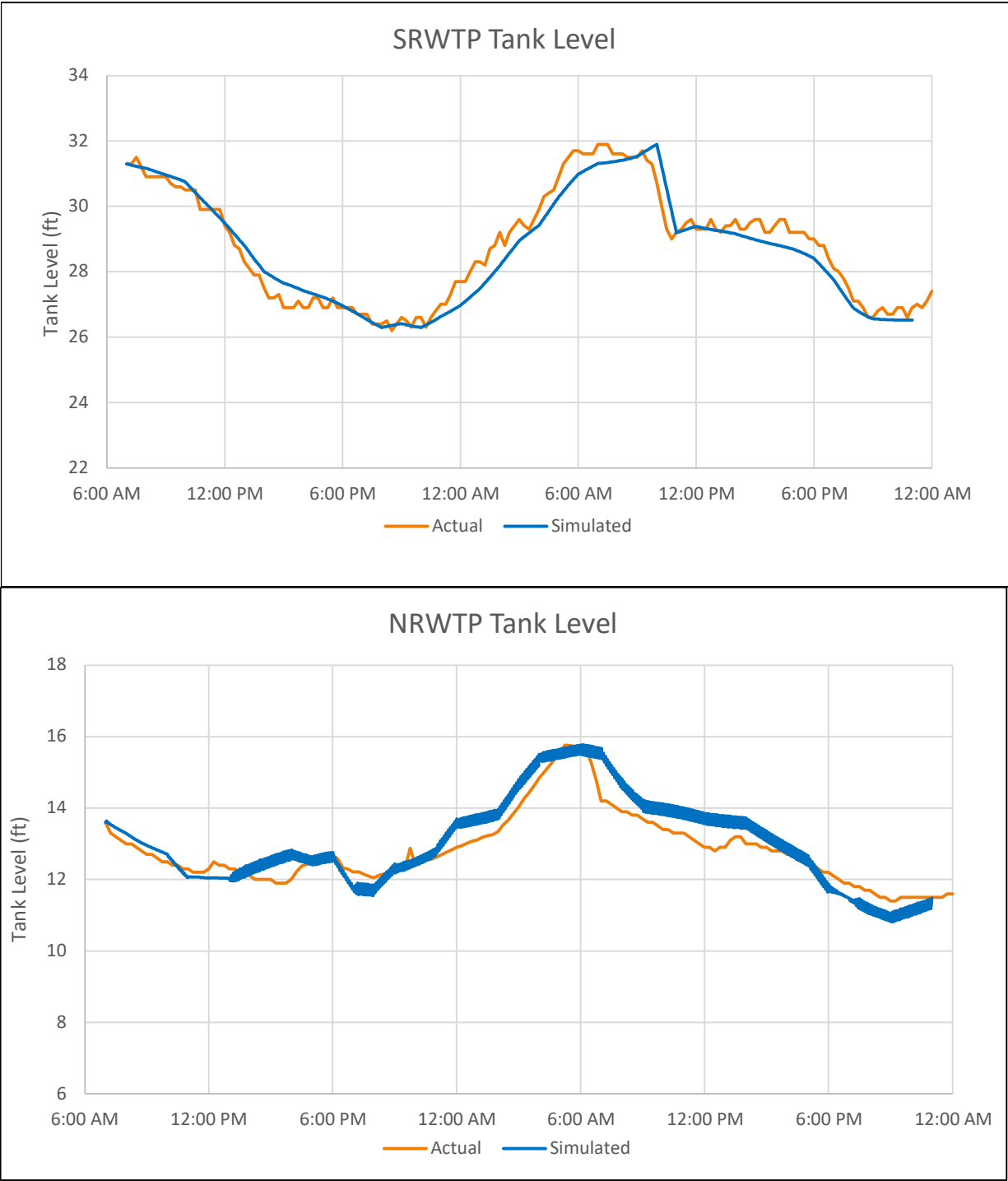
- SRWTP and NRWTP Ground Storage Tank Levels,
- SRWTP and NRWTP Flows,
- SRWTP Discharge Pressures,
- NRWTP Elevated Tank and Nash Repump Station Ground Storage Tank Level, and
- Water System Pressure Readings from Nine (9) Remote Monitoring Locations.

5.4.1 Model Calibration to WTP and System Pressure Data

The ground storage tanks levels at both the SRWTP and NRWTP compared well as shown in **Figure 5-3**. Additionally, the flow leaving the WTPs also compared well except for a few times at the SRWTP (late morning to early afternoon on October 4th and early morning on October 5th) as shown on **Figure 5-4**. Matching the water flows at the NRWTP followed the general trend however the transition from higher

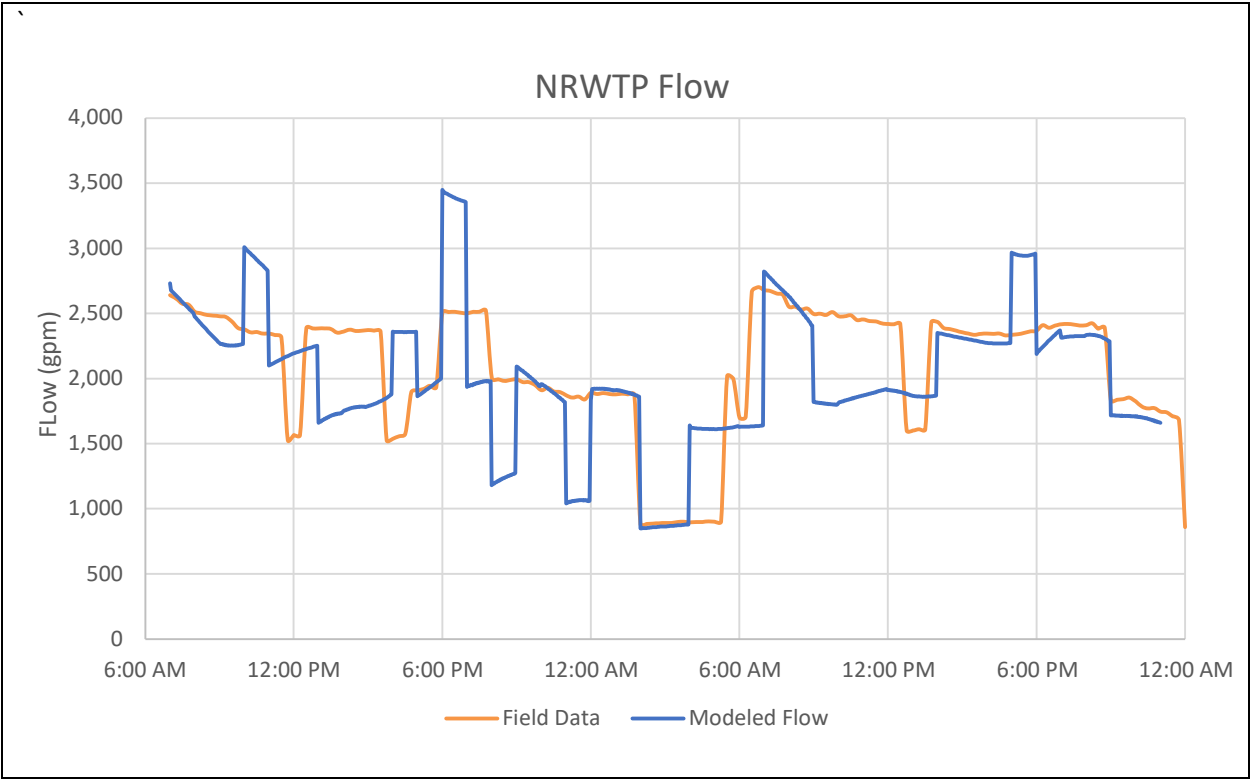
to lower flows does not match due to limitations in the model and the manual nature of the pump operation at the NRWTP.

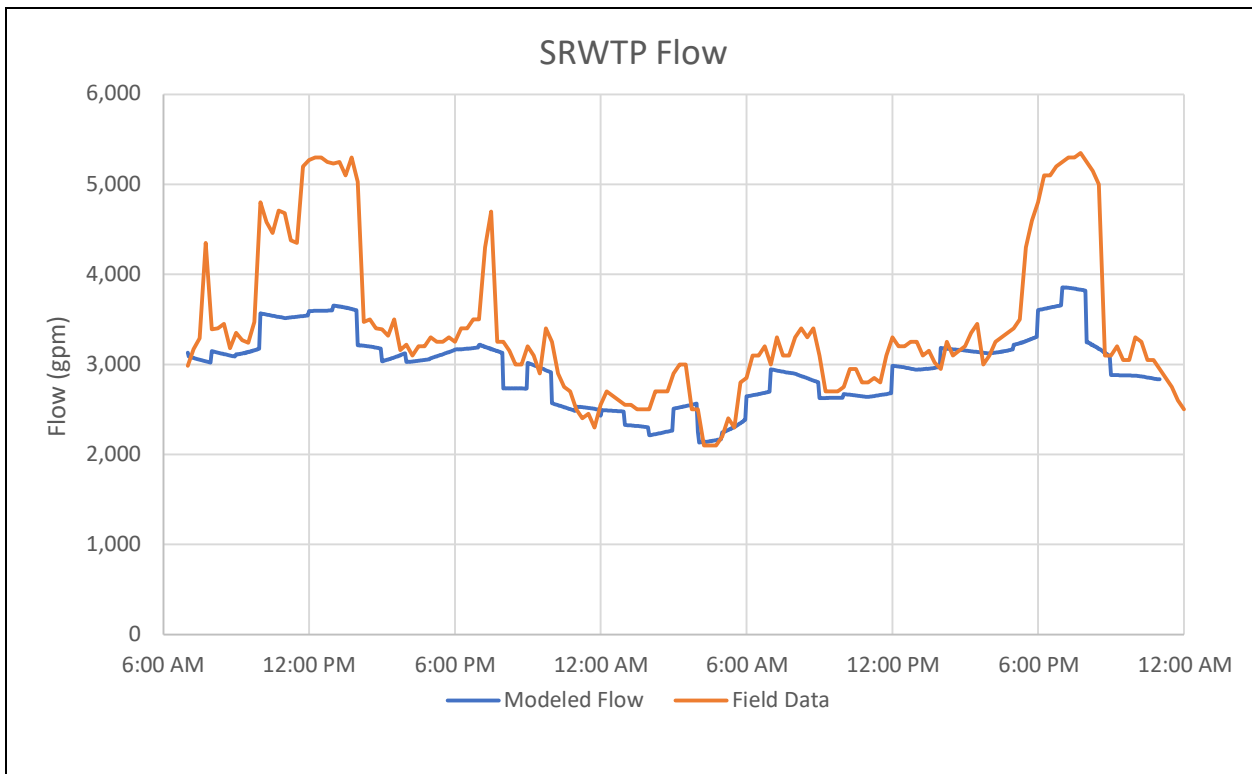
Figure 5-3. Comparison of Model Predicted and Actual WTP Tank Water Levels



The modeled discharge pressure at the SRWTP (discharge pressure at NRWTP is based on the elevated tank level) matched very well with the actual field readings. Since the SRWTP high-service water distribution pumps use variable frequency drive controlling the pump discharge based upon maintaining a system pressure setpoint, simulating this operation in the model allows this to match very well. When attempting to match the high flows from the SRWTP (shown in **Figure 5-4**), the pressures then did not match at these times. For calibration purposes, matching the distribution pressures took precedence.

Figure 5-4. Comparison of Model Predicted and Actual WTP Flows to Distribution





The elevated water storage tank is connected to the water distribution system at the NRWTP while the Nash Repump Station ground storage tank is filled at night during low flow conditions and water is withdrawn from the tank during peak flow conditions. The elevated tank levels in the model were slightly higher at the beginning of the calibration period (October 4th and early on the 5th) but matched better in the early morning hours of the 5th.

The levels in the Nash Repump Station tanks corresponded closely with the duration when the fill line was open showing rising tank levels and the pumps were actively operating showing a decreasing tank level. The actual filling rate was not known so this number was adjusted using a throttle control valve to match the tank levels.

Figure 5-5. Comparison of Model Predicted and Actual SRWTP Discharge Pressure

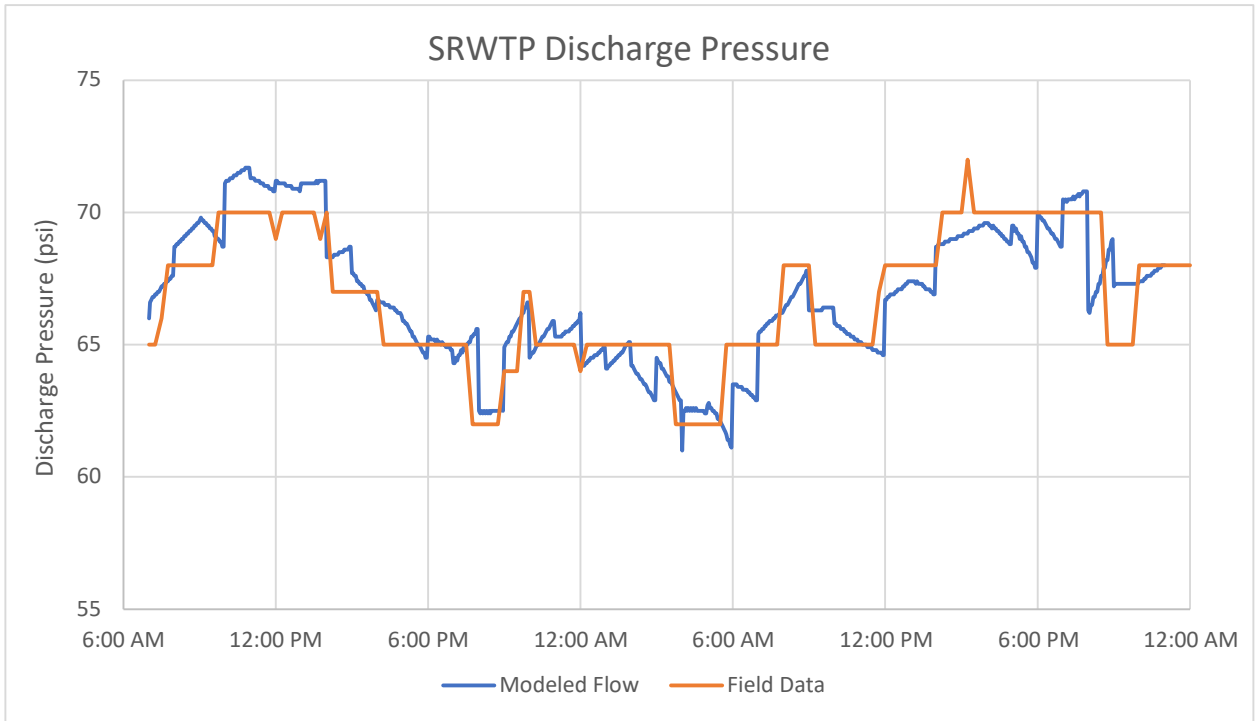
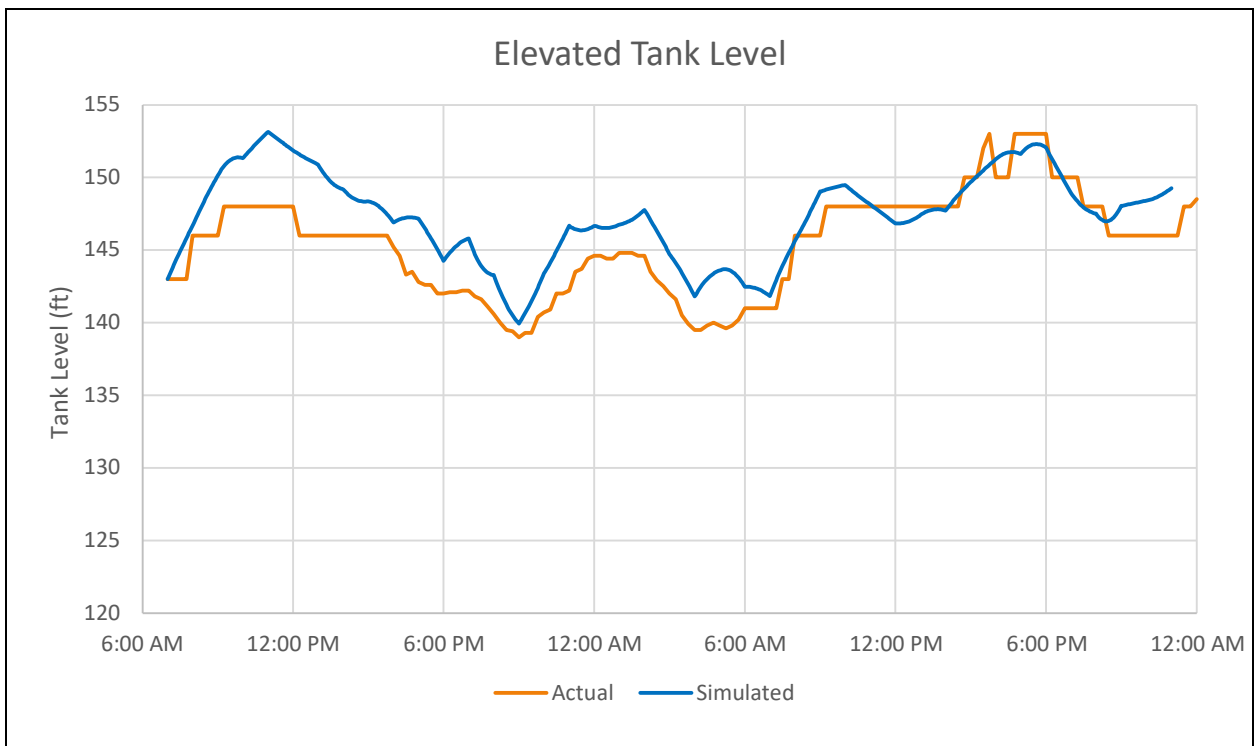


Figure 5-6. Comparison of Model Predicted and Actual System Tank Water Levels



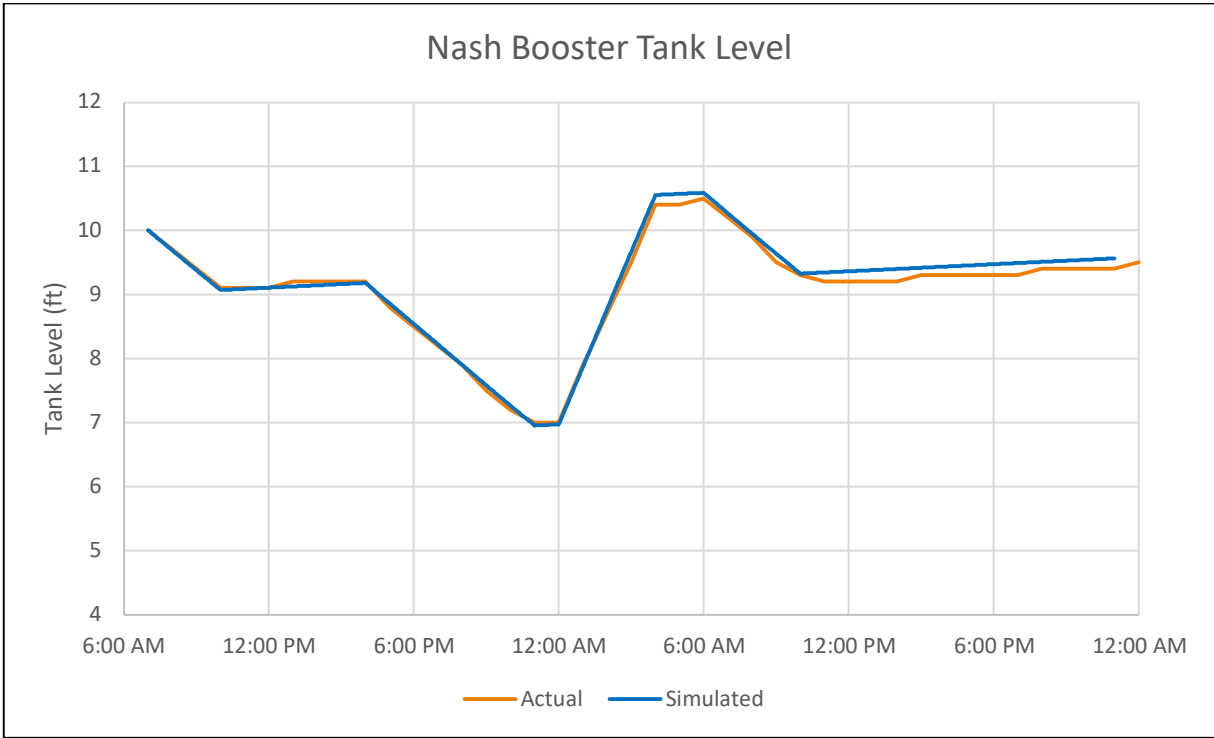




Figure 5-7

Comparison of Model and Actual Pressures at the Remote Monitoring Stations

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5.5 Model Calibration to Hydrant Test Data

Following model calibration to the WTP data, fire hydrant flow tests conducted around the City during the same time frame were used to adjust C factors, demands, and pipe connectivity to best match the residual pressures. Fire hydrant test data was collected on October 5, 2021, for eighteen (18) hydrants, at two (2) different times, across the city. With eighteen (18) hydrants tested twice a day and measured for static and residual pressure, a total of 72 pressure readings were collected. The locations of the hydrant tests are shown in **Figure 5-8**.

Several of the hydrant test static pressure readings were determined to be unreasonable as the resulting hydraulic grade was greater than the hydraulic grade at the WTP. There was some correlation between these readings with one (1) of the two (2) crews performing the tests. The hydrant data used for calibration used a subset of the collected data or fifty-four (54) of the seventy-two (72) pressure readings as all of the pressure readings taking during the tests (i.e. hydrants open) and half of the static pressure tests were used.

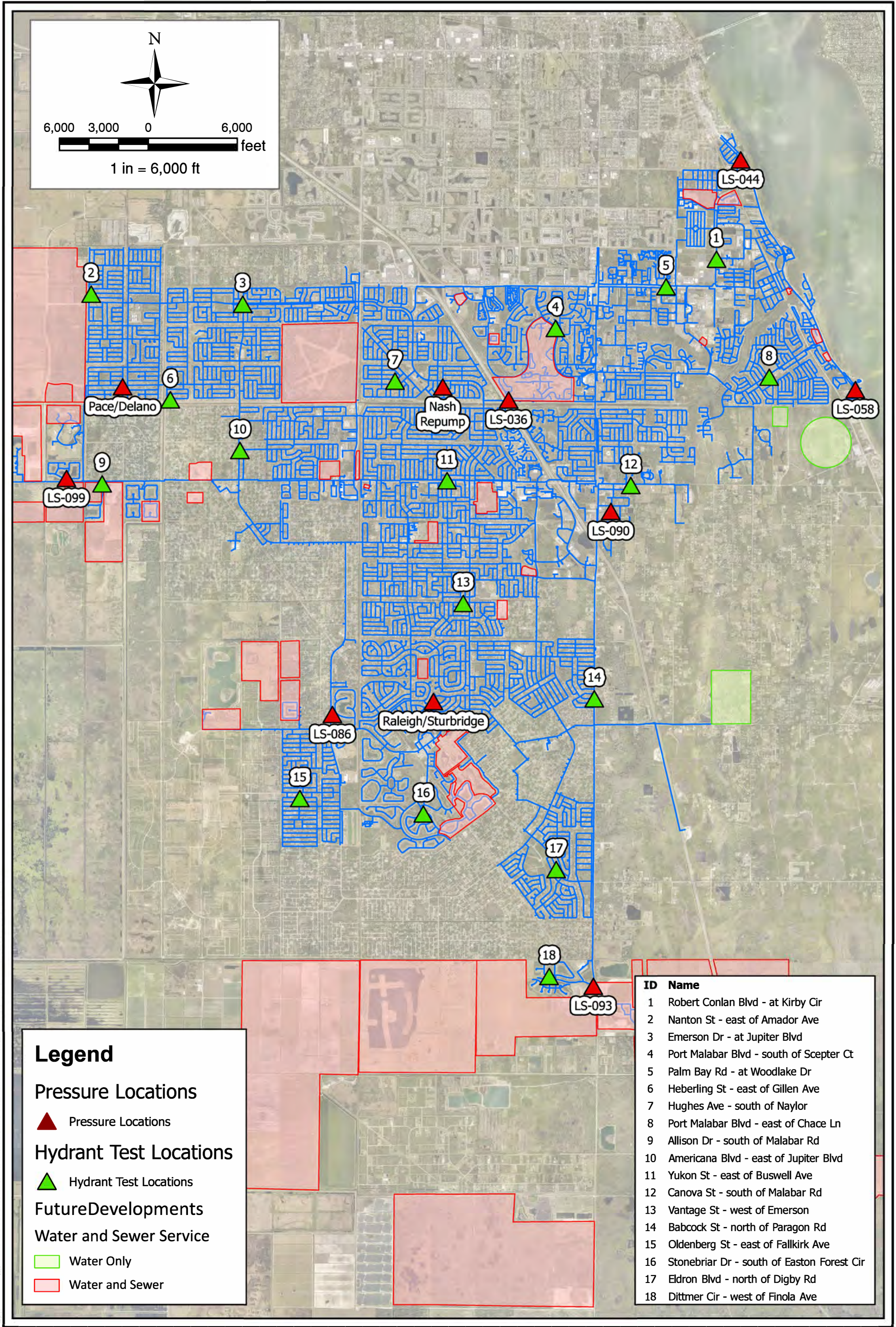
Adjustment groups for the water demand were divided into the area east of I-95 and west of I-95 both with a minimum and maximum demand of 1.0 and 1.5 respectively. Adjustments to the water mains C factor in the Darwin Calibrator optimization were grouped by material type and age, based on data available in GIS. For each group, the C factor was allowed to be adjusted in increments of five (5) as follows:

- Ductile Iron Pipe (DIP): There is very little ductile iron pipe in the system so optimization was not based on age. For DIP, the C factor was adjusted between 110 and 150.
- Asbestos Cement (AC): Groups were created based on the age for the three (3) decades from 1960 through the 1980s. C factors were allowed to be adjusted between 70 and 130.
- Plastic Pipe (PVC and HDPE): Plastic pipe was divided into the same groups as AC pipe with all pipes constructed after 1980 in the same group. Plastic pipe from the 1960's was adjusted between 90 and 150, 100 and 150 for the 1970's, and 110 to 150 for 1980's and beyond.

The optimized run using Darwin calibration resulted in AC pipe prior to 1980 with a C factor of 90 and 120 for after 1980. The C factor was 140 for plastic pipe and 145 for DIP independent of the age of the pipe. Demand did not change as the adjustment factor stayed at 1.0.

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Table 5-2 shows the results of the calibration for the eighteen (18) static pressure readings while **Table 5-3** shows the results of the calibration for the thirty-six (36) hydrant tests. Overall, the average hydraulic grade line (HGL) difference for all fifty-four (54) pressure readings was 3.4 ft or 1.5 psi. When only looking at the hydrant tests, the average difference is 0.6 ft or 0.3 psi. For all fifty-four (54) tests, 98% of the tests (all but one) were less than 10 psi while two-thirds of the tests were less than 5 psi difference. When looking at the hydrant tests only, all of the hydrant tests were less than 8 psi difference while 72% (26 of 32) were less than 5 psi difference.

Table 5-2. Calibration Results for the Hydrant Test Static Pressure Readings

Location ID	Model Junction ID	Observed Hydraulic Grade (ft)	Simulated Hydraulic Grade (ft)	Hydraulic Grade Difference (ft)	Pressure Difference (psi)
10-HYD100321 - AM Static	J-14466	168.14	146.19	-21.95	9.5
10-HYD100321 - PM Static	J-14466	163.54	150.3	-13.24	5.7
14-HYD100094 - AM Static	J-19347	169.17	148.76	-20.4	8.8
17-HYD100228 - AM Static	J-16686	158.24	147.01	-11.23	4.9
1-HYD101455 - PM Static	J-15020	167.05	153.92	-13.13	5.7
2-HYD100056 - AM Static	J-19012	133.65	143.2	9.56	4.1
2-HYD100056 - PM Static	J-19012	133.65	143.2	9.56	4.1
3-HYD100164 - AM Static	J-14181	158.02	146.35	-11.66	5.0
3-HYD100164 - PM Static	J-14181	158.02	149.74	-8.28	3.6
4-HYD100568 - AM Static	J-20197	159.32	147.93	-11.4	4.9
4-HYD100568 - PM Static	J-20197	159.32	150.81	-8.51	3.7
5-HYD102872 - PM Static	J-15504	155.56	152.35	-3.21	1.4
6-HYD100902 - AM Static	J-19214	155.67	144.75	-10.92	4.7
6-HYD100902 - PM Static	J-19214	132.65	149.46	16.8	7.3
7-HYD100434 - AM Static	J-20115	171.22	146.7	-24.52	10.6
7-HYD100434 - PM Static	J-20115	159.71	150.13	-9.57	4.1
9-HYD100875 - AM Static	J-16328	166.09	146.2	-19.89	8.6
9-HYD100875 - PM Static	J-16328	161.48	150.34	-11.15	4.8

Table 5-3. Calibration Results for the Hydrant Test Flow Residual Pressures

Location ID	Model Junction ID	Observed Hydraulic Grade (ft)	Simulated Hydraulic Grade (ft)	Hydraulic Grade Difference (ft)	Pressure Difference (psi)
10-HYD100321 - AM	J-14466	133.61	132.53	-1.08	0.5
10-HYD100321 - PM	J-14466	133.61	135.99	2.38	1.0
11-HYD102144 - AM	J-19331	134.46	128.01	-6.45	2.8
11-HYD102144 - PM	J-19331	134.46	132.06	-2.4	1.0
12-HYD101919 - AM	J-19890	148.98	131.2	-17.78	7.7
12-HYD101919 - PM	J-19890	137.47	136.14	-1.33	0.6
13-HYD102555 - AM	J-16321	141.86	134.14	-7.73	3.3
13-HYD102555 - PM	J-16321	141.86	137.56	-4.3	1.9
14-HYD100094 - AM	J-19347	123.13	138.59	15.46	6.7
14-HYD100094 - PM	J-19347	139.25	140.53	1.28	0.6
15-HYD102700 - AM	J-19594	131.49	124.4	-7.09	3.1
15-HYD102700 - PM	J-19594	119.98	131.64	11.65	5.0
16-HYD102204 - AM	J-20365	149.91	137.44	-12.47	5.4
16-HYD102204 - PM	J-20365	140.7	147.05	6.34	2.7
17-HYD100228 - AM	J-16686	112.2	128.22	16.02	6.9
17-HYD100228 - PM	J-16686	132.92	129.24	-3.68	1.6
18-HYD103362 - AM	J-20004	131.64	122.22	-9.42	4.1
18-HYD103362 - PM	J-20004	128.19	123.98	-4.2	1.8
1-HYD101455 - AM	J-15020	145.18	138.7	-6.48	2.8
1-HYD101455 - PM	J-15020	138.28	140.02	1.75	0.8
2-HYD100056 - AM	J-19012	109.47	100.32	-9.16	4.0
2-HYD100056 - PM	J-19012	96.81	112.73	15.92	6.9
3-HYD100164 - AM	J-14181	146.51	129.83	-16.68	7.2
3-HYD100164 - PM	J-14181	135	136.64	1.65	0.7
4-HYD100568 - AM	J-20197	136.3	134.48	-1.82	0.8
4-HYD100568 - PM	J-20197	136.3	137.49	1.19	0.5
5-HYD102872 - AM	J-15504	144.05	132.83	-11.22	4.9
5-HYD102872 - PM	J-15504	132.54	135.26	2.72	1.2
6-HYD100902 - AM	J-19214	118.84	105.41	-13.43	5.8
6-HYD100902 - PM	J-19214	105.03	112.4	7.37	3.2
7-HYD100434 - AM	J-20115	126.33	122.02	-4.31	1.9
7-HYD100434 - PM	J-20115	113.66	128.79	15.12	6.5
8-HYD101398 - AM	J-20665	130.55	126.11	-4.44	1.9
8-HYD101398 - PM	J-20665	122.5	129.61	7.11	3.1
9-HYD100875 - AM	J-16328	125.8	128.37	2.57	1.1
9-HYD100875 - PM	J-16328	120.05	134.1	14.06	6.1

5.6 Observations and Conclusions

As part of the Master Plan, The City of Palm Bay requires the development and calibration of the water transmission/distribution system hydraulic model. This model serves as the basis for developing an understanding of the current and future water system infrastructure needs. The following observations are noted related to the calibrated model as described in the section.

- The calibrated model accurately predicts current system flows.
- The calibrated model accurately predicts current system pressures.
- The calibrated model accurately predicts current tank levels.

In conclusion, the calibrated model can be relied upon to provide a basis for evaluation of capital improvements to the City's water infrastructure in the five-, ten-, and twenty-year time horizons.

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Section 6 -Evaluation of Existing Water Distribution System

6.1 Introduction

Section 6 of the City of Palm Bay Water Master Plan describes the use of the calibrated water distribution hydraulic model to evaluate the performance of the existing system as described below:

- a) The master plan will evaluate the performance of the existing system using the updated water distribution system model, site visits, and review of operating data.
- b) The water distribution system will be evaluated to identify areas that may experience low pressure, inadequate available fire flow, excess pipe velocities, etc.
- c) Storage and pumping facilities capacity shall be evaluated to determine if adequate water storage is maintained to meet the existing average day demand and the fire flow requirements.
- d) Any upgrades to the existing water distribution system to meet current service requirements will be identified.

6.2 Evaluation Criteria

Consistent with regulatory requirements and previous City of Palm Bay Water Master Plans, the criteria used to evaluate the existing water transmission and distribution system including the following criteria.

- a) **Pressure** – The City requires static water system pressures between 45 psi and 80 psi during average day conditions and not less than 40 psi during peak periods in accordance with AWWA Standard G200 and Ten State Standards Section 7.3.1.
- b) **Velocity** – Water mains are considered acceptable with pipe velocities less than approximately 5 feet per second (fps).
- c) **Fire Flow** – The following minimum fire flows are used to evaluate the water system: 1,000 gpm at 20 psi for residential areas, 2,500 gpm at 20 psi for commercial areas, and 3,500 gpm at 20 psi for industrial areas in accordance with the Insurance Service Office Fire Suppression Rating Schedule Section 604 (Insurance Service Office, 2012)
- d) **Pumping Capacities** – Pumping capacity was considered acceptable when the firm capacity (i.e., with the largest pump out of service) at each facility exceeded peak hour demands per Ten State Standards Section 6.3 and Chapter 62-555.320 (15) F.A.C..

- e) **Water Treatment Capacity** – Water treatment plant capacity must equal or exceed the maximum day demand per Chapter 62-555.320 (6) F.A.C.
- f) **Well Capacity** – Raw water wells cannot exceed the permitted water withdrawal established by the Consumptive Use Permit No. 202.
- g) **Storage Capacity** – Storage capacity must be equal to or exceed 25% of the maximum daily flow with provisions for fire flow, as required by Chapter 62-555.320 (19) F.A.C.

6.3 Model Development

Refer to **Section 5** of this Water Master Plan report details of the water hydraulic model development and calibration.

Since the steady-state model runs do not account for system storage, particularly out in the distribution system, an extended period simulation (EPS) is developed to assist in evaluating the system operation, assess if the system has adequate storage, and ensure the system can replenish the storage out in the system. In order to run an EPS, logical controls have to be developed to turn pumps on and off and make any other adjustments as the demands change during the day.

Below is a description of the logical control established for the existing conditions EPS that are used in subsequent model scenarios modified as necessary as demands increase and new components are added to the system.

- 1) During morning peak flow conditions (7-9 am), Nash Repump Station High-Service Pump (HSP) No. 1 was operated. During the afternoon peak flow conditions (6-9 pm), Nash Repump Station HSP Nos. 1 and 2 operated.
- 2) During low conditions (12 – 6 am), the Nash Repump Station ground storage tank was filled. Similarly, a rule is created for the throttle control valve used to restrict flow into the tank. This setting is adjusted based on the necessary flow needed to fill the tank.
- 3) By default, the initial pumps in operation at the EPS start time (midnight) include NRWTP HSP No. 1, NRWTP HSP No. 5, and SRWTP HSP No. 3. These pumps are in operation throughout the simulation.

Rules are created to turn on additional pumps at NRWTP and/or SRWTP based on the system demand. Base water demands under average conditions for the existing model is approximately 5,000 gpm. When the demand increases to 7,000 gpm, SRWTP HSP #1 operates. When demand

increases to more than 9,000 gpm, NRWTP HSP #4 operates, and finally, when the demand reaches more than 11,000 gpm, NRWTP HSP #6 operates. When the system demands all below each of these trigger points, the pumps will then turn off.

6.4 Evaluation of the Existing Water System

6.4.1 Evaluation of Water System Pressures

The existing conditions water system pressures were evaluated for the steady-state scenarios including the average day, maximum day, and peak hour model design scenarios. In general, the water system pressures ranged between the target pressure ranges of 40 to 70 psi. The peak hour design scenario was the most demanding which required the operation of four (4) high-service distribution pumps at NRWTP, three (3) high-service distribution pumps at the Nash Repump Station, and two (2) high-service distribution pumps at the SRWTP. Water system pressures were modeled to be highest in the areas around the active pumps while reduced water system pressures were observed southeast of the Nash Repump Station and the northwest portion of the City's system. Please see **Figures 6-1** through **Figure 6-3** for the distribution of water system pressures through the service area. See **Table 6-1** for a summary of water system pressures including in-service high-service distribution pumps for each steady-state modeling design scenario.

Table 6-1. Existing Conditions Steady-State Model Scenarios

Steady-State Scenario	Total Demand (gpm)	High-Service Pump Number Running			System Pressures		
		North Regional WTP	Nash Repump Station	South Regional WTP	Min (psi)	Max (psi)	Avg (psi)
Calibration	6,150	4,5	N/A	1,3	47.0	70.7	61.4
Average Day	4,970	1,5	N/A	3	51.7	69.2	59.5
Maximum Day	6,770	3,5	1	1,3	49.4	68.4	56.8
Peak Hour	11,670	2,3,5,6	1,2,3	1,3	40.9	67.8	50.5

Note: In each of the steady-state scenarios shown above in **Table 5-1**, additional pumping capacity is available since North Regional WTP has a total of seven (7) existing pumps, Nash Repump Station has four (4) existing pumps, and South Regional has four (4) existing pumps.

6.4.2 Evaluation of Water System Velocities

Existing system water main pipe velocities were reviewed as part of the steady-state scenario modeling analysis. The vast majority of velocities were below the 5-fps threshold; however, several instances of higher velocities were observed in piping directly downstream of high-service water distribution pumps which is expected. Overall, system water main pipe velocities for the model scenarios are acceptable. See **Figures 6-3 through 6-6** for system water main pipe velocities for the existing conditions average day, maximum day, and peak hour steady-state model design scenarios.

6.4.3 Evaluation of Fire Flows

Fire flow analysis was performed on the entire existing water distribution system using the maximum day model design scenario. Fire flow demand was applied to respective model junctions in a sequential fashion such that every junction is tested for fire flow demand while the rest of the system was modeled under “stressed” the maximum day design scenario. Most system junctions can provide the required fire flow while under the maximum day scenario; however, 7% of system junctions, approximately 400 of 5,800 system junctions, did not provide the minimum flows and/or pressures required by the fire flow criteria.

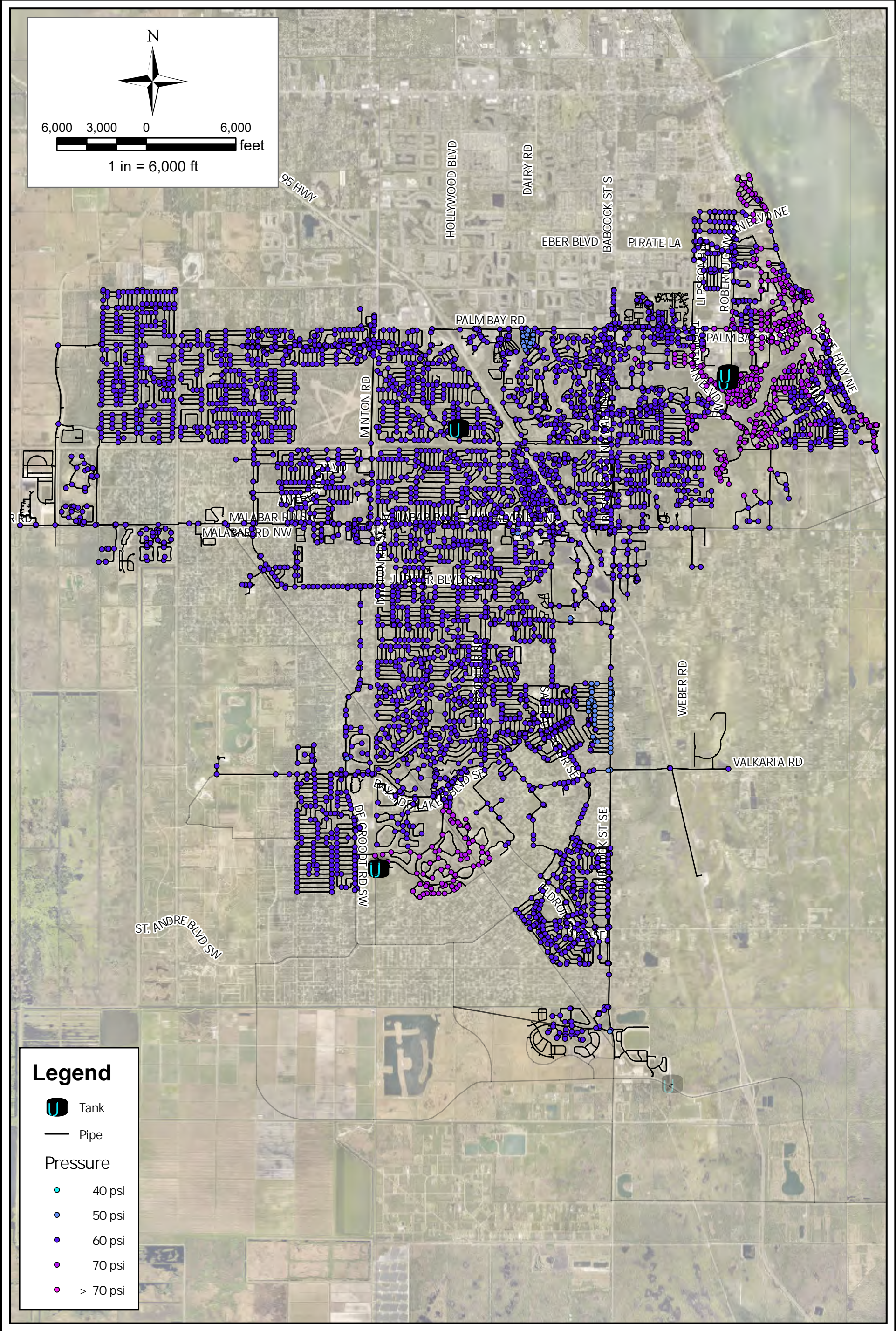
Overall, the failing fire flow nodes coincided with the location of smaller diameter water main piping, less the 6-inch diameter in the northeast quadrant of the City’s water system. Further analysis included a review of the fire hydrant geographical location throughout the City. A five hundred (500)-ft buffer around each hydrant location was generated in GIS. The hydrant buffer zone coverage showed that the city has sufficient hydrant coverage and that modeling node junctions that failed fire flow criteria were generally covered by nearby hydrants. Overall, the City’s fire flow capacity is adequate when fire hydrant coverage is considered as part of the analysis.

6.4.4 Evaluation of High-Service Distribution Pumping Capacities

The existing high-service distribution pump capacities were observed to be generally sufficient to provide water flows and system pressure under all model scenarios with the highest capacity high-service distribution pump at each station not in used.

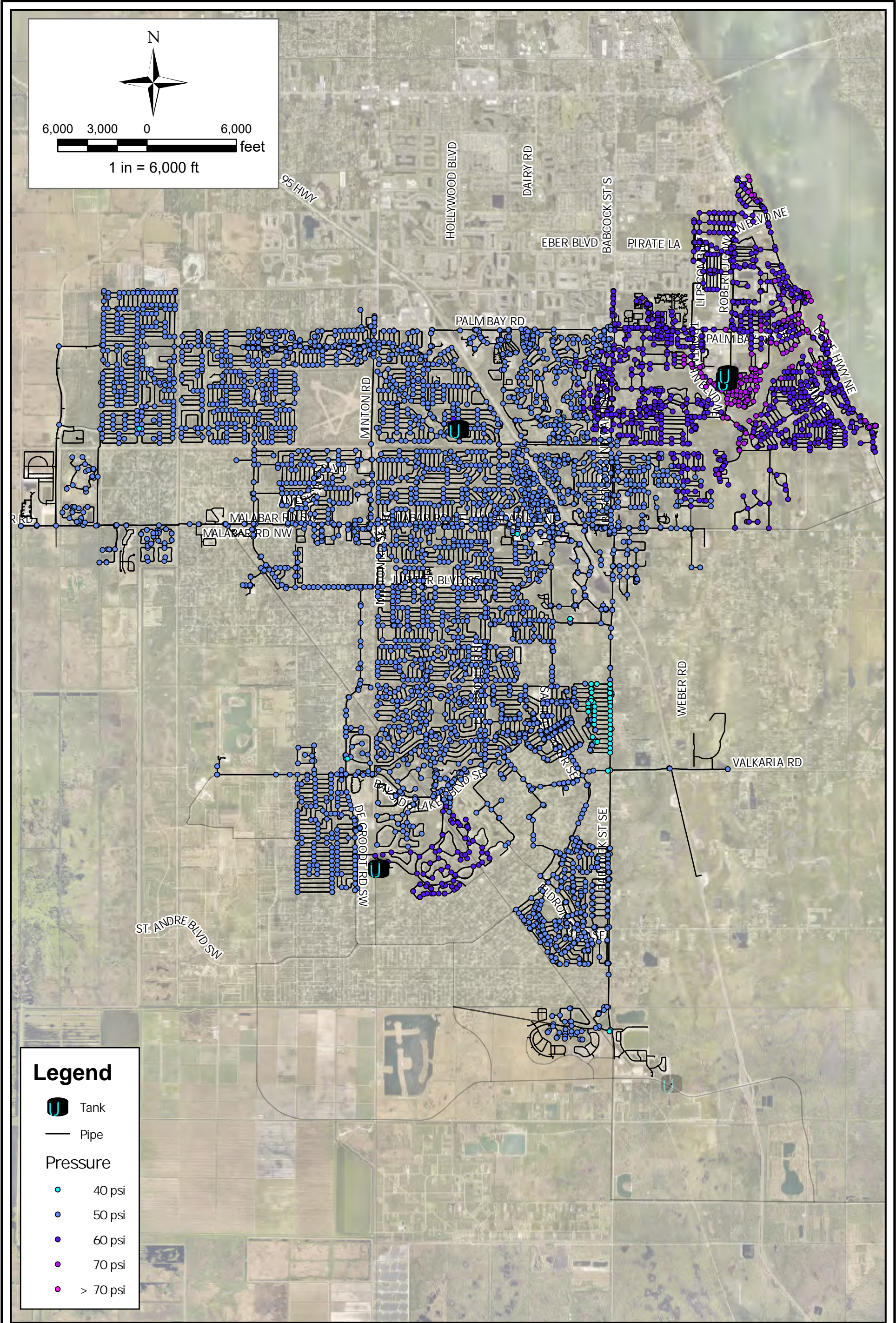
As noted in **Section 6.3.3**, fire flow was not adequate for 7% of junctions; however, this issue is generally a result of smaller water main pipe sizing concentrated in the northeast portion of the City’s water system and not related to pumping capacities.

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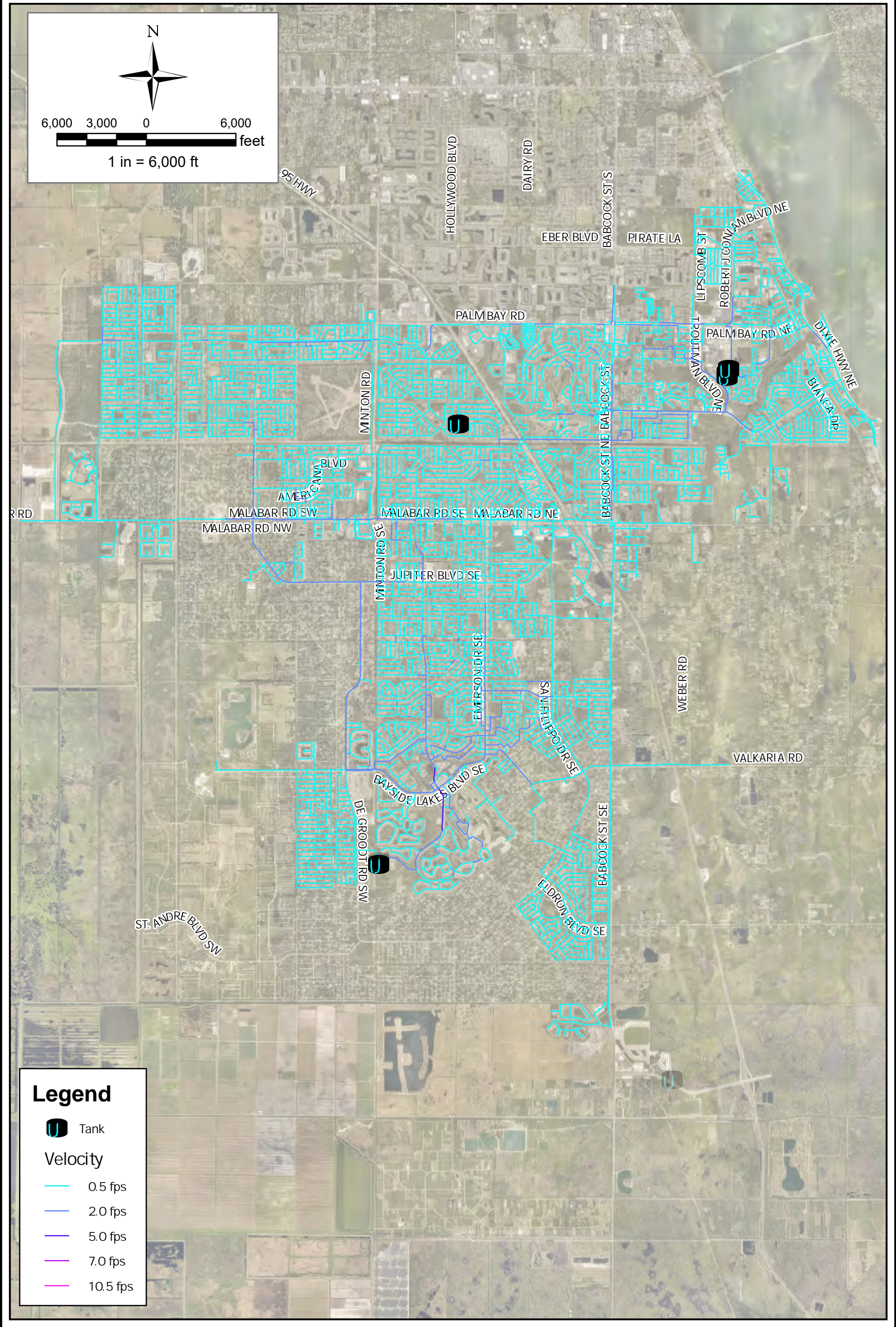


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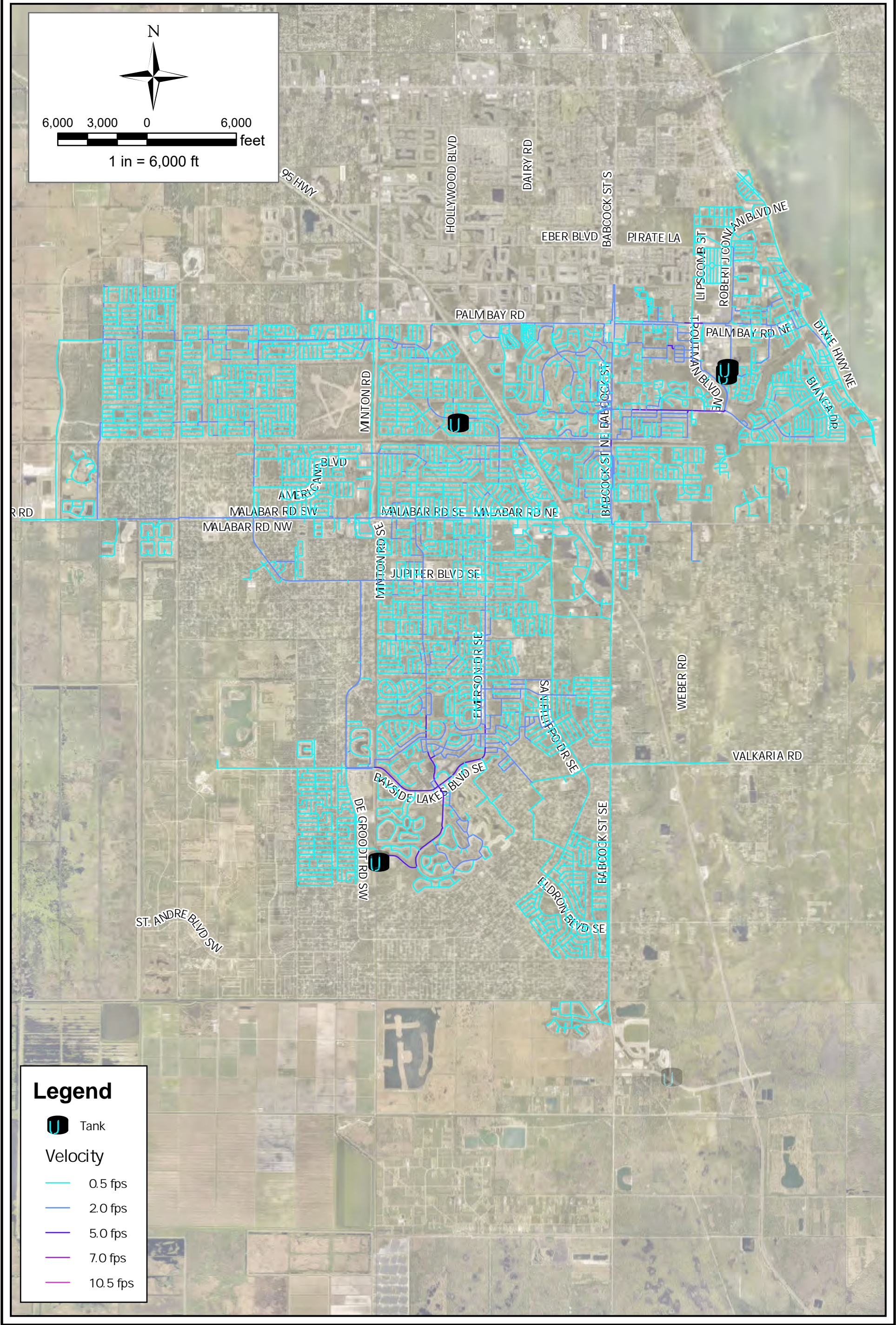
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Legend

 Tank

Velocity

-  0.5 fps
-  2.0 fps
-  5.0 fps
-  7.0 fps
-  10.5 fps



**INFRASTRUCTURE
SOLUTION SERVICES**

Melbourne | Sarasota | Panama City Beach

**Current Conditions Maximum Day Velocities
Water Master Plan Update
City of Palm Bay Utilities Department**

PROJ. NO.
PBU009

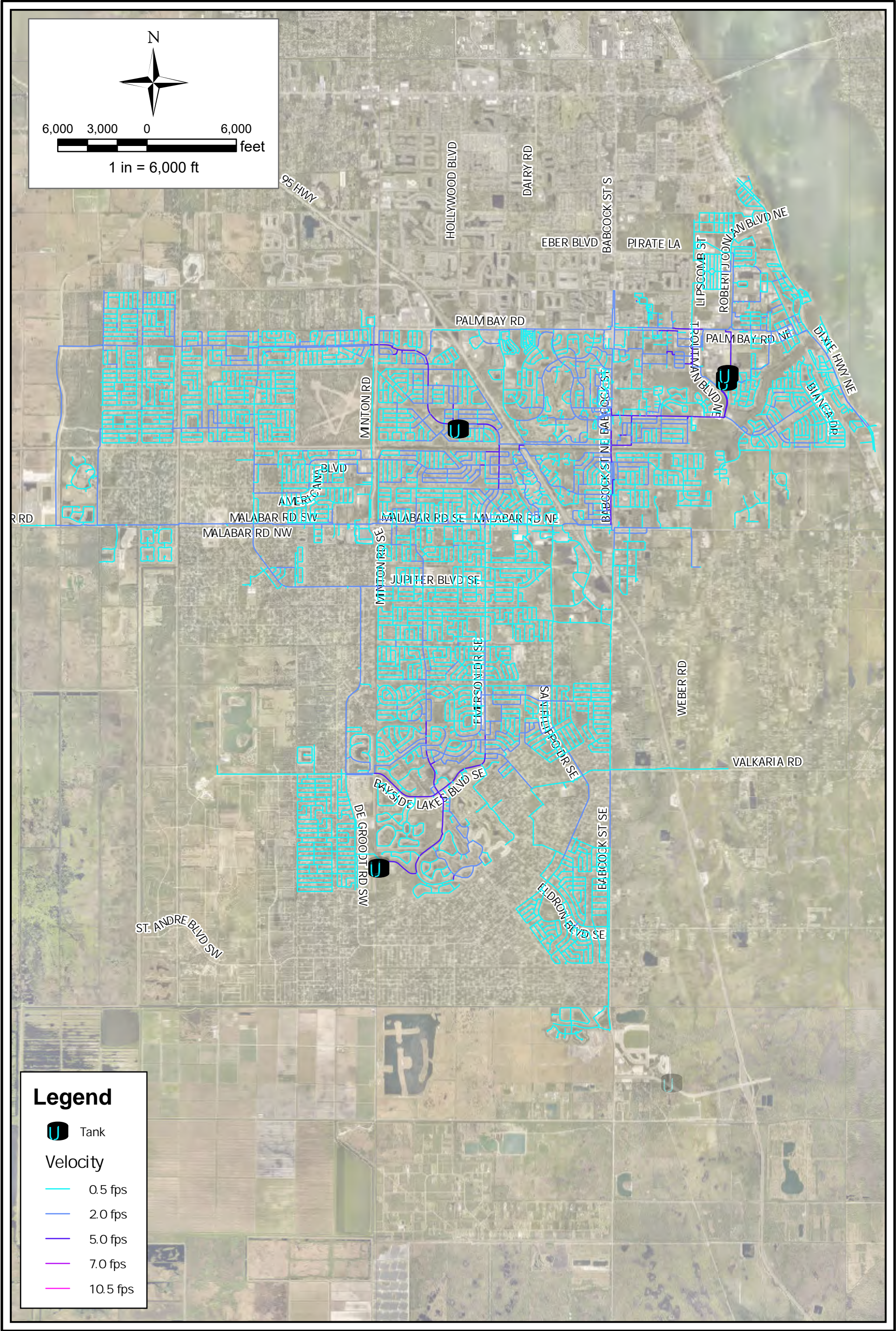
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FIGURE NO.

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Legend

 Tank

Velocity

-  0.5 fps
-  2.0 fps
-  5.0 fps
-  7.0 fps
-  10.5 fps



INFRASTRUCTURE
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Current Conditions Peak Hour Velocities
Water Master Plan Update
City of Palm Bay Utilities Department

PROJ. NO.
PBU009

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6.4.5 Evaluation of Water Treatment Capacities

Per Chapter 62-555 F.A.C., water treatment plant capacity must equal or exceed the maximum day demand. As noted in **Table 6-1**, the maximum day demand is equal to approximately 6,770 gpm which equates to approximately 11.7 MGD. The NRWTP has a rated water treatment capacity of 10.0 MGD and the SRWTP has a rated treatment capacity of 6.0 MGD after completion of the current expansion. Therefore, the City's total permitted water treatment capacity is approximately 16.0 MGD which is well above the maximum day demand of 11.7 MGD.

6.4.6 Evaluation of Groundwater Supply Well Capacities

The supply of groundwater cannot exceed the permitted water withdrawal established by the SJRWMD CUP. As of 2021, the total permitted withdrawal from raw water wells on an annual average daily flow basis from combined surficial and Floridian aquifers is approximately 14.9 MGD. The actual groundwater well withdrawals are well below the permitted volume allowable under the CUP. The following table compares the permitted groundwater withdraws as compared to the actual reported withdraws for 2021:

Table 6-2. Permitting and Actual Groundwater Withdrawal for 2021

Water Treatment Plant	Ground Water Source	Permitted Withdrawal	2021 Actual Withdrawal
North Regional Lime Softening	Surficial Aquifer	4.7 MGD AADF	3.25 MGD AADF
North Regional Reverse Osmosis	Floridian Aquifer	RO-1: 0.70 MGD AADF	Not in Use
South Regional Reverse Osmosis	Floridian Aquifer	9.54 MGD AADF	4.91 MGD AADF
	Total	14.94 MGD	8.16 MGD

6.4.7 Evaluation of Water System Storage Capacities

The water system storage capacity must be equal to or exceed 25% of the maximum daily flow with provisions for fire flow. Total storage inclusive of all City water storage tanks is 7.5 million gallons.

The maximum day demand is 11.7 MGD and therefore, 25% of the maximum day demand is 2.9 million gallons which is well exceeded.

6.5 Extended Period Simulation

The EPS with logical controls as described in **Section 6.3** was evaluated for the existing system performance through the course of one (1) 24-hour period and assessed system storage. Analysis of the EPS results includes system pressures, pump flows, cumulative pump discharge volumes, and system tank storage. Additionally, the EPS was used to assess the City's elevated tower tank and the approximate residence time of each system tank.

6.5.1 System Water Pressures

System water pressures were assessed during the EPS modeling scenario by observing the water system pressures at system junctions throughout the City's water system. System pressures range from 45.9 psi to 64.0 psi at the time of peak demand, 8:00 PM, which are consistent with City and industry standards. See **Figure 6-7** for the system pressures at the time of the extended period peak demand, 8:00 PM.

6.5.2 High-Service Pump Flows and Cumulative Discharge Volumes

Pump flows for each high-service distribution pump operational during the EPS modeling simulation have been graphically compiled for the NRWTP, SRWTP, and Nash Repump Station. See **Figures 6-8, 6-9, and 6-10** for the respective compiled pump flows and **Figure 6-11 through Figure 6-14** for cumulative pump discharge volumes.

Three (3) high-service distribution pumps operate throughout the EPS modeling scenario as shown in the figures. These high-service pumps are operated by plant personnel such that pumps are periodically alternated to minimize wear and provide maintenance. In general, three Yespumps provide for approximately 90% of the cumulative volume during the EPS scenario as shown in **Figure 6-14**. Additional high-service distribution pumping is provided by additional pumps at SRWTP, Nash Repump Station, and NRWTP during peak demand in accordance with the logical controls as noted in **Section 6.3**. In general, the City's high-service distribution pumps adequately supply and satisfy the system water demands throughout the 24-hour extended period modeling simulation.

6.5.3 System Tank Storage

System tank storage was assessed by reviewing the City's water tank elevations through the course of the one (1) day 24-hour simulation period. See the following storage tank level graphics **Figures 6-15 through 6-19**.

It should be noted that the NRWTP ground storage tanks (identified as TR-GST 1 [0.5 MG] and TR-GST 2 [1.0 MG]) are hydraulically connected within the EPS model representation and effectively act as a single 1.5 MG ground storage tank to compensate for software limitations.

The tank percentage full figures show that the system storage is sufficient to provide for the City's water demands throughout the EPS scenario with tank levels generally ranging from 55% to nearly 100% capacity for the tanks that provide storage for system pumps.

6.5.4 Elevated Tower Tank

The NRWTP elevated tank is a special case since it provides pressure damping by "floating" over the system at an elevated hydraulic grade and also provides additional storage during high-demand periods of the day. **Figure 6-17** shows that the tower tank percentage is full during the course of the EPS modeling scenario and shows that the tower tank volume is fully utilized for system demands with the percentage full ranging from approximately 90% in the morning prior to system demand to 15% after peak demand in the evening.

The EPS simulation was run with and without the tower tank to assess the pressure-damping effect of the system. See attached **Figures 6-20 and 6-21** for the nearby junction pressures with and without the tower tank which demonstrates that the tower tank does provide significant system pressure damping during the extended period simulation.

6.5.5 Ground Storage Tank Residence Times

Approximate residence times were calculated for each tank based on the EPS results. As noted in **Table 6-2** average volumes and average flows were calculated for each tank and then approximate tank residence times were calculated in minutes and hours. **Table 6-3** shows acceptable residence times for the system tanks with the exception of the Nash Repump Station tank which exceeds a 60-hour residence time. Water quality may be impacted due to excessive Nash Repump Station tank residence time. It is recommended to evaluate the water volume maintained in the ground storage tank at the Nash Repump Station for the purpose of several approaches to reduce the Nash Repump Station ground storage tank

residence times including 1) increasing the high-service pumping rates to withdraw additional water through the ground storage tank or 2) decreasing the operating volume within the ground storage tank.

Table 6-3. Ground Storage Tank Residence Times

Ground Storage Tank ID	Tank Capacity (MG)	Average Volume (gallons)	Average Flow (gpm)	Residence Time (Minutes)	Residence Time (Hours)
NRWTP GST 1 and GST 2	1.5	1,184,585	2,236	510	8.5
NRWTP Elevated Tower	0.5	307,664	317	970	16.2
SRWTP GST 1	2.0	1,875,935	2,864	665	10.9
Nash Repump Station	1.5	988,703	265	3,728	62.1

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Figure 6-8. North Regional WTP Pump Flows

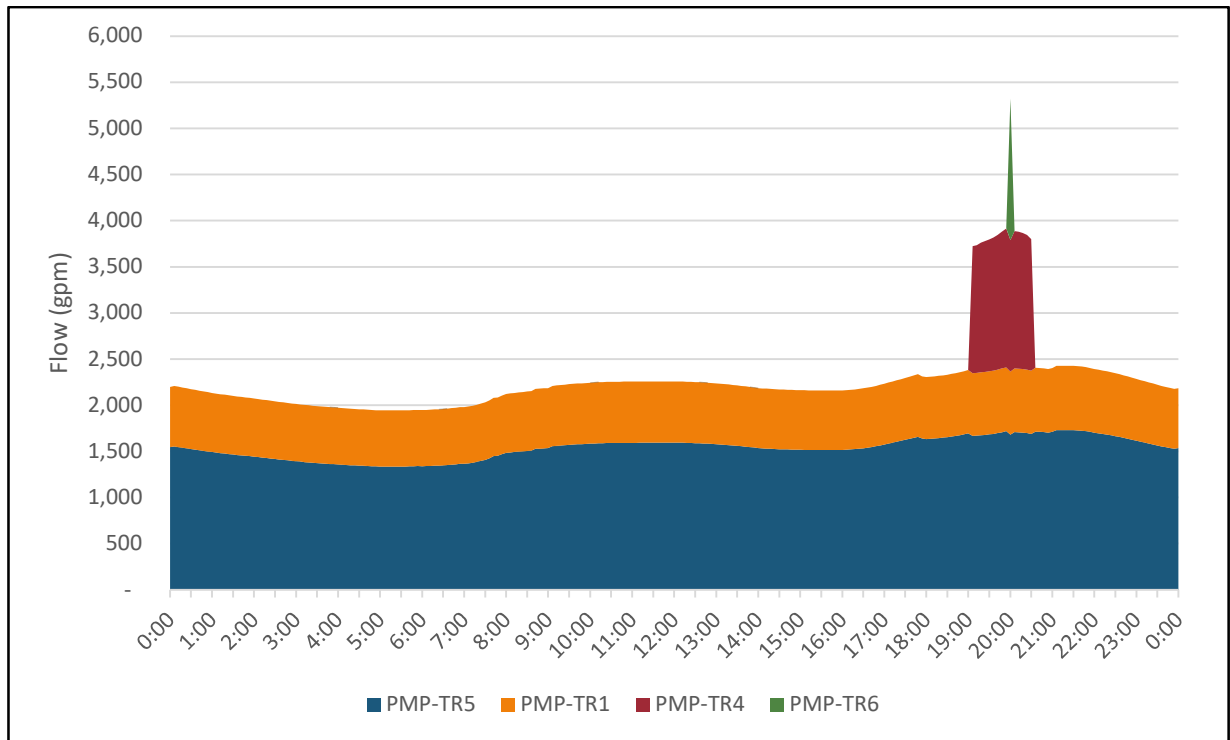


Figure 6-9. South Regional WTP Pump Flows

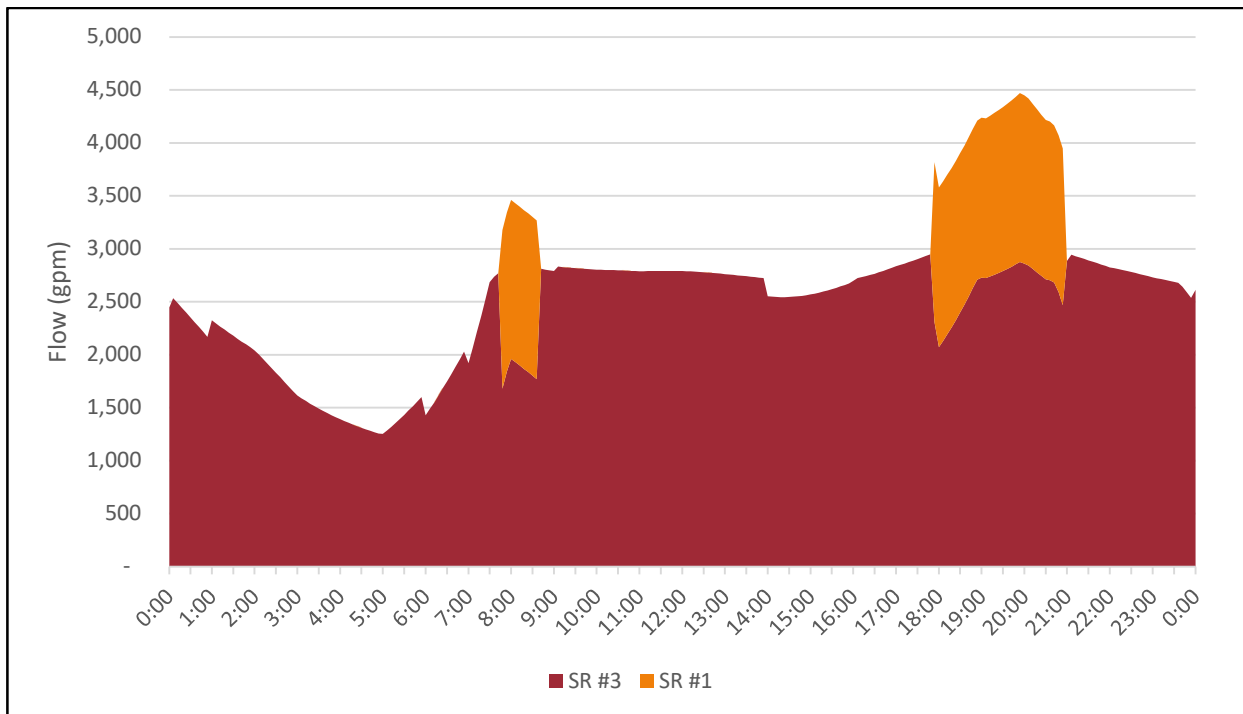


Figure 6-10. Nash Repump Station Pump Flows

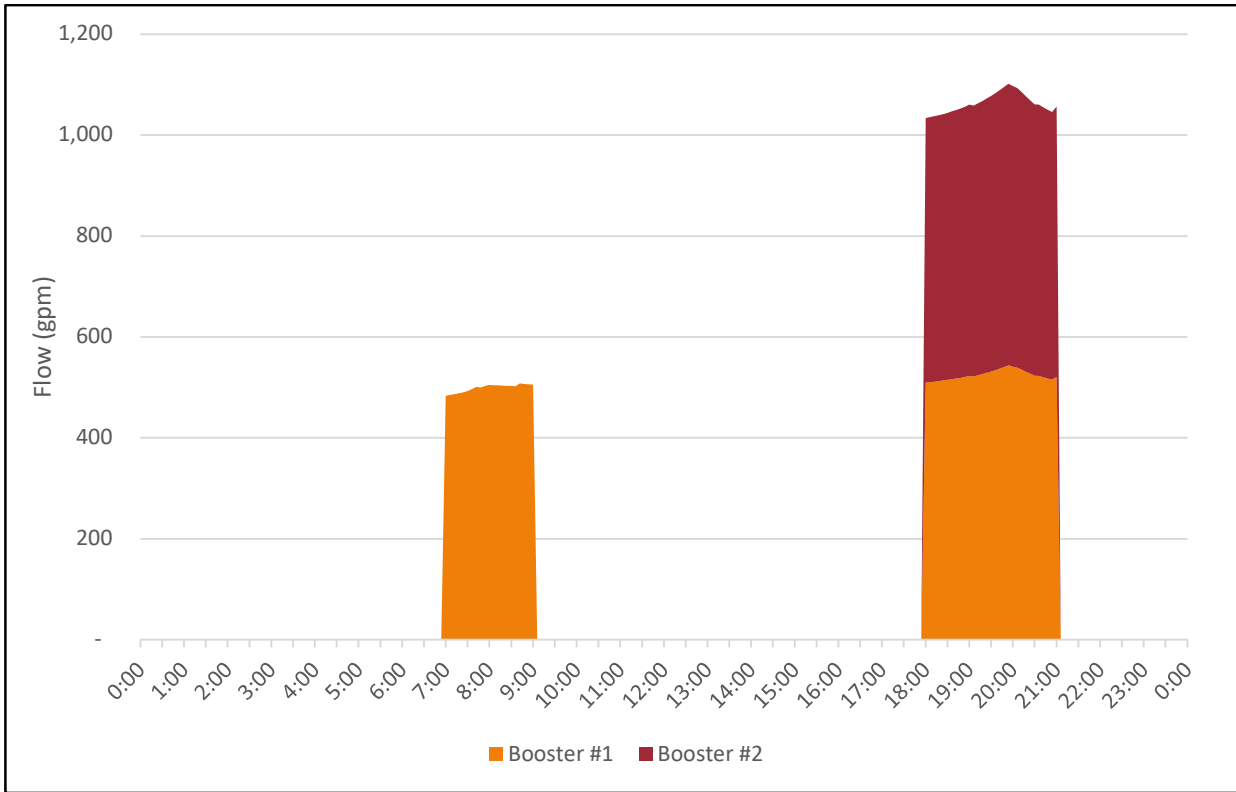


Figure 6-11. North Regional WTP Cumulative Pump Volumes

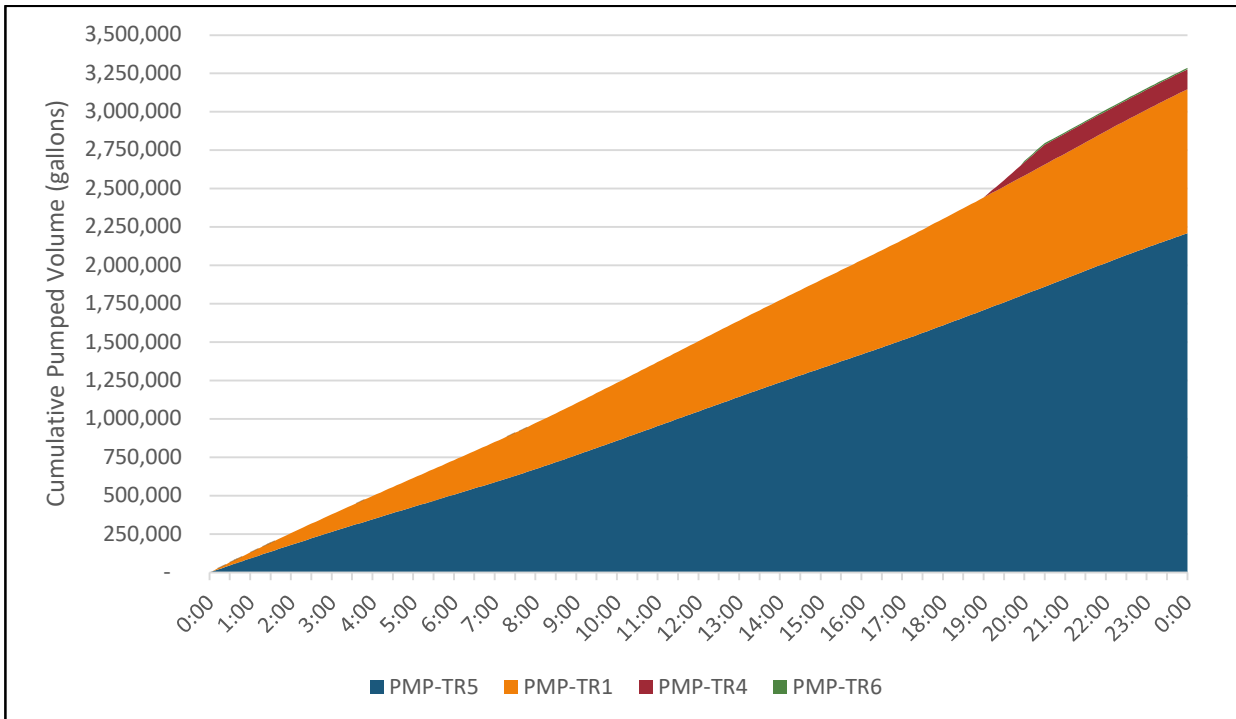


Figure 6-12. South Regional WTP Cumulative Pump Volumes

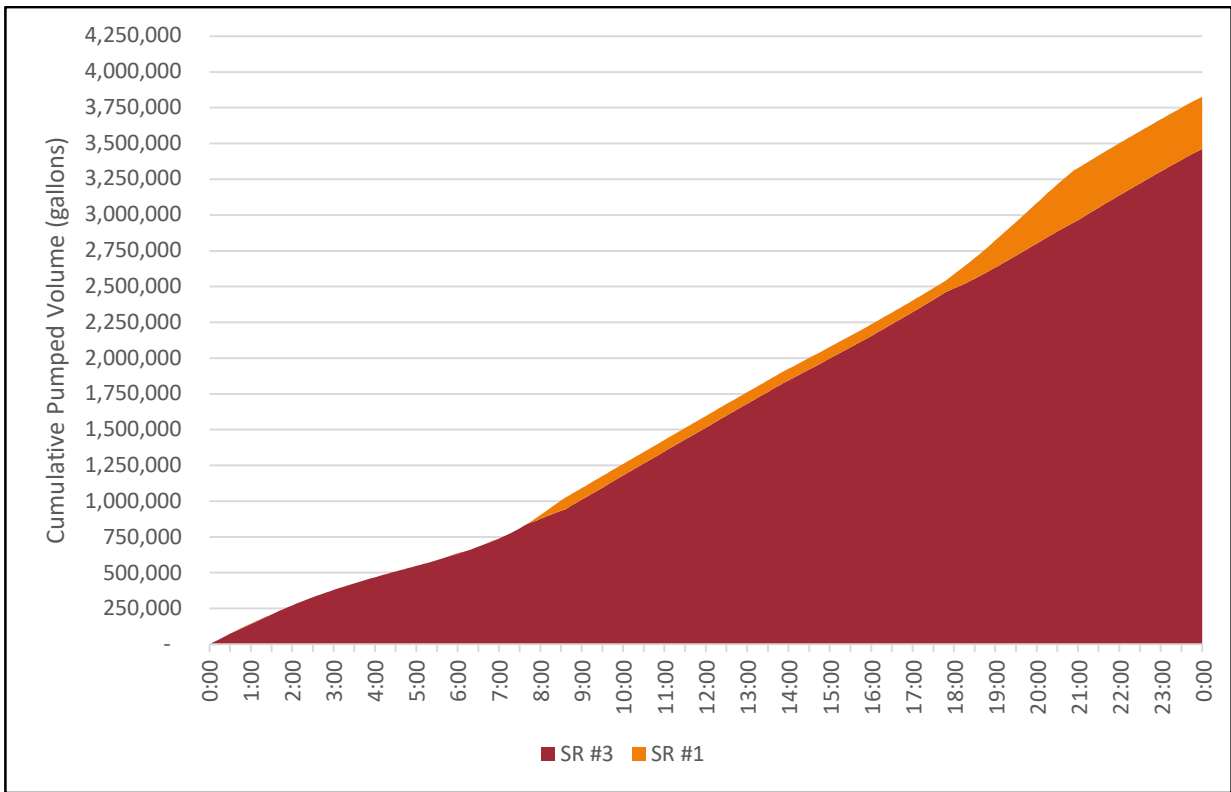


Figure 6-13. Nash Repump Station Cumulative Pump Volumes

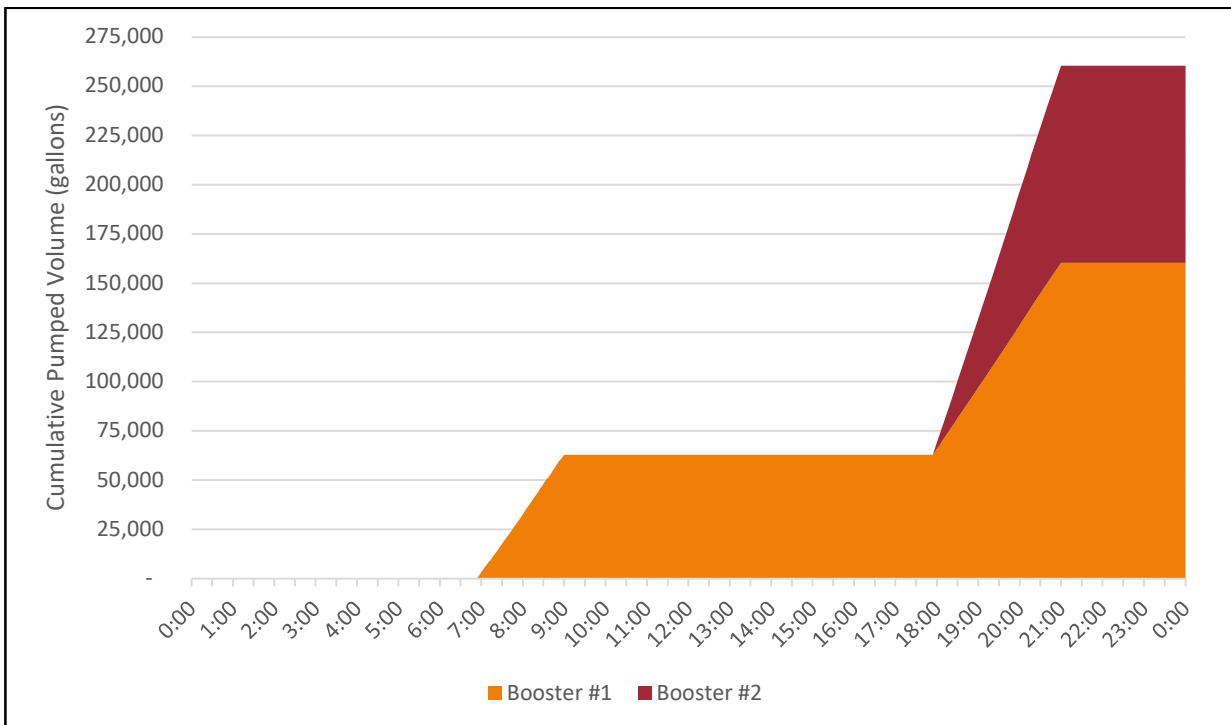


Figure 6-14. System Wide Cumulative Pump Volumes

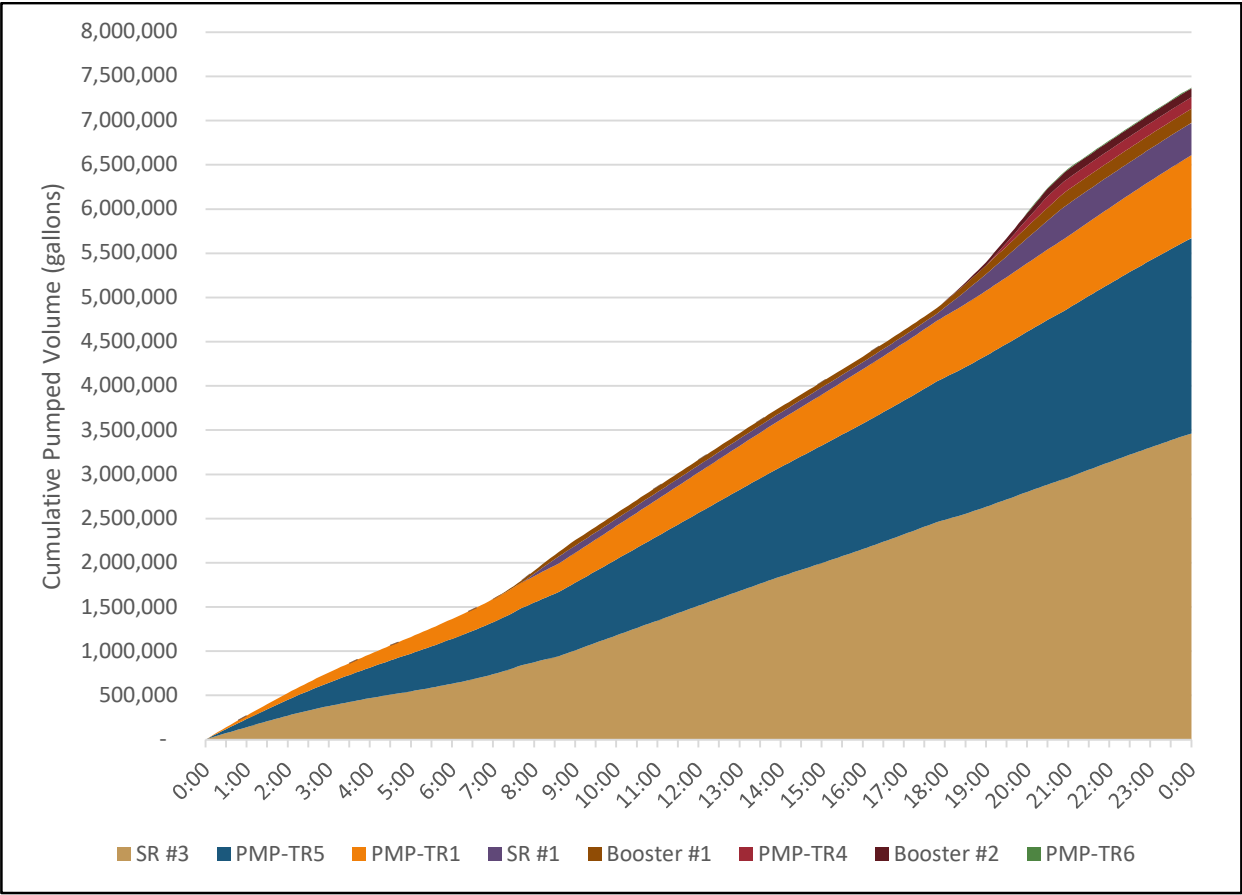


Figure 6-15. NRWTP Ground Storage Tank No. 1 Tank Percentage Full

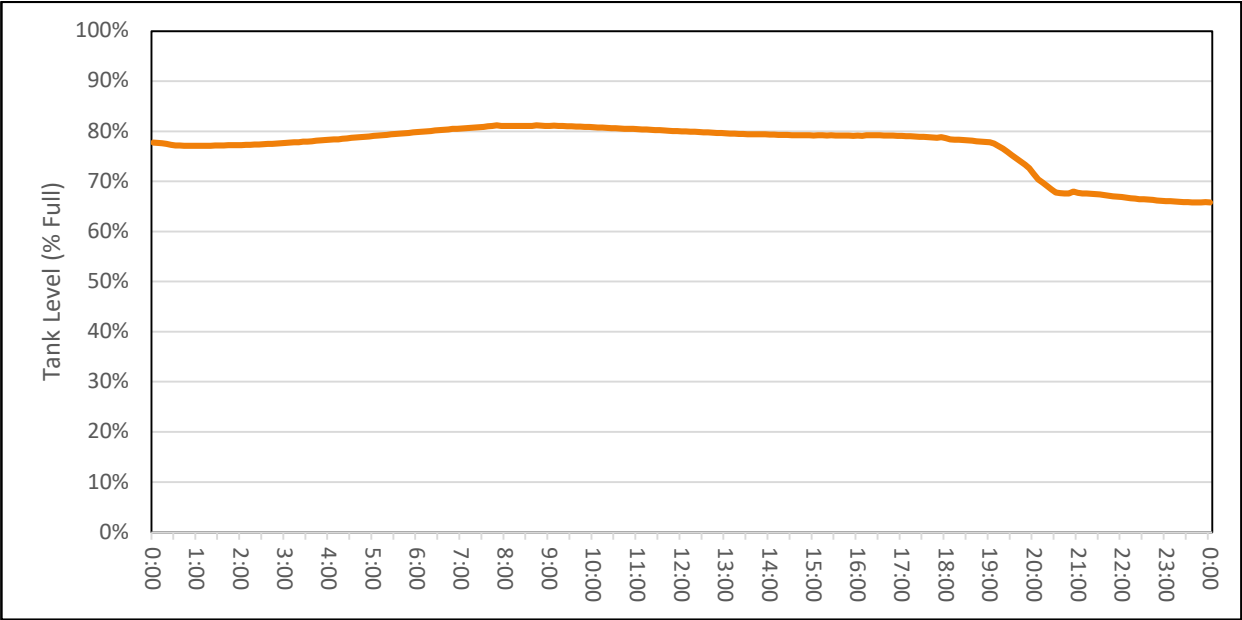


Figure 6-16. NRWTP Ground Storage Tank No. 2 Tank Percentage Full

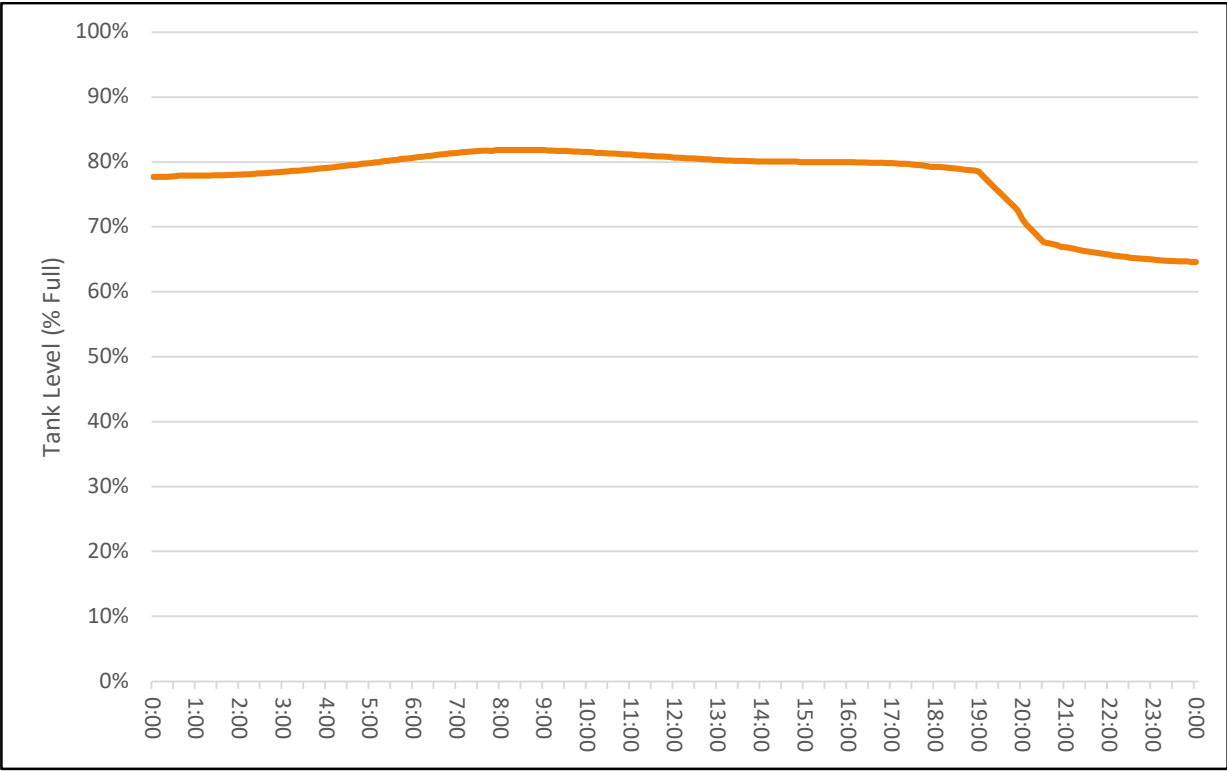


Figure 6-17. NRWTP Elevated Tower Tank Percentage Full

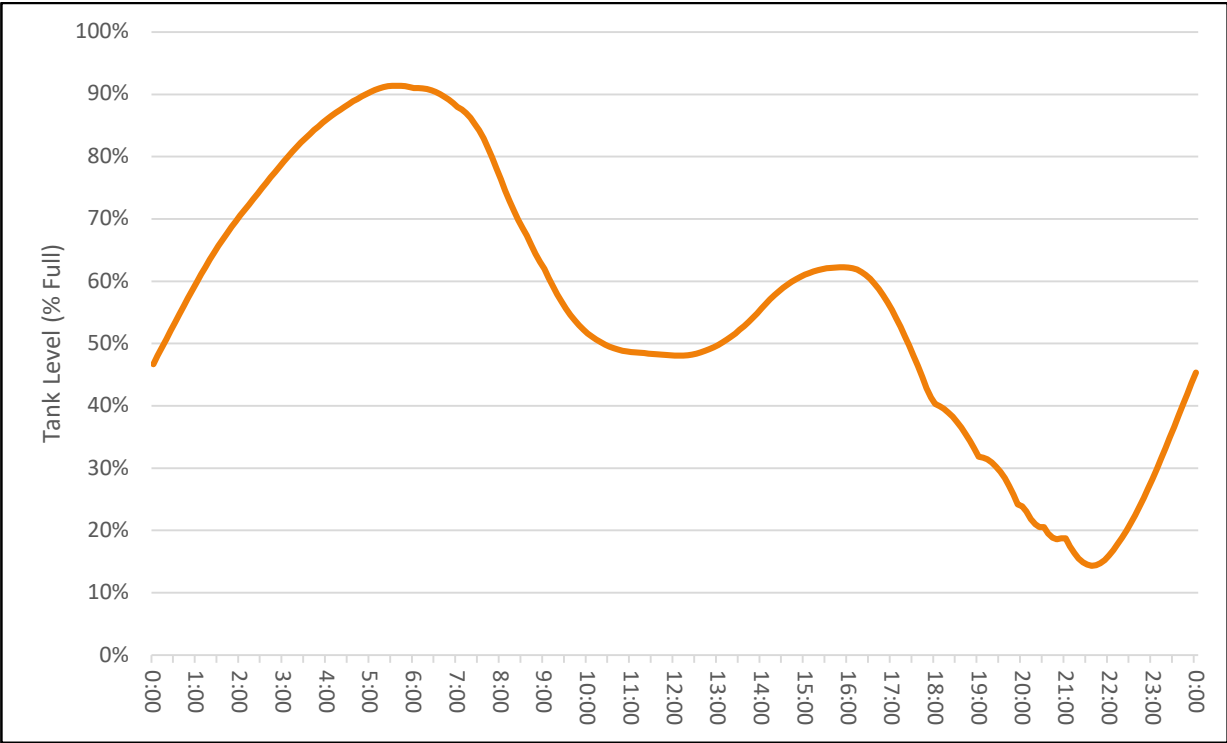


Figure 6-18. SRWTP Ground Storage Tank No. 1 Tank Percentage Full

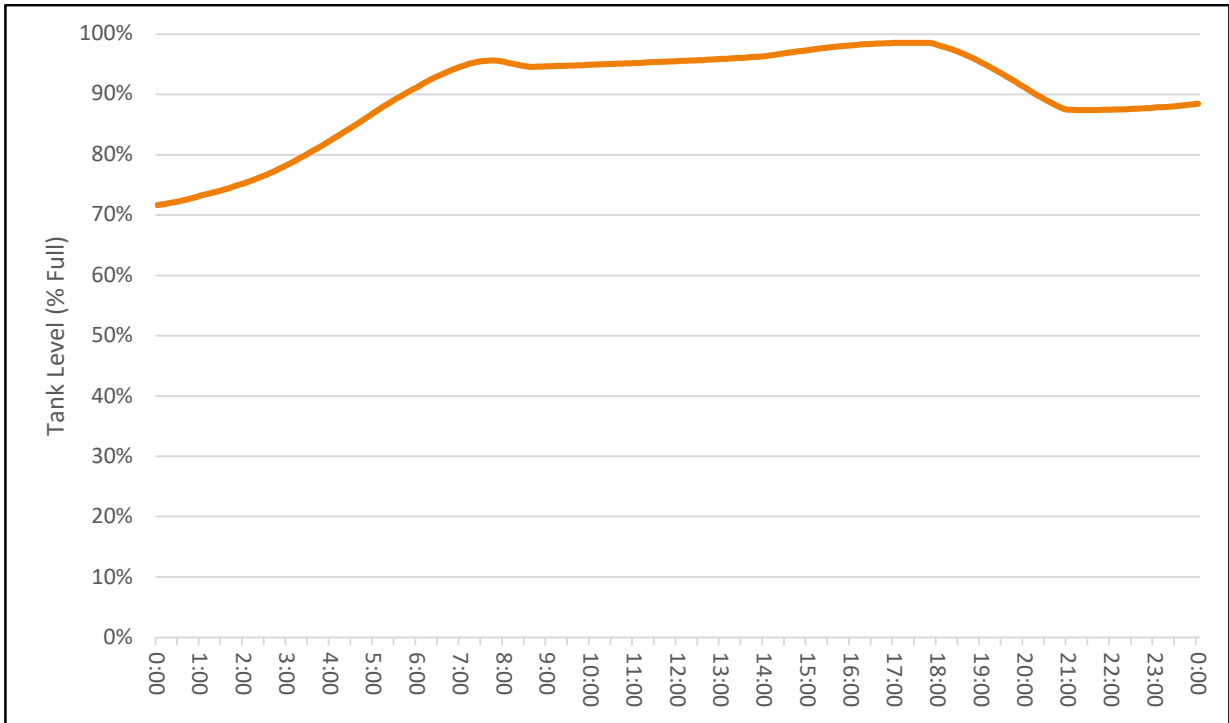


Figure 6-19. Repump Station Tank Percentage Full

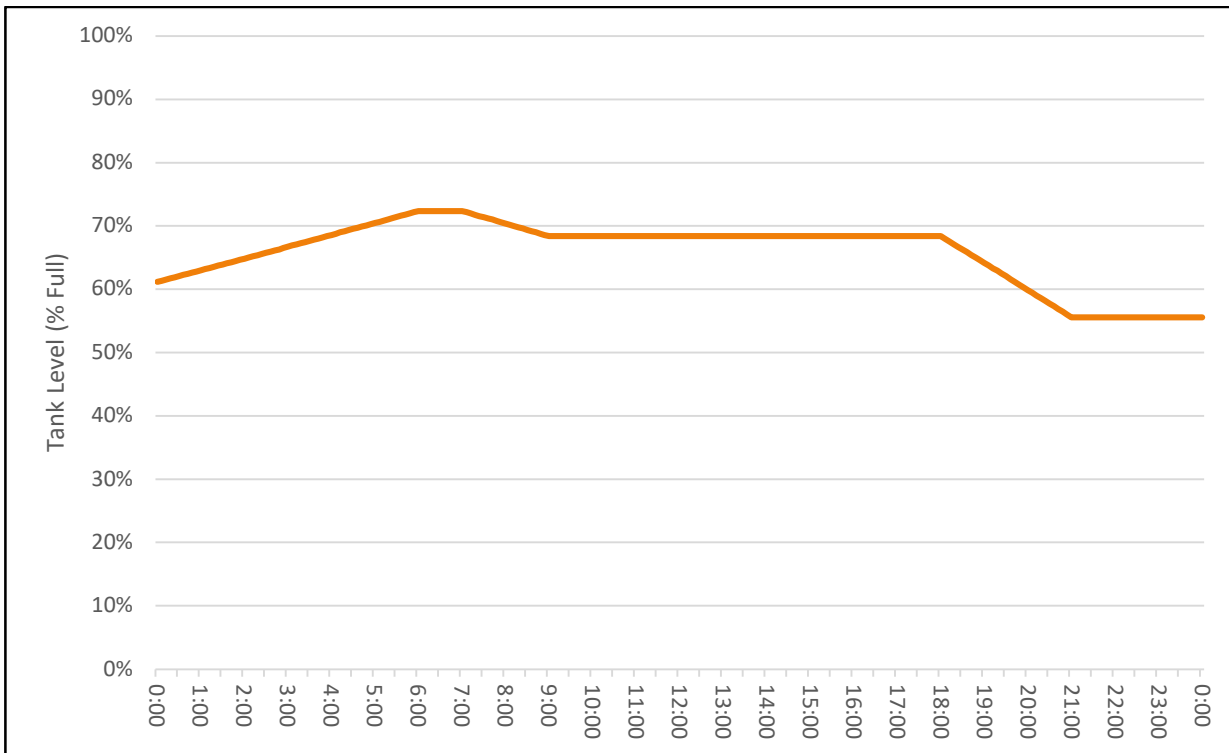


Figure 6-20. Junction J-20783 Pressure with Tower Tank

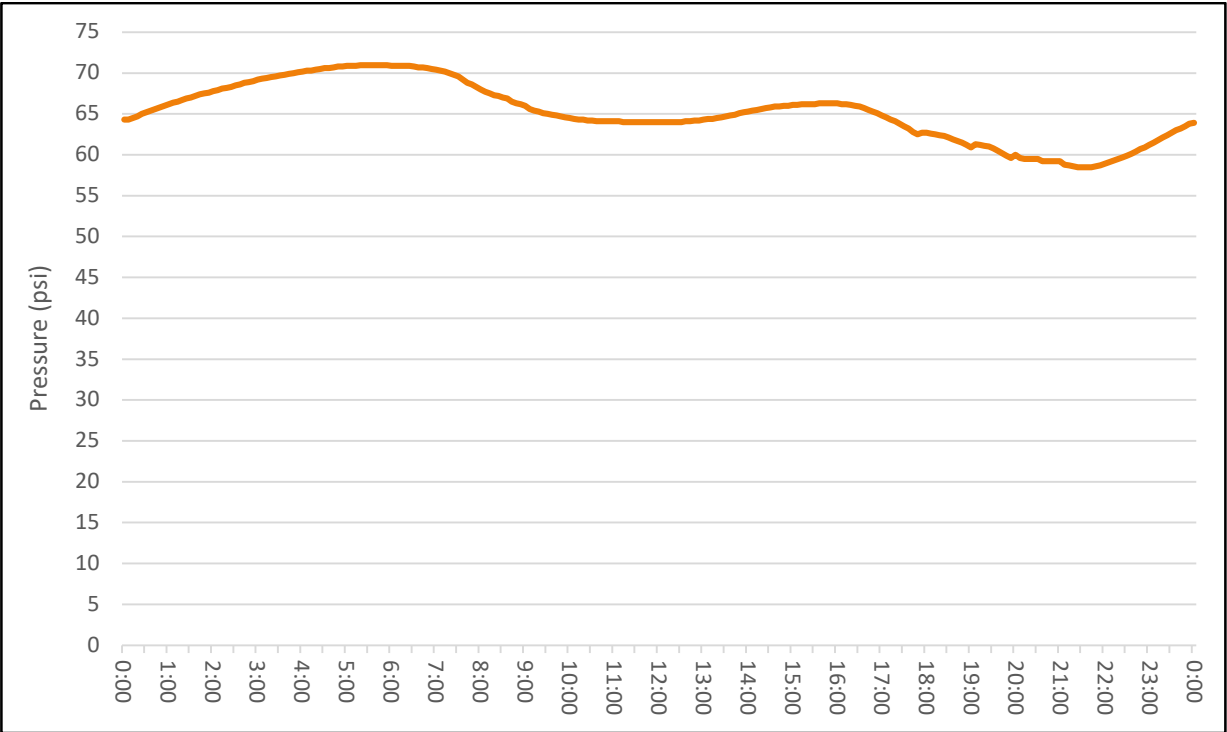
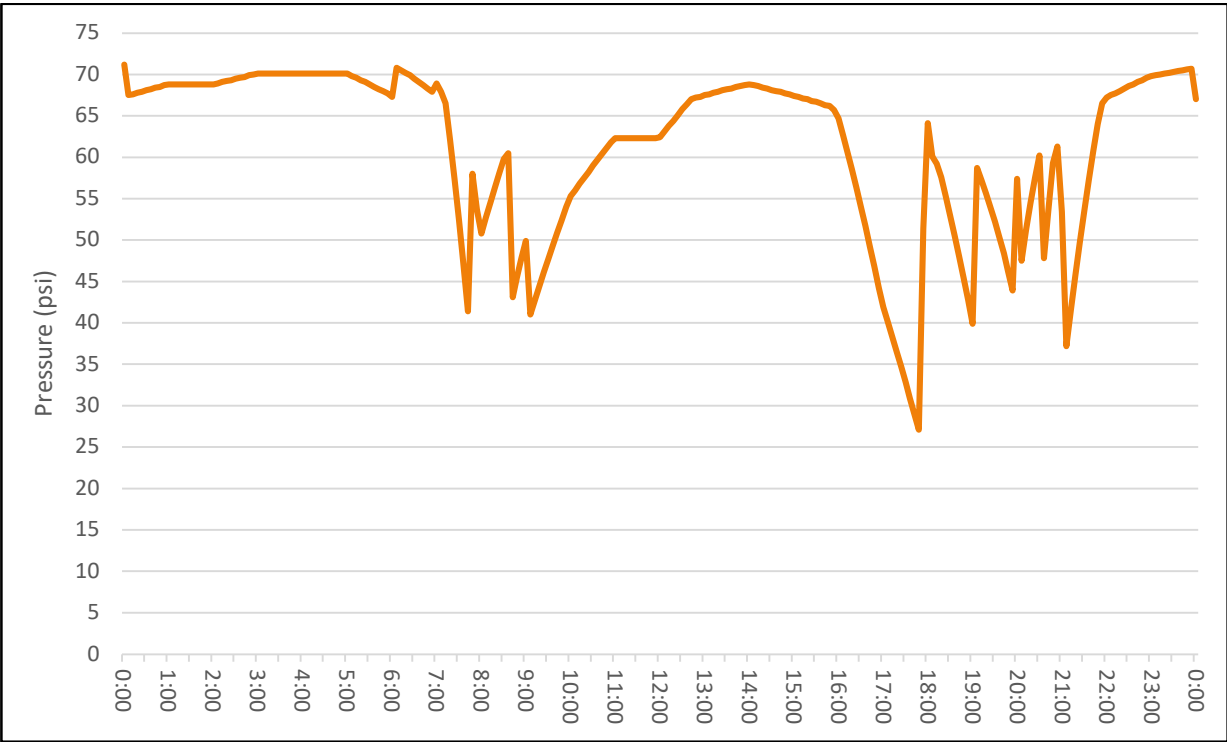


Figure 6-21. Junction J-20783 Pressure without Tower Tank



6.6 Observations and Recommendations

The existing conditions of the City of Palm Bay's water distribution system were modeled and assessed using the City's existing GIS water system data and the water hydraulic modeling framework in WaterGEMS. Existing system analysis included average day, maximum day (for fire flow analysis), and peak hour modeling design conditions. Additionally, a 24-hour extended period simulation was performed. Based on these water model simulations and results, the following observations and recommendations are provided for the City's consideration.

6.6.1 Observations

The following observations are based on the City of Palm Bay's existing water system modeling results as described in this Section.

- Modeled water distribution system pressures are acceptable in the average day and peak hour water model design simulations.
- Modeled water main pipe velocities were observed to be acceptable in the average day and peak hour water model design simulations.
- Modeled fire flow results based on the maximum day model scenario show that approximately 7% of system junctions did not meet the minimum fire flow pressure and/or flow requirements of 20 psi and 1,000 gpm. However, hydrant coverage throughout the city is generally sufficient to cover junctions that did not meet the fire flow requirements. Insufficient pressures and flows were generally observed in the northeast quadrant of the city in areas with small-diameter ACP piping.
- High-service distribution pumping capacity was modeled to be sufficient to provide for system demands in all model scenarios.
- WTP capacity exceeds maximum day demand.
- The groundwater supply does not exceed the permitted water withdrawal established by the CUP.
- Water storage capacity exceeds 25% of the maximum daily flow with provisions for fire flow.
- EPS modeled water system pressure results ranging from 45.9 to 64.0 psi are acceptable.
- EPS modeled high-service distribution pump flows and cumulative discharge volume results show that the system pumps provide for system demand through the course of the 24-hour EPS scenario.

- EPS modeled tank storage results show that the system tanks provide for system demand through the course of the 24-hour EPS scenario.
- The elevated tower tank EPS results show that the tower tank provides useful benefits including system pressure damping as well as additional storage for water demand.
- Tank residence times calculated from EPS results are generally acceptable except for the Nash Repump Station ground storage tank with a residence time of over sixty (60) hours.

6.6.2 Recommendations

The following recommendations are based on the City of Palm Bay's existing water system modeling results and observations.

- Small diameter (less than 6-inches) and AC water main piping exist in the northeast quadrant of the city. Fire flow modeling showed the small diameter AC water main piping coincided with insufficient fire flow results. It is recommended that small diameter (defined as < 6-in diameter) and all existing AC watermain piping replacement be incorporated into the City's future Capital Improvement Plans (CIPs). It is also recommended that a minimum 8-inch PVC pipe is used for replacement of existing water main piping.
- Based on the EPS existing system modeling, the NRWTP elevated tower tank benefits the City's water system operations by pressure damping and providing additional storage during peak demand. It is recommended that the elevated tower tank continue to be maintained and operated as part of the City's water system.
- Based on the EPS existing system modeling, the residence time of the Nash Repump Station ground storage tank exceeds sixty (60) hours. Further analysis of the Nash Repump Station ground storage tank is recommended to determine if tank residency time can be reduced through extended pumping periods throughout the day and/or modifying how the station is operated.

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Section 7 -Evaluation of Future Five-Year Water Transmission/Distribution System

7.1 Introduction

Section 7 of the City of Palm Bay Water Master Plan describes the uses of the hydraulic water transmission/distribution system model to evaluate the future condition infrastructure needs of the system at the five-year planning horizon as described below:

- a) The water distribution system will be evaluated to identify areas that may experience low pressure, inadequate available fire flow, excess pipe velocities, etc.
- b) Storage facilities shall be evaluated to determine if adequate water storage is maintained to meet the future average day demand and the fire flow requirements.
- c) The water distribution system components necessary to serve future development will be identified and appropriately sized.
- d) For each planning horizon, the water main, high-service pumping, and system storage upgrades necessary to meet projected water flows shall be sized and identified.

7.2 Five-Year Water Demands

Future water demands have been incorporated into the model for the five-year planning horizon. Future five-year demands have been provided by the City based on anticipated developments. Additionally, the City provided “in-fill” demand within areas of existing development. **Table 7-1** provides five-year demands of anticipated developments.

Table 7-1. Five-Year Future Water Demands

Map ID	Development Name	Development Type	Five-Year Water Demands	
			Equivalent Residential Connections	Demand (gpd)
A	Palm Vista (Lennar)	Residential, Mixed	400	90,000
B	Palm Vista Everlands	Residential, Mixed	162	36,450
C	SJRWMD Property	Single Family Residential	55.2	12,420
		Multi-Family Residential	-	-
D	St Johns Preserve	Residential, Mixed	248	55,800

Map ID	Development Name	Development Type	Five-Year Water Demands	
			Equivalent Residential Connections	Demand (gpd)
E	Fred Poppe Park RV Campground	Commercial/RV	45	10,125
F	Lennar South	Residential, Mixed	-	-
G	West 80 Acres, LLC	Single Family Residential	-	-
H	Malabar Estates	Single Family Residential	-	-
I	Chapparal	Single Family Residential	361.2	81,270
		Multi-Family Residential	-	-
J	Brentwood Phase 3	Single Family Residential	97	21,825
K	Sanibel Cove	Single Family Residential	50	11,250
L	Avery Springs	Single Family Residential	140	31,500
M	Minton Road Airforce Facility	Mixed use	-	-
N	Health First Wellness Village	Mixed Use	100	22,500
O	Minton Road Commercial	Commercial	77	17,325
P	City Hall Expansion	Municipal	15	3,375
Q	AD1 Global	Mixed Use Commercial	82	18,450
R	Sabal Key	Single Family Residential	40	9,000
S-1	Country Club Lakes Estates I-IV	Single Family Residential	199	44,775
S-2	Reserve at County Club Lakes Estates	Single Family Residential	154	34,650
		Multi-Family Residential	46	10,350
T	Westshore Apartments	Multi-Family Residential	212	47,700
U	Northshore (Aqua Apartments)	Residential	325	73,125
		Commercial	56	12,600
V	Clearmont Trace	Multi-Family Residential	28	6,300
W	Pelican Harbor Marina	Commercial	75	16,875
X	Eztopeliz	Mixed use / Multi-Family Residential	-	-
Y	Tropical Arms Apartments	Residential	84	18,900
Z	Twin Lakes (Malabar)	Residential	16	3,600
AA	Malabar, Town of	Residential, mixed	130	29,250
BB	Joe Daddy Golf Course Property	Multi-Family Residential	176	39,600
		Commercial	60	13,500
CC	Crown Square	Multi-Family Residential	216	48,600
		Potential Building Space	40	9,000
DD	San Filippo Apartments	Residential	172	38,700
EE	Gulfport Key	Single Family Residential	77	17,325
FF	Bayridge	Single Family Residential	143	32,175
GG	Richmond Estates	Single Family Residential	149	33,525

Map ID	Development Name	Development Type	Five-Year Water Demands	
			Equivalent Residential Connections	Demand (gpd)
HH	Wingham	Residential, mixed	-	-
II	Hampton Manor	Assisted Living Facility	7	1,575
		Multi-Family Residential	65	14,625
JJ	Eagle Crest	Single Family Residential	54	12,150
KK	Preserves at Stonebriar	Single Family Residential	329	74,025
LL	Rolling Meadows Lakes	Single Family Residential	467.8	105,255
MM-1	Waterstone Phase II	Single Family Residential	1061	238,725
		Mixed Use	-	-
MM-2	Waterstone (Cypress Bay West)	Residential, mixed	1352	304,200
NN	Cypress Bay	Single Family Residential	593	133,425
		Mixed Use Commercial	-	-
OO	Emerald Lakes - West of I-95	Residential, Mixed	1132.5	254,813
PP	Emerald Lakes - East of I-95	Residential, Mixed	435.8	98,055
QQ	Pete Holdings (Jeff Lee)	Residential, Mixed	-	-
RR	Micco Village	Mixed use	-	-
SS	Calumet Farms	Residential, Mixed	-	-
TT	Willowbrook	Residential, Mixed	-	-
FIVE-YEAR PROPOSED DEVELOPMENT TOTALS			9,728	2,188,688

Note: Development areas without values shown above have planned development in the ten- and twenty-year planning horizons.

7.3 Model Development

Refer to **Section 5** of this Water Master Plan report details of the water hydraulic model development and calibration.

7.3.1 Steady State Model Runs

Simulations for the City's water distribution system include steady-state analysis under three (3) design conditions: average day, maximum day (for fire flow analysis), and peak hour. Since the steady-state simulations do not account for system water storage, the number of high-service distribution pumps operated in each modeling condition was based on the water demands for the respective scenario. The number of high-service distribution pumps operated in the model for each design condition was adjusted

as needed to maintain normal operating pressures between 40 and 70 psi and an available fire flow of 1,000 gpm for residential use and 2,500 gpm for commercial use.

7.3.2 *Extended Period Simulation Runs*

The following is a description of the logical controls established for the future five-year conditions EPS that are used in the modeling scenarios, modified as necessary as demands increase and new components are added to the system.

- 1) During morning peak flow conditions (7-9 am), the Nash Repump Station HSP No. 1 operated. During the afternoon peak flow conditions (6-9 pm), Nash Repump Station HSP Nos. 1 and 2 operated.
- 2) During low conditions (12 – 6 am), the Nash Repump and South Booster Station ground storage tanks were filled by modeling the operation of a throttle control valve used to restrict flow into the tank. The control valve setting was established based on the fill the tank within the given time interval.
- 3) By default, the initial pumps in operation at the EPS start time (midnight) include NRWTP HSP No. 1, NRWTP HSP No. 5, SRWTP HSP No. 2, SRWTP HSP No. 3, and SRWTP HSP No. 5. These pumps were operated throughout the simulation.
- 4) The operation of additional high-service pumps at NRWTP and/or SRWTP were modeled based on the system demand. Base water demands under average conditions for the future model are approximately 5,000 gpm. When the demand increases to 7,000 gpm, SRWTP HSP No. 1 operates. When demand increases to more than 9,000 gpm, NRWTP HSP No. 4 operates, and finally when demand reaches more than 11,000 gpm, NRWTP HSP No. 6 operates. When the system demands fall below each of these trigger points, the pump will then turn off.

7.4 *Evaluation of Future Water System*

7.4.1 *Evaluation of Water System Pressures*

Table 7-2 shows that water system pressures were maintained between 40 and 70 psi for the average day, maximum day, and peak hour modeling scenarios. See **Figures 7-1, 7-2, and 7-3** for system-wide pressure for the previously mentioned scenarios.

Table 7-2. Five-Year Steady-State Model Scenarios

Steady-State Scenario	Total Demand (gpm)	High-Service Pump Number Running			System Pressures		
		North Regional WTP	Nash Booster	South Regional WTP	Min (psi)	Max (psi)	Avg (psi)
Average Day	6,616	3,5	4	1,3	52.4	68.9	58.1
Maximum Day	8,629	3,5	4	1,3	43.1	66.4	49.9
Peak Hour	14,448	3,5	1,4	1,3,5,6	41.4	64.4	48.0

Note: In each of the steady-state scenarios shown above in Table 6-2, additional pumping capacity is available.

7.4.2 Evaluation of Water System Velocities

Water main pipe velocities were reviewed as part of the steady-state scenario analysis. The vast majority of velocities were below the 5 fps threshold; however, several instances of higher pipe velocities were observed in piping directly downstream of pumps which is expected. Overall, the water main pipe velocities for the model scenarios are acceptable.

7.4.3 Evaluation of Fire Flows

Fire flow analysis was performed on the entire system with the maximum day model scenario. Most system junctions can provide the required fire flow while under the maximum day scenario; however, 9% of system junctions, approximately 500 of 5,800 system junctions, did not provide the minimum flows and/or pressures required by the fire flow criteria. Overall, the failing fire flow nodes coincided with the smaller diameter piping, less than 6-inches in diameter in the northeast quadrant of the City's water system. Further analysis included review of fire hydrant coverage throughout the City. 500-ft buffers were generated in GIS at each City hydrant location. The hydrant buffer coverage showed that the City has sufficient hydrant coverage and that junctions that failed fire flow criteria were generally covered by nearby hydrants. Overall, the City's fire flow capacity is adequate when fire hydrant coverage is considered as part of the analysis.

7.4.4 Evaluation of High-Service Distribution Pumping Capacities

High-service distribution pumping capacities were observed to be generally sufficient to provide water flows and system water pressure under all model scenarios with the highest capacity pumps at each station not used.

As noted in **Section 7.3.3**, fire flow was not adequate for 9% of junctions; however, this issue is generally a result of smaller pipe sizing concentrated in the northeast portion of the City's water system and not related to pump capacities.

7.4.5 Evaluation of Water Treatment Capacities

Per Chapter 62-555 F.A.C., WTP capacity must equal or exceed maximum day demand. As noted in **Table 7-1**, the maximum day demand is equal to approximately 8,629 gpm which equates to approximately 12 MGD. The City's total rated water treatment capacity is approximately 16.0 MGD which is well above the maximum day demand of 12 MGD.

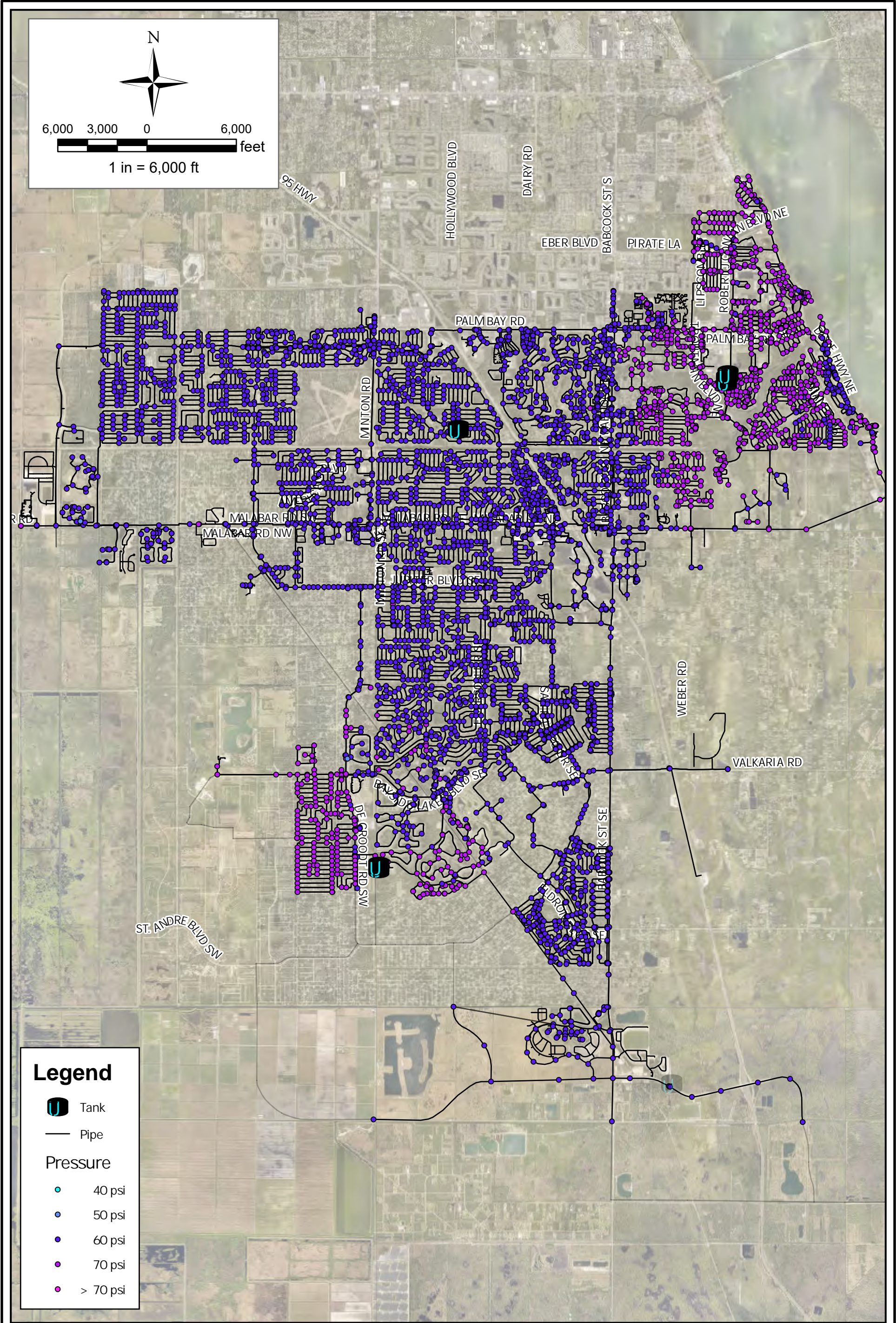
7.4.6 Evaluation of Storage Capacities

Storage capacity must be equal to or exceed 25% of the maximum daily flow with provisions for fire flow.. The total water storage capacity in the five-year planning horizon inclusive of all City water storage tanks is 7.5 million gallons. The maximum day demand is 12 MGD and therefore, 25% of the maximum day demand is three (3) million gallons which is well exceeded by the 7.5-million-gallon storage capacity.

7.4.7 Extended Period Simulation

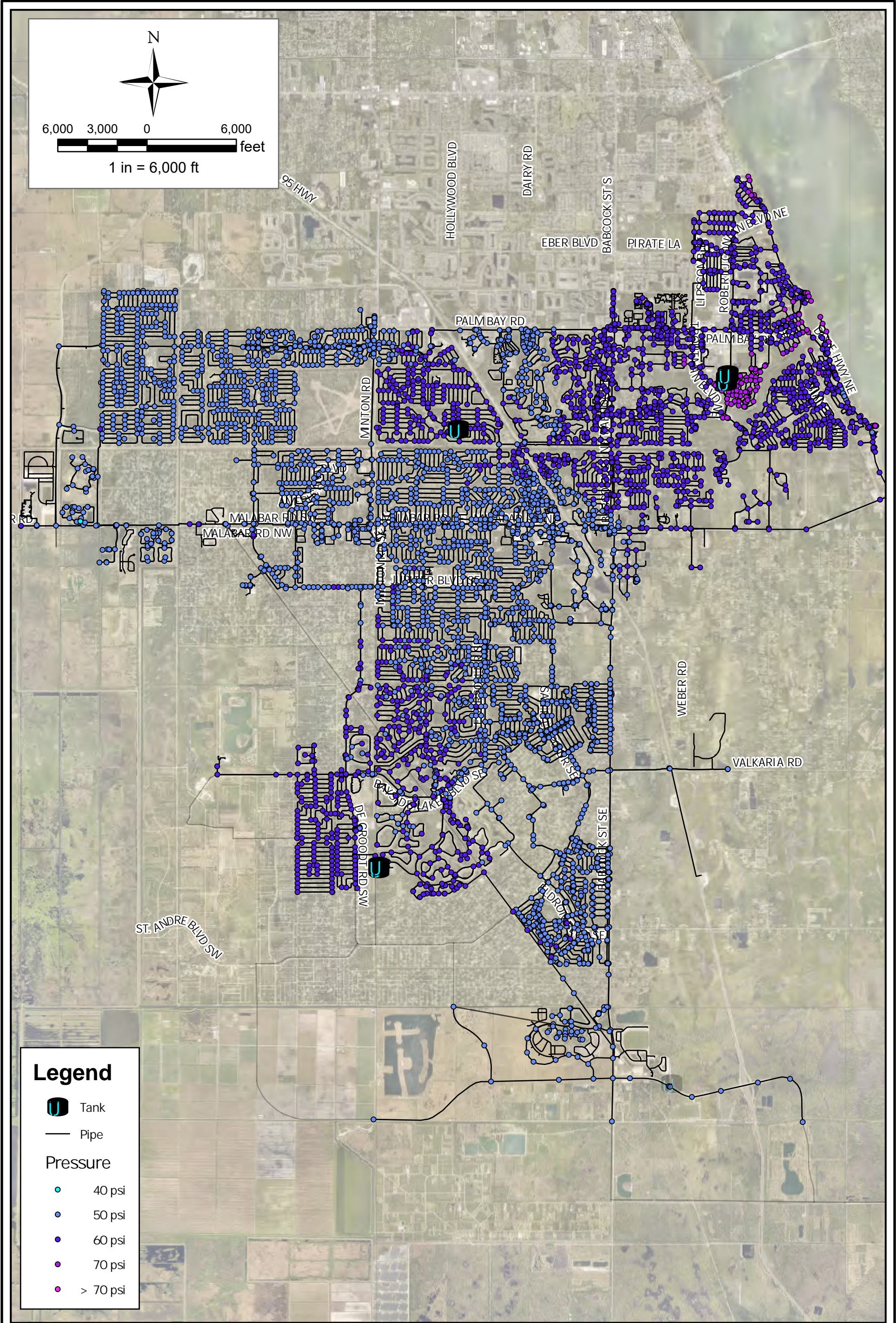
The extended period simulation with logical controls as described in **Section 7.2** was evaluated for system performance through the course of one (1) 24-hour period. Analysis of the EPS results include water system pressures, pump flows, cumulative pump discharge volumes, and system tank storage. Review of the extended period simulation results indicates that the City's water distribution system operates as expected over the 24-hour simulation period.

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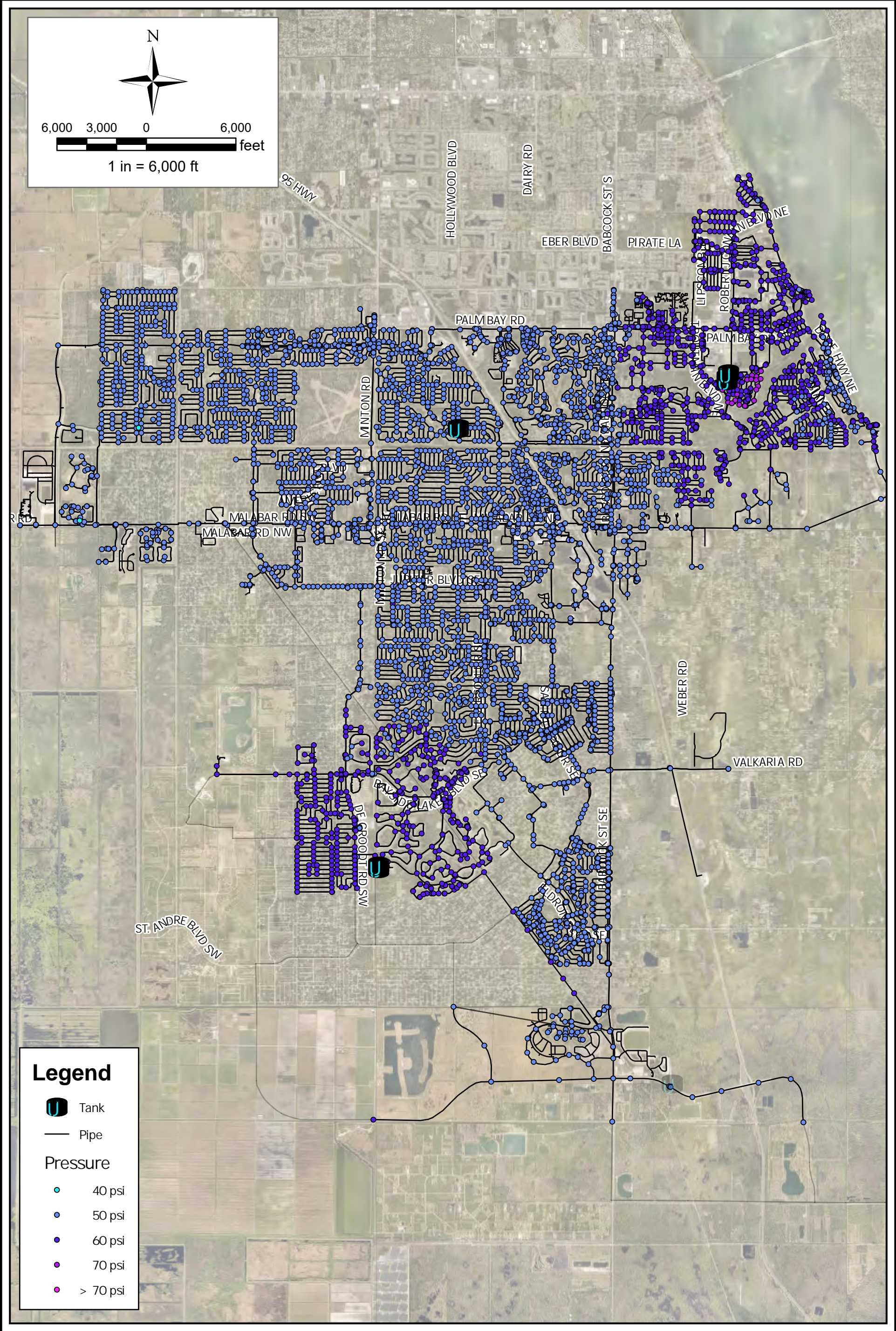


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Legend

-  Tank
-  Pipe

Pressure

-  40 psi
-  50 psi
-  60 psi
-  70 psi
-  > 70 psi



**INFRASTRUCTURE
SOLUTION SERVICES**

Melbourne | Sarasota | Panama City Beach

**5-Year Peak Hour Pressures
Water Master Plan Update
City of Palm Bay Utilities Department**

PROJ. NO.
PBU009
DATE:
JUNE 2024

FIGURE NO.
7-3

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7.5 Capital Improvement Needs

Capital improvement needs have been considered for the five-year planning horizon and are included in the five-year hydraulic model scenario. **Table 7-3** provides the anticipated water transmission/distribution system capital improvement needs for the five-year planning horizon. See **Figure 7-4** for locations of proposed water transmission/distribution system capital improvement needs according to CIP number shown in **Table 7-** Refer to **Appendix A** for details of each capital improvement need.

Note that a South Booster Station was considered a Five-year improvement; however, based on modeling analysis, the South Booster Station will not be needed unless commercial developments along the St. Johns Parkway corridor are proposed with the five-year planning horizon since commercial developments require 2,500 gpm for fire flow.

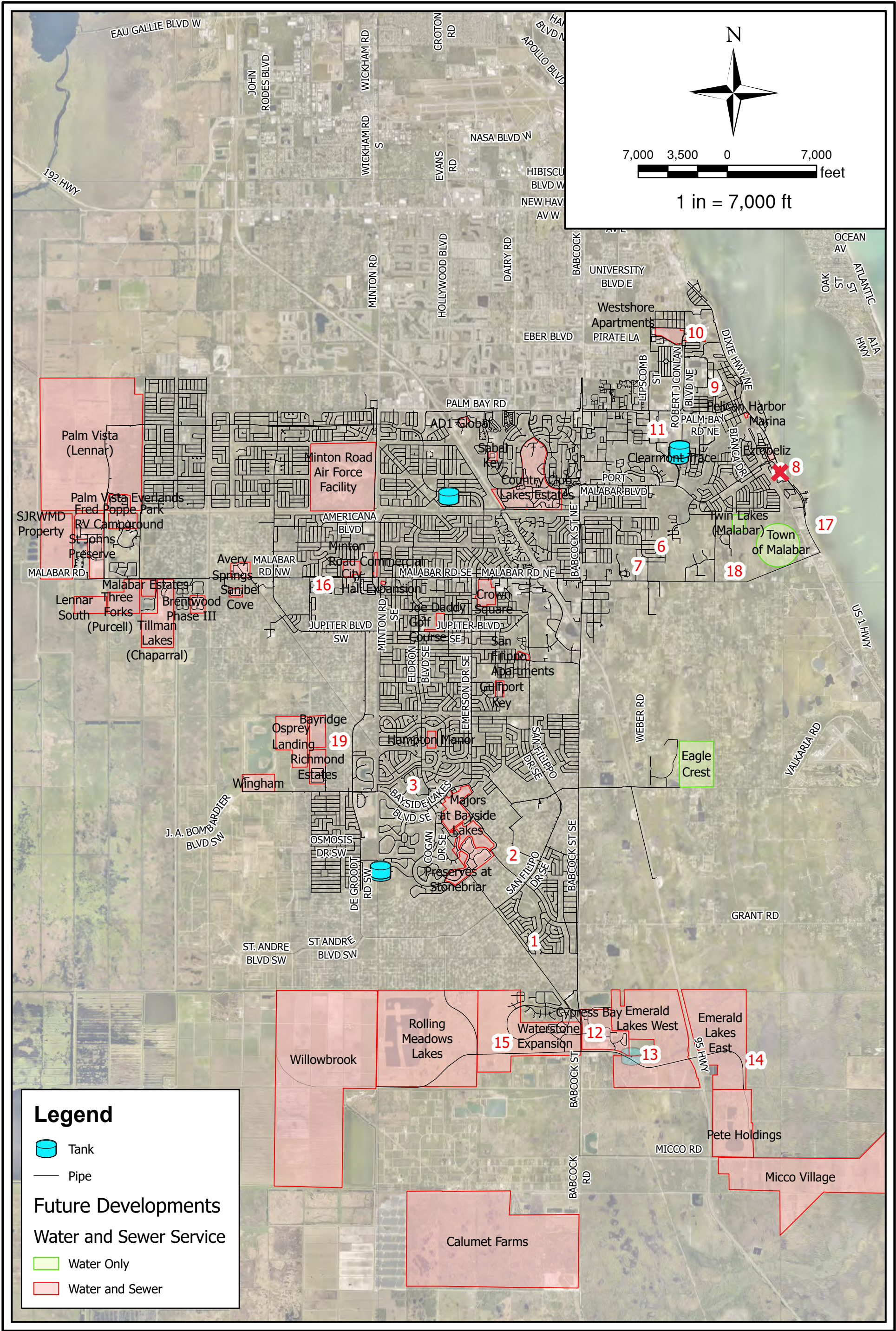
Table 7-3. Five-Year Water Transmission/Distribution System Capital Improvements Needs

Five-Year Capital Improvements Needs	CIP Project Type	WM Quantity (LF)
CIP No. 1: 16" Watermain Loop in FPL Corridor (Paigo St SE - Babcock St)	16" and 24" WM	16,260
CIP No. 2: 8" Watermain Loop on Eldron Blvd SE (Windbrook Dr SE - Rabbit St SE)	8" WM	3,008
CIP No. 3: 6" WM Loop on Devonwood Ct SE to Eldron Blvd SE (N of Bayside Lakes)	6" WM	1,005
CIP No. 4: NOT USED	NA	NA
CIP No. 5: 8" WM Loop on US-1 (N of Wedgewood Dr NE) across US-1	8" WM	111
CIP No. 6: 6" WM Loop Fallon Blvd NE to Greenwood Blvd NE	6" WM	331
CIP No. 7: 8" WM Loop Admiral Dr (Extended) to Malabar Road (S of Oaklyn)	8" WM	1,449
CIP No. 8: Replace 8" WM with 12" WM on US-1 (Anglers Dr NE - Breezy Palms RV Park)	12" WM	5,150
CIP No. 9: Replace 2" WM with 6" WM on Eaglerock St ME and 6" WM loop to Fourth Ave NE	6" WM	605
CIP No. 10: 6" WM Loop Danr Dr NE to Myers Dr NE under Railroad	6" WM	375
CIP No. 11: Replace 6" WM with 12" WM on Clearmont St NE at Gunpowder Dr NE	12" WM	17
CIP No. 12: 16" WM Extension to Babcock St (S of Mara Loma Blvd)	16" WM	2,120



Five-Year Capital Improvements Needs	<i>CIP Project Type</i>	<i>WM Quantity (LF)</i>
CIP No. 13: 16" WM Extension E of Babcock St for Emerald City Development	16" WM	11,832
CIP No 14: 16" WM Extension S of 16" WM Extension for Emerald City and Pete Holdings Developments	16" WM	3,870
CIP No. 15: 16" WM Extension on Davis Ln Extended for Waterstone and Rolling Meadows Developments	16" WM	23,145
CIP No. 16: 12" WM Loop on Garvey Rd (Malabar Rd - White Cloud St SW)	12" WM	1,980
CIP No. 17: 12" WM Extension on US-1 (Breezy Palms RV Park Malabar Rd) for Town of Malabar	12" WM	9,518
CIP No. 18: 12" WM Loop on Malabar Rd (US-1 to Weber Rd) for Town of Malabar	12" WM	8,050
CIP No. 19: 8" WM Extension on Falls Church St SE (W of Degroodt Rd SW) for Bayridge Development	8" WM	2,123
CIP No. 20: ACP WM Replacement near Palm Bay Fire Station No. 1	6" WM	1,900
CIP No. 21: ACP WM Replacement at North Regional Utilities Campus	16" WM	2,100
CIP No. 22: ACP WM Replacement adjacent to BEALLS Outlet	8" and 12" WM	2,100
CIP No. 23: ACP WM Replacement along Meadowbrooks Rd NE	6" WM	3,700

Note: Capital improvement needs relating to the renewal and replacement of the current assets of the water supply and water treatment plants can be found in **Section 10**. Capital improvement needs relating to the future needs of the water supply and water treatment plants can be found in **Section 11**.

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Legend

-  Tank
-  Pipe

Future Developments

Water and Sewer Service

-  Water Only
-  Water and Sewer



**INFRASTRUCTURE
SOLUTION SERVICES**

Melbourne | Sarasota | Panama City Beach

Five-Year Capital Improvement Needs Water Master Plan City of Palm Bay Utilities Department

PROJ. NO.
PBU009

DATE:
JUN 2024

FIGURE NO.

7-4

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The following is a summary of the proposed water transmission/distribution system capital improvement needs including a general description of improvements and general purpose for improvement.

- **CIP No. 1: 16" Watermain Loop in FPL Corridor (Paigo Street SE - Babcock Street):** Water main to serve transmission line providing water to areas with proposed development located south of the SRWTP. The water main loop will also increase fire flow capacity in the area.
- **CIP No. 2: 8" Watermain Loop on Eldron Blvd SE (Windbrook Drive SE - Rabbit Street SE):** Water main to provide additional looping in the southern part of the city. This will improve fire flow capacity, provide system redundancy, and potentially improve water quality.
- **CIP No. 3: 6" WM Loop on Devonwood Court SE to Eldron Blvd SE (N of Bayside Lakes):** Water main to provide additional looping in the Lake Forest Subdivision. This will improve fire flow capacity, provide system redundancy, and potentially improve water quality.
- **CIP No. 4: NOT USED.**
- **CIP No. 5: 8" WM Loop on US-1 (N of Wedgewood Drive NE) across US-1:** Water main loop to eliminate dead-end line and provide sufficient fire flow protection.
- **CIP No. 6: 6" WM Loop Fallon Blvd NE to Greenwood Blvd NE:** Water main to provide redundancy to the neighborhoods along Fallon Street (south of Kent Street) which are currently served by a single water main. The watermain will also provide sufficient fire flow protection and potentially improve water quality.
- **CIP No. 7: 8" WM Loop Admiral Drive (Extended) to Malabar Road (S of Oaklyn):** Water main to provide redundancy to the neighborhoods along Fallon Street (south of Kent Street) which are currently served by a single water main. The watermain will also provide sufficient fire flow protection and potentially improve water quality.
- **CIP No. 8: Replace 8" WM with 12" WM on US-1 (Anglers Drive NE - Breezy Palms RV Park):** Water main replacement to improve flow conveyance along US-1 and provide sufficient fire flow protection.
- **CIP No. 9: Replace 2" WM with 6" WM on Eaglerock St ME and 6" WM loop to Fourth Avenue NE:** Water main replacement and loop to eliminate dead-end water mains along Eagle Rock Street and 4th Avenue. The loop will provide sufficient fire flow protection, system redundancy, and potentially improve water quality.

- **CIP No. 10: 6" WM Loop Danr Drive NE to Myers Drive NE under Railroad:** Water main loop across the railroad to eliminate the dead-end water mains. The loop will provide sufficient fire flow protection, system redundancy, and potentially improve water quality.
- **CIP No. 11: Replace 6" WM with 12" WM on Clearmont Street NE at Gunpowder Drive NE:** Water main to be replaced and provide adequate pipe velocities.
- **CIP No. 12: 16" WM Extension to Babcock Street (S of Mara Loma Blvd):** Water main to provide water including fire flow for future developments.
- **CIP No. 13: 16" WM Extension E of Babcock Street for Emerald City Development:** Water main to provide water including fire flow for future developments.
- **CIP No 14: 16" WM Extension S of 16" WM Extension for Emerald City and Pete Holdings Developments:** Water main to provide water including fire flow for future developments.
- **CIP No. 15: 16" WM Extension on Davis Lane Extended for Waterstone and Rolling Meadows Developments:** Water main to provide water including fire flow for future development.
- **CIP No. 16: 12" WM Loop on Garvey Road (Malabar Road - White Cloud Street SW):** Water main to provide water including fire flow for future development
- **CIP No. 17: 12" WM Extension on US-1 (Breezy Palms RV Park Malabar Road) for Town of Malabar:** Water main loop to provide water service including fire flow to the Town of Malabar.
- **CIP No. 18: 12" WM Loop on Malabar Road (US-1 to Weber Road) for Town of Malabar:** Water main loop to provide water service including fire flow to the Town of Malabar.
- **CIP No. 19: 8" WM Extension on Falls Church Street SE (W of Degroodt Road SW) for Bayridge Development:** Water main extension to provide water including fire flow for the Bayridge development.
- **CIP No. 20: ACP WM Replacement near Palm Bay Fire Station No. 1:** Ongoing replacement of undersized and ACP water lines.
- **CIP No. 21: ACP WM Replacement at North Regional Utilities Campus:** Ongoing replacement of undersized and ACP water lines
- **CIP No. 23: ACP WM Replacement along Meadowbrooks Road NE:** Ongoing replacement of undersized and ACP water lines

7.6 Observations and Recommendations

The future five-year planning horizon conditions of the City of Palm Bay's water distribution system were modeled and assessed using the City's future GIS water system data and the water system hydraulic model. Analysis of the future condition included average day, maximum day (for fire flow analysis), and peak hour modeling design conditions. Additionally, a 24-hour extended-period simulation was performed. Based on these water model simulations and results, the following observations and recommendations are provided for the City's consideration.

7.6.1 Observations

The following observations are based on the City of Palm Bay's future water system modeling results.

- Results for the average day, maximum day, and peak hour design modeling simulations showed the City's water system can be maintained at a standard pressure range between 40 and 70 psi.
- Fire flow results show that approximately 9% of the model's hydraulic nodes were not able to achieve the minimum fire flow of 1,000 gpm at 20 psi; however, hydrant coverage in the city is sufficient to provide fire flow to deficient nodes of the city which are concentrated in areas of small diameter piping.
- Water demands expected at the five-year planning horizon were incorporated into the distribution model which resulted in the need for additional high-service distribution pump operation within the model; therefore, the City will likely need to modify the operation of their WTPs and repump station high-service distribution pumps to accommodate anticipated water demand at the five-year planning horizon.
- **Table 7-3** provides a listing of recommended capital improvement needs at the five-year planning horizon. These improvement needs have been incorporated into the water hydraulic model and provide benefits to the City's water system including "looped" distribution, upsized piping, and new distribution piping in areas of anticipated development.

7.6.2 Recommendations

The following recommendations are based on the City of Palm Bay's future water system modeling results and observations.

- The water distribution system recommendations for the five-year time planning horizon include the capital improvement needs listed in **Table 7-3**. While a South Booster Station was considered during the five-year planning horizon modeling effort, it was determined that a South Booster Station will not be needed until the five-to-ten-year planning horizon if commercial development along the St. Johns Parkway is not initiated in the five-year planning horizon.

Section 8 -Evaluation of Future Ten-Year Water Transmission/Distribution System

8.1 Introduction

Section 8 of the City of Palm Bay Water Master Plan describes the use of the hydraulic water transmission/distribution system model to evaluate the future condition infrastructure needs of the system at the ten-year planning horizon as described below:

- a) The water distribution system will be evaluated to identify areas that may experience low pressure, inadequate available fire flow, excess pipe velocities, etc.
- b) Storage facilities shall be evaluated to determine if adequate water storage is maintained to meet the future average day demand and the fire flow requirements.
- c) The water distribution system components necessary to serve future development will be identified and appropriately sized.
- d) For each planning horizon, the water main, high-service pumping, and system storage upgrades necessary to meet projected water flows shall be sized and identified.

8.2 Ten-Year Water Demands

Future water demands have been incorporated into the model for the ten-year planning horizon. Future ten-year demands have been provided by the City based on anticipated developments. Additionally, the City provided “in-fill” demand within areas of existing development. **Table 8-1** provides ten-year demands of anticipated developments.

Table 8-1. Ten-Year Future Water Demands

Map ID	Development Name	Development Type	Ten-Year Water Demands	
			Equivalent Residential Connections	Water Demand (gpd)
A	Palm Vista (Lennar)	Residential, Mixed	1800	405,000
B	Palm Vista Everlands	Residential, Mixed	-	-
C	SJRWMD Property	Single Family Residential	220.8	49,680
		Multi-Family Residential	324	72,900
D	St Johns Preserve	Residential, Mixed	248	55,800

Map ID	Development Name	Development Type	Ten-Year Water Demands	
			Equivalent Residential Connections	Water Demand (gpd)
E	Fred Poppe Park RV Campground	Commercial/RV	-	-
F	Lennar South	Residential, Mixed	352	79,200
G	West 80 Acres, LLC	Single Family Residential	-	-
H	Malabar Estates	Single Family Residential	77	17,325
I	Chapparal	Single Family Residential	240.8	54,180
		Multi-Family Residential	75	16,875
J	Brentwood Phase 3	Single Family Residential	-	-
K	Sanibel Cove	Single Family Residential	-	-
L	Avery Springs	Single Family Residential	-	-
M	Minton Road Airforce Facility	Mixed use	65	14,625
N	Health First Wellness Village	Mixed Use	-	-
O	Minton Road Commercial	Commercial	-	-
P	City Hall Expansion	Municipal	-	-
Q	AD1 Global	Mixed Use Commercial	-	-
R	Sabal Key	Single Family Residential	-	-
S-1	Country Club Lakes Estates I-IV	Single Family Residential	-	-
S-2	Reserve at County Club Lakes Estates	Single Family Residential	-	-
		Multi-Family Residential	-	-
T	Westshore Apartments	Multi-Family Residential	-	-
U	Northshore (Aqua Apartments)	Residential	-	-
		Commercial	-	-
V	Clearmont Trace	Multi-Family Residential	-	-
W	Pelican Harbor Marina	Commercial	-	-
X	Eztopeliz	Mixed use / Multi-Family Residential	311.25	70,031
Y	Tropical Arms Apartments	Residential	-	-
Z	Twin Lakes (Malabar)	Residential	-	-
AA	Malabar, Town of	Residential, mixed	195	43,875
BB	Joe Daddy Golf Course Property	Multi-Family Residential	-	-
		Commercial	-	-
CC	Crown Square	Multi-Family Residential	-	-
		Potential Building Space	-	-
DD	San Filippo Apartments	Residential	-	-
EE	Gulfport Key	Single Family Residential	-	-
FF	Bayridge	Single Family Residential	-	-
GG	Richmond Estates	Single Family Residential	-	-

Map ID	Development Name	Development Type	Ten-Year Water Demands	
			Equivalent Residential Connections	Water Demand (gpd)
HH	Wingham	Residential, mixed	250	56,250
II	Hampton Manor	Assisted Living Facility	-	-
		Multi-Family Residential	-	-
JJ	Eagle Crest	Single Family Residential	54	12,150
KK	Preserves at Stonebriar	Single Family Residential	-	-
LL	Rolling Meadows Lakes	Single Family Residential	935.6	210,510
MM-1	Waterstone Phase II	Single Family Residential	-	-
		Mixed Use	-	-
MM-2	Waterstone (Cypress Bay West)	Residential, mixed	-	-
NN	Cypress Bay	Single Family Residential	-	-
		Mixed Use Commercial	-	-
OO	Emerald Lakes - West of I-95	Residential, Mixed	1510	339,750
PP	Emerald Lakes - East of I-95	Residential, Mixed	871.6	196,110
QQ	Pete Holdings (Jeff Lee)	Residential, Mixed	983	221,175
RR	Micco Village	Mixed use	240	54,000
SS	Calumet Farms	Residential, Mixed	-	-
TT	Willowbrook	Residential, Mixed	-	-
TEN-YEAR PROPOSED DEVELOPMENT TOTALS			8,753	1,969,000

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

8.3 Model Development

Refer to **Section 5** of this Water Master Plan report details of the water hydraulic model development and calibration.

8.3.1 South Booster Station Model Representation

For the ten-year and future planning horizon hydraulic model, an additional water booster pump station was incorporated into the model representation framework. This station will be in the vicinity of the Babcock St and St Johns Heritage Parkway intersection in the southeast section of the area. This will be required to support the expected commercial fire flows in the region. The station will be fed and will

discharge into the 16-inch water mains running along the St Johns Heritage Parkway. Providing a direct feed to the station from the main transmission water main feeding from the north is critical.

The South Booster Station would be similar to the existing Nash Repump Station in configuration with ground storage tank(s) and several low- and high-capacity split case centrifugal high-service distribution pumps. The station would be intended to operate in the initial ten-year planning horizon to meet commercial fire flow needs in the southeast section of the City along the St Johns Heritage Parkway corridor. The station is also needed for peak hour and maximum day demands. To minimize excessive water age within the ground storage tank, the station would also be expected to be operated meeting water demands during high water use time periods.

The station is intended to be constructed with either one 1.5 MG or two 0.75 MG ground storage tanks. The tanks would be filled from the system during the low flow overnight time period using a flow control valve. The high-service distribution pumps would draw from the tank and pump into the system.

The South Booster Station would be like the existing Nash Repump Station in configuration initially with two lower capacity high-service distribution pumps rated at 555 gpm @ 205 ft TDH, 40 HP and two higher capacity high-service distribution pumps rated at 1,250 gpm @ 140 ft TDH, 75 HP. All pumps would be operated using variable frequency drives. The pumps would be expected to be manually operated remotely as needed like the Nash Repump Station.

8.3.2 Steady State Model Runs

Simulations for the City's water distribution system include steady-state analysis under three (3) design conditions: average day, maximum day (for fire flow analysis), and peak hour. Since the steady state simulations do not account for system water storage, the high-service distribution pumps were operated in the model based on the water demands for the respective scenario. The number of operating high-service distribution pumps in the model were adjusted as needed to maintain normal operating pressures between 40 and 70 psi and available fire flow of 1,000 gpm for residential use and 2,500 gpm for commercial use.

8.3.3 Extended Period Simulation Run

The following is a description of the logical controls established for the future ten-year conditions EPS that are used in model scenarios, modified as necessary as demands increase and new components are added to the system.

- 1) During morning peak flow conditions (7-9 am), Nash Repump Station HSP No 1 was operated and the South Booster Station HSP No. 1 was operated. During the afternoon peak flow conditions (6-9 pm), HSP Nos 1 and 4 at both stations were operated.
- 2) During low conditions (12 – 6 am), the Nash Repump and South Booster Station ground storage tanks were filled by modeling the operation of a throttle control valve used to restrict flow into the tank. The control valve setting was established based on the fill the tank within the given time interval.

By default, the initial high-service distribution pumps being operated at the EPS start time (12:00 AM) include NRWTP HSP No. 1, NRWTP HSP No. 3, SRWTP HSP No. 1, SRWTP HSP No. 3, SRWTP HSP No. 5, SRWTP HSP No. 6. These pumps are in operation throughout the simulation.

Rules are created to turn on additional high-service distribution pumps at NRWTP and/or SRWTP based on the system demand. Base water demands under average conditions for the future model are approximately 5,000 gpm. When the demand increases to 7,000 gpm, SRWTP HSP No. 1 was operated. When demand increases to more than 9,000 gpm, NRWTP HSP No 5 was operated, and finally when demands reaches more than 11,000 gpm, NRWTP HSP No. 6 was operated. When the system demands fall below each of these trigger points, the pump will then turn off.

8.4 Evaluation of Future Water System

8.4.1 Evaluation of System Pressures

Table 8-2 shows that water system was modeled to be maintained between 40 and 70 psi for the average day, maximum day, and peak hour design scenarios. See **Figures 8-1, 8-2, and 8-3** for system wide water pressure for the previously mentioned design scenarios.

Table 8-2. Ten-Year Steady-State Model Scenarios

Steady-State Scenario	Total Demand (gpm)	High-Service Pump Number Running				System Pressures		
		North Regional WTP	Nash Booster	South Regional WTP	South Booster	Min (psi)	Max (psi)	Avg (psi)
Average Day	8,500	3,5	4	1,3	N/A	46.3	62.4	52.5
Maximum Day	12,385	1,3,5	1,4	1,3,5	1,4	52.2	69.9	57.8

Steady-State Scenario	Total Demand (gpm)	High-Service Pump Number Running				System Pressures		
		North Regional WTP	Nash Booster	South Regional WTP	South Booster	Min (psi)	Max (psi)	Avg (psi)
Peak Hour	19,437	1,2,3,5,6	1,4	1,2,3,5,6	1,4	41.5	67.2	50.7

Note: In each of the steady-state scenarios shown above in Table 3-1, additional pumping capacity is available.

8.4.2 Evaluation of Water System Main Velocities

System water main pipe velocities were reviewed as part of the steady-state scenario analysis. Most velocities were below the 5-fps threshold; however, several instances of higher velocities were observed in piping directly downstream of pumps which is expected. Overall, system velocities for the model scenarios are acceptable.

8.4.3 Evaluation of Fire Flows

Fire flow analysis was performed on the entire system with the maximum day model scenario. Most system junctions are able to provide the required fire flow while under the maximum day scenario; however, 6% of system junctions, approximately 350 of 5,800 system junctions, did not provide the minimum flows and/or pressures required by the fire flow criteria. Overall, the failing fire flow nodes coincided with the smaller diameter piping, less than 6-inches in diameter in the northeast quadrant of the City's water system. Further analysis included review of fire hydrant coverage throughout the City. Five hundred (500)-ft buffers were generated in GIS at each City hydrant location. The hydrant buffer coverage showed that the City has sufficient hydrant coverage and that junctions that failed fire flow criteria were generally covered by nearby hydrants. Overall, the City's fire flow capacity is adequate when fire hydrant coverage is considered as part of the analysis.

A South Booster Station has been added to the model to accommodate fire flow demands. The station is not needed for average day demands; however, the station is needed for peak hour and maximum day demands including future development fire flows in the southern portion of the city.

8.4.4 Evaluation of High-Service Distribution Pumping Capacities

High-service distribution pumping capacities were modeled to be generally sufficient to provide water flows and system water pressure under all model scenarios with the highest capacity pumps at each station not used. As noted in **Section 8.3.3**, fire flow was not adequate for 6% of junctions; however, this

issue is generally a result of smaller diameter pipe sizing concentrated in the northeast portion of the City's water system and not related to pump capacities.

8.4.5 Evaluation of Water Treatment Capacities

Per Chapter 62-555 F.A.C., WTP capacity must equal or exceed maximum day demand. As noted in **Table 8-2**, the maximum day demand is equal to approximately 8,629 gpm which equates to approximately 12 MGD. Therefore, the City's total permitted water treatment capacity is approximately 16.0 MGD which is well above the maximum day demand of 12 MGD.

8.4.6 Evaluation of Storage Capacities

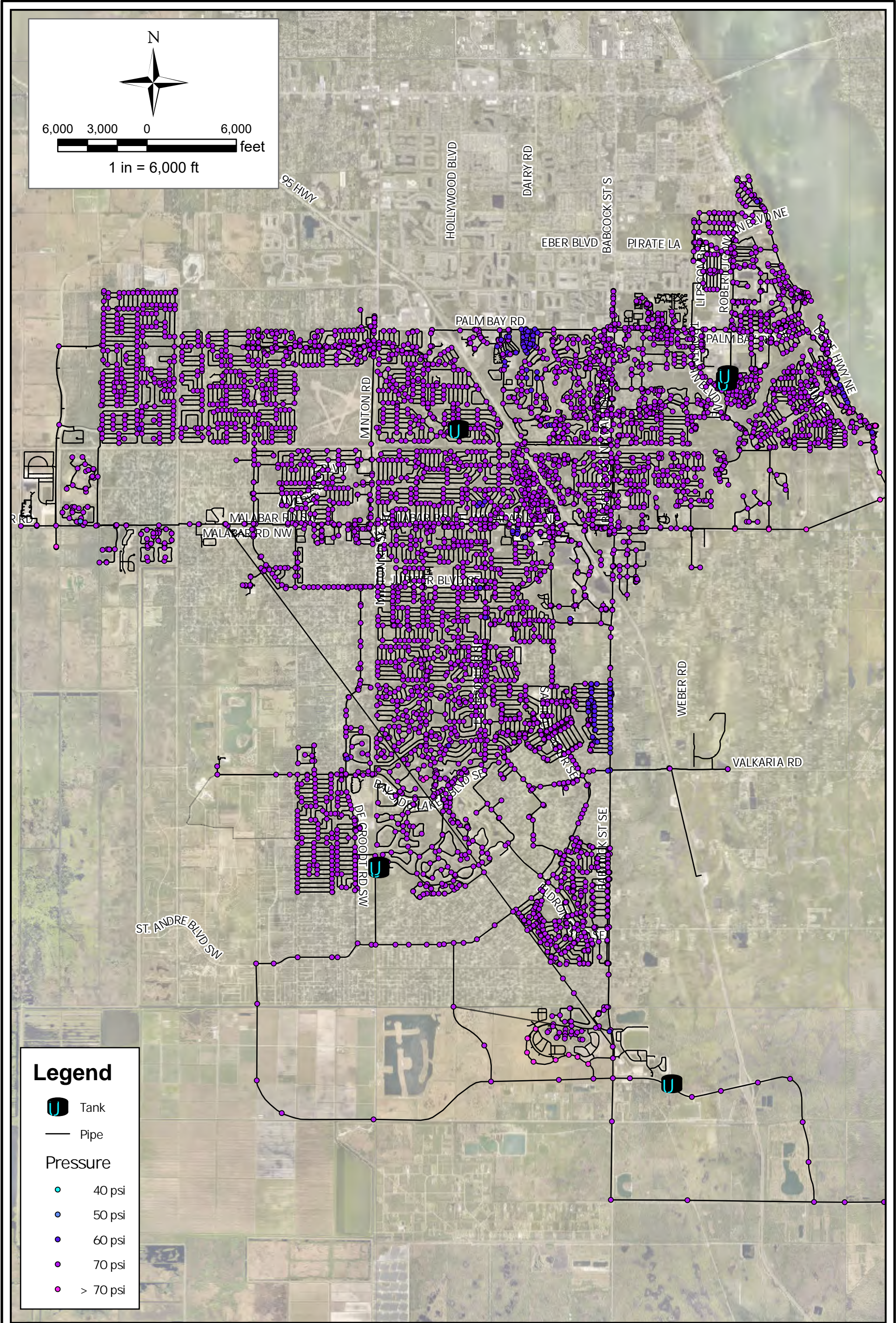
Storage capacity must be equal to or exceed 25% of the maximum daily flow with provisions for fire flow. Therefore, total storage at the ten -year planning horizon inclusive of all City water storage tanks is 7.5 million gallons. The maximum day demand is 12 MGD and therefore, 25% of the maximum day demand is three (3) million gallons which is well exceeded by the 7.5-million-gallon storage capacity.

8.4.7 Extended Period Simulation

The EPS with logical controls as described in **Section 8.2.2** was evaluated for system performance through the course of one (1) 24-hour period. Analysis of the EPS results include water system pressures, high-service distribution pumped flows, cumulative pump discharge volumes, and system tank storage. Review of the extended period simulation results indicates that the City's water distribution system operates as expected over the 24-hour simulation period.

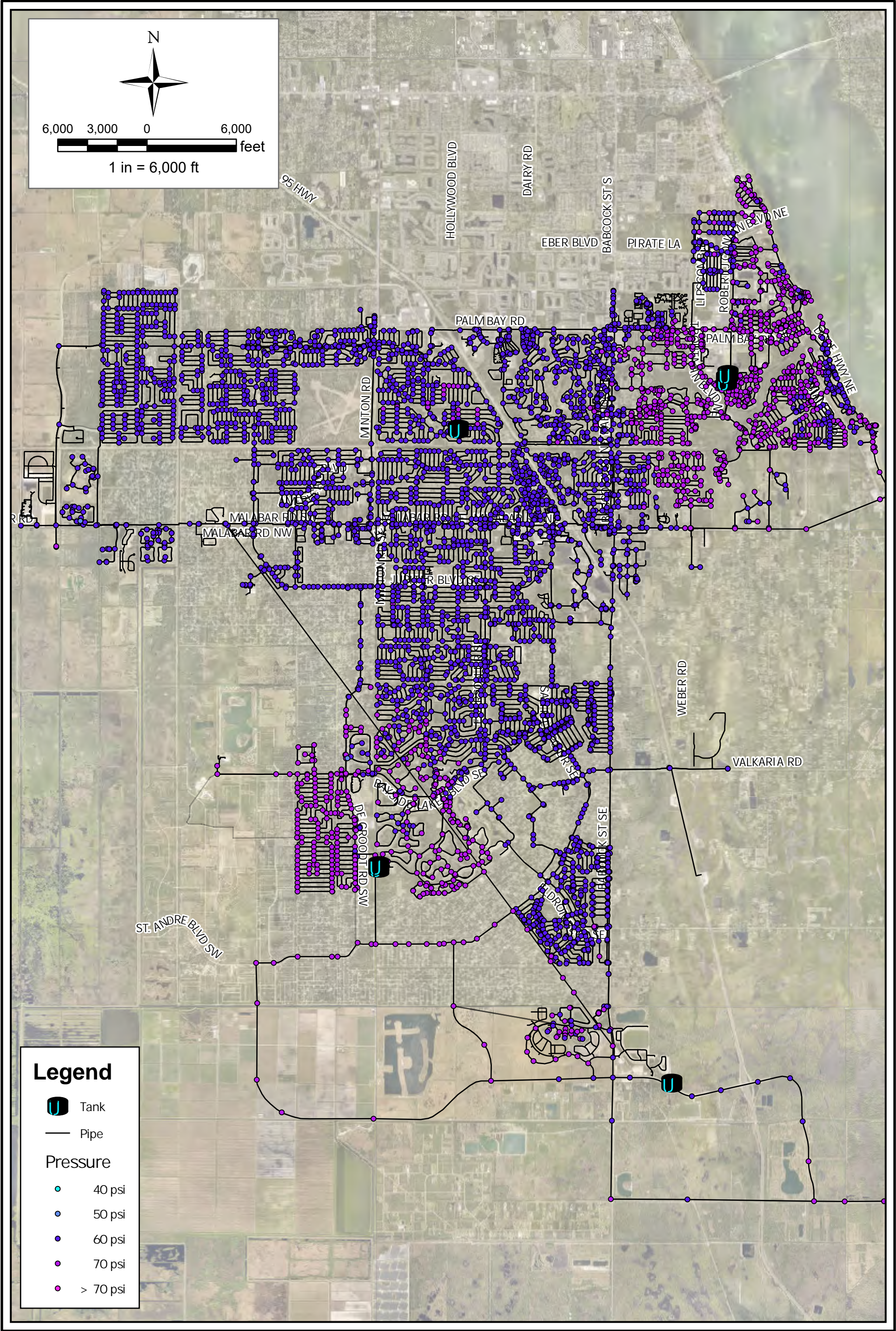
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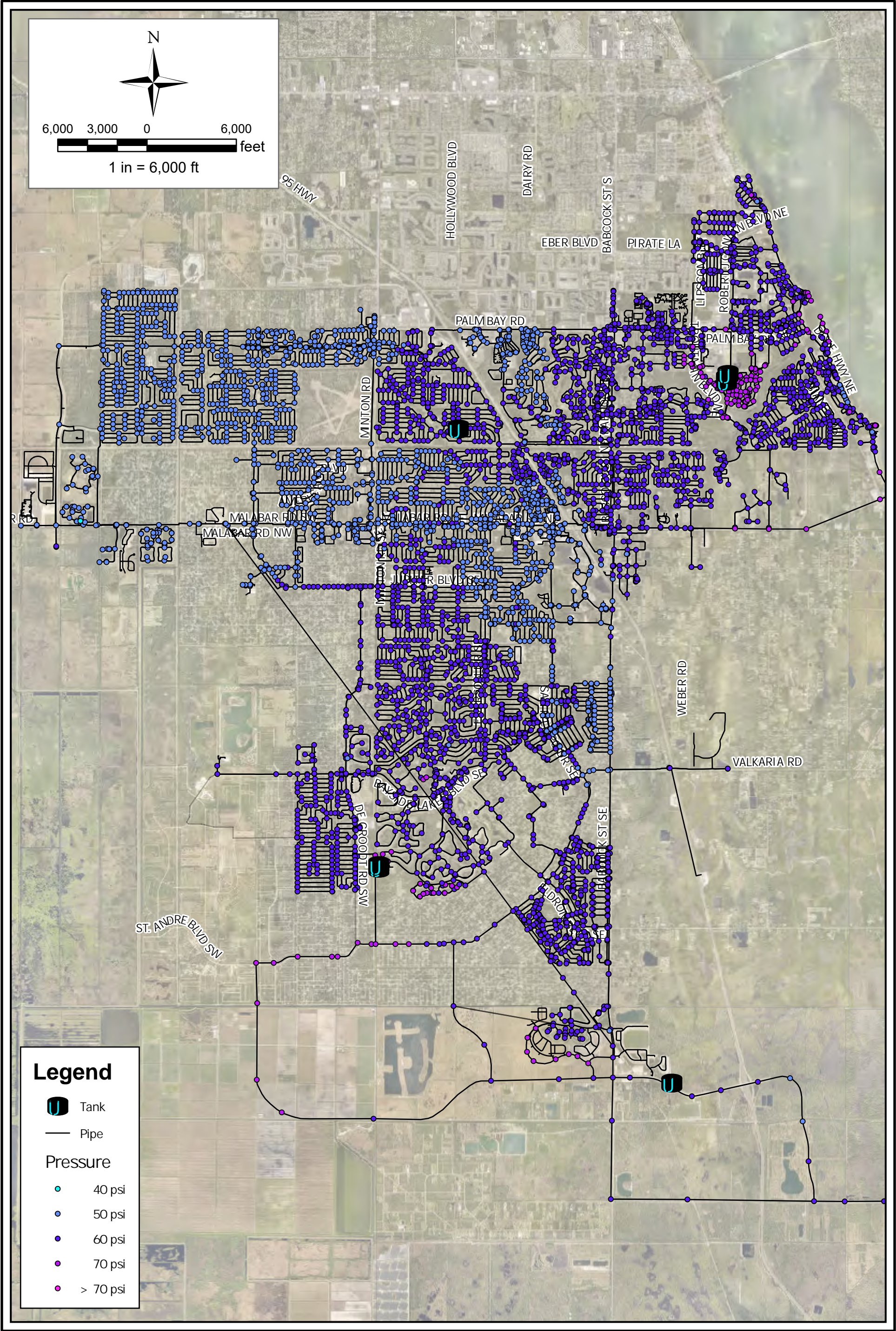
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8.5 Capital Improvement Needs

Capital improvement needs have been considered for the ten-year planning horizon and are included in the ten-year hydraulic model scenario. **Table 8-3** provides the anticipated water transmission/distribution system capital improvement needs for the ten-year water system improvements. See **Figure 8-4** for locations of proposed water transmission/distribution system capital improvement needs according to CIP numbers shown in **Table 8-3**. Refer to **Appendix A** for details of each capital improvement need.

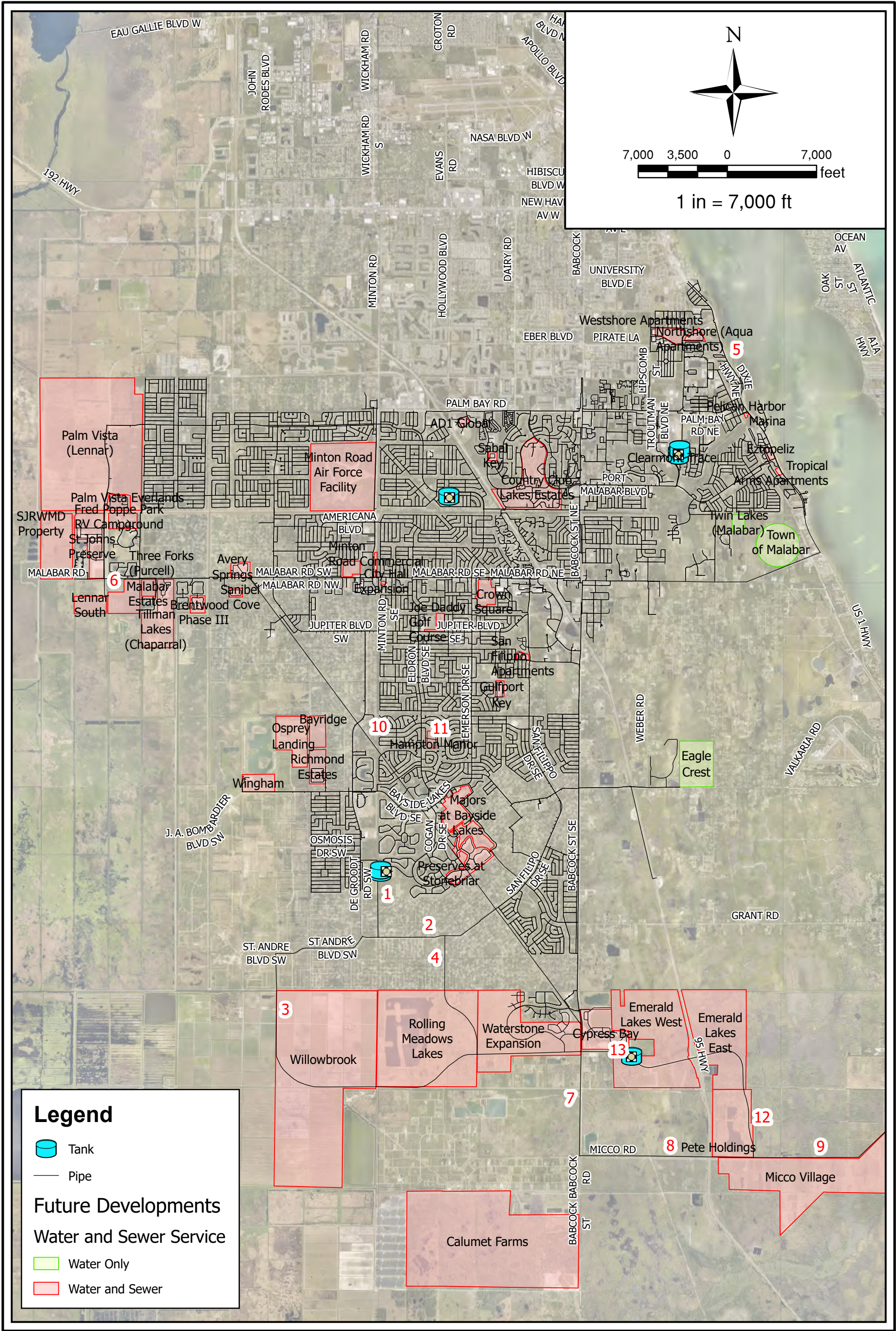
Table 8-3. Ten-Year Water Transmission/Distribution System Capital Improvements Needs

<i>Ten-Year Capital Improvements Needs</i>	<i>CIP Project Type</i>	<i>WM Quantity (LF)</i>
CIP No. 1: 24" WM Loop from SRWTP to San Filippo Dr SE	24" WM	5,970
CIP No. 2: 16" WM Loop on San Filippo Dr SE (Degroodt Rd SW to FPL)	16" WM	11,231
CIP No. 3: 16" WM Loop on St. Andre Blvd to Willowbrook Development	16" WM	24,525
CIP No. 4: 16" WM Loop from San Filippo Dr SE to Rolling Meadows Development	16" WM	4,285
CIP No. 5: Replace Exist. 6"-10" WM w/ 12" WM on US-1 (Pospisil Ave NE -S of University Blvd)	12" WM	13,775
CIP No. 6: 8" WM Extension S of Malabar Rd for Lennar South Development	8" WM	2,000
CIP No. 7: 16" WM Extension Babcock St (Davis Ln - Micco Rd)	16" WM	8,203
CIP No 8: 12" WM Loop on Micco Rd (Babcock St - Micco Village Development)	12" WM	13,640
CIP No. 9: 16" WM Extension on Micco Rd for Micco Village Development	16" WM	14,532
CIP No. 10: 16" WM Loop in FPL Easement (Cogan Dr SE-Malabar Rd)	16" WM	29,086
CIP No. 11: 6" WM Loop from Pilgrim Ln SE to Satz St SE for Las Palmas Development	6" WM	945
CIP No. 12: 16" WM Loop through Pete Holdings (Emerald Lake to Micco Village)	16" WM	5,570
CIP No. 13: South Water Booster Station – First Phase	GST and HS Pumping	NA
CIP No. 14: ACP WM Replacement adjacent to Veteran's Memorial Park	2" to 12" WM	27,000
CIP No. 15: ACP WM Replacement near Indian River Flats	6" WM	4,800
CIP No. 16: ACP WM Replacement adjacent to Abeto St. NE	6" WM	5,200
CIP No. 17: ACP WM Replacement along Main St NE Area	8" and 12" WM	5,000
CIP No. 18: ACP WM Replacement within Highland Shores Turkey River Estates	2", 6" and 8" WM	9,400

Note: Capital improvement needs relating to the renewal and replacement of the current assets of the water supply and water treatment plants can be found in **Section 10**. Capital improvement needs relating to the future needs of the water supply and water treatment plants can be found in **Section 11**.

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The following is a summary of the proposed water transmission/distribution system capital improvement needed at the ten-year planning horizon including a general description of improvements and purpose for improvement.

- **CIP No. 1: 24" WM Loop from SRWTP to San Filippo Drive SE:** Water main to serve as transmission line providing water to areas south of the SRWTP. It will improve redundancy in the water system and increase fire flow capacity in the area.
- **CIP No. 2: 16" WM Loop on San Filippo Drive SE (Degroodt Road SW to FPL):** Water main extension along San Filippo to provide an additional transmission line to the southern areas of the city. This line is required for redundancy, providing sufficient fire flows, and maintaining adequate velocities in lines transporting water from the SRWTP.
- **CIP No. 3: 16" WM Loop on St. Andre Blvd to Willowbrook Development:** Water main extension along St. Andre and south to Willowbrook to provide an additional transmission line to the southern areas of the city. This line is required for redundancy, providing sufficient fire flows, and maintaining adequate velocities in lines transporting water from the SRWTP.
- **CIP No. 4: 16" WM Loop from San Filippo Drive SE to Rolling Meadows Development:** Water main extension from San Filippo south to Rolling Meadows to provide an additional transmission line to the southern areas of the city. This line is required for redundancy, providing sufficient fire flows, and maintaining adequate velocities in lines transporting water from the SRWTP.
- **CIP No. 5: Replace Exist. 6"-10" WM w/ 12" WM on US-1 (Pospisil Avenue NE -S of University Blvd):** Replacement of existing 6-inch, 8-inch, and 10-inch water pipe along US-1 with 12-inch pipe to improve flow conveyance and provide sufficient fire flow protection.
- **CIP No. 6: 8" WM Extension S of Malabar Road for Lennar South Development:** Water main extension to provide water to the proposed Lennar South development.
- **CIP No. 7: 16" WM Extension Babcock Street (Davis Lane - Micco Road):** Water main extension to loop the water system and provide water to the proposed Pete Holdings and Micco Village developments. These lines will also provide redundancy for the water main servicing the Emerald City development.
- **CIP No 8: 12" WM Loop on Micco Road (Babcock Street - Micco Village Development):** Water main extension to loop the water system and provide water to the proposed Pete Holdings and Micco Village developments. These lines will also provide redundancy for the water main servicing the Emerald City development.

- **CIP No. 9: 16" WM Extension on Micco Road for Micco Village Development:** Water main extension to loop the water system and provide water to the proposed Pete Holdings and Micco Village developments. These lines will also provide redundancy for the water main servicing the Emerald City development.
- **CIP No. 10: 16" WM Loop in FPL Easement (Cogan Drive SE-Malabar Road):** Transmission main within the FPL easement to provide additional conveyance from the SRWTP to the northwest part of the city for sustaining adequate system pressures and fire protection.
- **CIP No. 11: 6" WM Loop from Pilgrim Lane SE to Satz Street SE for Las Palmas Development:** Water main extension to provide water to loop the water system between Pilgrim Lane and Satz Street.
- **CIP No. 12: 16" WM Loop through Pete Holdings (Emerald Lake to Micco Village):** Water main extension to loop the water system and provide water to the proposed Pete Holdings and Micco Village developments. These lines will also provide redundancy for the water main servicing the Emerald City development.
- **CIP No. 13: South Water Booster Station – First Phase:** Construction of first phase of the South Booster Station to provide fire flow for future developments in the southern portion of the city. Improvements include either two 0.75 MG or one 1.5 MG ground storage tanks and 2,500 gpm of firm high-service distribution pumping.
- **CIP No. 14: ACP WM Replacement adjacent to Veteran's Memorial Park:** Ongoing replacement of undersized and ACP water lines.
- **CIP No. 15: ACP WM Replacement near Indian River Flats:** Ongoing replacement of undersized and ACP water lines. Ongoing replacement of undersized and ACP water lines.
- **CIP No. 16: ACP WM Replacement adjacent to Abeto Street NE:** Ongoing replacement of undersized and ACP water lines.
- **CIP No. 17: ACP WM Replacement along Main Street NE Area:** Ongoing replacement of undersized and ACP water lines.
- **CIP No. 18: ACP WM Replacement within Highland Shores Turkey River Estates:** Ongoing replacement of undersized and ACP water lines. Ongoing replacement of undersized and ACP water lines.

8.6 Observations and Recommendations

The future ten-year planning horizon conditions of the City of Palm Bay's water distribution system were modeled and assessed using the City's future GIS water system data and the water modeling program WaterGEMS. Future system analysis included average day, maximum day (for fire flow analysis), and peak hour design conditions. Additionally, a 24-hour extended period simulation was performed. Based on these water model simulations and results, the following observations and recommendations are provided for the City's consideration.

8.6.1 Observations

The following observations are based on the City of Palm Bay's future water system modeling results.

- Results for the average day, maximum day, and peak hour simulations show that the City's system can be maintained at a standard pressure range between 40 and 70 psi.
- A South Booster Station has been added to the model to accommodate fire flow demands. The station is not needed for average day demands; however, the station is needed for peak hour and maximum day demands including future development fire flows in the southern portion of the city.
- Water demands expected at the ten -year planning horizon were added to the distribution model which resulted in the need for additional high-service distribution pump operation within the model; therefore, the City will likely need to modify operation of their WTPs and booster station high-service distribution pumps to accommodate anticipated water demand over the ten year planning horizon.
- **Table 8-1** provides a listing of recommended capital improvement needs for the ten year planning horizon. These improvement needs have been incorporated into the water model and provide benefits to the City's water system including "looped" distribution, upsized piping, and new distribution piping in areas of anticipated development.

8.6.2 Recommendations

The following recommendations are based on the City of Palm Bay's future water system modeling results and observations.

- The water distribution system recommendations for the ten-year time horizon include the capital improvements needs listed in **Table 8-3**. A South Booster Station was considered during the ten-year modeling effort; it was determined that a South Booster Station will be needed for future demands.

Section 9 -Evaluation of Future Twenty-Year Water Transmission/Distribution System

9.1 Introduction

Section 9 of the City of Palm Bay Water Master Plan describes the use the hydraulic water transmission/distribution system model to evaluate the future condition infrastructure needs of the system at the twenty -year planning horizon as described below:

- a) The water distribution system will be evaluated to identify areas that may experience low-pressure, inadequate available fire flow, excess pipe velocities, etc.
- b) Water storage facilities shall be evaluated to determine if adequate water storage is maintained to meet the future average day demand and the fire flow requirements.
- c) The water distribution system components necessary to serve future development will be identified and appropriately sized.
- d) For each planning horizon, the water main, high-service pumping, and system storage upgrades necessary to meet projected water flows shall be sized and identified.

9.1.1 Twenty-Year Water Demands

Future water demands have been incorporated into the model for the twenty-year planning horizon. Future twenty-year demands have been provided by the City based on anticipated future developments. Additionally, the City provided “in-fill” demand within areas of existing development. **Table 9-1** provides twenty-year demands of anticipated developments.

Table 9-1. Future Twenty-Year Demands

Map ID	Development Name	Development Type	Twenty-Year Water Demands	
			Equivalent Residential Connections	Water Demand (gpd)
A	Palm Vista (Lennar)	Residential, Mixed	1,800	405,000
B	Palm Vista Everlands	Residential, Mixed	-	-
C	SJRWMD Property	Single Family Residential	276	62,100
		Multi-Family Residential	-	-
D	St Johns Preserve	Residential, Mixed	124	27,900

Map ID	Development Name	Development Type	Twenty-Year Water Demands	
			Equivalent Residential Connections	Water Demand (gpd)
E	Fred Poppe Park RV Campground	Commercial/RV	-	-
F	Lennar South	Residential, Mixed	-	-
G	Three Forks	Mixed Use	814	183,150
H	Malabar Estates	Single Family Residential	-	-
I	Chapparal	Single Family Residential	-	-
		Multi-Family Residential	-	-
J	Brentwood Phase 3	Single Family Residential	-	-
K	Sanibel Cove	Single Family Residential	-	-
L	Avery Springs	Single Family Residential	-	-
M	Minton Road Airforce Facility	Mixed Use	585	131,625
N	Health First Wellness Village	Mixed Use	-	-
O	Minton Road Commercial	Commercial	-	-
P	City Hall Expansion	Municipal	-	-
Q	AD1 Global	Mixed Use Commercial	-	-
R	Sabal Key	Single Family Residential	-	-
S-1	Country Club Lakes Estates I-IV	Single Family Residential	-	-
S-2	Reserve at County Club Lakes Estates	Single Family Residential	-	-
		Multi-Family Residential	-	-
T	Westshore Apartments	Multi-Family Residential	-	-
U	Northshore (Aqua Apartments)	Residential	-	-
		Commercial	-	-
V	Clearmont Trace	Multi-Family Residential	-	-
W	Pelican Harbor Marina	Commercial	-	-
X	Eztopeliz	Mixed use / Multi-Family Residential	103.75	23,344
Y	Tropical Arms Apartments	Residential	-	-
Z	Twin Lakes (Malabar)	Residential	-	-
AA	Malabar, Town of	Residential, mixed	325	73,125
BB	Joe Daddy Golf Course Property	Multi-Family Residential	-	-
		Commercial	-	-
CC	Crown Square	Multi-Family Residential	-	-
		Potential Building Space	-	-
DD	San Filippo Apartments	Residential	-	-
EE	Gulfport Key	Single Family Residential	-	-
FF	Bayridge	Single Family Residential	-	-
GG	Richmond Estates	Single Family Residential	-	-
HH	Wingham	Residential, mixed	250	56,250

Map ID	Development Name	Development Type	Twenty-Year Water Demands	
			Equivalent Residential Connections	Water Demand (gpd)
II	Hampton Manor	Assisted Living Facility	-	-
		Multi-Family Residential	-	-
JJ	Eagle Crest	Single Family Residential	-	-
KK	Preserves at Stonebriar	Single Family Residential	-	-
LL	Rolling Meadows Lakes	Single Family Residential	935.6	210,510
MM-1	Waterstone Phase II	Single Family Residential	-	-
		Mixed Use	-	-
MM-2	Waterstone (Cypress Bay West)	Residential, mixed	-	-
NN	Cypress Bay	Single Family Residential	-	-
		Mixed Use Commercial	-	-
OO	Emerald Lakes - West of I-95	Residential, Mixed	1,132.5	254,813
PP	Emerald Lakes - East of I-95	Residential, Mixed	871.6	196,110
QQ	Pete Holdings (Jeff Lee)	Residential, Mixed	983	221,175
RR	Ashton Park	Mixed use	450	101,250
SS	Calumet Farms	Residential, Mixed	3,304	743,400
TT	Willowbrook	Residential, Mixed	6,000	1,350,000
TWENTY-YEAR PROPOSED DEVELOPMENT TOTALS			17,954	4,040,000

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

Aston Park demands are shown in **Table 9.1** with four hundred fifty (450) equivalent residential connections for the twenty-year demands and a total of six hundred (600) equivalent residential connections are included in the model which includes the ten- and twenty-year demands. The City has indicated that Ashton Park may ultimately include significantly more ERCs; therefore, a separate level-of-service analysis has been prepared for Ashton Park including higher demands and provided to the City.

9.2 Model Development

Refer to **Section 5** of this Water Master Plan report details of the water hydraulic model development and calibration

9.2.1 Steady State Model Runs

Simulations for the City's water distribution system include steady-state analysis under three (3) design conditions: average day, maximum day (for fire flow analysis), and peak hour. Since the steady state simulations do not account for system storage, the high-service distribution pump operation was based on the water demands for the respective scenario. The number of operating high-service distribution pumps were adjusted as needed to maintain normal operating pressures between 40 and 70 psi and available fire flow of 1,000 gpm for residential areas and 2,500 gpm for commercial areas.

9.2.2 Extended Period Simulation Run

The following is a description of the logical controls established for the future twenty-year conditions EPS that are used in model scenarios, modified as necessary as demands increase and new components are added to the system.

- 1) During morning peak flow conditions (7-9 am), Nash Repump Station HSP Pump Nos. 1 and 4 and South Booster Station HSP No. 3 was operated. During the afternoon peak flow conditions (6:00-9:00 PM), Nash Repump Station HSP Pump 2 and South Booster Station HSP Nos. 3 and 4 at the South Booster Station were operated.
- 2) During low conditions (12 – 6 am), the Nash Repump and South Booster Station ground storage tanks were filled by modeling the operation of a throttle control valve used to restrict flow into the tank. The control valve setting was established based on the fill the tank within the given time interval.

By default, the initial pumps in operation at the EPS start time (12:00 AM) include NRWTP HSP No. 1, NRWTP HSP No. 3, NRWTP HSP No. 5, SRWTP HSP No. 1, and SRWTP HSP No. 5. These pumps are in operation throughout the simulation. The operation of additional high-service pumps at NRWTP and/or SRWTP were modeled based on the system water demand as previously described.

9.3 Performance Evaluation of Water System Future Conditions

9.3.1 Evaluation of Water System Pressures

Table 9-2 shows that water system pressures were modeled to be generally maintained between 40 and 70 psi for the average day, maximum day, and peak hour design scenarios. See **Figures 9-1, 9-2, and 9-3** for system wide water pressure for the previously mentioned scenarios.

Table 9-2. Twenty-Year Steady-State Model Scenarios

Steady-State Scenario	Total Demand (gpm)	High-Service Pump Number Running				System Pressures		
		North Regional WTP	Nash Booster	South Regional WTP	South Booster	Min (psi)	Max (psi)	Avg (psi)
Average Day	12,216	1,3,5	1,4	1,5	1	55.8	71.4	61.0
Maximum Day	15,431	1,3,5	1,4	1,5	1,3	47.7	67.8	54.1
Peak Hour	27,803	1,2,3,4,5,6	1,2,4	1,2,3,5,6	1,3,4	41.2	68.3	53.4

Note: In each of the steady-state scenarios shown above in **Table 9-2**, additional pumping capacity is available.

9.3.2 Evaluation of System Main Velocities

Water main pipe velocities were reviewed as part of the steady-state scenario analysis. Most velocities were below the 5-fps threshold; however, several instances of higher velocities were observed in piping directly downstream of pumps which is expected. Overall, system velocities for the model scenarios are acceptable.

9.3.3 Evaluation of Fire Flows

Fire flow analysis was performed on the entire system with the maximum day model scenario. The model shows most system junctions are able to provide the required fire flow while under the maximum day scenario; however, 7% of system junctions, approximately 400 of 5,860 system junctions, did not provide the minimum flows and/or pressures required by the fire flow criteria. The failing fire flow junctions coincided with the smaller diameter piping, less than 6-inches in diameter primarily located in the northeast quadrant of the City's water system. Further analysis included review of fire hydrant coverage throughout the City. Five hundred (500)-ft buffers were generated in GIS at each City hydrant location. The hydrant buffer coverage showed that the City has sufficient hydrant coverage and that model junctions that failed fire flow criteria were generally within 500 ft of a nearby hydrants. Overall, the City's fire flow capacity is adequate when fire hydrant coverage is considered as part of the analysis.

9.3.4 Evaluation of High-Service Distribution Pumping Capacities

The model demonstrated sufficient high-service distribution pumping capacities is expected to be available providing adequate flows and water system pressure under all model scenarios with the highest capacity pumps at each station not in use. Therefore, sufficient high-service distribution water pumping capacity is available for the future twenty-year planning horizon condition.

9.4 Evaluation of Water Treatment Capacities

Per Chapter 62-555 F.A.C., WTP capacity must equal or exceed the maximum day demand. As noted in **Table 9-1**, the maximum day demand is equal to approximately 8,629 gpm which equates to approximately 12 MGD. The City's total permitted water treatment capacity is approximately 16.0 MGD which is well above the maximum day demand of 12 MGD. A permitted water treatment capacity of 12 MGD minimum is required for the future twenty-year planning horizon condition.

9.4.1 Evaluation of Storage Capacities

Per Chapter 62-555 F.A.C., the system water storage capacity must be equal to or exceed 25% of the maximum daily flow with provisions for fire flow. The total system storage inclusive of all available water storage tanks is 7.5 million gallons. The maximum day demand is 22.2 MGD and therefore, 25% of the maximum day demand is 5.6 million gallons which is exceeded by the 7.5-million-gallon storage capacity. Therefore, the system storage capacity is sufficient for the future twenty-year planning horizon condition.

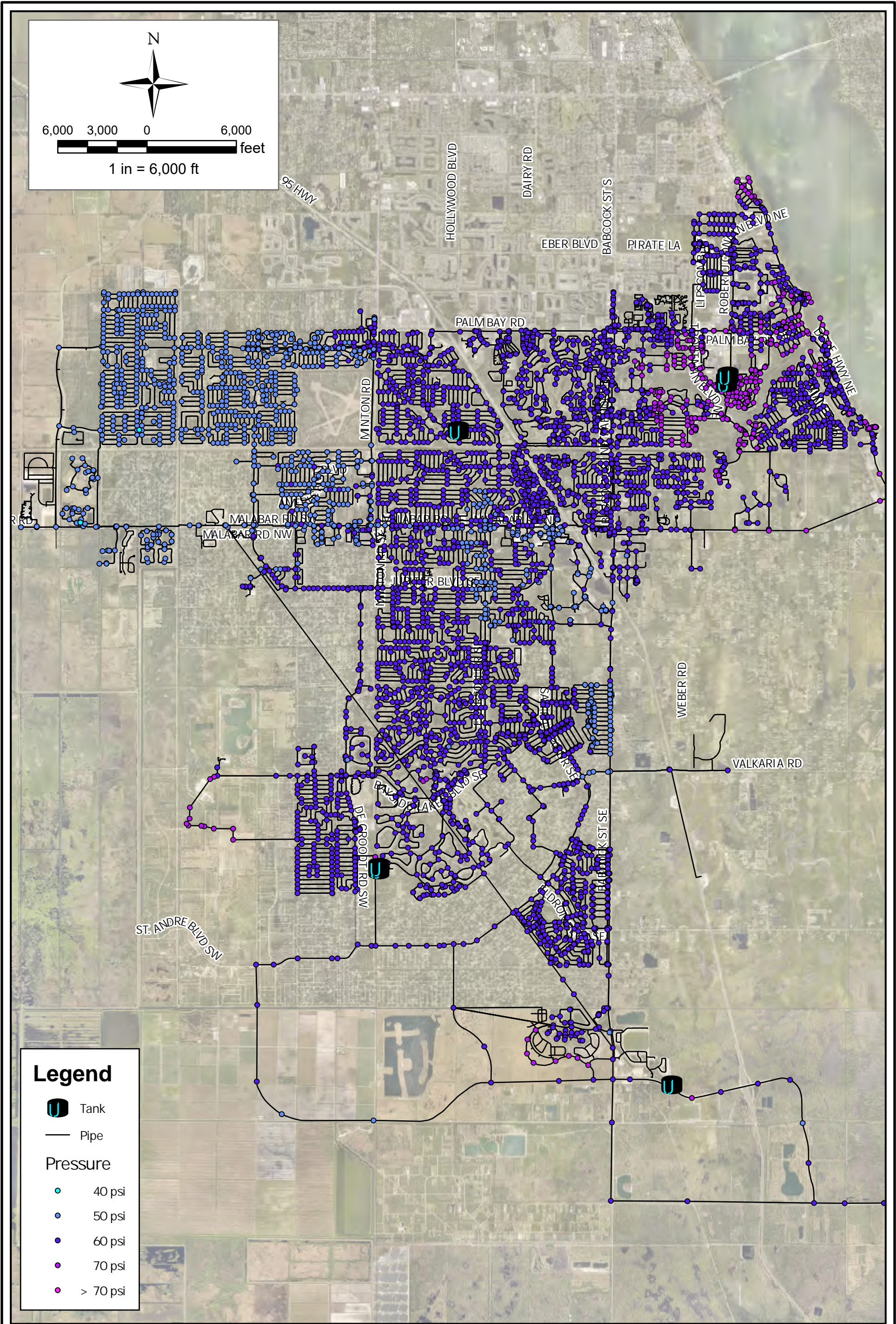
9.4.2 Extended Period Simulation

The EPS with logical controls as described in **Section 9.2.2** was evaluated for system performance through the course of one (1) 24-hour period. Analysis of the EPS results include system water pressures, high-service distribution pump flows, cumulative pump discharge volumes, and system tank storage. Review of the extended period simulation results indicates that the City's water distribution system operates as expected over the 24-hour simulation period.

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9.5 Capital Improvement Needs

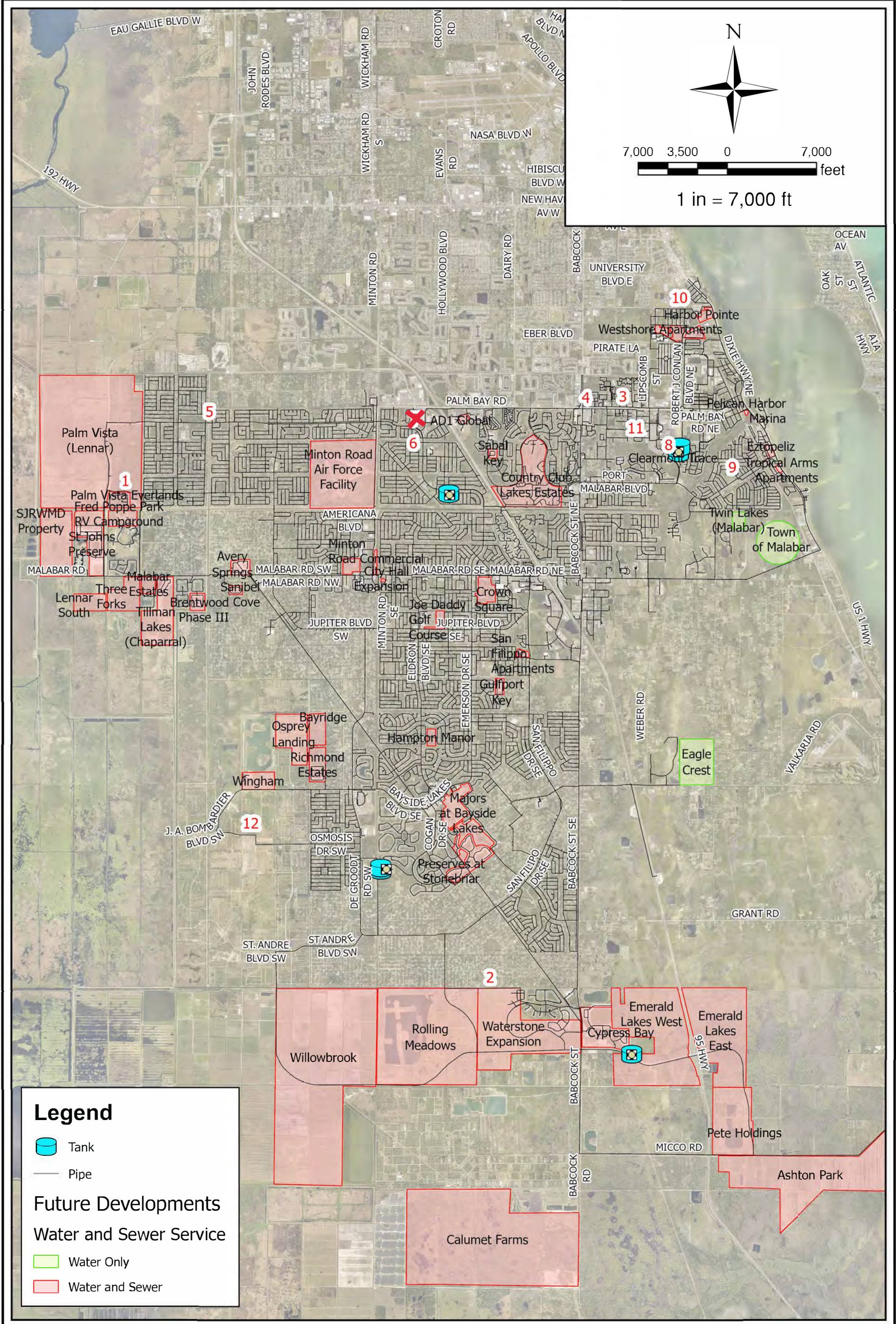
Capital improvement needs have been considered for the twenty-year planning horizon and are included in the twenty year hydraulic water system model. **Table 9-3** provides the anticipated water transmission/distribution system capital improvement needs for the twenty-year planning horizon water system improvements. See **Figure 9-4** for locations of proposed water transmission/distribution system capital improvement needs according to IDs shown in **Table 9-3**. Refer to **Appendix A** for details of each capital improvement need.

Table 9-3. Twenty-Year Water Transmission/Distribution System Capital Improvements Needs

Twenty-Year Capital Improvements Needs	CIP Project Type	WM Quantity (LF)
CIP No. 1: 8" WM Loop on Pace (Gillmar-St to Johns Heritage Pkwy)	8" WM	2,720
CIP No. 2: 12" WM Loop on Mara Loma Extended to Lowry Extended	12" WM	7,770
CIP No. 3: Replace 8" w/ 12" WM on Palm Bay Rd (Babcock St NE to Clearmont St NE)	12" WM	6,303
CIP No. 4: 12" WM Loop on Palm Bay Rd across Babcock	12" WM	262
CIP No. 5: Replace 8" WM w/ 16" WM on Emerson Dr (W of Medina Ave NE to W of Amador Ave NE)	16" WM	9,742
CIP No. 6: Replace 12" WM w/ 16" WM on Emerson (Nash Repump Station to W of Minton)	16" WM	9,910
CIP No. 7: NOT USED	NA	NA
CIP No. 8: Replace 20" WM w/ 24" WM Along Canal (NE of Clearmont to NRWTP)	24" WM	754
CIP No. 9: Replace 8" WM w/ 12" WM on Port Malabar Blvd (Daytona Dr NE to Bianca Dr NE)	12" WM	1,232
CIP No. 10: Replace 10" WM w/ 12" WM on Conlan/Northview/Florida/Kingswood (Palm Bay Rd-US-1)	12" WM	10,609
CIP No. 11: Replace 6" and 8" WM w/ 12" WM on Clearmont St NE (Franklin St NE-Palm Bay Rd NE)	12" WM	2,320
CIP No. 12: 12" WM Loop from JA Bombardier Blvd SW dead-end to Osmosis Dr SW /O'Connell Ave SW	12" WM	12,285
CIP No. 13: South Booster Station -- Second Phase	HS Pumping	NA
CIP No. 14: ACP WM Replacement in Holiday Park MHP	6", 8", and 12" WM	30,000
CIP No. 15: ACP WM Replacement adjacent to Glenbrooke Senior Living	6" and 12" WM	14,300
CIP No. 16: ACP WM Replacement within Vincent Kirby Industrial Park	12" WM	7,800
CIP No. 17: ACP WM Pipe Replacement near Lipscomb Park	6" WM	15,300

Note: Capital improvement needs relating to the renewal and replacement of the current assets of the water supply and water treatment plants can be found in **Section 10**. Capital improvement needs relating to the future needs of the water supply and water treatment plants can be found in **Section 11**.

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The following is a summary of the proposed water transmission/distribution system capital improvement needs including a general description of improvements and purpose for improvement.

- **CIP No. 1: 8" WM Loop on Pace (Gillmar Street to Johns Heritage Parkway):** The 8-inch water main loop provides redundancy to the proposed 16-inch line servicing the Palm Vista developments. This improvement is primarily required due to providing water service to the planned twenty-year Palm Vista demands.
- **CIP No. 2: 12" WM Loop on Mara Loma Extended to Lowry Extended:** The 12-inch water main will provide redundancy to the dead-end system servicing approximately 330 homes. This loop will improve fire protection, water quality, and provide another source of conveyance to service the proposed developments to the southeast.
- **CIP No. 3: Replace 8" w/ 12" WM on Palm Bay Road (Babcock Street NE to Clearmont Street NE):** The 12-inch water main replacement along Palm Bay Road will provide additional conveyance from the NRWTP to the system to the west. This improvement is required due to system-wide twenty-year demands.
- **CIP No. 4: 12" WM Loop on Palm Bay Road across Babcock St:** The 12-inch extension across Babcock St will provide additional conveyance from the NRWTP to the system to the west. This improvement is required due to system-wide twenty-year demands.
- **CIP No. 5: Replace 8" WM w/ 16" WM on Emerson Drive (W of Medina Avenue NE to W of Amador Avenue NE):** The 16-inch water main replacement on Emerson Drive will provide additional conveyance in the northern part of the city necessary for the increasing future water demands.
- **CIP No. 6: Replace 12" WM w/ 16" WM on Emerson Drive (Nash Repump Station to W of Minton):** The 16-inch water main replacement on Emerson Drive will provide additional conveyance in the northern part of the city necessary for the increasing future water demands.
- **CIP No. 7: NOT USED.**
- **CIP NO. 8: Replace 20" WM w/ 24" WM Along Canal (NE of Clearmont to NRWTP):** The existing 20-inch water main to be replaced with 24-inch pipe to provide adequate pipe velocities during peak demand conditions.
- **CIP No. 9: Replace 8" WM w/ 12" WM on Port Malabar Blvd (Daytona Drive NE to Bianca Drive NE):** The existing 8-inch water line along Port Malabar to be replaced with 12-inch pipe to improve conveyance toward US-1 and improve fire flow protection.

- **CIP No. 10: Replace 10" WM w/ 12" WM on Conlan/Northview/Florida/Kingswood (Palm Bay Road-US-1):** The existing 10-inch water main to be replaced with 12-inch pipe to improve conveyance and fire flow protection for the commercial and industrial areas in the northeast part of the city.
- **CIP No. 11: Replace 6" and 8" WM w/ 12" WM on Clearmont Street NE (Franklin St NE-Palm Bay Road NE)** The existing 6-inch and 8-inch water lines should be replaced with 12inch pipe to improve conveyance and fire flow protection to the west of the Troutman WTP.
- **CIP No. 12: 12" WM Loop from JA Bombardier Blvd SW dead-end to Osmosis Drive SW /O'Connel Avenue SW:** The 12-inch water main loop will eliminate a 1-mile dead-end line and increase fire flow capacity, provide system redundancy, and improve water quality.
- **CIP No. 13: South Booster Station -- Second Phase:** Increase the largest pump sizes at the northern and southern booster stations to provide required system pressures during peak periods of water use for the proposed developments in the southeast and northwest parts of the city.
- **CIP No. 14: ACP WM Replacement in Holiday Park MHP:** Ongoing replacement of undersized and ACP water lines.
- **CIP No. 15: ACP WM Replacement adjacent to Glenbrooke Senior Living:** Ongoing replacement of undersized and ACP water lines.
- **CIP No. 16: ACP WM Replacement within Vincent Kirby Industrial Park:** Ongoing replacement of undersized and ACP water lines.
- **CIP No. 17: ACP WM Pipe Replacement near Lipscomb Park:** Ongoing replacement of undersized and ACP water lines.

9.6 Observations and Recommendations

The future twenty-year planning horizon conditions of the City of Palm Bay's water distribution system were modeled and assessed using the City's future GIS water system data and the water modeling program WaterGEMS. Future system analysis included average day, maximum day (for fire flow analysis), and peak hour. Additionally, a 24-hour extended-period simulation was performed. Based on these water model simulations and results, the following observations and recommendations are provided for the City's consideration.

9.6.1 Observations

The following observations are based on the City of Palm Bay's future water system modeling results.

- Results for the average day, maximum day, and peak hour simulations show that the City's system can be generally maintained at a standard pressure range between 40 and 70 psi.
- Water demands expected at the twenty-year planning horizon were added to the distribution model which resulted in the need for additional high-service distribution pump operation within the model; therefore, the City will likely need to modify operation of their WTP and booster station high-service distribution pumps to accommodate anticipated water demand for the twenty-year planning horizon.
- **Table 9-3** provides a listing of recommended capital improvement needs for the twenty-year planning horizon. These improvement needs have been incorporated into the water model and provide benefits to the City's water system including "looped" distribution, upsized piping, and new distribution piping in areas of anticipated development.

9.6.2 Recommendations

The following recommendations are based on the City of Palm Bay's future water system modeling results and observations.

- The water distribution system recommendations for the twenty-year planning horizon include the capital improvements needs listed in **Table 9-3**.
- The City has indicated that Ashton Park may ultimately include significantly more ERCs than currently modeled; therefore, a separate level-of-service analysis has been prepared for Ashton Park including higher demands and provided to the City under separate cover. If Ashton Park is fully developed, then further water system analysis will be required and may require further system improvements to meet water demand from the Ashton Park development.

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Section 10 -Evaluation of Existing Water Treatment Facilities Needs

10.1 Introduction

Section 10 of the City of Palm Bay Water Master Plan evaluates the current condition of the existing water treatment facilities and identified needs for the renewal and replacement of these facilities including:

- North Regional Lime Softening Water Treatment Facility (NRWTP)
- North Regional Reverse Osmosis Water Treatment Facility (NRROWTP)
- South Regional Reverse Osmosis Water Treatment Facility (SRWTP)
- Aquifer Storage and Recovery Well (ASR)

10.2 Approach

A general listing of the major treatment processes and equipment within each WTP was developed with previous knowledge of the City's facilities along with a review of project reports, drawings, and specifications. These listings were 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.

The City has completed a planning-level evaluation being undertaken by Tetra Tech to restart the operation of the NRROWTP. As an extensive amount of engineering evaluation and analysis of those facilities has already been undertaken by others, physical evaluation of the NRROWTP has not been performed for this Work.

Furthermore, the SRWTP has recently completed a significant project to expand its capacity from 4.0 to 6.0 MGD. As a result, most of the infrastructure for this facility is either new or has been evaluated by the Engineer of Record for that project. Therefore, a physical evaluation of the SRWTP has not been performed for this work. Improvement needs at the SRWTP were based solely on infrastructure

approaching the end of its useful service life and was not addressed by the recently completed expansion project.

10.2.1 Sources of Data

Sources of specific facility information include the following:

General Information

- Water Master Plan, Wade Trim, July 2012
- SCADA Master Plan, Wade Trim, February 2015
- Water Master Plan, Wade Trim, October 2017

Water Supply Wells

- Consumptive Use Permit No. 202. St Johns River Water Management District , May 2010
- Well Condition Survey, Ardaman & Associates, October 2018
- Sanitary Survey Report, FDEP, Sept 2019
- Sanitary Survey Report, FDEP, Sept 2021

North Regional Lime Softening Water Treatment Facility

- Port Malabar Water Plant 3.0 MGD, General Development Utilities, Inc. July 1972
- Modifications of the Port Malabar Water Treatment Plant, CH2M Hill, February 1983
- Operations and Maintenance Manual Volume I Operations, CH2M Hill, December 1985
- Port Malabar Water Treatment Plant Expansion from 6.0 to 10.0 MGD, September 1988 (Record Drawings)
- Sodium Hypochlorite & Sulfuric Acid Chemical Injection Systems, Sinclair Engineering Company, April, 2009
- Troutman Lime Softening Water Treatment Plant Improvement Program, Wade Trim, July 2013
- Lime Slurry and Polymer Feed System, Wade Trim
- Filter Rehabilitation and Backwash Supply Piping Replacement, Wade Trim, Jan 2017
- Treatment Unit No. 2 Rehabilitation, Wade Trim, February 2017.
- 500,000 Gallon Ground Storage Tank Rehabilitation, Wade Trim, March 2017
- Treatment Unit No. 1 Rehabilitation, Wade Trim, May 2018
- Phase 3 Large Diameter Filter Piping Replacement, Wade Trim May 2018
- Sanitary Survey Report, FDEP, Sept 2019
- Rehabilitation Project, Wade Trim, July 2019
- Lime Slaking Silo Replacement, Wade Trim, Aug 2020
- Sanitary Survey Report, FDEP, Sept 2021
- Sodium Hypochlorite Upgrade, Odyssey Manufacturing Company, November 2021

North Regional Reverse Osmosis Water Treatment Facility

- Reverse Osmosis Water Treatment Plant, Masteller & Moler, Inc. Feb 1999
- North Regional Water Treatment Plant Upgrades Preliminary Design Investigations, Tetra Tech, October 2020

South Regional Reverse Osmosis Water Treatment Facility

- Preliminary Design Report, Hartman & Associates, Inc., March 2002

- South Regional Water Treatment Plant, Hartman & Associates, Inc., July 2004
- High Pressure & High-Service Pump VFD Replacement, Wade Trim, March 2017
- Sanitary Survey Report, FDEP, Sept 2018
- South Regional Water Treatment Plant Expansion 4 MGD to 6 MGD, Tetra Tech, November 2020
- Sanitary Survey Report, FDEP, Sept 2021

Aquifer Storage and Recovery Well

- Sanitary Survey Report, FDEP, Sept 2018
- Sanitary Survey Report, FDEP, Sept 2021

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 evaluate an asset's performance and expected replacement frequency most effectively. 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 | • Inability to perform designed duty |
| • Unusual noise, heat, or odor when operating | • Equipment nonfunctional or tagged-out |
| • Excessive vibration | • Safety issues |
| • Leaking packing glands | • Absence of leaks |
| • Evidence of wear | • 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 System

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 asset 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 has over time developed a range of typical renewal and replacement (R&R) intervals 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 (years)
Civil	Site Work	50
	Asphalt Paving	25
Structural	General	50
	Concrete	50
	Fiberglass	25
	Steel	25
	Plastic/Reinforced Plastic	10

	<i>Asset Type</i>	<i>Original Useful Service Life (years)</i>
	Coatings – High Performance	15
	Coatings – General	10
Mechanical	General	25
	Vertical Turbine Pump	30
	Centrifugal Pump	25
	Equipment Motors	15
	Valves	30 to 40
	Chemical Feed Equipment	10
	Chemical Feed Piping/Valves	15
	Yard Piping and Valves	50
	Switchgear and Motor Control Center	30
	Emergency Generator	30
	Variable Frequency Drives	20
Electrical	Elec Valve Actuators	30
	Sensors and Transmitters	15
Instrumentation	Automatic Sampler	20
	Flow Meters	30
	PLCs	10
Control Systems	SCADA	10
	Instrumentation	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 (OUL) minus the number of years the asset has been in service (calculated from the installation year). The RUL is calculated as follows:

$$\text{RUL} = \text{OUL} - \text{Years in Service (1)}$$

The calculator 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 Water Treatment Plant Facilities Condition Assessment

10.3.1 Water Supply Wells

In 2018, the City performed a detailed condition survey of the groundwater wells supplying the raw water for the NRWTP (Ardaman & Associates, 2018). The information contained within this report serves as the basis for identifying the general condition issues with the NRWTP surficial aquifer wells. Identification of further condition details, needs, and scoping of well rehabilitation or well replacement is beyond the scope of work of this analysis.

The following is a summary of the surficial aquifer water supply wells condition survey findings contained in the 2018 report.

- The following table presents the age of the surficial aquifer water supply wells as of 2018.

Table 10-3. Age of Surficial Aquifer Water Supply Wells

Well Age (as of 2018) ¹	Number of Wells
< 10 Yrs Old	0
Between 11 and 20 Yrs Old	0
Between 21 and 30 Yrs Old	13
Between 31 and 40 Yrs Old	10
Between 41 and 50 Yrs Old	11
> 50 Yrs Old	3
Total	37

¹Taken from Well Condition Survey, Table 3 Prepared by Ardaman & Associates, 2018.

- 64% of the NRWTP surficial aquifer water supply wells (24 of 37 wells) are older than the expected useful service life of thirty (30) years as of 2018.
- The NRWTP surficial aquifer water supply wells thirty (30) years old or less account for a total of 74% of the total annual pumped volume in 2017 or 1,937 MG.
- Surficial aquifer water supply greater than thirty (30) years old accounts for a total of 26% of the total annual volume pumped in 2017 or 695 MG.

- The changes in the static water levels (current minus original levels) for thirty-two (32) active surficial aquifer wells ranged from -18.45 to 6.50 feet below measuring point (bmp) and averaged -3.55 feet bmp.
- The changes in the pumping water levels (current minus original levels) could be determined for thirty-two (32) active surficial aquifer wells and ranged from -30.30 to 36.83 feet bmp and averaged 3.43 feet bmp.
- The change in pump rate (current minus design pump rate) for the surficial aquifer wells ranges between -85 and 204 gpm.
- Twenty-three (23) surficial aquifer wells had a decrease in specific capacity and nine (9) wells that had an increase in specific capacity. With 63% of the surficial aquifer wells experiencing a significant reduction of specific capacity of greater than 10%, the wells should be further analyzed and possibly considered for rehabilitation.
- The well condition survey shows that the older the wells are, the greater the likelihood that they experience a bacteriological problem. With aging comes the corrosion of the casing and fittings that may expose the well to bacteriological contaminants.
- The well condition survey shows that the older the wells are, the greater the likelihood that they experience a water quality problem. Pumping from a well for a longer period of time may lead to upconing of lower quality water from below the production zone possibly leading to an increase in chloride concentrations. With aging comes the corrosion of the casing from iron bacteria that may lead to higher iron concentrations in the water.
- The report identified nine (9) surficial aquifer wells with water production, bacteriological, and water quality problems including NRWTP Wells Nos. 10, 28, 3, 23, 49, 11, 24, 22, and 5, with two (2) of these wells having a reduction in both pump rate and specific capacity. These wells were identified as the highest priority for testing and rehabilitation.
- The report identified twelve (12) surficial aquifer wells with problems in two (2) categories including NRWTP Wells Nos.: 54, 51, 59, 30, 68, 9, 52, 20, 18, 12, 25, and 8, with the top five (5) of these wells having a reduction in both pump rate and specific capacity and the bottom four (4) having no water production problem. These wells should have a moderate priority for testing and rehabilitation.

- If surficial aquifer wells are to be replaced, consideration should be given to finding alternate well sites in the western portion of the well field where water quality appears to be better for both chloride and iron concentrations.

Based upon the overall condition issues with the surficial aquifer wells as described in the 2018 condition survey report, significant well rehabilitation or well replacement needs would have to be identified and related costs established for the continued use of the NRWTP surficial aquifer wells on a long-term basis.

Based upon the current condition of the NRWTP surficial aquifer water supply wells, the operational capacity of the well field is currently limited to about 4 MGD. The NRWTP has consistently been able to deliver up to approximately 4.0 MGD of treated water into the water distribution system on a max day condition over the past few years. For this reason, the NRWTP operational capacity will be limited to 4.0 MGD due to the limitations of the well field to deliver surficial aquifer groundwater to the WTP.

10.3.2 Treatment Facilities

In July 2013, the City completed the Troutman Lime Softening Water Treatment Plant Improvement Program Report (Wade Trim, 2013) which identified and prioritized a series of projects to maintain and extend the operational life of the facility. The City has been undertaking numerous upgrade projects as identified in this report including the following projects:

Table 10-4. North Regional Lime Softening WTP Upgrade Projects Since 2012

Project Title	Scope of Work	Year Completed
Phase 1 Large Diameter Filter Piping Replacement	<ul style="list-style-type: none"> • Replace Filter Influent Large Diameter Steel Piping • Replace Valves 	2015
Lime Slurry and Polymer Feed System Replacement	<ul style="list-style-type: none"> • Replace Polymer Feed System • Replace Lime Slurry Feed System • Replace Lime Slurry Canopy 	2017
Lime Softening Treatment Unit No. 2 Rehabilitation	<ul style="list-style-type: none"> • Replace Process Equipment • Replace Piping/Valves • Repair Concrete Structure • Recoat Concrete Structure • Replace Electrical, Instrumentation, and Controls 	2019

Project Title	Scope of Work	Year Completed
500K Ground Storage Tank Rehabilitation	<ul style="list-style-type: none"> • Repair Exterior and Interior Concrete Cracks / Spalls • Construct Roof Dome • Recoat Exterior and Interior Concrete Structure 	2018
Lime Softening Treatment Unit No. 1 Rehabilitation	<ul style="list-style-type: none"> • Replace Process Equipment • Replace Piping/Valves • Repair Concrete Structure • Recoat Concrete Structure • Replace Electrical, Instrumentation, and Controls 	2019
Phase 3 Large Diameter Filter Piping Replacement	<ul style="list-style-type: none"> • Replace Filter Filtrate and Drain Large Diameter Steel Piping • Replace Valves • Replace Pneumatic Air Piping • Replace Sample, Drain, and Hypochlorite Feed Piping • Replace Chlorine Analyzers, Turbidimeters, and Controls 	2020
Rehabilitation Project	<ul style="list-style-type: none"> • Replace Generator • Replace Seven High-Service Pumps • Replace Four Filter Transfer/Backwash Pumps 	2022
Lime Slaking Silo Replacement	<ul style="list-style-type: none"> • Replace Two Lime Silos and Related Components 	2023
Sodium Hypochlorite Chemical Feed System Upgrade	<ul style="list-style-type: none"> • Chemical Feed Building Modifications • Replace Sodium Hypochlorite Feed Metering Skids and Related Chemical Feed Piping 	2023
Lime Softening Treatment Unit No. 3 Rehabilitation	<ul style="list-style-type: none"> • Replace Process Equipment • Replace Piping/Valves • Repair Concrete Structure • Recoat Concrete Structure • Replace Electrical, Instrumentation, and Controls 	Under Design/Bidding

The completion of these projects greatly impacts 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 WTP infrastructure through the replacement of equipment approaching the end of it's useful service life.

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

Table 10-5. North Regional Lime Softening WTP Asset Condition Rating Summary

Unit Process	Average Useful Life Remaining (%)	General Condition Assessment	Equipment < 40% Remaining Useful Service Life
Solids Contact Clarifier No. 1	82%	1	<ul style="list-style-type: none"> None
Solids Contact Clarifier No. 2	87%	1	<ul style="list-style-type: none"> None
Solids Contact Clarifier No. 3	0%	5	<ul style="list-style-type: none"> All Equipment
Large Diameter Steel Piping and Valves	80%	1	<ul style="list-style-type: none"> None
Fiter Nos. 1, 2, 3 and F	75%	1	<ul style="list-style-type: none"> None
Clear Well	45%	2	<ul style="list-style-type: none"> Concrete Structure/Coatings
Backwash and Transfer Pumps Nos. 1,2,3,4	90%	1	<ul style="list-style-type: none"> None
Ground Storage Tank No. 1	76%	1	<ul style="list-style-type: none"> None
Ground Storage Tank No. 2	100%	1	<ul style="list-style-type: none"> None
High-Service Pumps Nos. 1 to 7	90%	1	<ul style="list-style-type: none"> None
Coagulant Feed System	10%	2 to 3	<ul style="list-style-type: none"> Chem Feed Pumps
Lime Feed System	54%	2	<ul style="list-style-type: none"> Lime Slurry Feed Pumps
Polymer Feed System	20%	2	<ul style="list-style-type: none"> Polymer Feed System
Acid Feed System	30%	2 to 3	<ul style="list-style-type: none"> Acid Feed Pumps
Phosphate Feed System	0%	2 to 3	<ul style="list-style-type: none"> Phosphate Feed System
Ammonia Feed System	44%	1	<ul style="list-style-type: none"> None
Fluoride Feed System	0%	5	<ul style="list-style-type: none"> Fluoride Feed System
Emergency Generator and Fuel System	85%	1	<ul style="list-style-type: none"> None
Electrical System	50%	2	<ul style="list-style-type: none"> Transfer Switch Motor Control Center No. 1 Motor Control Center No. 2
Control System	12%	2	<ul style="list-style-type: none"> HMIs PLCs
Water Treatment Plant Facilities	35%	2	<ul style="list-style-type: none"> Control Building HSP Building No. 1 Site Work Asphalt Paving

A more detailed Asset Condition Rating for all equipment can be found in **Section 10.6**.

As shown in the **Table 10-5**, 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 experienced 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 Future Needs

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

Five-Year Improvement Needs

- **CIP No. 28: NRWTP Backwash Ponds and Drying Beds Nos 2/3/4 Rehabilitation.** Work includes the following:
 - Backwash Ponds
 - Removal of settled sludge,
 - Regrading the side slopes,
 - installation of a HDPE liner
 - Drying Beds
 - Replacement of Isolation Gates
 - Cleaning, Repair, or Replacement of Underdrains Lines
- **CIP No. 29: NRWTP Rehabilitation, Electrical, and Control System Improvements.** Rehabilitate the NRWTP to include the following work:
 - Replace Lime Slurry Chemical Feed Pumps
 - Replace Acid Chemical Feed Pumps
 - Replace Transfer Switch, Motor Control Center No. 1, and Motor Control Center No. 2
 - Replace Main PLC and all four (4) Filter PLCs
 - Monitor the Condition of Clear Well Concrete and Make Repairs As Needed

Ten-Year Improvement Needs

- None

Twenty-Year Improvement Needs

- None

It should be noted, that the PBUD intends to gradually phase out the lime softening water treatment process at the NRWTP transitioning to a new RO facility. The improvement needs identified above should be viewed in light of the proposed plans. The higher cost needs (such as the electrical and control system improvements) could be deferred as needed if the planning and design phases for the new RO facility progress forward as expected.

10.4 North Regional Reverse Osmosis Water Treatment Plant Facilities Condition Assessment

10.4.1 Water Supply Wells

In 2018, the City performed a detailed condition survey of the groundwater wells supplying the raw water for the NRROWTP (Ardaman & Associates, 2018) The information contained within this report will serve as the basis for identifying the general condition issues with the Floridan aquifer wells. Identification of further condition details, needs, and scoping of well rehabilitation or well replacement is beyond the scope of work for this analysis.

The following is a summary of the Floridan aquifer water supply wells condition survey findings contained in the 2018 report.

- The North Regional RO wells are nineteen (19) years old, being constructed in 1999.
- The North Regional RO wells were identified as having water production problems. RO 1 exhibited a 54% change in specific capacity and RO 2 exhibited a 42% change in specific capacity.
- The North Regional RO 1 was identified as having water quality problems.
- None of the North Regional RO wells were identified as having bacteriological problems.
- The North Regional RO wells have experienced minimal use since the RO treatment system was shut down in 2009.

The 2018 report identified the need to further evaluate the water production and water quality issues with the NRROWTP Floridan aquifer groundwater supply wells before future or long-term dependence on the use of the well.

10.4.2 Treatment Plant

The City has not operated the NRROWTP system since 2009 due to high electrical costs, brine disposal issues, and excess water production capacity at the other facilities. The treatment plant assets would generally be considered unserviceable requiring replacement.

10.4.3 Future Needs

A Preliminary Design Investigation report prepared by Tetra Tech in 2022 recommended the complete replacement of the current treatment system, construction of multiple replacement Floridian production wells, and a deep injection well for brine disposal at a planning level cost of 22.9 million dollars (Tetra Tech, 2022). This project would restore 1.5 MGD of potable water production at the North Regional Utilities Campus site utilizing the existing infrastructure and would be the initial phase of additional reverse osmosis treatment.

Subsequently, in March 2024, Tetra Tech prepared a Master Plan report providing additional feasibility and conceptual project planning for the future construction of up to 10 MGD of reverse osmosis water treatment plant capacity with all related infrastructure on the North Regional Utilities Campus site (Tetra Tech, 2024) The report includes the following:

- 1) Preliminary design for 12.5 MGD of brackish wellfield to support the proposed NRROWTP project.
- 2) Site conceptual plan for up to 10.0 MGD of reverse osmosis water supply, production, and disposal capacity in three (3) phases on the North Regional Utilities Campus..
- 3) Preliminary reverse osmosis treatment system design and evaluation.
- 4) Conceptual plan for site stormwater needs
- 5) Conceptual plan for RO concentrate management
- 6) Conceptual plan for electrical and control system improvements needed to support 10 MGD future build-out conditions.

The City has determined the need and has taken early action to begin planning up to 10.0 MGD of reverse osmosis water supply, production, and disposal capacity in three (3) phases on the North Regional WTP campus to eventually retire the surficial aquifer groundwater supply, lime softening treatment, and residuals disposal facilities.

10.5 South Regional Reverses Osmosis Water Treatment Plant Facilities Condition Assessment

10.5.1 Water Supply Wells

In 2018, the City performed a detailed condition survey of the groundwater wells supplying the raw water for the NRWTP (Ardaman & Associates, 2018) The information contained within this report will serve as the basis for identifying the general condition issues with the Floridan aquifer wells. Identification of further condition details, needs, and scoping of well rehabilitation or well replacement is beyond the scope of work for this analysis.

The following is a summary of the Floridan aquifer water supply wells condition survey findings contained in the 2018 report.

- The three (3) original SRWTP RO wells are sixteen (16) years old, being constructed in 2002.
- The SRO 1 was identified as having water production problems with a 65% specific capacity change.
- None of the SRWTP RO wells were identified as having water quality or bacteriological problems.

The 2018 report recommended the need to determine whether the change in production is a result of the change of the potentiometric surface elevation, a change in specific capacity, pump wearing, or a combination of reasons.

10.5.2 Treatment Plant

In December 2023, the City completed a project to expand the capacity of the SRWTP from 4.0 MGD to 6.0 MGD. This project included several well field and treatment plant improvements as listed in the following table:

Table 10-6. South Regional WTP Expansion Project Improvements

Unit Process	Description
Water Supply Wells	<ul style="list-style-type: none">• One additional Floridan Aquifer supply well with pump/motor and related yard piping improvements
RO Pretreatment	<ul style="list-style-type: none">• Two additional RO pretreatment cartridge filter units
High Pressure Pumps	<ul style="list-style-type: none">• One new RO Feed High-Pressure Pump• Existing spare RO Feed High Pressure Pump installed as permanent use

Unit Process	Description
RO Treatment	<ul style="list-style-type: none"> • Replace membranes in existing two reverse osmosis treatment skids • Two new Reverse Osmosis treatment skids
RO Posttreatment	<ul style="list-style-type: none"> • One new blower for Degasification System • Addition of clean-in-place system for Degasification System
Chlorine Contact Chamber	<ul style="list-style-type: none"> • No Improvements
Transfer Pumps	<ul style="list-style-type: none"> • One new Finished Water Transfer Pump
Ground Storage Tanks	<ul style="list-style-type: none"> • One new 2.0 MG Finished Water Ground Storage Tank
High-Service Pumps	<ul style="list-style-type: none"> • Two new High-Service Pumps
Sulfuric Acid	<ul style="list-style-type: none"> • Inspection of Acid Bulk Storage Tank • Replacement Acid Chemical Feed Piping
Antiscalant	<ul style="list-style-type: none"> • No Improvements
Sodium Hypochlorite	<ul style="list-style-type: none"> • Replacement Hypochlorite Chemical Feed Piping
Ammonia	<ul style="list-style-type: none"> • No Improvements
Caustic Soda (Sodium Hydroxide)	<ul style="list-style-type: none"> • Inspection of Hydroxide Bulk Storage Tank • Two replacement Hydroxide Chemical Feed Pumps for pH Adjustment • One replacement Hydroxide Chemical Feed Pumps for Odor Control
Hydrofluorosilic Acid	<ul style="list-style-type: none"> • No Improvements
Phosphate Inhibitor	<ul style="list-style-type: none"> • No Improvements
Carbon Dioxide	<ul style="list-style-type: none"> • New Gaseous Carbon Dioxide Storage and Chemical Feed System
Concentrate Disposal	<ul style="list-style-type: none"> • No Improvements

The completion of this project greatly impacts the overall general condition of the facility as it not only increased the water production capacity but also addressed many specific equipment/component condition issues. Furthermore, the project decreased the service life of a large amount of critical WTP infrastructure through the replacement of equipment approaching the end of its useful service life.

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

Table 10-7. South Regional RO WTP Asset Condition Rating Summary

Unit Process	Average Useful Life Remaining (%)	General Condition Assessment	Equipment < 40% Remaining Useful Service Life
Ground Water Supply	47%	2	<ul style="list-style-type: none"> SRWTP Well Nos. 1/2/3 Well Pump and Motors
RO Pretreatment	49%	1	<ul style="list-style-type: none"> None
High-Pressure Pumps	67%	2	<ul style="list-style-type: none"> None
RO Treatment	83%	1	<ul style="list-style-type: none"> None
Degasification /Odor Control	47%	2	<ul style="list-style-type: none"> Blower/Motor, Degasification Tower and Odor Control
Chlorine Contact Chamber and Transfer Pumps	58%	1	<ul style="list-style-type: none"> Transfer Pumps/Motor Nos 1 and 3
Ground Storage Tanks	71%	1	<ul style="list-style-type: none"> None
High-Service Pumps	55%	1	<ul style="list-style-type: none"> HS Pumps/Motor Nos 1, 2,3, 4
Sulfuric Acid	21%	2 to 3	<ul style="list-style-type: none"> Bulk Storage Metering Pumps Chem Feed Piping
Antiscalant	21%	2 to 3	<ul style="list-style-type: none"> Bulk Storage Tanks Metering Pumps Chem Feed Piping
Sodium Hypochlorite	31%	2	<ul style="list-style-type: none"> Transfer Pumps Metering Pumps Chem Feed Piping
Ammonia	24%	2	<ul style="list-style-type: none"> Storage Tank Ammoniators
Caustic Soda (Sodium Hydroxide)	54%	1	<ul style="list-style-type: none"> Bulk Tank Day Tank Chem Feed Piping
Hydrofluorosilic Acid	24%	2	<ul style="list-style-type: none"> Day Tank Metering Pumps Chem Feed Piping
Phosphate Inhibitor	24%	2	<ul style="list-style-type: none"> Day Tank Metering Pumps Chem Feed Piping

Unit Process	Average Useful Life Remaining (%)	General Condition Assessment	Equipment < 40% Remaining Useful Service Life
Carbon Dioxide	96%	1	<ul style="list-style-type: none"> None
Concentrate Disposal	40%	1	<ul style="list-style-type: none"> Lined Holding Pond Air Compressor
In-Plant Lift Station	37%	2	<ul style="list-style-type: none"> Submersible Pumps
Emergency Generator and Fuel System	37%	1	<ul style="list-style-type: none"> Emergency Generator Fuel System
Electrical System	62%	1	<ul style="list-style-type: none"> Automatic Transfer Switch Main Breaker MCC No. 1 MCC No. 2 MCC No. 3 MCC No. 4
Control System	36%	2	<ul style="list-style-type: none"> Human Machine Interface I/O-4 Panel and PLC 4 I/O-5 Panel and PLC 5 I/O-6 Panel and PLC 6 I/O-7 Panel and PLC 7
Facilities	53%	1	<ul style="list-style-type: none"> Asphalt Paving

A more detailed Asset Condition Rating for all equipment can be found in **Section 10.6**.

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 five to ten years. This is particularly an issue with assets with a shorter useful service life (such as ten 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.

10.5.3 Future Needs

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

Five-Year Improvement Needs

- **CIP No. 27: SRWTP Rehabilitation.** Work includes the following:
 - Replace SRWTP RO Well Nos. 1, 2, and 3 Pump and Motors
 - Replace Caustic Bulk Storage Tank, Day Tank, Chemical Feed Pumps, and related Chem Feed Piping
 - Replace Acid Bulk Storage Tank, Day Tank, Chemical Feed Pumps, and related Chem Feed Piping
 - Replace Antiscalant Day Tank, Chemical Feed Pumps, and related Chem Feed Piping
 - Replace Phosphate Day Tank, Chemical Feed Pumps, and related Chem Feed Piping
 - Replace Fluoride Bulk Storage Tank, Day Tank, Chemical Feed Pumps, and related Chem Feed Piping
 - Replace Hypochlorite Bulk Storage Tank, Transfer Pumps, Day Tank, Chemical Feed Pumps, and related Chem Feed Piping
 - Replace Pond Liner
 - Replace In-Plant Lift Station Submersible Pumps
 - Replace Control System Components

Ten-Year Improvement Needs

- **CIP No. 22: SRWTP Rehabilitation and Electrical System Improvements.** Work includes the following:
 - Replace Blend and RO Cartridge Filters
 - Replace High Pressure RO Pump No. 1 and 2 Pump and Motor
 - Replace Degasifier Towers and Odor Control Scrubbers
 - Replace Transfer Pump No. 1 and 3 Pump/Motor
 - Replace High-Service Pump No. 3 and 4 Pump/Motor
 - Replace Deep Injection Well Pump/Motor
 - Replace Emergency Generator and Fuel System
 - Replace MCCs
 - Rehabilitate Paving

Twenty-Year Improvement Needs

- Rehabilitate Ground Storage Tank No. 1

10.6 Observations and Recommendations

The existing conditions of the current water treatment facilities have been assessed using an approach that assigned a condition rating to all the major components of each WTP. 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.

10.6.1 Observations

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

- The NRWTP surficial aquifer groundwater wells require significant well rehabilitation or well replacement for the continued use of these wells on a long-term basis.
- The reliable operation capacity of the NRWTP surficial aquifer groundwater wells is currently limited to about 4.0 MGD due to the limitations of the well field to deliver surficial aquifer groundwater to the NRWTP.
- The NRWTP has had a number of rehabilitation projects completed since 2015. The rehabilitation of Lime Softening Treatment Unit No. 3 is currently being advertised as of May 2024.
- The NRWTP Backwash Pond, Save All Pond, and Lime Drying Beds require rehabilitation. This is the last significant project identified in the 2013 Improvement Program to be completed.
- The asset condition rating and useful service life remaining analysis determined the following equipment at the NRWTP is approaching or is at the end of its useful service life: Lime Slurry Chemical Feed Hose Pumps, Acid Feed Pumps, Main Transfer Switch, MCC-1, MCC-2, Man Plant PLC, and Filter PLCs 1/2/3/4.
- The NRROWTP facility has not operated since 2009 due to high electrical costs, brine disposal issues, and excessive water production capacity provided by other facilities. The treatment plant assets are considered unserviceable and require replacement.

- The City has commenced the design investigation/feasibility and preliminary design for up to 10 MGD of reverse osmosis water treatment and disposal in three phases to be located at the North Regional Utilities Campus site
- In December 2023, the City completed a project to expand the SRWRT from 4.0 to 6.0 MGD which included significant improvements to the facility.
- However, a large amount of the existing infrastructure at the SRWTP will need to be replaced at the 5-year or 10-year planning horizon as they approach the end of their useful service life including multiple chemical feed systems, pumps/motors, emergency generators, and electrical motor control centers.

10.6.2 Recommendations

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

- Implement the CIPs identified in this Section to address the needs of the existing water treatment plant infrastructure.
- Continue the project planning and design efforts to construct the new reverse osmosis water treatment plant facilities at the North Regional Utilities campus site and begin the phased discontinuing use of the NRWTP lime softening water treatment facilities over the next 10 to 20 years. This work will decrease the reliance of the City to use the surficial aquifer groundwater as the water source for the potable water produced at the NRWTP.

10.7 Additional Information

The following presents the details of the condition assessment scoring for the North Regional Water Treatment Plant and the South Regional Water Treatment Plant.

PROCESS	LOCATION	EQUIPMENT	TYPE	CAPACITY	MOTOR SIZE (HP)	YEAR INSTALLED	ORIGINAL USEFUL LIFE (YRS)	YEARS IN SERVICE	RUL (YRS)	RUL (%)
SOFTENING	SOLIDS CONTACT CLARIFIER NO. 1	WALKWAY BRIDGE				2020	30	4	26	87%
SOFTENING	SOLIDS CONTACT CLARIFIER NO. 1	CASCADE TRAY AERATOR		3500 gpm		2020	30	4	26	87%
SOFTENING	SOLIDS CONTACT CLARIFIER NO. 1	CLARIFIER HOOD STRUCTURE				2020	30	4	26	87%
SOFTENING	SOLIDS CONTACT CLARIFIER NO. 1	DRAFT TUBES				2020	30	4	26	87%
SOFTENING	SOLIDS CONTACT CLARIFIER NO. 1	ROTOR IMPELLER, DRIVE, & MOTOR			10	2020	30	4	26	87%
SOFTENING	SOLIDS CONTACT CLARIFIER NO. 1	EFFLUENT RADIAL LAUNDERS				2020	30	4	26	87%
SOFTENING	SOLIDS CONTACT CLARIFIER NO. 1	RAW WATER FLOW CONTROL VALVE & PIPING				2020	30	4	26	87%
SOFTENING	SOLIDS CONTACT CLARIFIER NO. 1	SLUDGE BLOWDOWN VALVES				2020	30	4	26	87%
SOFTENING	SOLIDS CONTACT CLARIFIER NO. 1	FLUSHING CONTROL VALVE & PIPING				2020	30	4	26	87%
SOFTENING	SOLIDS CONTACT CLARIFIER NO. 1	CONCRETE STRUCTURE				2020	25	4	21	84%
SOFTENING	SOLIDS CONTACT CLARIFIER NO. 1	CONCRETE COATINGS				2020	10	4	6	60%
SOFTENING	SOLIDS CONTACT CLARIFIER NO. 1	CHEMICAL FEED LINES				2020	10	4	6	60%
SOFTENING	SOLIDS CONTACT CLARIFIER NO. 1	RW MAGNETIC FLOW METER				2020	30	4	26	87%
SOFTENING	SOLIDS CONTACT CLARIFIER NO. 2	WALKWAY BRIDGE				2021	30	3	27	90%
SOFTENING	SOLIDS CONTACT CLARIFIER NO. 2	CLARIFIER HOOD STRUCTURE				2021	30	3	27	90%
SOFTENING	SOLIDS CONTACT CLARIFIER NO. 2	DRAFT TUBES				2021	30	3	27	90%
SOFTENING	SOLIDS CONTACT CLARIFIER NO. 2	ROTOR IMPELLER, DRIVE, & MOTOR			10	2021	30	3	27	90%
SOFTENING	SOLIDS CONTACT CLARIFIER NO. 2	EFFLUENT RADIAL LAUNDERS				2021	30	3	27	90%
SOFTENING	SOLIDS CONTACT CLARIFIER NO. 2	RAW WATER FLOW CONTROL VALVE & PIPING				2021	30	3	27	90%
SOFTENING	SOLIDS CONTACT CLARIFIER NO. 2	SLUDGE BLOWDOWN VALVES				2021	30	3	27	90%
SOFTENING	SOLIDS CONTACT CLARIFIER NO. 2	FLUSHING CONTROL VALVE & PIPING				2021	30	3	27	90%
SOFTENING	SOLIDS CONTACT CLARIFIER NO. 2	CONCRETE STRUCTURE				2021	25	3	22	88%
SOFTENING	SOLIDS CONTACT CLARIFIER NO. 2	CONCRETE COATINGS				2021	10	3	7	70%
SOFTENING	SOLIDS CONTACT CLARIFIER NO. 2	CHEMICAL FEED LINES				2021	10	3	7	70%
SOFTENING	SOLIDS CONTACT CLARIFIER NO. 2	RW MAGNETIC FLOW METER				2021	30	3	27	90%
SOFTENING	SOLIDS CONTACT CLARIFIER NO. 3	WALKWAY BRIDGE				1987	30	37	-7	0%
SOFTENING	SOLIDS CONTACT CLARIFIER NO. 3	CLARIFIER HOOD STRUCTURE				1987	30	37	-7	0%
SOFTENING	SOLIDS CONTACT CLARIFIER NO. 3	DRAFT TUBES				1987	30	37	-7	0%
SOFTENING	SOLIDS CONTACT CLARIFIER NO. 3	ROTOR IMPELLER, DRIVE, & MOTOR			10	1987	30	37	-7	0%
SOFTENING	SOLIDS CONTACT CLARIFIER NO. 3	EFFLUENT RADIAL LAUNDERS				1987	30	37	-7	0%
SOFTENING	SOLIDS CONTACT CLARIFIER NO. 3	RAW WATER FLOW CONTROL VALVE & PIPING				1987	30	37	-7	0%
SOFTENING	SOLIDS CONTACT CLARIFIER NO. 3	SLUDGE BLOWDOWN VALVES				1987	30	37	-7	0%
SOFTENING	SOLIDS CONTACT CLARIFIER NO. 3	FLUSHING CONTROL VALVE & PIPING				1987	30	37	-7	0%
SOFTENING	SOLIDS CONTACT CLARIFIER NO. 3	CONCRETE STRUCTURE				1987	25	37	-12	0%
SOFTENING	SOLIDS CONTACT CLARIFIER NO. 3	CONCRETE COATINGS				1987	10	37	-27	0%
SOFTENING	SOLIDS CONTACT CLARIFIER NO. 3	CHEMICAL FEED LINES				1987	10	37	-27	0%
SOFTENING	SOLIDS CONTACT CLARIFIER NO. 3	RW MAGNETIC FLOW METER				1987	30	37	-7	0%

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PROCESS	LOCATION	EQUIPMENT	TYPE	CAPACITY	MOTOR SIZE (HP)	YEAR INSTALLED	ORIGINAL USEFUL LIFE (YRS)	YEARS IN SERVICE	RUL (YRS)	RUL (%)
FILTRATION	YARD PIPING	LARGE DIA STEEL PIPING & VALVES- CONTACT UNITS TO FILTERS				2015	30	9	21	70%
FILTRATION	YARD PIPING	LARGE DIA STEEL PIPING & VALVES - FILTER BACKWASH				2019	30	5	25	83%
FILTRATION	YARD PIPING	LARGE DIA STEEL PIPING & VALVES - FILTER EFF & DRAIN				2020	30	4	26	87%
FILTRATION	FILTER NO. 1	CONCRETE STRUCTURE				2019	25	5	20	80%
FILTRATION	FILTER NO. 1	CONCRETE COATINGS				2019	10	5	5	50%
FILTRATION	FILTER NO. 1	FILTER UNDER DRAINS				2019	25	5	20	80%
FILTRATION	FILTER NO. 1	FILTER MEDIA				2019	25	5	20	80%
FILTRATION	FILTER NO. 1	SURFACE WASH SWEEPS & PIPING				2019	25	5	20	80%
FILTRATION	FILTER NO. 1	FILTER WASH WATER TROUGHS				2019	25	5	20	80%
FILTRATION	FILTER NO. 2	CONCRETE STRUCTURE				2019	25	5	20	80%
FILTRATION	FILTER NO. 2	CONCRETE COATINGS				2019	10	5	5	50%
FILTRATION	FILTER NO. 2	FILTER UNDER DRAINS				2019	25	5	20	80%
FILTRATION	FILTER NO. 2	FILTER MEDIA				2019	25	5	20	80%
FILTRATION	FILTER NO. 2	SURFACE WASH SWEEPS & PIPING				2019	25	5	20	80%
FILTRATION	FILTER NO. 2	FILTER WASH WATER TROUGHS				2019	25	5	20	80%
FILTRATION	FILTER NO. 3	CONCRETE STRUCTURE				2019	25	5	20	80%
FILTRATION	FILTER NO. 3	CONCRETE COATINGS				2019	10	5	5	50%
FILTRATION	FILTER NO. 3	FILTER UNDER DRAINS				2019	25	5	20	80%
FILTRATION	FILTER NO. 3	FILTER MEDIA				2019	25	5	20	80%
FILTRATION	FILTER NO. 3	SURFACE WASH SWEEPS & PIPING				2019	25	5	20	80%
FILTRATION	FILTER NO. 3	FILTER WASH WATER TROUGHS				2019	25	5	20	80%
FILTRATION	FILTER NO. 4	CONCRETE STRUCTURE				2019	25	5	20	80%
FILTRATION	FILTER NO. 4	CONCRETE COATINGS				2019	10	5	5	50%
FILTRATION	FILTER NO. 4	FILTER UNDER DRAINS				2019	25	5	20	80%
FILTRATION	FILTER NO. 4	FILTER MEDIA				2019	25	5	20	80%
FILTRATION	FILTER NO. 4	SURFACE WASH SWEEPS & PIPING				2019	25	5	20	80%
FILTRATION	FILTER NO. 4	FILTER WASH WATER TROUGHS				2019	25	5	20	80%
FILTRATION	BACKWASH & TRANSFER PUMP ROOM	SURFACE WASH BOOSTER PUMP				2019	25	5	20	80%
PROCESS	LOCATION	EQUIPMENT	TYPE	CAPACITY	MOTOR SIZE (HP)	YEAR INSTALLED	ORIGINAL USEFUL LIFE (YRS)	YEARS IN SERVICE	RUL (YRS)	RUL (%)
CLEAR WELL	CLEAR WELL	CONCRETE STRUCTURE				1973	50	51	-1	0%
CLEAR WELL	CLEAR WELL	ACCESS HATCH				2021	25	3	22	88%
CLEAR WELL	BACKWASH & TRANSFER PUMP ROOM	BACKWASH & TRANSFER PUMP NO. 1	Vertical Turbine	3,720 gpm @ 40 ft TDH	60	2021	30	3	27	90%
CLEAR WELL	BACKWASH & TRANSFER PUMP ROOM	BACKWASH & TRANSFER PUMP NO. 2	Vertical Turbine	3,720 gpm @ 40 ft TDH	60	2021	30	3	27	90%
CLEAR WELL	BACKWASH & TRANSFER PUMP ROOM	BACKWASH & TRANSFER PUMP NO. 3	Vertical Turbine	3,720 gpm @ 40 ft TDH	60	2021	30	3	27	90%
CLEAR WELL	BACKWASH & TRANSFER PUMP ROOM	BACKWASH & TRANSFER PUMP NO. 4	Vertical Turbine	3,720 gpm @ 40 ft TDH	60	2021	30	3	27	90%
STORAGE	GROUND STORAGE TANK NO. 1	GROUND STORAGE TANK NO. 1		500,000 gal		2018	25	6	19	76%
STORAGE	GROUND STORAGE TANK NO. 2	GROUND STORAGE TANK NO. 2		1,000,000 gal		2024	25	0	25	100%
HSP	HSP BUILDING NO. 1 SOUTH	HIGH SERVICE PUMP NO. 1	Split Case Centrifugal	500 gpm @ 175 ft TDH	50	2021	30	3	27	90%
HSP	HSP BUILDING NO. 1 SOUTH	HIGH SERVICE PUMP NO. 2	Split Case Centrifugal	900 gpm @ 175 ft TDH	60	2021	30	3	27	90%
HSP	HSP BUILDING NO. 1 SOUTH	HIGH SERVICE PUMP NO. 3	Split Case Centrifugal	900 gpm @ 175 ft TDH	60	2021	30	3	27	90%
HSP	HSP BUILDING NO. 2 NORTH	HIGH SERVICE PUMP NO. 4	Split Case Centrifugal	1,700 gpm @ 185 ft TDH	100	2021	30	3	27	90%
HSP	HSP BUILDING NO. 2 NORTH	HIGH SERVICE PUMP NO. 5	Split Case Centrifugal	1,700 gpm @ 185 ft TDH	100	2021	30	3	27	90%
HSP	HSP BUILDING NO. 2 NORTH	HIGH SERVICE PUMP NO. 6	Split Case Centrifugal	1,700 gpm @ 185 ft TDH	100	2021	30	3	27	90%
HSP	HSP BUILDING NO. 2 NORTH	HIGH SERVICE PUMP NO. 7	Split Case Centrifugal	1,700 gpm @ 185 ft TDH	100	2021	30	3	27	90%

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PROCESS	LOCATION	EQUIPMENT	TYPE	CAPACITY	MOTOR SIZE (HP)	YEAR INSTALLED	ORIGINAL USEFUL LIFE (YRS)	YEARS IN SERVICE	RUL (YRS)	RUL (%)
COAGULANT	COAGULANT FEED AREA	COAGULANT CHEMICAL FEED PUMPS				2015	10	9	1	10%
LIME FEED	LIME SILO NO. 1	LIME SILO NO. 1				2022	25	2	23	92%
LIME FEED	LIME SILO NO. 1	LIME SLAKER NO. 1				2014	25	10	15	60%
LIME FEED	LIME SILO NO. 2	LIME SILO NO. 2				2022	25	2	23	92%
LIME FEED	LIME SILO NO. 2	LIME SLAKER NO. 2				2014	25	10	15	60%
LIME FEED	LIME SLURRY AREA	LIME SLURRY TANK				2016	25	8	17	68%
LIME FEED	LIME SLURRY AREA	LIME SLURRY PUMP NO. 1				2016	10	8	2	20%
LIME FEED	LIME SLURRY AREA	LIME SLURRY PUMP NO. 2				2016	10	8	2	20%
LIME FEED	LIME SLURRY AREA	LIME SLURRY PUMP NO. 3				2016	10	8	2	20%
POLYMER FEED	POLYMER FEED AREA	NEAT POLYMER FEED PUMP				2016	10	8	2	20%
POLYMER FEED	POLYMER FEED AREA	POLYMER FEED MAKE-UP UNIT				2016	10	8	2	20%
POLYMER FEED	POLYMER FEED AREA	POLYMER FEED BATCH TANK				2016	10	8	2	20%
POLYMER FEED	POLYMER FEED AREA	POLYMER FEED BATCH TANK MIXER				2016	10	8	2	20%
POLYMER FEED	POLYMER FEED AREA	POLYMER FEED METERING PUMP SKID				2016	10	8	2	20%
ACID FEED	ACID BULK TANK AREA	ACID BULK TANK NO. 1				2009	25	15	10	40%
ACID FEED	ACID BULK TANK AREA	ACID BULK TANK NO. 2				2009	25	15	10	40%
ACID FEED	ACID BULK TANK AREA	ACID BULK TANK CONTAINMENT AREA & COATINGS				2009	25	15	10	40%
ACID FEED	ACID FEED AREA	ACID FEED METERING PUMP SKID				2009	10	15	-5	0%
PHOSPHATE FEED	PHOSPHATE FEED AREA	PHOSPHATE FEED SOLUTION TANK				2014	10	10	0	0%
PHOSPHATE FEED	PHOSPHATE FEED AREA	PHOSPHATE FEED METERING PUMP SKID				2014	10	10	0	0%
HYPO FEED	HYPO FEED AREA	HYPOCHLORITE BULK STORAGE TANK NO. 1				2009	25	15	10	40%
HYPO FEED	HYPO FEED AREA	HYPOCHLORITE BULK STORAGE TANK NO. 2				2009	25	15	10	40%
HYPO FEED	HYPO FEED AREA	HYPOCHLORITE BULK STORAGE TANK NO. 3				2009	25	15	10	40%
HYPO FEED	HYPO FEED AREA	HYPOCHLORITE FEED METERING PUMP SKID				2023	10	1	9	90%
AMMONIA FEED	AMMONIA FEED AREA	AMMONIA BULK STORAGE TANK				2010	25	14	11	44%
AMMONIA FEED	AMMONIA FEED AREA	AMMONIATOR NO. 1				2010	25	14	11	44%
AMMONIA FEED	AMMONIA FEED AREA	AMMONIATOR NO. 2				2010	25	14	11	44%
FLUORIDE FEED	FLUORIDE FEED AREA	HYDROFLUOSILIC ACID BULK STORAGE TANK				NOT IN USE				
FLUORIDE FEED	FLUORIDE FEED AREA	HYDROFLUOSILIC ACID DAY TANK				NOT IN USE				
FLUORIDE FEED	FLUORIDE FEED AREA	HYDROFLUOSILIC ACID FRRF METERING PUMP SKID				NOT IN USE				
PROCESS	LOCATION	EQUIPMENT	TYPE	CAPACITY	MOTOR SIZE (HP)	YEAR INSTALLED	ORIGINAL USEFUL LIFE (YRS)	YEARS IN SERVICE	RUL (YRS)	RUL (%)
ELECTRICAL	GENERATOR BUILDING	EMERGENCY GENERATOR				2021	20	3	17	85%
ELECTRICAL	GENERATOR BUILDING	GENERATOR DIESEL FUEL SYSTEM				2021	20	3	17	85%
ELECTRICAL	WTP CONTROL BUILDING	TRANSFER SWITCH				1985	20	39	-19	0%
ELECTRICAL	HSP BUILDING NO. 2 NORTH	TRANSFER SWITCH				1985	20	39	-19	0%
ELECTRICAL	WTP CONTROL BUILDING	MCC-1				1985	20	39	-19	0%
ELECTRICAL	HSP BUILDING NO. 2 NORTH	MCC-2				1985	20	39	-19	0%
ELECTRICAL	HSP BUILDING NO. 1 SOUTH	MCC-3				2021	20	3	17	85%
ELECTRICAL	ELECTRICAL ROOM	HIGH SERVICE PUMP NO. 6 VFD				2021	20	3	17	85%
ELECTRICAL	ELECTRICAL ROOM	BACKWASH & TRANSFER PUMP NO. 2 VFD				2021	20	3	17	85%
ELECTRICAL	ELECTRICAL ROOM	BACKWASH & TRANSFER PUMP NO. 3 VFD				2021	20	3	17	85%

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PROCESS	LOCATION	EQUIPMENT	TYPE	CAPACITY	MOTOR SIZE (HP)	YEAR INSTALLED	ORIGINAL USEFUL LIFE (YRS)	YEARS IN SERVICE	RUL (YRS)	RUL (%)
CONTROLS	WTP CONTROL BUILDING	LAB ROOM HMI				2012	10	12	-2	0%
CONTROLS	WTP CONTROL BUILDING	CONTROL PANEL HMI				2012	10	12	-2	0%
CONTROLS	WTP CONTROL BUILDING	RO WTP HMI				2012	10	12	-2	0%
CONTROLS	WTP CONTROL BUILDING	MAIN CONTROL PANEL				2012	10	12	-2	0%
CONTROLS	WTP CONTROL BUILDING	MAIN PLC				2012	10	12	-2	0%
CONTROLS	WTP CONTROL BUILDING	PLC FILTER NO. 1				2012	10	12	-2	0%
CONTROLS	WTP CONTROL BUILDING	PLC FILTER NO. 2				2012	10	12	-2	0%
CONTROLS	WTP CONTROL BUILDING	PLC FILTER NO. 3				2012	10	12	-2	0%
CONTROLS	WTP CONTROL BUILDING	PLC FILTER NO. 4				2012	10	12	-2	0%
CONTROLS	WTP CONTROL BUILDING	FREE CHLORINE ANALYZER				2019	15	5	10	67%
CONTROLS	WTP CONTROL BUILDING	TURBIDMETER				2019	15	5	10	67%
PROCESS	LOCATION	EQUIPMENT	TYPE	CAPACITY	MOTOR SIZE (HP)	YEAR INSTALLED	ORIGINAL USEFUL LIFE (YRS)	YEARS IN SERVICE	RUL (YRS)	RUL (%)
FACILITIES	WTP CONTROL BUILDING					1973	50	51	-1	0%
FACILITIES	HSP BUILDING NO. 1 SOUTH					1973	50	51	-1	0%
FACILITIES	HSP BUILDING NO. 2 NORTH					1985	50	39	11	22%
FACILITIES	GENERATOR BUILDING					2021	50	3	47	94%
FACILITIES	ELEVATED WALKWAYS	ELEVATED WALKWAYS				2019	30	5	25	83%
FACILITIES	SITE WORK					1973	50	51	-1	0%
FACILITIES	ASPHALT PAVING					1973	25	51	-26	0%
FACILITIES	HYPOCHLORITE FEED AREA	HYPOCHLORITE CANOPY				2009	25	15	10	40%
FACILITIES	LIME SLURRY AREA	LIME SLURRY CANOPY				2016	25	8	17	68%

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PROCESS	LOCATION	EQUIPMENT	TYPE	CAPACITY	MOTOR SIZE (HP)	YEAR INSTALLED	ORIGINAL USEFUL LIFE (YRS)	YEARS IN SERVICE	RUL (YRS)	RUL (%)
GW Supply	SRO-1	Well Casing				2005	50	19	31	62%
GW Supply	SRO-1	Well Head Components/Valves/Meter/Pipe Header				2005	35	19	16	46%
GW Supply	SRO-1	Well Pump and Motor (WP-101)	Vertical Turbine	1750 gpm	100	2005	25	19	6	24%
GW Supply	SRO-2	Well Casing				2005	50	19	31	62%
GW Supply	SRO-2	Well Head Components/Valves/Meter/Pipe Header				2005	35	19	16	46%
GW Supply	SRO-2	Well Pump and Motor (WP-102)	Vertical Turbine	1750 gpm at 140 ft TDH	100	2005	25	19	6	24%
GW Supply	SRO-3	Well Casing				2005	50	19	31	62%
GW Supply	SRO-3	Well Head Components/Valves/Meter/Pipe Header				2005	35	19	16	46%
GW Supply	SRO-3	Well Pump and Motor (WP-103)	Vertical Turbine	1750 gpm at 140 ft TDH	100	2005	25	19	6	24%
GW Supply	SRO-4	Well Casing				2023	50	1	49	98%
GW Supply	SRO-4	Well Head Components/Valves/Meter/Pipe Header				2023	35	1	34	97%
GW Supply	SRO-4	Well Pump and Motor (WP-104)	Vertical Turbine	1750 gpm at 140 ft TDH	100	2023	25	1	24	96%
PROCESS	LOCATION	EQUIPMENT	TYPE	CAPACITY	MOTOR SIZE (HP)	YEAR INSTALLED	ORIGINAL USEFUL LIFE (YRS)	YEARS IN SERVICE	RUL (YRS)	RUL (%)
Pretreatment	Micron Filter Area	Blend Cartridge Filter (MF-0401)		1736 gpm		2005	30	19	11	37%
Pretreatment	Micron Filter Area	Blend Cartridge Filter (MF-0402)		1736 gpm		2005	30	19	11	37%
Pretreatment	Micron Filter Area	RO Pretreatment Cartridge Filter (MF-0501)		1736 gpm		2005	30	19	11	37%
Pretreatment	Micron Filter Area	RO Pretreatment Cartridge Filter (MF-0502)		1736 gpm		2005	30	19	11	37%
Pretreatment	Micron Filter Area	RO Pretreatment Cartridge Filter (MF-0503)		1736 gpm		2005	30	19	11	37%
Pretreatment	Micron Filter Area	RO Pretreatment Cartridge Filter (MF-0504)		1736 gpm		2023	30	1	29	97%
Pretreatment	Micron Filter Area	RO Pretreatment Cartridge Filter (MF-0505)		1736 gpm		2023	30	1	29	97%
Pretreatment	Micron Filter Area	30" Pretreatment to RO Header (30-PTRW-SST)				2005	30	19	11	37%
PROCESS	LOCATION	EQUIPMENT	TYPE	CAPACITY	MOTOR SIZE (HP)	YEAR INSTALLED	ORIGINAL USEFUL LIFE (YRS)	YEARS IN SERVICE	RUL (YRS)	RUL (%)
RO Process	Pump Room	High Pressure RO Feed Pump/Motor (HPP-0601)	Vertical Turbine	1750 gpm @ 530 ft TDH	300	2005	30	19	11	37%
RO Process	Pump Room	High Pressure RO Feed Pump/Motor (HPP-0602)	Vertical Turbine	1750 gpm @ 530 ft TDH	300	2005	30	19	11	37%
RO Process	Pump Room	High Pressure RO Feed Pump/Motor (HPP-0603)	Vertical Turbine	1750 gpm @ 530 ft TDH	300	2023	30	1	29	97%
RO Process	Pump Room	High Pressure RO Feed Pump/Motor (HPP-0604)	Vertical Turbine	1750 gpm @ 530 ft TDH	300	2023	30	1	29	97%
PROCESS	LOCATION	EQUIPMENT	TYPE	CAPACITY	MOTOR SIZE (HP)	YEAR INSTALLED	ORIGINAL USEFUL LIFE (YRS)	YEARS IN SERVICE	RUL (YRS)	RUL (%)
RO Process	RO Skid Room	RO Skid No. 1		1.75 MGD		2023	20	1	19	95%
RO Process	RO Skid Room	RO Skid No. 2		1.75 MGD		2023	20	1	19	95%
RO Process	RO Skid Room	RO Skid No. 3		1.75 MGD		2023	20	1	19	95%
RO Process	RO Skid Room	RO Skid No. 4		1.75 MGD		2023	20	1	19	95%
RO Process	RO Skid Room	24" Perm Header				2005	30	19	11	37%
PROCESS	LOCATION	EQUIPMENT	TYPE	CAPACITY	MOTOR SIZE (HP)	YEAR INSTALLED	ORIGINAL USEFUL LIFE (YRS)	YEARS IN SERVICE	RUL (YRS)	RUL (%)
Degas	Blower Room	Blower/Motor (08-BL-01)	Centrifugal		40	2005	30	19	11	37%
Degas	Blower Room	Blower/Motor (08-BL-03)	Centrifugal		40	2005	30	19	11	37%
Degas	Blower Room	Blower/Motor (08-BL-02)	Centrifugal		40	2023	30	1	29	97%
Degas	Degasifier/Odor Control	42" Air Duct to Degasifier	FRP			2005	30	19	11	37%
Degas	Degasifier/Odor Control	Degasifier Tower (DGS-0801)				2005	30	19	11	37%
Degas	Degasifier/Odor Control	Degasifier Tower (DGS-0802)				2005	30	19	11	37%
Degas	Degasifier/Odor Control	42" Air Duct from Degasifier to Odor Control	FRP			2005	30	19	11	37%
Odor	Degasifier/Odor Control	Stage 1 Odor Control Scrubber (SCR-0801)				2005	30	19	11	37%
Odor	Degasifier/Odor Control	Stage 2 Odor Control Scrubber (SCR-0802)				2005	30	19	11	37%
Odor	Degasifier/Odor Control	Recirculation Pump (RCP-0801)			10	2005	30	19	11	37%
Odor	Degasifier/Odor Control	Recirculation Pump (RCP-0802)			10	2005	30	19	11	37%
Odor	Degasifier/Odor Control	Recirculation Pump (RCP-0803)			10	2005	30	19	11	37%
Odor	Degasifier/Odor Control	Cleaning Pump (08-PMP-04)				2023	30	1	29	97%
Odor	Degasifier/Odor Control	Blower Room				2005	50	19	31	62%
PROCESS	LOCATION	EQUIPMENT	TYPE	CAPACITY	MOTOR SIZE (HP)	YEAR INSTALLED	ORIGINAL USEFUL LIFE (YRS)	YEARS IN SERVICE	RUL (YRS)	RUL (%)
Disinfection	Chlorine Contact Chamber	Chlorine Contact Chamber				2005	50	19	31	62%
Disinfection	Chlorine Contact Chamber	Transfer Pump/Motor (TP-1)	Vertical Turbine	3475 gpm	50	2005	30	19	11	37%
Disinfection	Chlorine Contact Chamber	Transfer Pump/Motor (TP-2)	Vertical Turbine	3475 gpm	50	2023	30	1	29	97%
Disinfection	Chlorine Contact Chamber	Transfer Pump/Motor (TP-3)	Vertical Turbine	3475 gpm	50	2005	30	19	11	37%

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PROCESS	LOCATION	EQUIPMENT	TYPE	CAPACITY	MOTOR SIZE (HP)	YEAR INSTALLED	ORIGINAL USEFUL LIFE (YRS)	YEARS IN SERVICE	RUL (YRS)	RUL (%)
Finished Water	Yard Piping	30" WM to GST				2005	50	19	31	62%
Finished Water	Ground Storage Tank	Ground Storage Tank				2005	50	19	31	62%
Finished Water	Ground Storage Tank	Ground Storage Tank				2023	50	1	49	98%
Finished Water	Yard Piping	30/36" WM GST to HSP				2005	50	19	31	62%
PROCESS	LOCATION	EQUIPMENT	TYPE	CAPACITY	MOTOR SIZE (HP)	YEAR INSTALLED	ORIGINAL USEFUL LIFE (YRS)	YEARS IN SERVICE	RUL (YRS)	RUL (%)
HSP	Pump Room	High Service Pump/Motor (HSP1301)	Vertical Turbine	1111 gpm	60	2005	30	19	11	37%
HSP	Pump Room	High Service Pump/Motor (HSP1302)	Vertical Turbine	1111 gpm	60	2005	30	19	11	37%
HSP	Pump Room	High Service Pump/Motor (HSP1303)	Vertical Turbine	2222 gpm	125	2005	30	19	11	37%
HSP	Pump Room	High Service Pump/Motor (HSP1304)	Vertical Turbine	2222 gpm	125	2005	30	19	11	37%
HSP	Pump Room	High Service Pum/Motor (HSP1305)	Vertical Turbine	2222 gpm	125	2023	30	1	29	97%
HSP	Pump Room	High Service Pump/Motor (HSP1306)	Vertical Turbine	2222 gpm	125	2023	30	1	29	97%
HSP	Yard Piping	Finished Water Venturi Meter				2005	30	19	11	37%
Finished Water	Yard Piping	30" WM to System				2005	50	19	31	62%
PROCESS	LOCATION	EQUIPMENT	TYPE	CAPACITY	MOTOR SIZE (HP)	YEAR INSTALLED	ORIGINAL USEFUL LIFE (YRS)	YEARS IN SERVICE	RUL (YRS)	RUL (%)
CO2	Carbon Dioxide Chem Feed System	Carbon Dioxide Storage Tank				2023	25	1	24	96%
CO2	Carbon Dioxide Chem Feed System	Carrier Water Booster Pumps (21-PMP-34)	Vertical In-Line Centrifugal Pump	120 gpm	10	2023	25	1	24	96%
CO2	Carbon Dioxide Chem Feed System	Carbon Dioxide Pressurized Solution Feed Panel No 2 (21-PSF-22)				2023	25	1	24	96%
CO2	Carbon Dioxide Chem Feed System	Carbon Dioxide Master Control Panel				2023	25	1	24	96%
CO2	Carbon Dioxide Chem Feed System	Carbon Dioxide Chem Feed Piping and Injection Point				2023	25	1	24	96%
PROCESS	LOCATION	EQUIPMENT	TYPE	CAPACITY	MOTOR SIZE (HP)	YEAR INSTALLED	ORIGINAL USEFUL LIFE (YRS)	YEARS IN SERVICE	RUL (YRS)	RUL (%)
Caustic	Hydroxide Chem Feed System	Hydroxide Bulk Storage Tank (BST-2001)				2005	25	19	6	24%
Caustic	Hydroxide Chem Feed System	Hydroxide Bulk Storage Tank Containment Area				2005	25	19	6	24%
Caustic	Hydroxide Chem Feed System	Hydroxide Day Tank (DT-2002)				2005	25	19	6	24%
Caustic	Hydroxide Chem Feed System	Hydroxide Chem Feed Pump/Motor-Stage 1 Scrubber (20-CFP-01)	Solenoid Diaphragm	12 gph	0.5	2023	10	1	9	90%
Caustic	Hydroxide Chem Feed System	Hydroxide Chem Feed Pump/Motor-Stage 2 Scrubber (20-CFP-02)	Solenoid Diaphragm		0.5	2005	10	19	-9	0%
Caustic	Hydroxide Chem Feed System	Hydroxide Chem Feed Pump/Motor-Caustic Feed (20-CFP-03)	Hydraulic Actuated Diaphragm	15 gph	0.5	2023	10	1	9	90%
Caustic	Hydroxide Chem Feed System	Hydroxide Chem Feed Pump/Motor-Caustic Feed (20-CFP-04)	Hydraulic Actuated Diaphragm	15 gph	0.5	2023	10	1	9	90%
Caustic	Hydroxide Chem Feed System	Hydroxide Chem Feed Piping				2023	10	1	9	90%
PROCESS	LOCATION	EQUIPMENT	TYPE	CAPACITY	MOTOR SIZE (HP)	YEAR INSTALLED	ORIGINAL USEFUL LIFE (YRS)	YEARS IN SERVICE	RUL (YRS)	RUL (%)
Acid	Acid Chem Feed System	Acid Bulk Storage Tank (BST-1801)				2005	25	19	6	24%
Acid	Acid Chem Feed System	Acid Bulk Storage Tank Containment Area				2005	25	19	6	24%
Acid	Acid Chem Feed System	Acid Day Tank (DT-2002)				2005	25	19	6	24%
Acid	Acid Chem Feed System	Acid Chem Feed Pump/Motor (18-CFP-01)				2005	25	19	6	24%
Acid	Acid Chem Feed System	Acid Chem Feed Pump/Motor (18-CFP-02)				2005	25	19	6	24%
Acid	Acid Chem Feed System	Acid Chem Feed Pump/Motor (18-CFP-03)				2005	25	19	6	24%
Acid	Acid Chem Feed System	Acid Chem Feed Pump/Motor (18-CFP-04)				2005	25	19	6	24%
Acid	Acid Chem Feed System	Acid Chem Feed Piping				2005	10	19	-9	0%
PROCESS	LOCATION	EQUIPMENT	TYPE	CAPACITY	MOTOR SIZE (HP)	YEAR INSTALLED	ORIGINAL USEFUL LIFE (YRS)	YEARS IN SERVICE	RUL (YRS)	RUL (%)
Antiscalant	Antiscalant Chem Feed System	Antiscalant Containment Area				2005	25	19	6	24%
Antiscalant	Antiscalant Chem Feed System	Antiscalant Day Tank (DT-1615)				2005	25	19	6	24%
Antiscalant	Antiscalant Chem Feed System	Antiscalant Metering Pump/Motor (16-CFP-01)	Solenoid Diaphragm	Initial (0.7 gph) Ultimate (2.1 gph)		2005	25	19	6	24%
Antiscalant	Antiscalant Chem Feed System	Antiscalant Metering Pump/Motor (16-CFP-02)	Solenoid Diaphragm	Initial (0.7 gph) Ultimate (2.1 gph)		2005	25	19	6	24%
Antiscalant	Antiscalant Chem Feed System	Antiscalant Metering Pump/Motor (16-CFP-03)	Solenoid Diaphragm	Initial (0.7 gph) Ultimate (2.1 gph)		2005	25	19	6	24%
Antiscalant	Antiscalant Chem Feed System	Antiscalant Chem Feed Piping				2005	10	19	-9	0%
PROCESS	LOCATION	EQUIPMENT	TYPE	CAPACITY	MOTOR SIZE (HP)	YEAR INSTALLED	ORIGINAL USEFUL LIFE (YRS)	YEARS IN SERVICE	RUL (YRS)	RUL (%)
Phosphate	Phosphate Chem Feed System	Phosphate Containment Area				2005	25	19	6	24%
Phosphate	Phosphate Chem Feed System	Phosphate Day Tank (DT-1715)				2005	25	19	6	24%
Phosphate	Phosphate Chem Feed System	Phosphate Meteiring Pump/Motor (17-CFP-01)	Solenoid Diaphragm	Initial (0.2 gph) Ultimate (0.5 gph)		2005	25	19	6	24%
Phosphate	Phosphate Chem Feed System	Phosphate Meteiring Pump/Motor (17-CFP-02)	Solenoid Diaphragm	Initial (0.2 gph) Ultimate (0.5 gph)		2005	25	19	6	24%
Phosphate	Phosphate Chem Feed System	Phospahte Chem Feed Piping				2005	10	19	-9	0%

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PROCESS	LOCATION	EQUIPMENT	TYPE	CAPACITY	MOTOR SIZE (HP)	YEAR INSTALLED	ORIGINAL USEFUL LIFE (YRS)	YEARS IN SERVICE	RUL (YRS)	RUL (%)
Fluoride	Fluoride Chem Feed System	Hydrofluorosilicic Acid Containment Area				2005	25	19	6	24%
Fluoride	Fluoride Chem Feed System	Hydrofluorosilicic Acid Bulk Storage Tank (19-BST-01)		5000		2005	25	19	6	24%
Fluoride	Fluoride Chem Feed System	Hydrofluorosilicic Acid Day Tank (DT-1902)				2005	25	19	6	24%
Fluoride	Fluoride Chem Feed System	Hydrofluorosilicic Acid Metering Pump/Motor (19-CFP-01)	Solenoid Diaphragm	Initial (0.6 gph) Ultimate (1.54 gph)		2005	25	19	6	24%
Fluoride	Fluoride Chem Feed System	Hydrofluorosilicic Acid Metering Pump/Motor (19-CFP-02)	Solenoid Diaphragm	Initial (0.6 gph) Ultimate (1.54 gph)		2005	25	19	6	24%
Fluoride	Fluoride Chem Feed System	Hydrofluorosilicic Acid Chem Feed Piping				2005	10	19	-9	0%
PROCESS	LOCATION	EQUIPMENT	TYPE	CAPACITY	MOTOR SIZE (HP)	YEAR INSTALLED	ORIGINAL USEFUL LIFE (YRS)	YEARS IN SERVICE	RUL (YRS)	RUL (%)
Ammonia	Ammonia Chem Feed System	Ammonia Bulk Storage Tank (BST-1501)				2005	25	19	6	24%
Ammonia	Ammonia Chem Feed System	Ammoniator		200 ppd		2005	25	19	6	24%
Ammonia	Ammonia Chem Feed System	Ammoniator		200 ppd		2005	25	19	6	24%
Ammonia	Ammonia Chem Feed System	Ammonia Chem Feed Piping				2005	25	19	6	24%
PROCESS	LOCATION	EQUIPMENT	TYPE	CAPACITY	MOTOR SIZE (HP)	YEAR INSTALLED	ORIGINAL USEFUL LIFE (YRS)	YEARS IN SERVICE	RUL (YRS)	RUL (%)
Bleach	Hypochlorite Chem Feed System	Hypochloirte Bulk Storage Tank (14-BST-01)		6650		2014	25	10	15	60%
Bleach	Hypochlorite Chem Feed System	Hypochloirte Bulk Storage Tank (14-BST-02)		6650		2014	25	10	15	60%
Bleach	Hypochlorite Chem Feed System	Hypochlorite Transfer Pump/Motor (14-CTP-01)	Hypochlorite Transfer Pump	80 gpm at 15 feet TDH	2	2005	25	19	6	24%
Bleach	Hypochlorite Chem Feed System	Hypochlorite Transfer Pump/Motor (14-CTP-02)	Hypochlorite Transfer Pump	80 gpm at 15 feet TDH	2	2005	25	19	6	24%
Bleach	Hypochlorite Chem Feed System	Hypochlorite Day Tank (DT-1401)				2005	25	19	6	24%
Bleach	Hypochlorite Chem Feed System	Hypochlorite Day Tank (DT-1402)				2005	25	19	6	24%
Bleach	Hypochlorite Chem Feed System	Hypochlorite Metering Pump/Motor (14-CFP-01)	Solenoid Diaphragm	Initial (5.0 gph) Ultimate (12.4 gph)		2005	25	19	6	24%
Bleach	Hypochlorite Chem Feed System	Hypochlorite Metering Pump/Motor (14-CFP-02)	Solenoid Diaphragm	Initial (5.0 gph) Ultimate (12.4 gph)		2005	25	19	6	24%
Bleach	Hypochlorite Chem Feed System	Hypochlorite Metering Pump/Motor (14-CFP-03)	Hydraulic Actuated Diaphragm	Initial (13.4 gph) Ultimate (33.5 gph)		2005	25	19	6	24%
Bleach	Hypochlorite Chem Feed System	Hypochlorite Metering Pump/Motor (14-CFP-04)	Hydraulic Actuated Diaphragm	Initial (13.4 gph) Ultimate (33.5 gph)		2005	25	19	6	24%
Bleach	Hypochlorite Chem Feed System	Hypochlorite Chem Feed Piping				2005	25	19	6	24%
PROCESS	LOCATION	EQUIPMENT	TYPE	CAPACITY	MOTOR SIZE (HP)	YEAR INSTALLED	ORIGINAL USEFUL LIFE (YRS)	YEARS IN SERVICE	RUL (YRS)	RUL (%)
Disposal	Yard Piping	Concentrate Piping from WTP to DIW PS				2005	25	19	6	24%
Disposal	Deep Injection Well	Lined Holding Pond				2005	30	19	11	37%
Disposal	Deep Injection Well	Deep Injection Well Pump/Motor				2005	30	19	11	37%
Disposal	Deep Injection Well	Deep Injection Well Pump/Motor				2005	30	19	11	37%
Disposal	Deep Injection Well	Surge Tank				2005	30	19	11	37%
Disposal	Deep Injection Well	Well Head Components/Valves/Meter/Pipe Header				2005	35	19	16	46%
Disposal	Deep Injection Well	Well Casing				2005	50	19	31	62%
Disposal	Deep Injection Well	Air Compressor				2005	25	19	6	24%
PROCESS	LOCATION	EQUIPMENT	TYPE	CAPACITY	MOTOR SIZE (HP)	YEAR INSTALLED	ORIGINAL USEFUL LIFE (YRS)	YEARS IN SERVICE	RUL (YRS)	RUL (%)
In-Plant PS	In-Plant PS	Wet Well Structure				2005	50	19	31	62%
In-Plant PS	In-Plant PS	Submersible Pump	Submersible pump	230 GPM @ 36 FT	5	2005	25	19	6	24%
In-Plant PS	In-Plant PS	Submersible Pump	Submersible pump	230 GPM @ 36 FT	5	2005	25	19	6	24%
In-Plant PS	In-Plant PS	Valve Vault/Piping/Valves				2005	30	19	11	37%
PROCESS	LOCATION	EQUIPMENT	TYPE	CAPACITY	MOTOR SIZE (HP)	YEAR INSTALLED	ORIGINAL USEFUL LIFE (YRS)	YEARS IN SERVICE	RUL (YRS)	RUL (%)
Electrcial	Emergency Generator	Emergency Generator		1250 kW		2005	30	19	11	37%
Electrcial	Emergency Generator	Above Grade Fuel Tank		4000 gal		2005	30	19	11	37%
Electrcial	Emergency Generator	Fuel Line Piping				2005	30	19	11	37%

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PROCESS	LOCATION	EQUIPMENT	TYPE	CAPACITY	MOTOR SIZE (HP)	YEAR INSTALLED	ORIGINAL USEFUL LIFE (YRS)	YEARS IN SERVICE	RUL (YRS)	RUL (%)
Electrcial	Electrical Room	Automatic Transfer Switch				2005	30	19	11	37%
Electrcial	Electrical Room	Main Control Breaker 1/2				2005	30	19	11	37%
Electrcial	Electrical Room	Motor Control Center No. 1				2005	30	19	11	37%
Electrcial	Electrical Room	Motor Control Center No. 2				2005	30	19	11	37%
Electrcial	Electrical Room	Motor Control Center No. 3				2005	30	19	11	37%
Electrcial	Electrical Room	Motor Control Center No. 4				2005	30	19	11	37%
Electrcial	Electrical Room	High Pressure Pump No. 1 VFD				2017	20	7	13	65%
Electrcial	Electrical Room	High Pressure Pump No. 2 VFD				2017	20	7	13	65%
Electrcial	Electrical Room	High Pressure Pump No. 3 VFD				2023	20	1	19	95%
Electrcial	Electrical Room	High Pressure Pump No. 4 VFD				2023	20	1	19	95%
Electrcial	Electrical Room	High Service Pump No. 1 VFD				2017	20	7	13	65%
Electrcial	Electrical Room	High Service Pump No. 2 VFD				2017	20	7	13	65%
Electrcial	Electrical Room	High Service Pump No. 3 VFD				2017	20	7	13	65%
Electrcial	Electrical Room	High Service Pump No. 4 VFD				2017	20	7	13	65%
Electrcial	Electrical Room	High Service Pump No. 5 VFD				2023	20	1	19	95%
Electrcial	Electrical Room	High Service Pump No. 6 VFD				2023	20	1	19	95%
PROCESS	LOCATION	EQUIPMENT	TYPE	CAPACITY	MOTOR SIZE (HP)	YEAR INSTALLED	ORIGINAL USEFUL LIFE (YRS)	YEARS IN SERVICE	RUL (YRS)	RUL (%)
Controls	Controls	RO Plant Human Machine Interface				2005	10	19	-9	0%
Controls	Controls	Ethernet Switch				2005	10	19	-9	0%
Controls	Controls	I/O-1 Panel & PLC 1				2023	10	1	9	90%
Controls	Controls	I/O-2 Panel & PLC 2				2023	10	1	9	90%
Controls	Controls	I/O-3 Panel & PLC 3				2023	10	1	9	90%
Controls	Controls	I/O-4 Panel & PLC 4				2005	10	19	-9	0%
Controls	Controls	I/O-5 Panel & PLC 5				2005	10	19	-9	0%
Controls	Controls	I/O-6 Panel & PLC 6				2005	10	19	-9	0%
Controls	Controls	I/O-7 Panel & PLC 7				2005	10	19	-9	0%
Controls	Controls	I/O-8 Panet & PLC 8				2023	10	1	9	90%
PROCESS	LOCATION	EQUIPMENT	TYPE	CAPACITY	MOTOR SIZE (HP)	YEAR INSTALLED	ORIGINAL USEFUL LIFE (YRS)	YEARS IN SERVICE	RUL (YRS)	RUL (%)
Facilities	RO Process and High Service Pump Building					2005	50	19	31	62%
Facilities	Chemcial Feed Building					2005	50	19	31	62%
Facilities	Site Work					2005	50	19	31	62%
Facilities	Asphalt Paving					2005	25	19	6	24%

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Section 11 -Evaluation of Future Water Treatment Facilities Needs

11.1 Introduction

Section 11 of the City of Palm Bay Water Master Plan described the evaluation to identify the needs of the water treatment facilities to serve the anticipated future growth 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 Water Demands

Sections 7, 8, and 9 of this Water 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 anticipated water demand 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 Water Demands by Planning Horizon

Timeframe	Number of ERCs	Average Annual Daily Demand (MGD)	Maximum Day Demand (MGD)	Peak Hour Demand (MGD)
Current	32,676	7.2	9.7	16.8
Five-Year	42,404	9.5	12.4	20.8
Ten-Year	51,157	12.2	17.8	28.0
Twenty-Year	69,111	17.6	22.2	40.0

The future water demands are projected to increase from 7.2 to 17.6 MGD on an annual average daily demand basis from the current condition to the twenty-year planning horizon. This is a very significant increase in anticipated water demand. This increase in future water demands will require significant expansion of the PBUD's water supply, water treatment, water storage, and water high-service distribution pumping to meet the future needs of the City.

11.3 Review of Current and Future Water Supply Requirements

To meet the water supply needs for each planning horizon, multiple new groundwater supply wells and related infrastructure will be needed. As discussed in **Sections 3.3 and 11** of this Master Plan report, the PBUD water system included multiple groundwater supply wells including the following:

- **NRWTP Surficial Aquifer Groundwater Wells:** Thirty-five (35) active wells ranging in total depth from 85 to 137 ft, with a combined rated pumping of 9.69 MGD MADF, a reliable operational capacity of 4.0 MGD MADF, and a SJWMD CUP limited permitting withdraw capacity of 4.7 MGD AADF.
- **NRROWTP Floridian Aquifer Groundwater Wells:** Three brackish wells with a total rated pumping capacity of approximately 6.0 MGD.
- **SRWTP Floridian Aquifer Groundwater Wells:** Four (4) brackish wells with a total rated pumping capacity of approximately 10.0 MGD.

Note: SJWMD CUP limits the total groundwater withdrawal from the Floridian Aquifer to gradually increase to 12.27 MGD in 2029.

As discussed later in this Section, the projected water treatment plant capacity is projected to increase from 10 MGD to 24 MGD over the twenty-year planning horizon. This increase in water treatment capacity is anticipated to be obtained by the following: a phase reduction in reliance on the NRWTP, a corresponding increase in the NRROWTP as this facility is developed, and a phased increase in the capacity of the SRWRF. Each of these facilities has a corresponding groundwater supply that provides the source water for the treatment process. The following table shows the projected future water supply capacity requirements for each WTP over the planning horizon.

Table 11-2. Projected Future Water Supply Capacity Requirements by Planning Horizon

Timeframe	Water Supply Required (MGD)	Water Supply Capacity (MGD)				Water Supply Capacity Improvements Needed
		Total	NRWTP	NRROWTP	SRWTP	
Current	11.5	14	4	0	10	NA
Five-Year	14.0	16	4	0	12	• SRO-5
Ten-Year	22.7	23.7	4	5.7	14	• NRO-3, 4, 5, 6

Timeframe	Water Supply Required (MGD)	Water Supply Capacity (MGD)				Water Supply Capacity Improvements Needed
		Total	NRWTP	NRROWTP	SRWTP	
						<ul style="list-style-type: none"> • SRO-6
Twenty-Year	30.0	32.4	0	14.4	18	<ul style="list-style-type: none"> • NRO-7, 8, 8, 10, 11, 12, 13, 14, 15, 16, & 17 • SRO-7 & 8

The table above shows the future water supply capacity needs including the construction of multiple Florida Aquifer groundwater wells supplying the SRWTP at this facility undergoes a series of expansions as each of the future planning horizons. As the flows being treated at the NRWTP decrease, the Surficial Aquifer groundwater supply needs are reduced. Similarly, the Florida Aquifer groundwater wells capacity needs to increase as the NRROWTP is developed from 0 to 14.4 MGD at the twenty-year planning horizon.

11.4 Review of Current and Future Water Treatment Capacity Requirements

To meet the water treatment capacity needs for each planning horizon, multiple treatment plant expansion will be needed. As discussed in **Sections 3.4, and 11** of this Master Plan report, the PBUD water system includes multiple water treatment facilities including the following:

- NRWTP with a current operational capacity of 4.0 MGD,
- NRROWTP is not in service, and
- SRWTP with a rated treatment capacity of 6.0 MGD.

In total, the PBUD currently has 10 MGD total reliable water treatment capacity. 1.0 MGD of additional capacity during peak or emergency conditions (fire flow for example) can be met on a short-term basis using the ASR.

The FDEP requires the water system to have sufficient rated treatment capacity to meet the maximum day water demands. As the future maximum day demands will exceed the current WTP capacity, additional plant capacity will be needed to meet the future planning horizon needs. These projected treatment plant capacity needs can be found in the following table.

Table 11-3. Projected Future Water Treatment Capacity Requirements by Planning Horizon

Timeframe	Maximum Day Demand (MGD)	Water Treatment Plant Capacity (MGD)				Water Treatment Plant Capacity Improvements Needed
		Total	NRWTP	NRROWTP	SRWTP	
Current	9.7	10	4	0	6	NA
Five-Year	12.4	12	4	0	8	<ul style="list-style-type: none"> • SRWTP to 8 MGD
Ten-Year	17.8	17.33	4	3.33	10	<ul style="list-style-type: none"> • NRROWTP to 3.33 MGD • SRWTP to 10 MGD
Twenty-Year	22.2	24	0	10	14	<ul style="list-style-type: none"> • NRROWTP to 10 MGD • SRWTP to 14 MGD

This analysis assumes the operational capacity of the NRWTP can be reliably maintained at a minimum 4 MGD through the ten-year planning horizon and that the anticipated NRROWTP facility will be progressed through the design and construction of the initial phase of plant capacity. At the twenty-year planning horizon, it is assumed the gradual phaseout of the NRWTP has been completed and the NRROWTP will be fully buildout.

The PBUD has commenced the design of increasing the SRWTP capacity to 8 MGD. A further expansion of the SRWTP to its full building capacity of 10 MGD within the existing building footprint is required at the ten-year planning horizon. A significant plant expansion to 14 MGD at the SRWTP will be needed for the twenty-year planning horizon. This project will include both a significant building construction (i.e. construction the mirror of the current RO process building and chemical feed buildings) but also equipping the building with all pretreatment, RO treatment, pumping, chemical feed, high-service distribution pumping and all related electrical/control system infrastructure.

11.4.1 Review of Current and Future Water Storage Requirements

As discussed previously in **Section 3.5.1**, the PBUD water system includes five (5) ground storage tanks and an elevated storage tank with a total capacity of the storage system is 7.5 MG.

The FDEP requires a minimum system storage capacity to equal to or exceed 25% of the maximum daily flow with provisions for fire flow. As such, additional water storage infrastructure will be needed for the future planning horizons as a component of other needed system infrastructure.

The following table summarizes the minimum required water storage capacities for each future planning horizon.

Table 11-4. Projected Future Water Storage Requirements by Planning Horizon

Timeframe	Maximum Day Demand (MGD)	Minimum System Storage Required (MG)	System Storage Available (MG)	System Storage Improvement Needs
Current	9.7	2.4	7.5	NA
Five-Year	12.4	3.1	7.5	None
Ten-Year	17.8	4.5	9.0	<ul style="list-style-type: none"> 1.5 MG South Booster Station GST
Twenty-Year	22.2	5.6	11	<ul style="list-style-type: none"> 2.0 MG SRWTP GST

The City is anticipating the need to construct at least two additional ground storage tank over the next twenty years. These will include the following

- New South Booster Station to support the new developments in the southeast. This facility will ultimately include the construction of 1.5 million gallons of additional water storage capacity.
- The expansion of the SRWTP from 10 MGD to 14 MGD will include a new 2.0 MG ground storage tank. This tank will serve as the finished water source for the new high-service distribution pumps proposed for the expanded plant capacity.

11.4.2 Review of Current and Future Water High-Service Distribution Pumping Requirements

Sections 7, 8, and 9 of this Water 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 peak hour demands for each planning horizon. This value serves as the basis for determining the needed minimum high-service distribution pumping capacity for each planning horizon.

The following table summarizes the modeled peak hour demands and firm high-service distribution pumping capacity for each planning horizon.

Table 11-5. Projected Future High-Service Distribution Pumping Requirements by Planning Horizon

Timeframe	Peak Hour Demand (MGD)	High-Service Firm Pumping Capacity (MGD)			High-Service Improvements Needs
		Total	NRWTP	SRWTP	
Current	16.8	28.9	13.1	15.8	NA
Five-Year	20.8	30.4	13.1	17.3	• 1.5 MGD HSP at SRWTP
Ten-Year	28.0	32.1	13.1	19.0	• 1.7 MGD HSP at SRWTP
Twenty-Year	40.0	41.6	13.1	28.5	• 9.5 MGD HSP at SRWTP

As shown in the table above, the NRWTP's firm high-service distribution pumping capacity is expected to remain constant at 13.1 MGD over the planning horizon. These pumps were recently replaced in 2022. Additional high-service distribution pumping capacity will be gradually increased at each planning horizon at the SRWTP. The largest increase in capacity will occur at the twenty-year planning horizon as a component of the planning SRWTP expansion from 10 to 14 MGD.

The firm high-service distribution pumping capacity at the Nash Repump Station is expected to remain constant at 2,500 gpm although the pumps are being replaced in-kind under a separate city project currently ongoing.

As stated in **Section 8.2**, an additional water booster pump station will be required in the vicinity of the Babcock St and St Johns Heritage Parkway intersection in the southeast section of the area. This will be required to support the expected commercial fire flows in the region. The South Booster Station would be similar to the existing Nash Repump Station in configuration with a ground storage tank(s) and several low- and high-capacity split case centrifugal high-service distribution pumps. The station would be intended to operate in the initial ten-year planning horizon to meet commercial fire flow needs in the southeast section of the City along the St Johns Heritage Parkway corridor. The station is also needed to meet peak hour and maximum day demands.

Initially, the station would be configured with two lower-capacity high-service distribution pumps rated at 555 gpm and two higher-capacity high-service distribution pumps rated at 1,250 gpm. This pump configuration would provide 2,500 gpm or 3.6 MGD of firm high-service distribution pumping capacity at

the proposed South Booster Station. In the twenty-year planning horizon, additional pumps would be added increasing the firm pumping capacity up to 3,375 gpm pr 6.3 MGD.

11.5 Future Needs

Capital improvement needs related to the anticipated future water supply, water treatment, water storage, and water high-service distribution pumping requirements located at the WTPs have been developed for the five-, ten-, and twenty-year time planning horizon as shown below:

Five-Year Improvement Needs

- **CIP No. 24: SRWTP Additional Floridian Aquifer Groundwater Supply Well (SRO-5).** Work includes New SRWTP Well No. 5 with related well pump, motor, yard piping, and related electrical/control improvements.
- **CIP No. 25: Replace One 60 HP with a 125 HP High Service Pump at SRWTP.**
- **CIP No. 26: SRWTP Expansion from 6 to 8 MGD..** Improvements include the following:
 - A new 1,750 GPM Reverse Osmosis Feed Pump
 - Install a Third Degasifier Unit.
 - CIP No. 24 Described Above
 - CIP 25 Described Above

Note: This project is currently being designed by Wade Trim under Task Order 23-10-WT

Ten-Year Improvement Needs

- **CIP No. 19: SRWTP Additional Floridian Aquifer Groundwater Supply Well (SRO-6).** Work includes New SRWTP Well No. 6 with related well pump, motor, yard piping, and related electrical/control improvements. CIP No. 20:
- **CIP No. 20: Replace One 60 HP with a 125 HP High Service Pump at SRWTP.**
- **CIP No. 21: SRWTP Expansion from 8 to 10 MGD..** Improvements include the following:
 - New Cartridge Filter
 - New Reverse Osmosis High-Pressure Feed Pumps
 - New RO Treatment Skid
- **CIP No. 23: Expand NRROWTP to 3.33 MGD.** Improvements include the following:
 - Demolition of existing RO Building, RO Degasifiers/Odor Control/Clearwell, Floridian Aquifer Groundwater Well RO-1, and reconfigure South Sludge Drying Bed No 1

- Constructed of proposed Floridian Aquifer Groundwater Well NRO-3, NRO-4, NRO-5 and NRO-6
- Construction of proposed RO Process Building and all related RO treatment process infrastructure
- Construction of proposed Degasifier, Odor Control, and Clearwel with Transfer Pump and all related infrastructure
- Construction of proposed Auxiliary Generator and associated fuel storage
- Construction of Deep Injection Well for brine disposal

Refer to the *City of Palm Bay North Regional Water Treatment Plant Reverse Osmosis Master Plan Report* prepared by Tetra Tech dated March 2024 for additional information (City of Palm Bay, 2024).

Twenty-Year Improvement Needs

- **CIP No. 18: Expand NRROWTP from 3.33 MGD to 10 MGD.** Improvements include the following:
 - Demolition of some off-site surficial aquifer groundwater wells
 - Constructed of proposed Floridian Aquifer Groundwater Well NRO-7, NRO-8, NRO-9, NRO-10, NRO-11, NRO-12, NRO-13, NRO-14, NRO-15, NRO-16, and NRO-17
 - Construction of proposed additional/expanded RO skids and all related infrastructure
 - Construction of proposed additional/expanded Degasifier and all related infrastructure
 - Construction of proposed additional/expanded Transfer Pumping
 - Construction of proposed additional/expanded Chemical Storage and Feed Facilities and all related infrastructure
 - Construction of proposed additional/expanded Concentrate Management Facilities and all related infrastructure

Refer to the *City of Palm Bay North Regional Water Treatment Plant Reverse Osmosis Master Plan Report* prepared by Tetra Tech dated March 2024 for additional information (City of Palm Bay, 2024).

- **CIP No. 19: Expand SRWTP treatment capacity from 10 to 14 MGD.**
 - Construct 2.0 MG ground storage tank at SRWTP

11.6 Observations and Recommendations

The future needs of the water treatment facilities, including the water supply, water treatment, water storage, and water high-service distribution pumping requirements located at the WTPs, have been determined to serve the anticipated future growth within the City. This analysis was conducted following the projection of future water demands at each planning horizon. From this work, multiple capital improvement projects were developed for each planning horizon.

11.6.1 Observations

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

- The future water demands by planning horizon are contained in **Table 11-1**. The projected growth of the City generally in new developments are expected to increase the number of ERCs from 32,700 currently to 69,100 at the twenty-year planning horizon. Similarly, the projected future water demand increased from 7.2 MGD currently to 17.6 MGD AADF at the twenty-year planning horizon.
- The future groundwater water supply requirements by planning horizon are contained in **Table 11-2**. The analysis show needing an increasing groundwater supply from 14 MGD currently to 32.4 MGD at the twenty-year planning horizon. Additional groundwater supply will be obtained by several additional Floridian Aquifer groundwater wells serving the SRWTP and multiple new Floridian Aquifer groundwater wells supplying the NRROWTP as that facility is developed.
- The future water treatment capacity requirements by planning horizon are contained in **Table 11-3**. This analysis indicated the need to provide from 10 MGD currently to 24 MGD of water treatment capacity at the twenty-year planning horizon. Expansion of the SRWTP from 6 MGD to 14 MGD will be needed. Furthermore, up to 10 MGD of water treatment capability is anticipated as the NRROWTP facility is developed at the twenty-year planning horizon.
- Over the planning horizon, additional ground storage will be constructed at the SRWTP and as part of the South Booster Station project.
- The high-service pumping capacity is projected to increase from 28.9 MGD currently to 41.6 MGD at the twenty-year planning horizon.
- The CIPs needed to meet these needs have been shown in **Section 11.5**.

11.6.2 Conclusions

The following recommendations are based on the future needs of the water treatment facilities infrastructure:

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

Section 12 -Capital Improvements Projects

12.1 Introduction

Section 12 of the City of Palm Bay Water Master Plan presents a compilation of the water system capital improvement project for each of the three (3) planning horizons including water supply, water treatment, water storage, high-service pumping, and water transmission/distribution system infrastructure improvements. This includes the following:

- 1) 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).
- 2) The employed methodology to assess and analyze the costs attributed to the water distribution system model for each of the three (3) planning horizons.
- 3) Categorize the costs for each of the three (3) planning horizons into distinct components, namely construction, engineering, project, and other associated expenses.
- 4) Define the subsequent steps imperative for the progression of this project, outlining the key actions and milestones necessary for its successful execution.
- 5) 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 raw water supply, water treatment, and water transmission/distribution 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)
- City of Palm Bay Projects
- Other similar projects previously completed by ISS

Project Costing Details

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

- Furnish and Install 8" PVC via Open-Cut Trenching with Testing and Chlorination: \$150.00 per LF
- Furnish and Install 12" PVC via Open-Cut Trenching with Testing and Chlorination: \$170.00 per LF
- Furnish and Install 16" PVC via Open-Cut Trenching with Testing and Chlorination: \$190.00 per LF
- Furnish and Install 20" Water Main (HDPE HDD) with Testing and Chlorination: \$400.00 per LF
- Conduct Demolition of Existing Asphalt Pavement: \$30.00 per SY
- Construct Asphalt Pavement (in entirety): \$75.00 per SY

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 a significant majority of capital improvement projects, a contingency of 25% was utilized consistent with Class 5 Order of Magnitude estimates (conceptualized projects). For all capital improvement projects involving the abandonment, grouting, and replacement of the ACP water main, a 30% contingency was utilized to account for additional design elements that were unknown at the time of the cost-estimating process and will not fully be known until the improvement projects are developed and design accordingly.

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 \$5.0 million utilized an engineering fee of 10% of the Construction Cost.
- Line work that was estimated to exceed a cost of \$5.0 million 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 Improvement Plan Cost Summary

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

Table 12-1. Summary of Five-Year Capital Improvements Costs

Five-Year Improvements	Construction Cost	Engineering Cost	Other Costs ¹	Project Cost
CIP No. 1: 16-in Watermain Loop in FPL Corridor (Paigo St SE - Babcock St)	\$9,000,000	\$675,000	NA	\$9,675,000
CIP No. 2: 8" Watermain Loop on Eldron Blvd SE (Windbrook Dr SE - Rabbit St SE)	\$1,000,000	\$100,000	NA	\$1,100,000
CIP No. 3: 6" WM Loop on Devonwood Ct SE to Eldron Blvd SE (N of Bayside Lakes)	\$250,000	\$25,000	\$30,000	\$305,000
CIP No. 4: NOT USED	NA	NA	NA	NA
CIP No. 5: 8" WM Loop on US-1 (N of Wedgewood Dr NE) across US-1	\$110,000	\$11,000	\$10,000	\$131,000
CIP No. 6: 6" WM Loop Fallon Blvd NE to Greenwood Blvd NE	\$120,000	\$12,000	NA	\$132,000
CIP No. 7: 8" WM Loop Admiral Dr (Extended) to Malabar Road (S of Oaklyn)	\$520,000	\$52,000	\$50,000	\$622,000
CIP No. 8: Replace 8" WM with 12" WM on US-1 (Anglers Dr NE - Breezy Palms RV Park)	\$2,600,000	\$260,000	NA	\$2,860,000
CIP No. 9: Replace 2" WM with 6" WM on Eaglerock St ME and 6" WM loop to Fourth Ave NE	\$310,000	\$31,000	\$20,000	\$361,000
CIP No. 10: 6" WM Loop Danr Dr NE to Myers Dr NE under Railroad	\$200,000	\$20,000	NA	\$220,000
CIP No. 11: Replace 6" WM with 12" WM on Clearmont St NE at Gunpowder Dr NE	\$120,000	\$12,000	NA	\$132,000
CIP No. 12: 16" WM Extension to Babcock St (S of Mara Loma Blvd)	\$800,000	\$80,000	NA	\$880,000
CIP No. 13: 16" WM Extension E of Babcock St for Emerald City Development	\$4,900,000	\$490,500	NA	\$5,390,000

Five-Year Improvements	Construction Cost	Engineering Cost	Other Costs ¹	Project Cost
CIP No 14: 16" WM Extension S of 16" WM Extension for Emerald City and Pete Holdings Developments	\$1,500,000	\$150,000	NA	\$1,650,000
CIP No. 15: 16" WM Extension on Davis Ln Extended for Waterstone and Rolling Meadows Developments	\$8,400,000	\$630,000	NA	\$9,030,000
CIP No. 16: 12" WM Loop on Garvey Rd (Malabar Rd - White Cloud St SW)	\$650,000	\$65,000	NA	\$715,000
CIP No. 17: 12" WM Extension on US-1 (Breezy Palms RV Park Malabar Rd) for Town of Malabar	\$3,500,000	\$350,000	\$75,000	\$3,925,000
CIP No. 18: 12" WM Loop on Malabar Rd (US-1 to Weber Rd) for Town of Malabar	\$2,600,000	\$260,000	\$50,000	\$2,910,000
CIP No. 19: 8" WM Extension on Falls Church St SE (W of Degroodt Rd SW) for Bayridge Development	\$1,100,000	\$110,000	NA	\$1,210,000
CIP No. 20: ACP WM Replacement near Palm Bay Fire Station No. 1	\$600,000	\$60,000	NA	\$660,000
CIP No. 21: ACP WM Replacement at North Regional Utilities Campus	\$1,200,000	\$120,000	NA	\$1,320,000
CIP No. 22: ACP WM Replacement adjacent to BEALLS Outlet	\$1,900,000	\$190,000	NA	\$2,090,000
CIP No. 23: ACP WM Replacement along Meadowbrooks Rd NE	\$1,400,000	\$140,000	NA	\$1,540,000
CIP No. 24: SRWTP Additional Floridan Aquifer Groundwater Supply Well (SRO-5)	\$1,700,000	\$170,000	NA	\$1,870,000
CIP No. 25: Replace One 60 HP with 125 HP High-Service Pump at SRWTP	\$500,000	\$75,000	NA	\$575,000
CIP No. 26: SRWTP Expansion from 6 MGD to 8 MGD	\$2,500,000	\$375,000	NA	\$2,875,000
CIP No. 27: SRWTP Rehabilitation	\$4,300,000	\$645,000	NA	\$4,945,000
CIP No. 28: NRWTP Backwash Ponds and Drying Beds Nos. 3/4/5 Rehabilitation	\$600,000	\$90,000	NA	\$690,000
CIP No. 29: NRWTP Rehabilitation, Electrical & Control System Improvements	\$2,500,000	\$375,000	NA	\$2,875,000
TOTAL FIVE-YEAR IMPROVEMENT COST				\$60,688,000

1- Other Costs include potential land acquisitions and easements

Table 12-2. Summary of Ten-Year Capital Improvements Costs

Ten-Year Improvements	Constructio n Cost	Engineering Cost	Other Costs¹	Project Cost
CIP No. 1: 24" WM Loop from SRWTP to San Filippo Dr SE	\$4,100,000	\$410,000	NA	\$4,510,000
CIP No. 2: 16" WM Loop on San Filippo Dr SE (Degroodt Rd SW to FPL)	\$6,100,000	\$457,500	NA	\$6,557,500
CIP No. 3: 16" WM Loop on St. Andre Blvd to Willowbrook Development	\$8,900,000	\$667,000	\$175,000	\$9,742,500
CIP No. 4: 16" WM Loop from San Filippo Dr SE to Rolling Meadows Development	\$1,800,000	\$180,000	NA	\$1,980,000
CIP No. 5: Replace Exist. 6"-10" WM w/ 12" WM on US-1 (Pospisil Ave NE -S of University Blvd)	\$7,400,000	\$555,000	NA	\$7,955,000
CIP No. 6: 8" WM Extension S of Malabar Rd for Lennar South Development	\$600,000	\$60,000	NA	\$660,000
CIP No. 7: 16" WM Extension Babcock St (Davis Ln - Micco Rd)	\$3,200,000	\$320,000	NA	\$3,520,000
CIP No 8: 12" WM Loop on Micco Rd (Babcock St - Micco Village Development)	\$4,800,000	\$480,000	NA	\$5,280,000
CIP No. 9: 16" WM Extension on Micco Rd for Micco Village Development	\$5,300,000	\$530,500	NA	\$5,830,500
CIP No. 10: 16" WM Loop in FPL Easement (Cogan Dr SE-Malabar Rd)	\$12,000,000	\$900,000	\$200,000	\$13,100,000
CIP No. 11: 6" WM Loop from Pilgrim Ln SE to Satz St SE for Las Palmas Development	\$600,000	\$60,000	\$90,000	\$750,000
CIP No. 12: 16" WM Loop through Pete Holdings (Emerald Lake to Micco Village)	\$2,200,000	\$220,000	\$75,000	\$2,495,000
CIP No. 13: South Water Booster Station – First Phase	\$6,500,000	\$975,000	\$500,000	\$7,975,000
CIP No. 14: ACP WM Replacement adjacent to Veteran's Memorial Park	\$10,400,000	\$780,000	NA	\$11,180,000
CIP No. 15: ACP WM Replacement near Indian River Flats	\$1,800,000	\$180,000	NA	\$1,980,000
CIP No. 16: ACP WM Replacement Adjacent to Abeto St. NE	\$2,000,000	\$200,000	NA	\$2,200,000
CIP No. 17: ACP WM Replacement along Main St NE Area	\$2,400,000	\$240,000	NA	\$2,640,000
CIP No. 18: ACP WM Replacement within Highland Shores Turkey River Estates	\$3,300,000	\$330,000	NA	\$3,630,000

Ten-Year Improvements	Construction Cost	Engineering Cost	Other Costs ¹	Project Cost
CIP No. 19: SRWTP Additional Floridan Aquifer Groundwater Supply Well (SRO-6)	\$1,700,000	\$255,000	NA	\$1,955,000
CIP No. 20: Replace One 60 HP with 125 HP High-Service Pump at SRWTP	\$500,000	\$75,000	NA	\$575,000
CIP No. 21: SRWTP Expansion from 8 MGD to 10 MGD	\$3,000,000	\$450,000	NA	\$3,450,000
CIP No. 22: SRWTP Rehabilitation and Electrical System Improvements	\$14,000,000	\$2,100,000	NA	\$16,100,000
CIP No. 23: Construct NRROWTP to 3.33 MGD with RO Wells & Deep Injection Well ²	NA	NA	NA	\$59,192,000
TOTAL TEN-YEAR IMPROVEMENT COST				\$168,748,000

- 1- Other Costs include potential land acquisitions and easements
- 2- Cost estimate details for the NRROWTP projects can be found in *City of Palm Bay North Regional Water Treatment Plant Reverse Osmosis Master Plan Report* prepared by Tetra Tech dated March 2024.

Table 12-3. Summary of Twenty-Year Capital Improvements Costs

Twenty-Year Improvements	Construction Cost	Engineering Cost	Other Costs ¹	Project Cost
CIP No. 1: 8" WM Loop on Pace (Gillmar-St to Johns Heritage Pkwy)	\$550,000	\$55,000	NA	\$605,000
CIP No. 2: 12" WM Loop on Mara Loma Extended to Lowry Extended	\$2,500,000	\$250,000	\$150,000	\$2,900,000
CIP No. 3: Replace 8" w/ 12" WM on Palm Bay Rd (Babcock St NE to Clearmont St NE)	\$4,400,000	\$440,000	NA	\$4,840,000
CIP No. 4: 12" WM Loop on Palm Bay Rd across Babcock	\$340,000	\$34,000	NA	\$374,000
CIP No. 5: Replace 8" WM w/ 16" WM on Emerson Dr (W of Medina Ave NE to W of Amador Ave NE)	\$4,700,000	\$470,000	NA	\$5,170,000
CIP No. 6: Replace 12" WM w/ 16" WM on Emerson (Nash Repump Station to W of Minton)	\$6,000,000	\$450,000	NA	\$6,450,000

Twenty-Year Improvements	Construction Cost	Engineering Cost	Other Costs ¹	Project Cost
CIP No. 7: NOT USED	NA	NA	NA	NA
CIP NO. 8: Replace 20" WM w/ 24" WM Along Canal (NE of Clearmont to NRWTP)	\$720,000	\$72,000	NA	\$792,000
CIP No. 9: Replace 8" WM w/ 12" WM on Port Malabar Blvd (Daytona Dr NE to Bianca Dr NE)	\$820,000	\$82,000	NA	\$902,000
CIP No. 10: Replace 10" WM w/ 12" WM on Conlan/Northview/Florida/Kingswood (Palm Bay Rd-US-1)	\$5,400,000	\$540,000	NA	\$5,940,000
CIP No. 11: Replace 6" and 8" WM w/ 12" WM on Clearmont St NE (Franklin St NE-Palm Bay Rd NE)	\$1,300,000	\$130,000	NA	\$1,430,000
CIP No. 12: 12" WM Loop from JA Bombardier Blvd SW dead-end to Osmosis Dr SW /O'Connel Ave SW	\$4,300,000	\$430,000	NA	\$4,730,000
CIP No. 13: South Booster Station -- Second Phase	\$2,700,000	\$405,000	NA	\$3,105,000
CIP No. 14: ACP WM Replacement in Holiday Park MHP	\$14,300,000	\$1,072,000	NA	\$15,372,000
CIP No. 15: ACP WM Replacement adjacent to Glenbrooke Senior Living	\$4,700,000	\$470,000	NA	\$5,170,000
CIP No. 16: ACP WM Replacement within Vincent Kirby Industrial Park	\$3,900,000	\$390,000	NA	\$4,290,000
CIP No. 17: ACP WM Pipe Replacement near Lipscomb Park	\$4,950,000	\$495,000	NA	\$5,445,000
CIP No. 18: Expand NRROWTP from 3.33 MGD to 10 MGD ²				\$58,574,000
CIP No. 19: Expand SRWTP from 10 MGD to 14 MGD	\$35,000,000	\$5,259,000	NA	\$40,250,000
TOTAL TWENTY-YEAR IMPROVEMENT COST				\$166,339,000

2- Other Costs include potential land acquisitions and easements

3- Cost estimate details for the NRROWTP projects can be found in *City of Palm Bay North Regional Water Treatment Plant Reverse Osmosis Master Plan Report* prepared by Tetra Tech dated March 2024.

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

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 preferred to contribute significantly to the project's seamless execution and the achievement of its defined objectives.

12.5.1 Observations

The following observations are based on the evaluation of the cost estimate for this Capital Improvement Project (CIP).

- The future conditions for the three (3) planning horizons (five-year, ten-year, and twenty-year) of the City of Palm Bay's water distribution system were modeled and assessed using the City's future GIS water system data and the water modeling program WaterGEMS.
- The GIS for the City's water distribution 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

City of Palm Bay North Regional Water Treatment Plant Reverse Osmosis Master Plan Report, Prepared by Tetra Tech, March 2024.

City of Palm Bay North Regional Water Treatment Plant Upgrades Preliminary Design Investigations, Prepared by Tetra Tech, Oct 202.

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

City of Palm Bay Well Condition Survey, Prepared by Ardaman & Associates, Oct 2018.

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

Florida Population: Census Summary 2020, Bureau of Economic and Business Research.

Fire Suppression Rating Schedule, Insurance Services Office, Inc, 2012.

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

Troutman Lime Softening Water Treatment Plant Improvement Program Report, Prepared by Wade Trim, 2013.

Troutman Lime Water Treatment Plant Improvement Program, Prepared by Wade Trim, July 2013.

Water Master Plan, City of Palm Bay, Prepared by Wade Trim, Inc., October 2017.

CAPITAL IMPROVEMENT DETAILS



INFRASTRUCTURE SOLUTION SERVICES ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PBU009 | Water Master Plan Update

5/30/2024

Infrastructure Solution Services, LLC

Five-Year Water System Capital Improvement Needs

Project Manager: CEM

Item Description		Line Item Total	Subtotal
PBU009 Water Master Plan Update			
CIP No. 1: 16" WM Loop in FPL Corridor (Paigo St SE - Babcock St SE)		\$ 9,000,000	
CIP No. 2: 8" WM Loop on Eldron Blvd SE (Windbrook Dr SE-Rabbit St SE)		\$ 1,000,000	
CIP No. 3: 6" WM Loop on Devonwood Ct SE to Eldron Blvd SE (N of Bayside Lakes)		\$ 250,000	
CIP No. 5: 8" WM Loop on US-1 (N of Wedgewood Dr NE) across US-1		\$ 170,000	
CIP No. 6: 6" WM Loop Fallon Blvd NE to Greenwood Blvd NE		\$ 120,000	
CIP No. 7: 8" WM Loop Admiral Dr (Extended) to Malabar Road (S of Oaklyn)		\$ 520,000	
CIP No. 8: Replace 8" WM with 12" WM on US-1 (Anglers Dr NE-Breezy Palms RV Park)		\$ 2,600,000	
CIP No. 9: Replace 2" WM with 6" WM on Eaglerock St NE & 6" WM loop to Fourth Ave NE		\$ 310,000	
CIP No. 10: 6" WM Loop Danr Dr NE to Myers Dr NE under Railroad		\$ 200,000	
CIP No. 11: Replace 6" WM with 12" WM on Clearmont St NE at Gunpowder Dr NE		\$ 120,000	
CIP No. 12: 16" WM Extension to Babcock St (S of Mara Loma Blvd)		\$ 800,000	
CIP No. 13: 16" WM Extension E of Babcock St for Emerald City Development		\$ 4,900,000	
CIP No 14: 16" WM Extension S of 16" WM Extension for Emerald City & Pete Holdings Developments		\$ 1,500,000	
CIP No. 15: 16" WM Extension on Davis Ln Extended for Waterstone and Rolling Meadows Developments		\$ 8,400,000	
CIP No. 16: 12" WM Loop on Garvey Rd (Malabar Rd-White Cloud St SW)		\$ 650,000	
CIP No. 17: 12" WM Extension on US-1 (Breezy Palms RV Park Malabar Rd) for Town of Malabar		\$ 3,500,000	
CIP No. 18: 12" WM Loop on Malabar Rd (US-1 to Weber Rd) for Town of Malabar		\$ 2,600,000	
CIP No. 19: 8" WM Extension on Falls Church St SW (W of Degroodt Rd SW) for Bayridge Development		\$ 1,100,000	
CIP No. 20: ACP WM Replacement near Palm Bay Fire Station No. 1		\$ 600,000	
CIP No. 21: ACP WM Replacement at North Regional Utilities Campus		\$ 1,200,000	
CIP No. 22: ACP WM Replacement adjacent to BEALLS Outlet		\$ 1,900,000	
CIP No. 23: ACP WM Replacement along Meadowbrooks Rd NE		\$ 1,400,000	
CIP No. 24: SRWTP Additional Floridan Aquifer Groundwater Supply Well (SRO-5)		\$ 1,700,000	
CIP No. 25: Replace One 60 HP with 125 HP High Service Pump at SRWTP		\$ 500,000	
CIP No. 26: SRWTP Expansion from 6 MGD to 8 MGD		\$ 2,500,000	
CIP No. 27: SRWTP Rehabilitation		\$ 4,300,000	
CIP No. 28: NRWTP Backwash Ponds and Drying Beds Nos. 3/4/5 Rehabilitation		\$ 600,000	
CIP No. 29: NRWTP Rehabilitation, Electrical & Control System Improvements		\$ 2,500,000	
ESTIMATE TOTAL			\$ 54,940,000

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5-Year Water CIP No. 1 A
Water Master Plan
City of Palm Bay Utilities Department

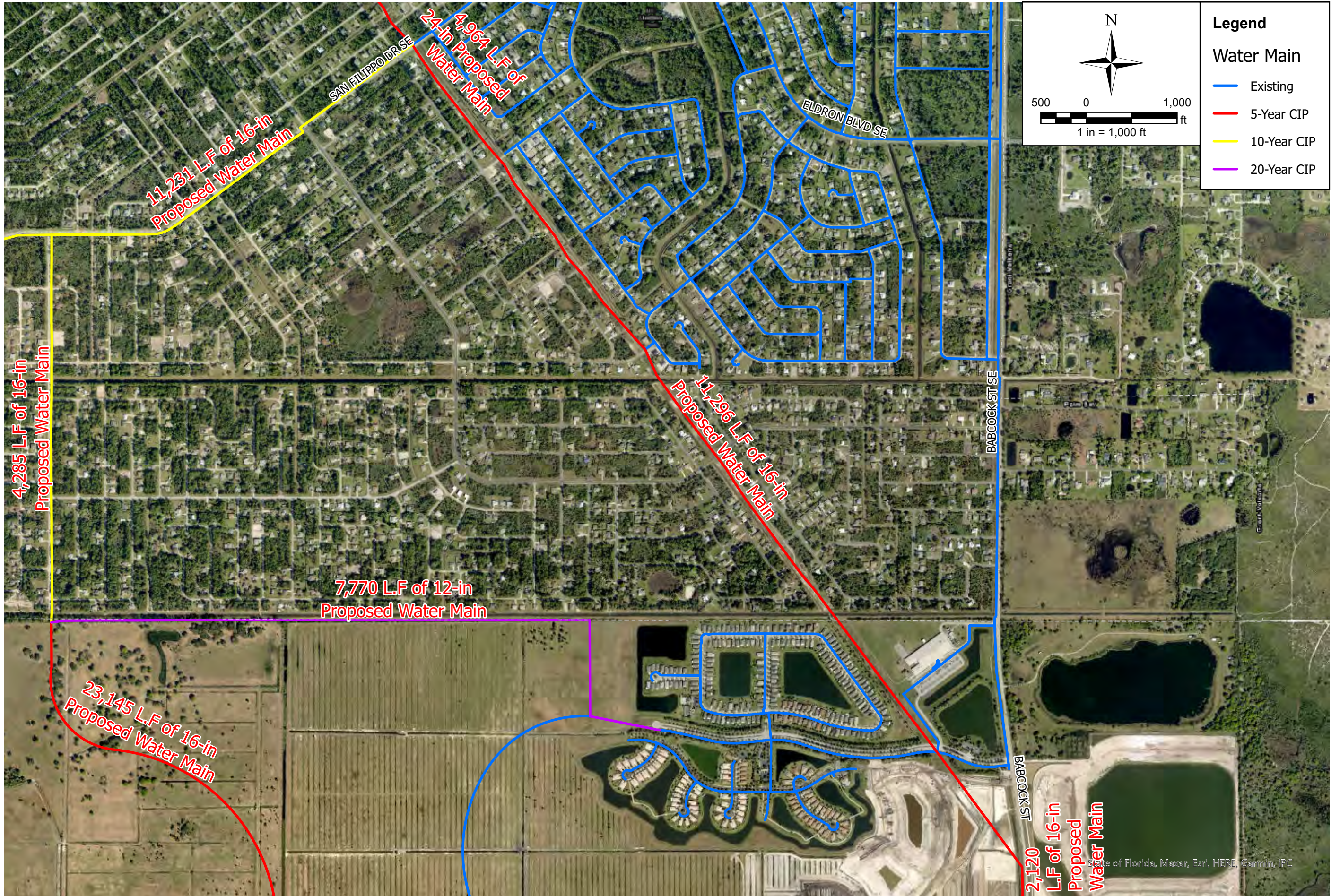
PROJECT NO.:
PBU009

DATE:
JUN 2024

FIGURE NO.

16" WM Loop in FPL Corridor
(Paigo St SE - Babcock St SE)

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INFRASTRUCTURE SOLUTION SERVICES ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PBU009 | Water Master Plan Update

5/30/2024
Infrastructure Solution Services, LLC

Five-Year Water System Capital Improvement Needs

CIP No. 1: 16" WM Loop in FPL Corridor (Paigo St SE - Babcock St SE)

Estimated By: JFN
Checked By: CEM
Project Manager: CEM

Specification	Division Code or Class	Item Description	Quantity	Unit	Unit Cost	Item Total	Subtotal
No.		General					
1		Mobilization/Demobilization	7.5%	Allow	\$ 6,239,340	\$ 467,951	
2		General Requirements, Bonds, and Insurance	5%	Allow	\$ 6,239,340	\$ 311,967	
3		Temporary Erosion Control & Protection		LS	\$ 50,000	\$ 50,000	
4		Testing Allowance		LS	\$ 6,000	\$ 6,000	
5		Maintenance of Traffic		LS	\$ 30,000	\$ 30,000	
6		Survey and Record Drawings		LS	\$ 7,500	\$ 7,500	\$ 873,418
		Demolition					
7		Conduct Demo of Existing Asphalt Pavement	170	SY	\$ 30	\$ 5,100	
8		Conduct Demo of Existing Sidewalk Pavement	10	SY	\$ 20	\$ 200	
9		Conduct Clearing and Grubbing (Miscellaneous)		LS	\$ 2,500	\$ 2,500	\$ 7,800
		Water Main Extension					
10		Furnish & Install 24" PVC via Open-Cut Trenching with Testing & Chlorination	4364	LF	\$ 350	\$ 1,527,400	
11		Furnish & Install 30" Water Main (HDPE HDD) with Testing & Chlorination	600	LF	\$ 1,000	\$ 600,000	
12		Furnish & Install 24" Gate Valves with Valve Box and Conc. Pad	14	EA	\$ 35,000	\$ 490,000	
13		Furnish & Install 16" PVC via Open-Cut Trenching with Testing & Chlorination	9796	LF	\$ 190	\$ 1,861,240	
14		Furnish & Install 20" Water Main (HDPE HDD) with Testing & Chlorination	1500	LF	\$ 400	\$ 600,000	
15		Furnish & Install 16" Gate Valves with Valve Box and Conc. Pad	33	EA	\$ 20,000	\$ 660,000	
16		Furnish & Install Fire Hydrant Assembly	16	EA	\$ 12,000	\$ 192,000	
17		Conduct Temporary Jumper Connection at Specified Locations	24	EA	\$ 2,500	\$ 60,000	
18		Conduct Bacterial Sampling of Line at Specified Locations	14	EA	\$ 1,800	\$ 25,200	\$ 6,015,840
		Civil/Site Restoration					
19		Conduct Final Grading & Restoration		LS	\$ 45,000	\$ 45,000	
20		Construct Sidewalk Pavement (in entirety)	10	SY	\$ 70	\$ 700	
21		Construct Asphalt Pavement (in entirety)	1020	SY	\$ 75	\$ 76,500	\$ 122,200
ESTIMATE SUBTOTAL						\$ 7,019,258	
C		Planning Level Contingency		%	25%	\$ 1,754,814	
ESTIMATE TOTAL						\$ 9,000,000	

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**5-Year Water CIP No. 2
Water Master Plan
City of Palm Bay Utilities Department**

PROJECT NO.:
PBU009
DATE:
JUN 2024
FIGURE NO.

8" WM Loop on Eldron Blvd SE
(Windbrook Dr SE - Rabbit St SE)



INFRASTRUCTURE SOLUTION SERVICES ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PBU009 | Water Master Plan Update

5/30/2024
Infrastructure Solution Services, LLC

Five-Year Water System Capital Improvement Needs

CIP No. 2: 8" WM Loop on Eldron Blvd SE (Windbrook Dr SE-Rabbit St SE)

Estimated By: JFN
Checked By: CEM
Project Manager: CEM

Specification Division Code or Class		Item Description	Quantity	Unit	Unit Cost	Item Total	Subtotal
No.	General						
1		Mobilization/Demobilization	7.5%	Allow	\$ 651,310	\$ 48,848	
2		General Requirements, Bonds, and Insurance	5%	Allow	\$ 651,310	\$ 32,566	
3		Temporary Erosion Control & Protection		LS	\$ 10,000	\$ 10,000	
4		Testing Allowance		LS	\$ 5,000	\$ 5,000	
5		Maintenance of Traffic		LS	\$ 15,000	\$ 15,000	
6		Survey and Record Drawings		LS	\$ 5,000	\$ 5,000	\$ 116,414
Demolition							
7		Conduct Demo of Existing Asphalt Pavement	90	SY	\$ 30	\$ 2,700	
8		Conduct Demo of Existing Driveway Pavement	110	SY	\$ 20	\$ 2,200	
9		Conduct Clearing and Grubbing (Miscellaneous)		LS	\$ 2,000	\$ 2,000	\$ 6,900
Water Main Extension							
10		Furnish & Install 8" PVC via Open-Cut Trenching with Testing & Chlorination	2718	LF	\$ 150	\$ 407,700	
11		Furnish & Install 10" Water Main (HDPE HDD) with Testing & Chlorination	300	LF	\$ 200	\$ 60,000	
12		Furnish & Install 8" Gate Valves with Valve Box and Conc. Pad	6	EA	\$ 3,500	\$ 22,330	
13		Furnish & Install Fire Hydrant Assembly	3	EA	\$ 12,000	\$ 38,280	
14		Conduct Temporary Jumper Connection at Specified Locations	3	EA	\$ 2,500	\$ 7,500	
15		Conduct Bacterial Sampling of Line at Specified Locations	3	EA	\$ 1,800	\$ 5,400	\$ 541,210
Civil/Site Restoration							
16		Conduct Final Grading & Restoration		LS	\$ 20,000	\$ 20,000	
17		Construct Driveway Pavement (in entirety)	110	SY	\$ 70	\$ 7,700	
18		Construct Asphalt Pavement (in entirety)	540	SY	\$ 75	\$ 40,500	\$ 68,200
ESTIMATE SUBTOTAL							\$ 732,724
C	Planning Level Contingency			%	25%	\$ 183,181	
ESTIMATE TOTAL							\$ 1,000,000

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5-Year Water CIP No. 3
Water Master Plan
City of Palm Bay Utilities Department

PROJECT NO.:
PBU009

DATE:
JUN 2024

FIGURE NO.

6" WM Loop on Devonwood Ct SE
to Eldron Blvd SE
(N of Bayside Lakes)



INFRASTRUCTURE SOLUTION SERVICES ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PBU009 | Water Master Plan Update

5/30/2024
Infrastructure Solution Services, LLC

Five-Year Water System Capital Improvement Needs

CIP No. 3: 6" WM Loop on Devonwood Ct SE to Eldron Blvd SE (N of Bayside Lakes)

Estimated By: JFN
Checked By: CEM
Project Manager: CEM

Specification Division Code or Class		Item Description	Quantity	Unit	Unit Cost	Item Total	Subtotal
No.	General						
1		Mobilization/Demobilization	7.5%	Allow	\$ 177,250	\$ 13,294	
2		General Requirements, Bonds, and Insurance	5%	Allow	\$ 177,250	\$ 8,863	
3		Temporary Erosion Control & Protection		LS	\$ 7,500	\$ 7,500	
4		Testing Allowance		LS	\$ 5,000	\$ 5,000	
5		Maintenance of Traffic		LS	\$ 5,000	\$ 5,000	
6		Survey and Record Drawings		LS	\$ 3,500	\$ 3,500	
Demolition							
7		Conduct Demo of Existing Asphalt Pavement	20	SY	\$ 30	\$ 600	\$ 10,600
8		Conduct Clearing and Grubbing (Miscellaneous)		LS	\$ 10,000	\$ 10,000	
Water Main Extension							
9		Furnish & Install 6" PVC via Open-Cut Trenching with Testing & Chlorination	1005	LF	\$ 90	\$ 90,450	\$ 131,650
10		Furnish & Install 6" Gate Valves with Valve Box and Conc. Pad	4	EA	\$ 2,600	\$ 10,400	
11		Furnish & Install Fire Hydrant Assembly	2	EA	\$ 12,000	\$ 24,000	
12		Conduct Temporary Jumper Connection at Specified Locations	2	EA	\$ 2,500	\$ 5,000	
13		Conduct Bacterial Sampling of Line at Specified Locations	1	EA	\$ 1,800	\$ 1,800	
Civil/Site Restoration							
14		Conduct Final Grading & Restoration		LS	\$ 5,000	\$ 5,000	\$ 14,000
15		Construct Asphalt Pavement (in entirety)	120	SY	\$ 75	\$ 9,000	
ESTIMATE SUBTOTAL							\$ 199,406
C	Planning Level Contingency			%	25%	\$ 49,852	
ESTIMATE TOTAL							\$ 250,000

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Legend

Water Main

- Existing
- 5-Year CIP
- 10-Year CIP
- 20-Year CIP



INFRASTRUCTURE SOLUTION SERVICES ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PBU009 | Water Master Plan Update

5/30/2024
Infrastructure Solution Services, LLC

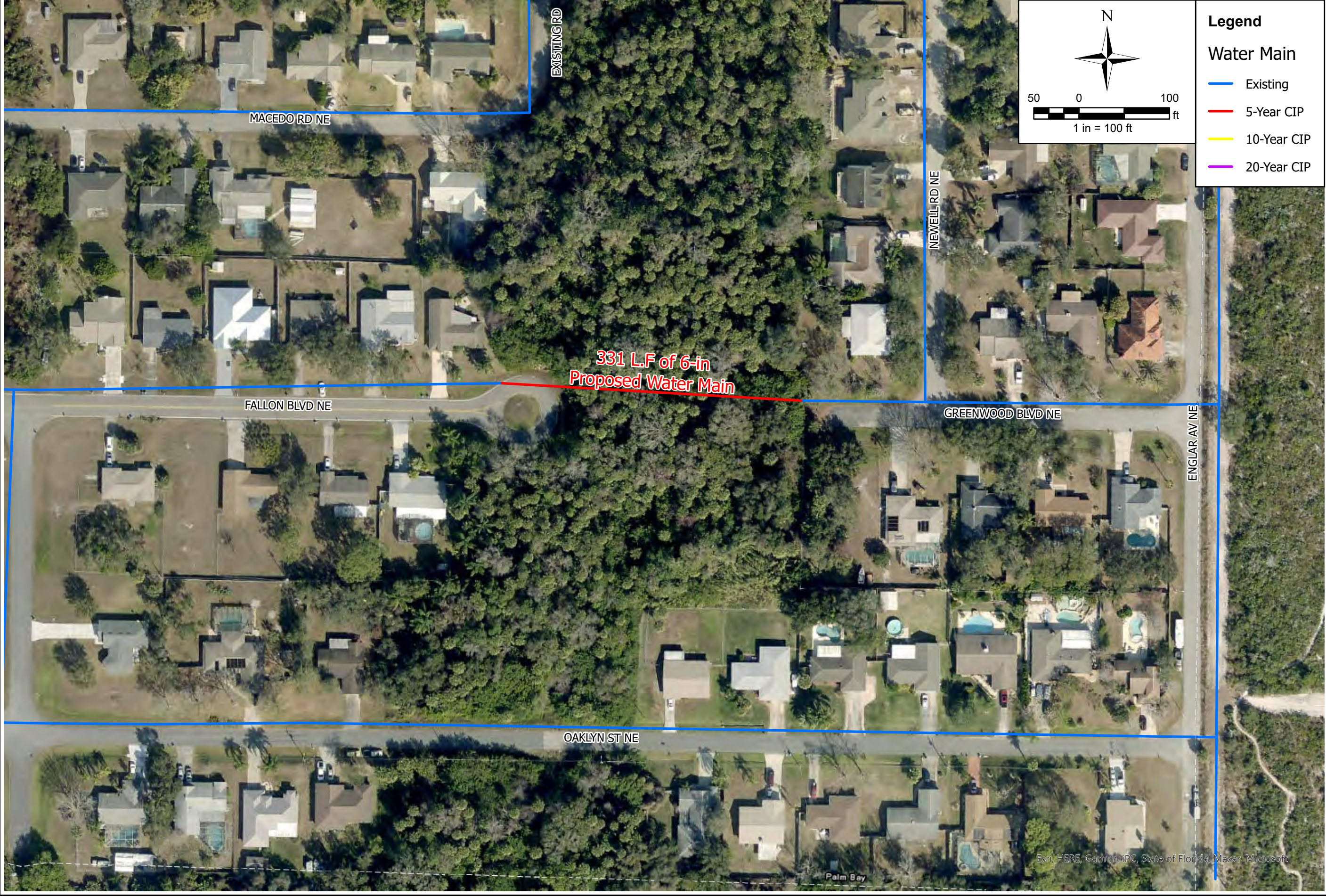
Five-Year Water System Capital Improvement Needs

CIP No. 5: 8" WM Loop on US-1 (N of Wedgewood Dr NE) across US-1

Estimated By: JFN
Checked By: CEM
Project Manager: CEM

Specification Division Code or Class		Item Description	Quantity	Unit	Unit Cost	Item Total	Subtotal
No.	General						
1		Mobilization/Demobilization	7.5%	Allow	\$ 118,575	\$ 8,893	\$ 30,322
2		General Requirements, Bonds, and Insurance	5%	Allow	\$ 118,575	\$ 5,929	
3		Temporary Erosion Control & Protection		LS	\$ 5,000	\$ 5,000	
4		Testing Allowance		LS	\$ 3,000	\$ 3,000	
5		Maintenance of Traffic		LS	\$ 5,000	\$ 5,000	
7		Survey and Record Drawings		LS	\$ 2,500	\$ 2,500	
Demolition							
8		Conduct Demo of Existing Asphalt Pavement	10	SY	\$ 30	\$ 300	\$ 300
Water Main Extension							
9		Furnish & Install 12" Water Main (HDPE HDD) with Testing & Chlorination	111	LF	\$ 225	\$ 24,975	\$ 91,775
10		Furnish & Install 12" Gate Valves with Valve Box and Conc. Pad	4	EA	\$ 15,000	\$ 60,000	
11		Conduct Temporary Jumper Connection at Specified Locations	2	EA	\$ 2,500	\$ 5,000	
12		Conduct Bacterial Sampling of Line at Specified Locations	1	EA	\$ 1,800	\$ 1,800	
Civil/Site Restoration							
13		Conduct Final Grading & Restoration		LS	\$ 5,000	\$ 5,000	\$ 11,000
14		Construct Asphalt Pavement (in entirety)	80	SY	\$ 75	\$ 6,000	
ESTIMATE SUBTOTAL							\$ 133,397
C	Planning Level Contingency			%	25%	\$ 33,349	
ESTIMATE TOTAL							\$ 170,000

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Legend

Water Main

- Existing
- 5-Year CIP
- 10-Year CIP
- 20-Year CIP

INFRASTRUCTURE SOLUTION SERVICES

ISS

Melbourne | Sarasota | Panama City Beach

6" WM Loop Fallon Blvd NE to Greenwood Blvd NE

5-Year Water CIP No. 6
Water Master Plan
City of Palm Bay Utilities Department

PROJECT NO.:
PBU009

DATE:
JUN 2024

FIGURE NO.

Esri, HERE, Garmin, IPC, State of Florida, Maxar, Microsoft



INFRASTRUCTURE SOLUTION SERVICES ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PBU009 | Water Master Plan Update

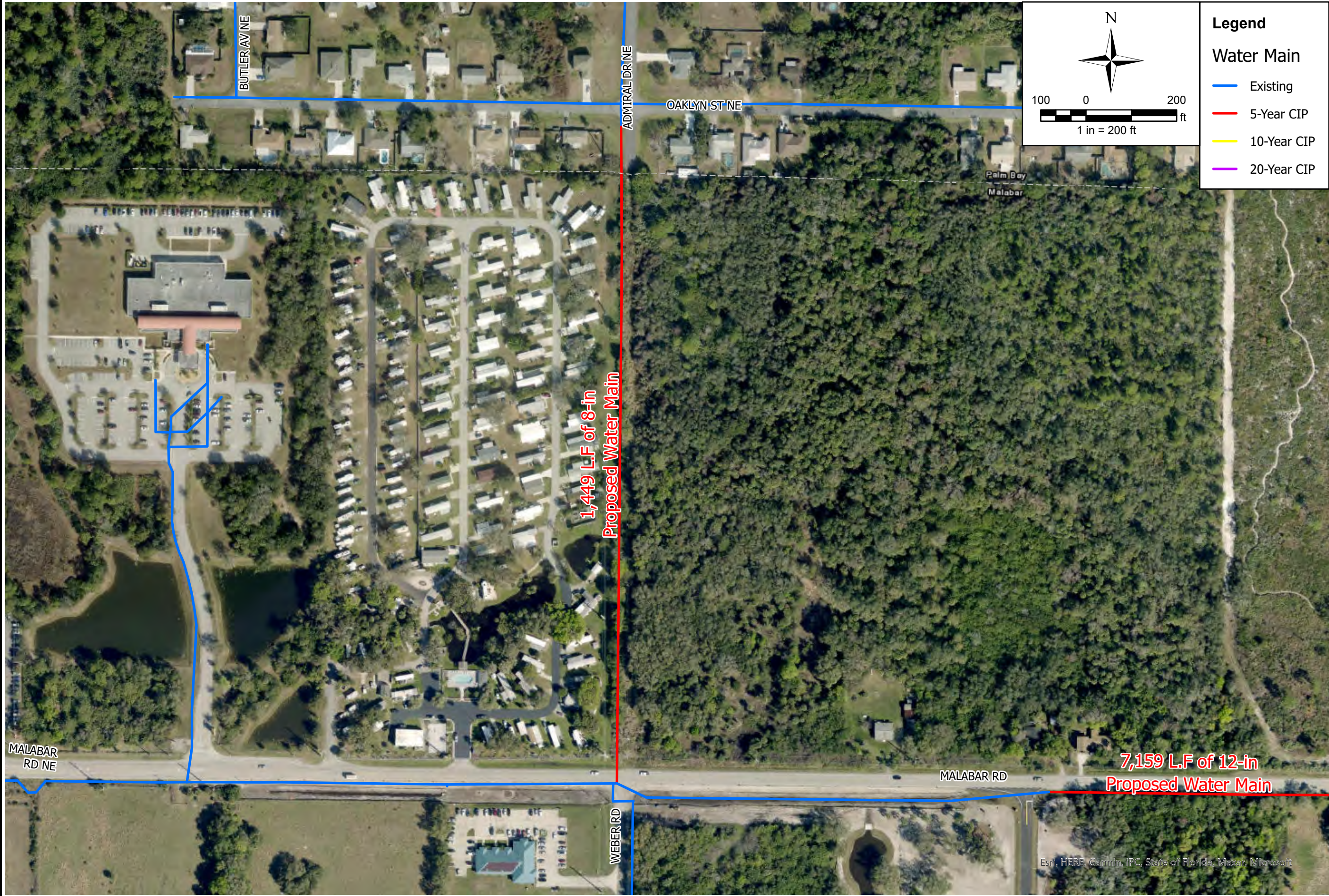
5/30/2024
Infrastructure Solution Services, LLC

Five-Year Water System Capital Improvement Needs
CIP No. 6: 6" WM Loop Fallon Blvd NE to Greenwood Blvd NE

Estimated By: JFN
Checked By: CEM
Project Manager: CEM

Specification Division Code or Class		Item Description	Quantity	Unit	Unit Cost	Item Total	Subtotal
No.	General						
1		Mobilization/Demobilization	7.5%	Allow	\$ 87,715	\$ 6,579	
2		General Requirements, Bonds, and Insurance	5%	Allow	\$ 87,715	\$ 4,386	
3		Temporary Erosion Control & Protection		LS	\$ 5,000	\$ 5,000	
4		Testing Allowance		LS	\$ 3,000	\$ 3,000	
5		Maintenance of Traffic		LS	\$ 5,000	\$ 5,000	
6		Survey and Record Drawings		LS	\$ 2,500	\$ 2,500	\$ 26,464
Demolition							
7		Conduct Demo of Existing Asphalt Pavement	35	SY	\$ 30	\$ 1,050	
8		Conduct Clearing and Grubbing (Miscellaneous)		LS	\$ 15,000	\$ 15,000	\$ 16,050
Water Main Extension							
9		Furnish & Install 6" PVC via Open-Cut Trenching with Testing & Chlorination	331	LF	\$ 90	\$ 29,790	
10		Furnish & Install 6" Gate Valves with Valve Box and Conc. Pad	2	EA	\$ 2,600	\$ 5,200	
11		Conduct Temporary Jumper Connection at Specified Locations	1	EA	\$ 2,500	\$ 2,500	
12		Conduct Bacterial Sampling of Line at Specified Locations	1	EA	\$ 1,800	\$ 1,800	\$ 39,290
Civil/Site Restoration							
13		Conduct Final Grading & Restoration		LS	\$ 7,500	\$ 7,500	
14		Construct Asphalt Pavement (in entirety)	125	SY	\$ 75	\$ 9,375	\$ 16,875
ESTIMATE SUBTOTAL							\$ 98,679
C	Planning Level Contingency			%	25%	\$ 24,670	
ESTIMATE TOTAL							\$ 120,000

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INFRASTRUCTURE SOLUTION SERVICES ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PBU009 | Water Master Plan Update

5/30/2024
Infrastructure Solution Services, LLC

Five-Year Water System Capital Improvement Needs

CIP No. 7: 8" WM Loop Admiral Dr (Extended) to Malabar Road (S of Oaklyn)

Estimated By: JFN
Checked By: CEM
Project Manager: CEM

Specification Division Code or Class		Item Description	Quantity	Unit	Unit Cost	Item Total	Subtotal
No.	General						
1		Mobilization/Demobilization	7.5%	Allow	\$ 371,550	\$ 27,866	
2		General Requirements, Bonds, and Insurance	5%	Allow	\$ 371,550	\$ 18,578	
3		Temporary Erosion Control & Protection		LS	\$ 20,000	\$ 20,000	
4		Testing Allowance		LS	\$ 5,000	\$ 5,000	
5		Maintenance of Traffic		LS	\$ 15,000	\$ 15,000	
7		Survey and Record Drawings		LS	\$ 5,000	\$ 5,000	\$ 91,444
Demolition							
8		Conduct Demo of Existing Asphalt Pavement	20	SY	\$ 30	\$ 600	
9		Conduct Clearing and Grubbing (Miscellaneous)		LS	\$ 25,000	\$ 25,000	\$ 25,600
Water Main Extension							
10		Furnish & Install 8" PVC via Open-Cut Trenching with Testing & Chlorination	1349	LF	\$ 150	\$ 202,350	
11		Furnish & Install 10" Water Main (HDPE HDD) with Testing & Chlorination	100	LF	\$ 200	\$ 20,000	
12		Furnish & Install 8" Gate Valves with Valve Box and Conc. Pad	4	EA	\$ 3,500	\$ 14,000	
13		Furnish & Install Fire Hydrant Assembly	1	EA	\$ 12,000	\$ 12,000	
14		Conduct Temporary Jumper Connection at Specified Locations	2	EA	\$ 2,500	\$ 5,000	
15		Conduct Bacterial Sampling of Line at Specified Locations	2	EA	\$ 1,800	\$ 3,600	\$ 256,950
Civil/Site Restoration							
16		Conduct Final Grading & Restoration		LS	\$ 35,000	\$ 35,000	
17		Construct Asphalt Pavement (in entirety)	120	SY	\$ 75	\$ 9,000	\$ 44,000
ESTIMATE SUBTOTAL							\$ 417,994
C	Planning Level Contingency			%	25%	\$ 104,498	
ESTIMATE TOTAL							\$ 520,000

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Esri, HERE, Garmin, iPC, State of Florida, Maxar, Microsoft

Legend

Water Main

- Existing
- 5-Year CIP
- 10-Year CIP
- 20-Year CIP



INFRASTRUCTURE SOLUTION SERVICES ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PBU009 | Water Master Plan Update

5/30/2024
Infrastructure Solution Services, LLC

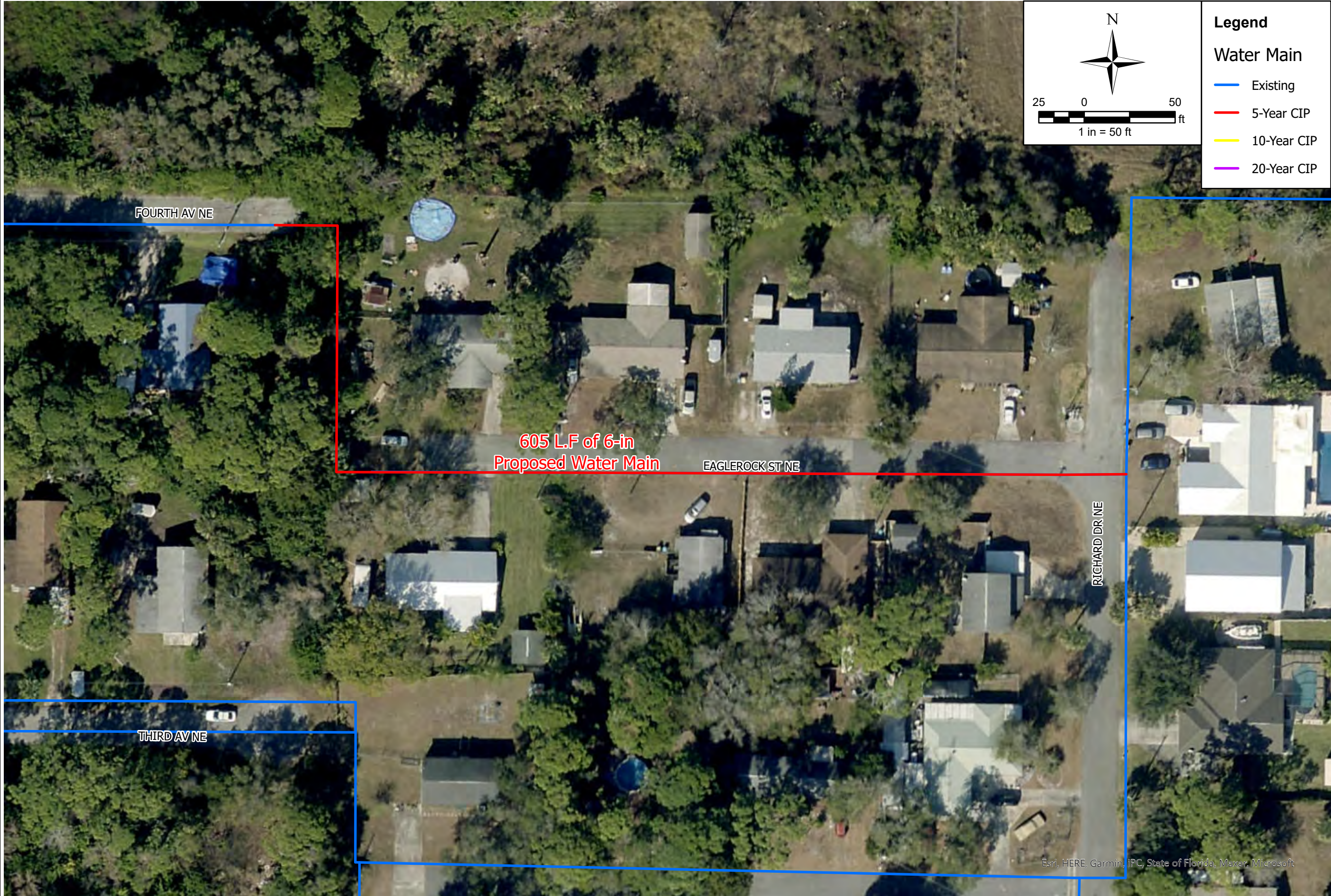
Five-Year Water System Capital Improvement Needs

CIP No. 8: Replace 8" WM with 12" WM on US-1 (Anglers Dr NE-Breezy Palms RV Park)

Estimated By: JFN
Checked By: CEM
Project Manager: CEM

Specification Division Code or Class		Item Description	Quantity	Unit	Unit Cost	Item Total	Subtotal
No.		General					
1		Mobilization/Demobilization	7.5%	Allow	\$ 1,839,075	\$ 137,931	
2		General Requirements, Bonds, and Insurance	5%	Allow	\$ 1,839,075	\$ 91,954	
3		Temporary Erosion Control & Protection		LS	\$ 15,000	\$ 15,000	
4		Testing Allowance		LS	\$ 5,000	\$ 5,000	
5		Maintenance of Traffic		LS	\$ 25,000	\$ 25,000	
6		Survey and Record Drawings		LS	\$ 5,500	\$ 5,500	\$ 280,384
		Demolition					
7		Conduct Demo of Existing Asphalt Pavement	115	SY	\$ 30	\$ 3,450	
8		Conduct Demo of Existing Sidewalk Pavement	80	SY	\$ 20	\$ 1,600	
9		Conduct Clearing and Grubbing (Miscellaneous)		LS	\$ 30,000	\$ 30,000	\$ 35,050
		Water Main Extension					
10		Furnish & Install 12" PVC via Open-Cut Trenching with Testing & Chlorination	1915	LF	\$ 170	\$ 325,550	
		Furnish & Install 16" Water Main (HDPE HDD) with Testing & Chlorination	3235	LF	\$ 300	\$ 970,500	
11		Furnish & Install 12" Gate Valves with Valve Box and Conc. Pad	18	EA	\$ 15,000	\$ 270,000	
12		Furnish & Install Fire Hydrant Assembly	5	EA	\$ 12,000	\$ 60,000	
13		Conduct Temporary Jumper Connection at Specified Locations	9	EA	\$ 2,500	\$ 22,500	
14		Conduct Bacterial Sampling of Line at Specified Locations	5	EA	\$ 1,800	\$ 9,000	\$ 1,657,550
		Civil/Site Restoration					
15		Conduct Final Grading & Restoration		LS	\$ 30,000	\$ 30,000	
16		Construct Sidewalk Pavement (in entirety)	80	SY	\$ 70	\$ 5,600	
17		Construct Asphalt Pavement (in entirety)	805	SY	\$ 75	\$ 60,375	\$ 95,975
ESTIMATE SUBTOTAL							\$ 2,068,959
C		Planning Level Contingency		%	25%	\$ 517,240	
ESTIMATE TOTAL							\$ 2,600,000

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5-Year Water CIP No. 9
Water Master Plan
City of Palm Bay Utilities Department

PROJECT NO.:
PBU009

DATE:
JUN 2024

FIGURE NO.

Replace 2" WM with 6" WM
on Eaglerock & 6" WM loop to Fourth



INFRASTRUCTURE SOLUTION SERVICES ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PBU009 | Water Master Plan Update

5/30/2024
Infrastructure Solution Services, LLC

Five-Year Water System Capital Improvement Needs

CIP No. 9: Replace 2" WM with 6" WM on Eaglerock St NE & 6" WM loop to Fourth Ave NE

Estimated By: JFN
Checked By: CEM
Project Manager: CEM

Specification Division Code or Class		Item Description	Quantity	Unit	Unit Cost	Item Total	Subtotal
No.	General						
1		Mobilization/Demobilization	7.5%	Allow	\$ 220,750	\$ 16,556	
2		General Requirements, Bonds, and Insurance	5%	Allow	\$ 220,750	\$ 11,038	
3		Temporary Erosion Control & Protection		LS	\$ 7,500	\$ 7,500	
4		Testing Allowance		LS	\$ 2,500	\$ 2,500	
5		Maintenance of Traffic		LS	\$ 5,000	\$ 5,000	
6		Survey and Record Drawings		LS	\$ 3,500	\$ 3,500	\$ 46,094
Demolition							
7		Conduct Demo of Existing Asphalt Pavement	215	SY	\$ 30	\$ 6,450	
8		Conduct Clearing and Grubbing (Miscellaneous)		LS	\$ 20,000	\$ 20,000	\$ 26,450
Water Main Extension							
9		Furnish & Install 6" PVC via Open-Cut Trenching with Testing & Chlorination	605	LF	\$ 90	\$ 54,450	
10		Furnish & Install 6" Gate Valves with Valve Box and Conc. Pad	3	EA	\$ 2,600	\$ 7,800	
11		Furnish & Install Fire Hydrant Assembly	1	EA	\$ 12,000	\$ 12,000	
12		Conduct Temporary Jumper Connection at Specified Locations	1	EA	\$ 2,500	\$ 2,500	
13		Conduct Bacterial Sampling of Line at Specified Locations	1	EA	\$ 1,800	\$ 1,800	\$ 78,550
Civil/Site Restoration							
14		Conduct Final Grading & Restoration		LS	\$ 3,500	\$ 3,500	
15		Construct Asphalt Pavement (in entirety)	1250	SY	\$ 75	\$ 93,750	\$ 97,250
ESTIMATE SUBTOTAL							\$ 248,344
C	Planning Level Contingency			%	25%	\$ 62,086	
ESTIMATE TOTAL							\$ 310,000

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5-Year Water CIP No. 10
Water Master Plan
City of Palm Bay Utilities Department

PROJECT NO.:
PBU009
DATE:
JUN 2024
FIGURE NO.

6" WM Loop Danr Dr NE to
Myers Dr NE under Railroad



INFRASTRUCTURE SOLUTION SERVICES ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

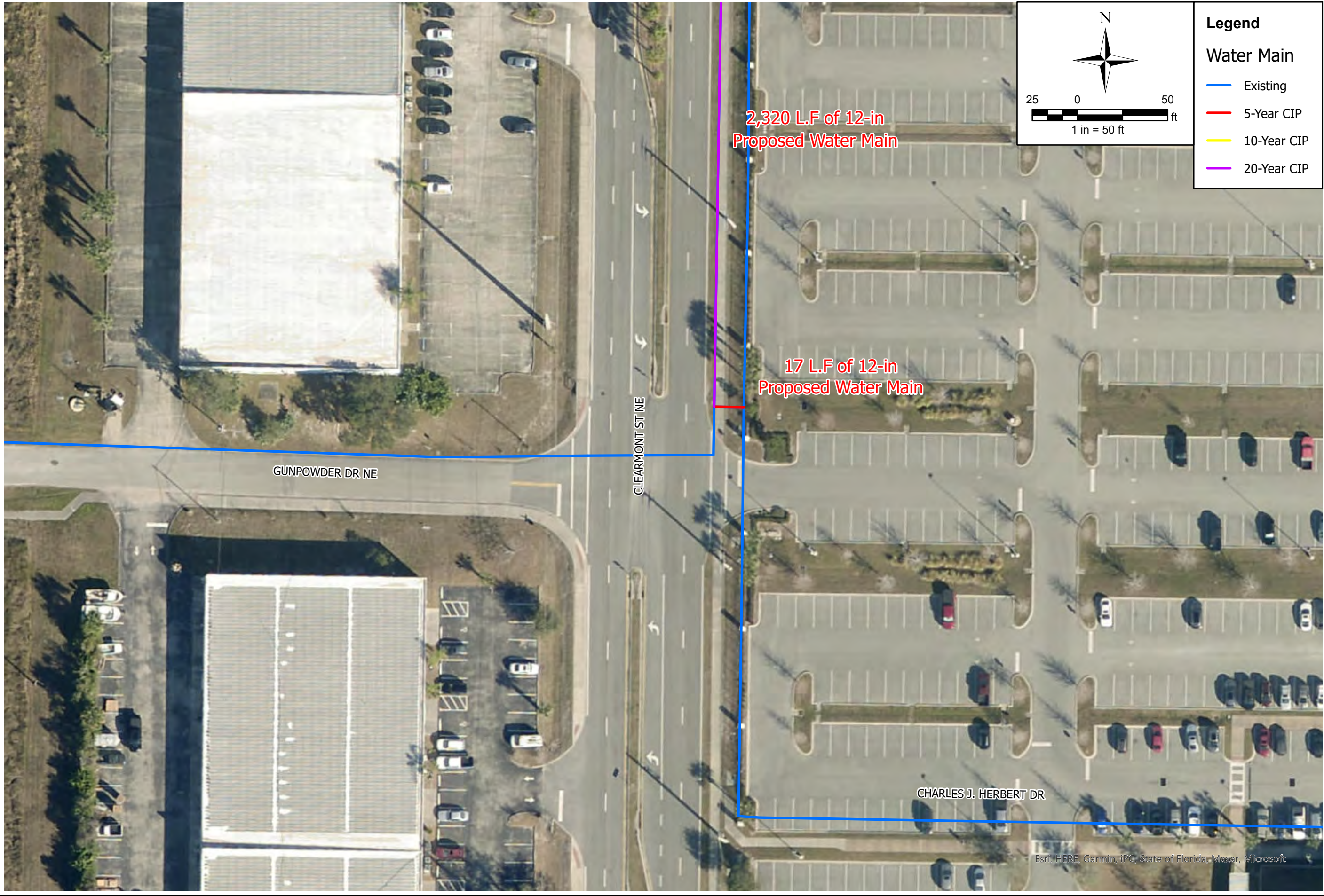
PBU009 | Water Master Plan Update

5/30/2024
Infrastructure Solution Services, LLC

Five-Year Water System Capital Improvement Needs
CIP No. 10: 6" WM Loop Danr Dr NE to Myers Dr NE under Railroad

Estimated By: JFN
Checked By: CEM
Project Manager: CEM

Specification Division Code or Class		Item Description	Quantity	Unit	Unit Cost	Item Total	Subtotal
No.	General						
1		Mobilization/Demobilization	7.5%	Allow	\$ 141,475	\$ 10,611	
2		General Requirements, Bonds, and Insurance	5%	Allow	\$ 141,475	\$ 7,074	
3		Temporary Erosion Control & Protection		LS	\$ 5,000	\$ 5,000	
4		Testing Allowance		LS	\$ 5,000	\$ 5,000	
5		Maintenance of Traffic		LS	\$ 10,000	\$ 10,000	
6		Survey and Record Drawings		LS	\$ 3,500	\$ 3,500	\$ 41,184
Demolition							
7		Conduct Demo of Existing Asphalt Pavement	15	SY	\$ 30	\$ 450	
8		Conduct Clearing and Grubbing (Miscellaneous)		LS	\$ 7,500	\$ 7,500	\$ 7,950
Water Main Extension							
9		Furnish & Install 8" Water Main (HDPE HDD) with Testing & Chlorination	497	LF	\$ 175	\$ 86,975	
10		Furnish & Install 8" Gate Valves with Valve Box and Conc. Pad	2	EA	\$ 3,500	\$ 7,000	
11		Conduct Temporary Jumper Connection at Specified Locations	1	EA	\$ 2,500	\$ 2,500	
12		Conduct Bacterial Sampling of Line at Specified Locations	1	EA	\$ 1,800	\$ 1,800	\$ 98,275
Civil/Site Restoration							
13		Conduct Final Grading & Restoration		LS	\$ 3,500	\$ 3,500	
14		Construct Asphalt Pavement (in entirety)	110	SY	\$ 75	\$ 8,250	\$ 11,750
ESTIMATE SUBTOTAL							\$ 159,159
C	Planning Level Contingency			%	25%	\$ 39,790	
ESTIMATE TOTAL							\$ 200,000





INFRASTRUCTURE SOLUTION SERVICES ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PBU009 | Water Master Plan Update

5/30/2024

Infrastructure Solution Services, LLC

Five-Year Water System Capital Improvement Needs

CIP No. 11: Replace 6" WM with 12" WM on Clearmont St NE at Gunpowder Dr NE

Estimated By:

JFN

Checked By:

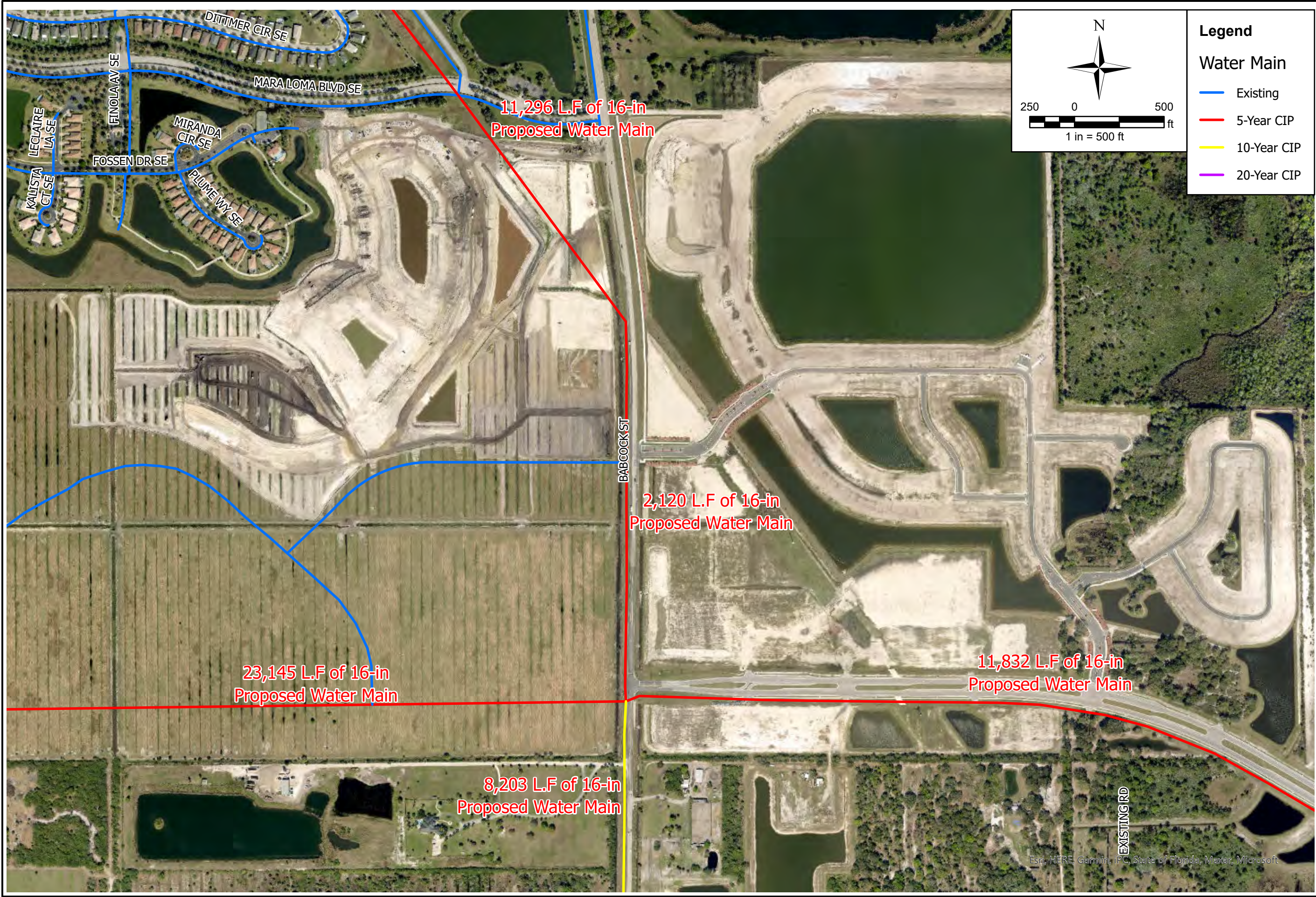
CEM

Project Manager:

CEM

Specification Division Code or Class		Item Description	Quantity	Unit	Unit Cost	Item Total	Subtotal
No.	General						
1		Mobilization/Demobilization	7.5%	Allow	\$ 86,190	\$ 6,464	
2		General Requirements, Bonds, and Insurance	5%	Allow	\$ 86,190	\$ 4,310	
3		Temporary Erosion Control & Protection		LS	\$ 2,000	\$ 2,000	
4		Testing Allowance		LS	\$ 2,500	\$ 2,500	
5		Maintenance of Traffic		LS	\$ 5,000	\$ 5,000	
6		Survey and Record Drawings		LS	\$ 2,000	\$ 2,000	
\$ 22,274							
Demolition							
7		Conduct Demo of Existing Sidewalk Pavement	5	SY	\$ 20	\$ 100	\$ 1,100
8		Conduct Clearing and Grubbing (Miscellaneous)		LS	\$ 1,000	\$ 1,000	
Water Main Extension							
9		Furnish & Install 12" PVC via Open-Cut Trenching with Testing & Chlorination	17	LF	\$ 170	\$ 2,890	\$ 69,690
10		Furnish & Install 12" Gate Valves with Valve Box and Conc. Pad	4	EA	\$ 15,000	\$ 60,000	
11		Conduct Temporary Jumper Connection at Specified Locations	2	EA	\$ 2,500	\$ 5,000	
12		Conduct Bacterial Sampling of Line at Specified Locations	1	EA	\$ 1,800	\$ 1,800	
Civil/Site Restoration							
14		Conduct Final Grading & Restoration		LS	\$ 2,500	\$ 2,500	\$ 3,900
15		Construct Sidewalk Pavement (in entirety)	20	SY	\$ 70	\$ 1,400	
ESTIMATE SUBTOTAL							\$ 96,964
C	Planning Level Contingency			%	25%	\$ 24,241	
ESTIMATE TOTAL							\$ 120,000

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5-Year Water CIP No. 12
Water Master Plan
City of Palm Bay Utilities Department

PROJECT NO.:
PBU009
DATE:
JUN 2024
FIGURE NO.

16" WM Extension to Babcock St
(S of Mata Loma Blvd)



INFRASTRUCTURE SOLUTION SERVICES ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PBU009 | Water Master Plan Update

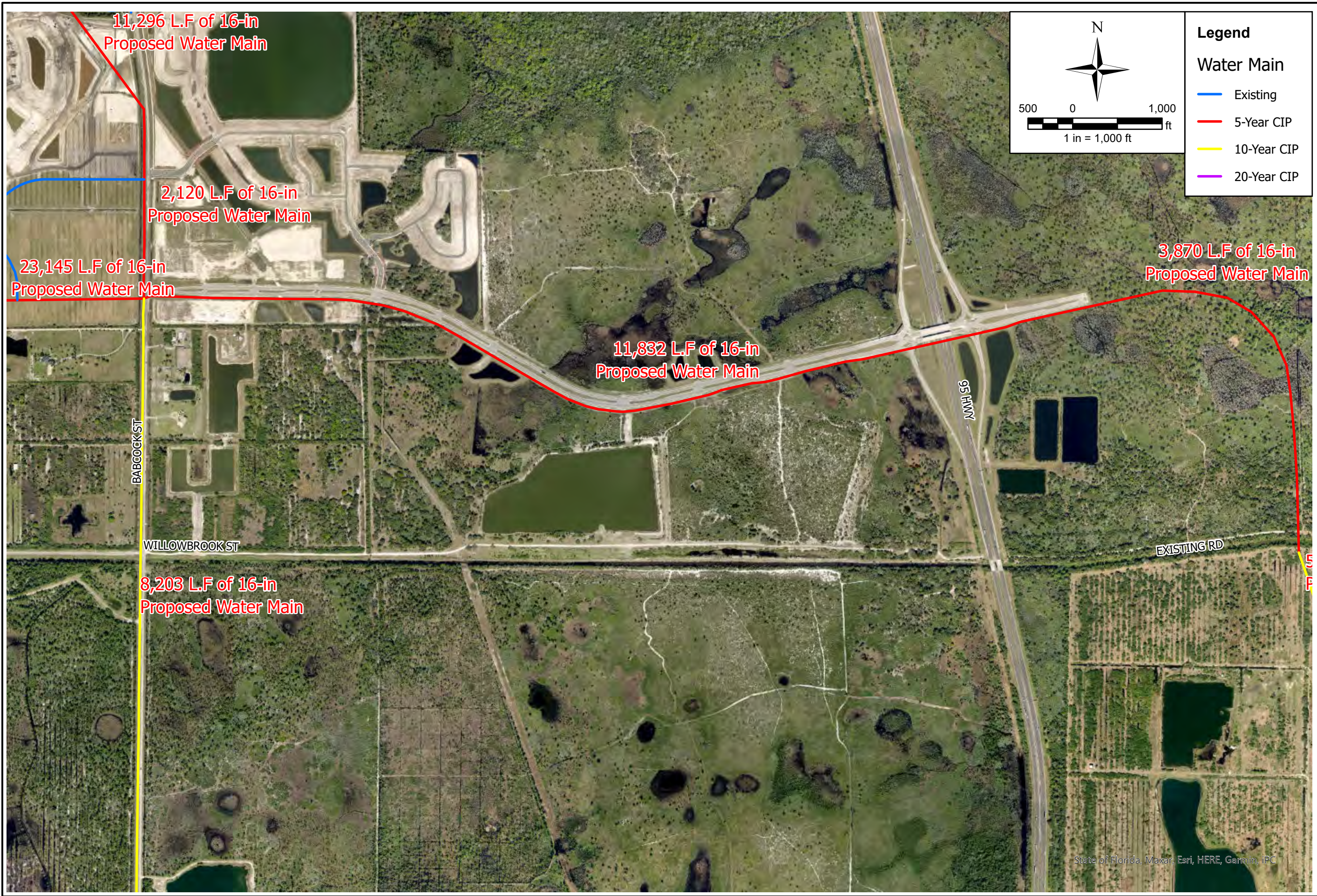
5/30/2024
Infrastructure Solution Services, LLC

Five-Year Water System Capital Improvement Needs
CIP No. 12: 16" WM Extension to Babcock St (S of Mara Loma Blvd)

Estimated By: JFN
Checked By: CEM
Project Manager: CEM

Specification Division Code or Class		Item Description	Quantity	Unit	Unit Cost	Item Total	Subtotal
No.	General						
1		Mobilization/Demobilization	7.5%	Allow	\$ 566,900	\$ 42,518	
2		General Requirements, Bonds, and Insurance	5%	Allow	\$ 566,900	\$ 28,345	
3		Temporary Erosion Control & Protection		LS	\$ 20,000	\$ 20,000	
4		Testing Allowance		LS	\$ 5,000	\$ 5,000	
5		Maintenance of Traffic		LS	\$ 5,000	\$ 5,000	
6		Survey and Record Drawings		LS	\$ 4,500	\$ 4,500	\$ 105,363
	Demolition						
7		Conduct Clearing and Grubbing (Miscellaneous)		LS	\$ 7,000	\$ 7,000	\$ 7,000
	Water Main Extension						
8		Furnish & Install 16" PVC via Open-Cut Trenching with Testing & Chlorination	2120	LF	\$ 190	\$ 402,800	
9		Furnish & Install 16" Gate Valves with Valve Box and Conc. Pad	4	EA	\$ 20,000	\$ 80,000	
10		Furnish & Install Fire Hydrant Assembly	2	EA	\$ 12,000	\$ 24,000	
11		Conduct Temporary Jumper Connection at Specified Locations	2	EA	\$ 2,500	\$ 5,000	
12		Conduct Bacterial Sampling of Line at Specified Locations	2	EA	\$ 1,800	\$ 3,600	\$ 515,400
	Civil/Site Restoration						
13		Conduct Final Grading & Restoration		LS	\$ 10,000	\$ 10,000	\$ 10,000
ESTIMATE SUBTOTAL							\$ 637,763
C		Planning Level Contingency		%	25%	\$ 159,441	
ESTIMATE TOTAL							\$ 800,000

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5-Year Water CIP No. 13
Water Master Plan
City of Palm Bay Utilities Department

PROJECT NO.:
PBU009

DATE:
JUN 2024

FIGURE NO.

16" WM Extension E of Babcock St
for Emerald City Development



INFRASTRUCTURE SOLUTION SERVICES ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PBU009 | Water Master Plan Update

5/30/2024
Infrastructure Solution Services, LLC

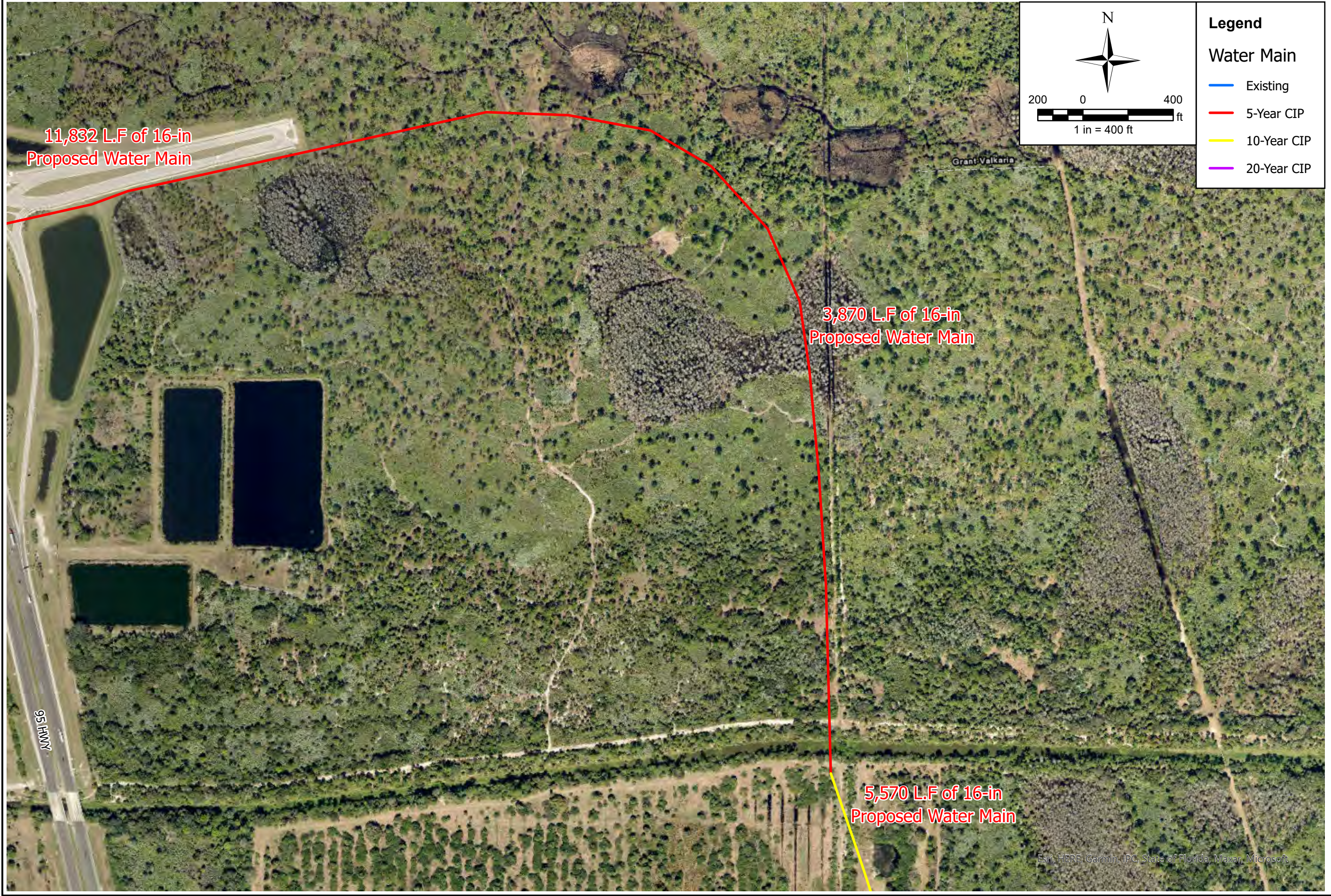
Five-Year Water System Capital Improvement Needs

CIP No. 13: 16" WM Extension E of Babcock St for Emerald City Development

Estimated By: JFN
Checked By: CEM
Project Manager: CEM

Specification Division Code or Class		Item Description	Quantity	Unit	Unit Cost	Item Total	Subtotal
No.	General						
1		Mobilization/Demobilization	7.5%	Allow	\$ 3,449,680	\$ 258,726	
2		General Requirements, Bonds, and Insurance	5%	Allow	\$ 3,449,680	\$ 172,484	
3		Temporary Erosion Control & Protection		LS	\$ 30,000	\$ 30,000	
4		Testing Allowance		LS	\$ 7,500	\$ 7,500	
5		Maintenance of Traffic		LS	\$ 50,000	\$ 50,000	
6		Survey and Record Drawings		LS	\$ 7,500	\$ 7,500	\$ 526,210
Demolition							
7		Conduct Demo of Existing Asphalt Pavement	20	SY	\$ 30	\$ 600	
8		Conduct Clearing and Grubbing (Miscellaneous)		LS	\$ 20,000	\$ 20,000	\$ 20,600
Water Main Extension							
9		Furnish & Install 16" PVC via Open-Cut Trenching with Testing & Chlorination	10032	LF	\$ 190	\$ 1,906,080	
10		Furnish & Install 20" Water Main (HDPE HDD) with Testing & Chlorination	1800	LF	\$ 400	\$ 720,000	
11		Furnish & Install 16" Gate Valves with Valve Box and Conc. Pad	24	EA	\$ 20,000	\$ 480,000	
12		Furnish & Install Fire Hydrant Assembly	10	EA	\$ 12,000	\$ 120,000	
13		Conduct Temporary Jumper Connection at Specified Locations	12	EA	\$ 2,500	\$ 30,000	
14		Conduct Bacterial Sampling of Line at Specified Locations	10	EA	\$ 1,800	\$ 18,000	\$ 3,274,080
Civil/Site Restoration							
15		Conduct Final Grading & Restoration		LS	\$ 45,000	\$ 45,000	
16		Construct Asphalt Pavement (in entirety)	200	SY	\$ 75	\$ 15,000	\$ 60,000
ESTIMATE SUBTOTAL							\$ 3,880,890
C	Planning Level Contingency			%	25%	\$ 970,223	
ESTIMATE TOTAL							\$ 4,900,000

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Legend

Water Main

- Existing
- 5-Year CIP
- 10-Year CIP
- 20-Year CIP



INFRASTRUCTURE SOLUTION SERVICES ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PBU009 | Water Master Plan Update

5/30/2024
Infrastructure Solution Services, LLC

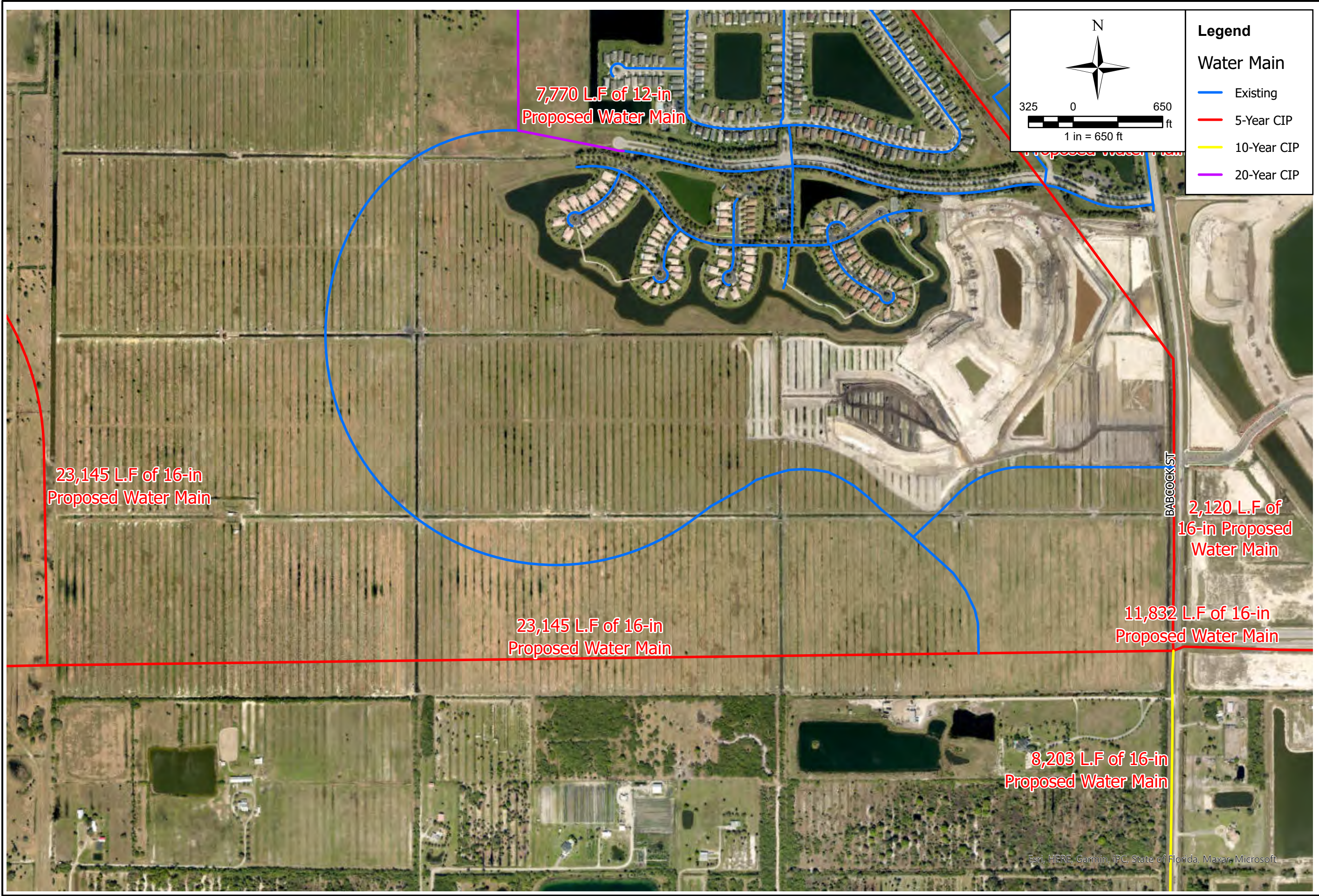
Five-Year Water System Capital Improvement Needs

Estimated By: JFN
Checked By: CEM
Project Manager: CEM

CIP No 14: 16" WM Extension S of 16" WM Extension for Emerald City & Pete Holdings Developments

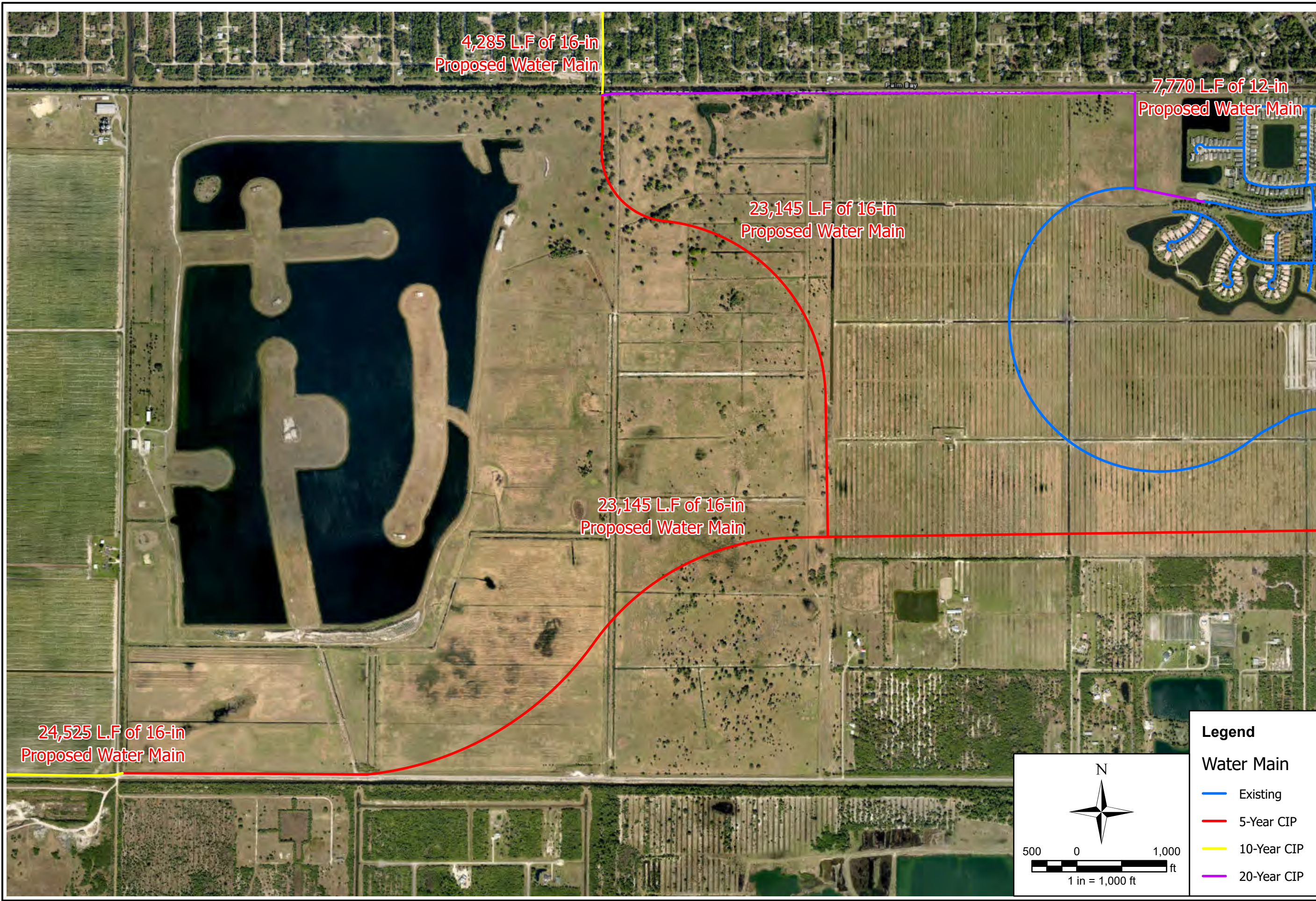
Specification Division Code or Class		Item Description	Quantity	Unit	Unit Cost	Item Total	Subtotal
No.	General						
1		Mobilization/Demobilization	7.5%	Allow	\$ 1,007,200	\$ 75,540	
2		General Requirements, Bonds, and Insurance	5%	Allow	\$ 1,007,200	\$ 50,360	
3		Temporary Erosion Control & Protection		LS	\$ 5,000	\$ 5,000	
4		Testing Allowance		LS	\$ 5,000	\$ 5,000	
5		Maintenance of Traffic		LS	\$ 2,000	\$ 2,000	
6		Survey and Record Drawings		LS	\$ 4,000	\$ 4,000	\$ 141,900
Demolition							
7		Conduct Clearing and Grubbing (Miscellaneous)		LS	\$ 15,000	\$ 15,000	\$ 15,000
Water Main Extension							
8		Furnish & Install 16" PVC via Open-Cut Trenching with Testing & Chlorination	3670	LF	\$ 190	\$ 697,300	
9		Furnish & Install 20" Water Main (HDPE HDD) with Testing & Chlorination	200	LF	\$ 400	\$ 80,000	
10		Furnish & Install 16" Gate Valves with Valve Box and Conc. Pad	6	EA	\$ 20,000	\$ 120,000	
11		Furnish & Install Fire Hydrant Assembly	3	EA	\$ 12,000	\$ 36,000	
12		Conduct Temporary Jumper Connection at Specified Locations	3	EA	\$ 2,500	\$ 7,500	
13		Conduct Bacterial Sampling of Line at Specified Locations	3	EA	\$ 1,800	\$ 5,400	\$ 946,200
Civil/Site Restoration							
14		Conduct Final Grading & Restoration		LS	\$ 30,000	\$ 30,000	\$ 30,000
ESTIMATE SUBTOTAL							\$ 1,133,100
C	Planning Level Contingency			%	25%	\$ 283,275	
ESTIMATE TOTAL							\$ 1,500,000

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Esri, HERE, Garmin, IPC, State of Florida, Maxar, Microsoft

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Legend

Water Main

- Existing
- 5-Year CIP
- 10-Year CIP
- 20-Year CIP

5-Year Water CIP No. 15 B
Water Master Plan
City of Palm Bay Utilities Department

PROJECT NO.:
PBU009

DATE:
JUN 2024

FIGURE NO.

16" WM Extension on Davis Ln
Extended for Waterstone
and Rolling Meadows Developments

INFRASTRUCTURE
SOLUTION SERVICES

ISS

Melbourne | Sarasota | Panama City Beach



INFRASTRUCTURE SOLUTION SERVICES ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PBU009 | Water Master Plan Update

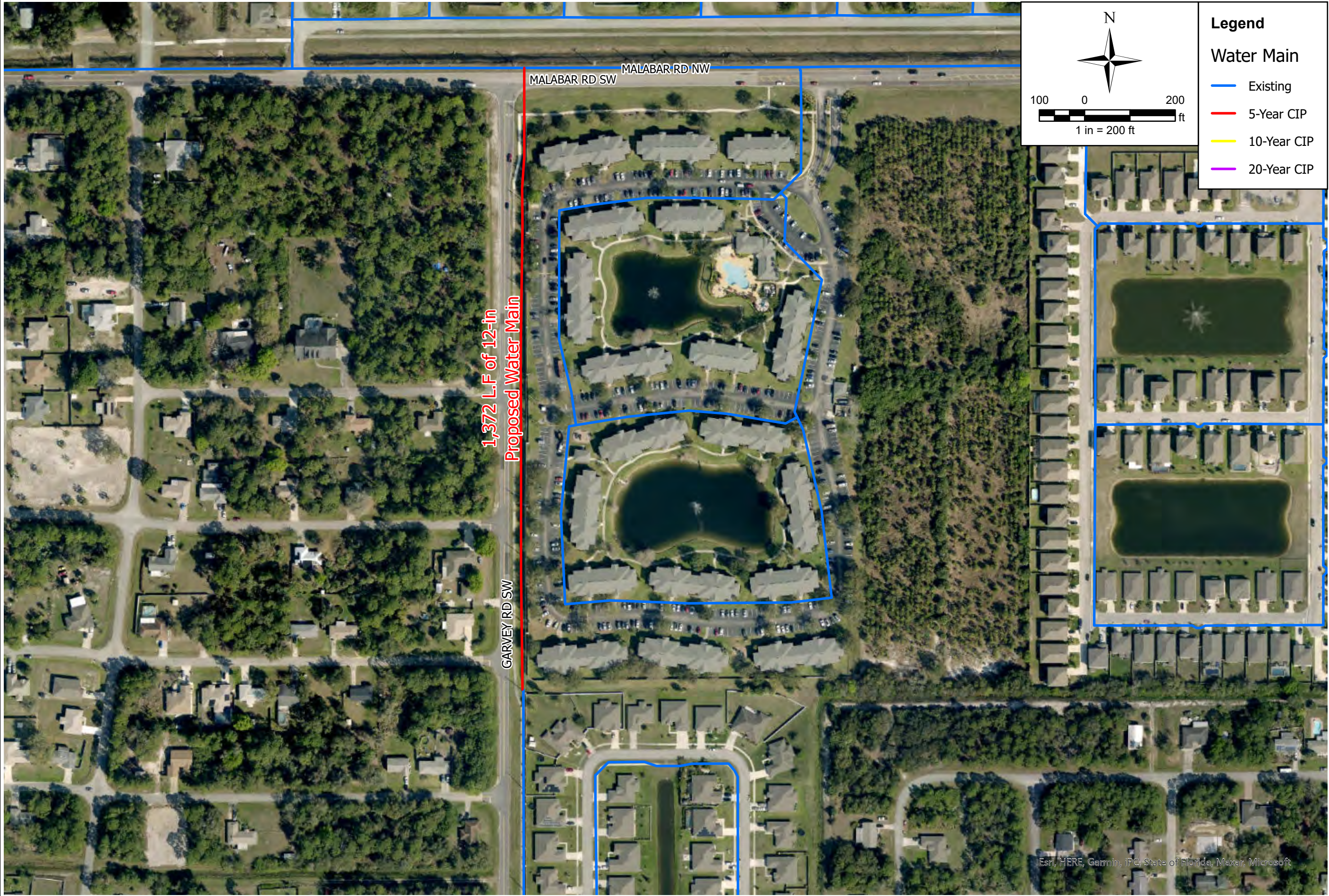
5/30/2024
Infrastructure Solution Services, LLC

Five-Year Water System Capital Improvement Needs

Estimated By: JFN
Checked By: CEM
Project Manager: CEM

CIP No. 15: 16" WM Extension on Davis Ln Extended for Waterstone and Rolling Meadows Developments

Specification Division Code or Class		Item Description	Quantity	Unit	Unit Cost	Item Total	Subtotal
No.		General					
1		Mobilization/Demobilization	7.5%	Allow	\$ 5,902,650	\$ 442,699	
2		General Requirements, Bonds, and Insurance	5%	Allow	\$ 5,902,650	\$ 295,133	
3		Temporary Erosion Control & Protection		LS	\$ 55,000	\$ 55,000	
4		Testing Allowance		LS	\$ 7,500	\$ 7,500	
5		Maintenance of Traffic		LS	\$ 30,000	\$ 30,000	
6		Survey and Record Drawings		LS	\$ 10,000	\$ 10,000	\$ 840,331
		Demolition					
7		Conduct Demo of Existing Asphalt Pavement	30	SY	\$ 30	\$ 900	
8		Conduct Clearing and Grubbing (Miscellaneous)		LS	\$ 30,000	\$ 30,000	\$ 30,900
		Water Main Extension					
9		Furnish & Install 16" PVC via Open-Cut Trenching with Testing & Chlorination	22795	LF	\$ 190	\$ 4,331,050	
10		Furnish & Install 20" Water Main (HDPE HDD) with Testing & Chlorination	350	LF	\$ 400	\$ 140,000	
11		Furnish & Install 16" Gate Valves with Valve Box and Conc. Pad	44	EA	\$ 20,000	\$ 880,000	
12		Furnish & Install Fire Hydrant Assembly	22	EA	\$ 12,000	\$ 264,000	
13		Conduct Temporary Jumper Connection at Specified Locations	22	EA	\$ 2,500	\$ 55,000	
14		Conduct Bacterial Sampling of Line at Specified Locations	19	EA	\$ 1,800	\$ 34,200	\$ 5,704,250
		Civil/Site Restoration					
15		Conduct Final Grading & Restoration		LS	\$ 50,000	\$ 50,000	
16		Construct Asphalt Pavement (in entirety)	200	SY	\$ 75	\$ 15,000	\$ 65,000
ESTIMATE SUBTOTAL							\$ 6,640,481
C		Planning Level Contingency		%	25%	\$ 1,660,120	
ESTIMATE TOTAL							\$ 8,400,000





INFRASTRUCTURE SOLUTION SERVICES ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PBU009 | Water Master Plan Update

5/30/2024
Infrastructure Solution Services, LLC

Five-Year Water System Capital Improvement Needs

CIP No. 16: 12" WM Loop on Garvey Rd (Malabar Rd-White Cloud St SW)

Estimated By: JFN
Checked By: CEM
Project Manager: CEM

Specification Division Code or Class		Item Description	Quantity	Unit	Unit Cost	Item Total	Subtotal
No.	General						
1		Mobilization/Demobilization	7.5%	Allow	\$ 461,740	\$ 34,631	
2		General Requirements, Bonds, and Insurance	5%	Allow	\$ 461,740	\$ 23,087	
3		Temporary Erosion Control & Protection		LS	\$ 7,500	\$ 7,500	
4		Testing Allowance		LS	\$ 5,000	\$ 5,000	
5		Maintenance of Traffic		LS	\$ 15,000	\$ 15,000	
6		Survey and Record Drawings		LS	\$ 5,000	\$ 5,000	\$ 90,218
Demolition							
7		Conduct Demo of Existing Sidewalk Pavement	350	SY	\$ 20	\$ 7,000	
8		Conduct Clearing and Grubbing (Miscellaneous)		LS	\$ 7,500	\$ 7,500	\$ 14,500
Water Main Extension							
9		Furnish & Install 12" PVC via Open-Cut Trenching with Testing & Chlorination	1242	LF	\$ 170	\$ 211,140	
10		Furnish & Install 16" Water Main (HDPE HDD) with Testing & Chlorination	130	LF	\$ 300	\$ 39,000	
11		Furnish & Install 12" Gate Valves with Valve Box and Conc. Pad	6	EA	\$ 15,000	\$ 90,000	
12		Furnish & Install Fire Hydrant Assembly	2	EA	\$ 12,000	\$ 24,000	
13		Conduct Temporary Jumper Connection at Specified Locations	3	EA	\$ 2,500	\$ 7,500	
14		Conduct Bacterial Sampling of Line at Specified Locations	2	EA	\$ 1,800	\$ 3,600	\$ 375,240
Civil/Site Restoration							
15		Conduct Final Grading & Restoration		LS	\$ 15,000	\$ 15,000	
16		Construct Sidewalk Pavement (in entirety)	350	SY	\$ 70	\$ 24,500	\$ 39,500
ESTIMATE SUBTOTAL							\$ 519,458
C	Planning Level Contingency			%	25%	\$ 129,864	
ESTIMATE TOTAL							\$ 650,000

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5-Year Water CIP No. 17
Water Master Plan
City of Palm Bay Utilities Department

PROJECT NO.:
PBU009

DATE:
JUN 2024

FIGURE NO.

12" WM Extension on US-1
(Breezy Palms RV Park Malabar Rd)
for Town of Malabar



INFRASTRUCTURE SOLUTION SERVICES ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PBU009 | Water Master Plan Update

5/30/2024
Infrastructure Solution Services, LLC

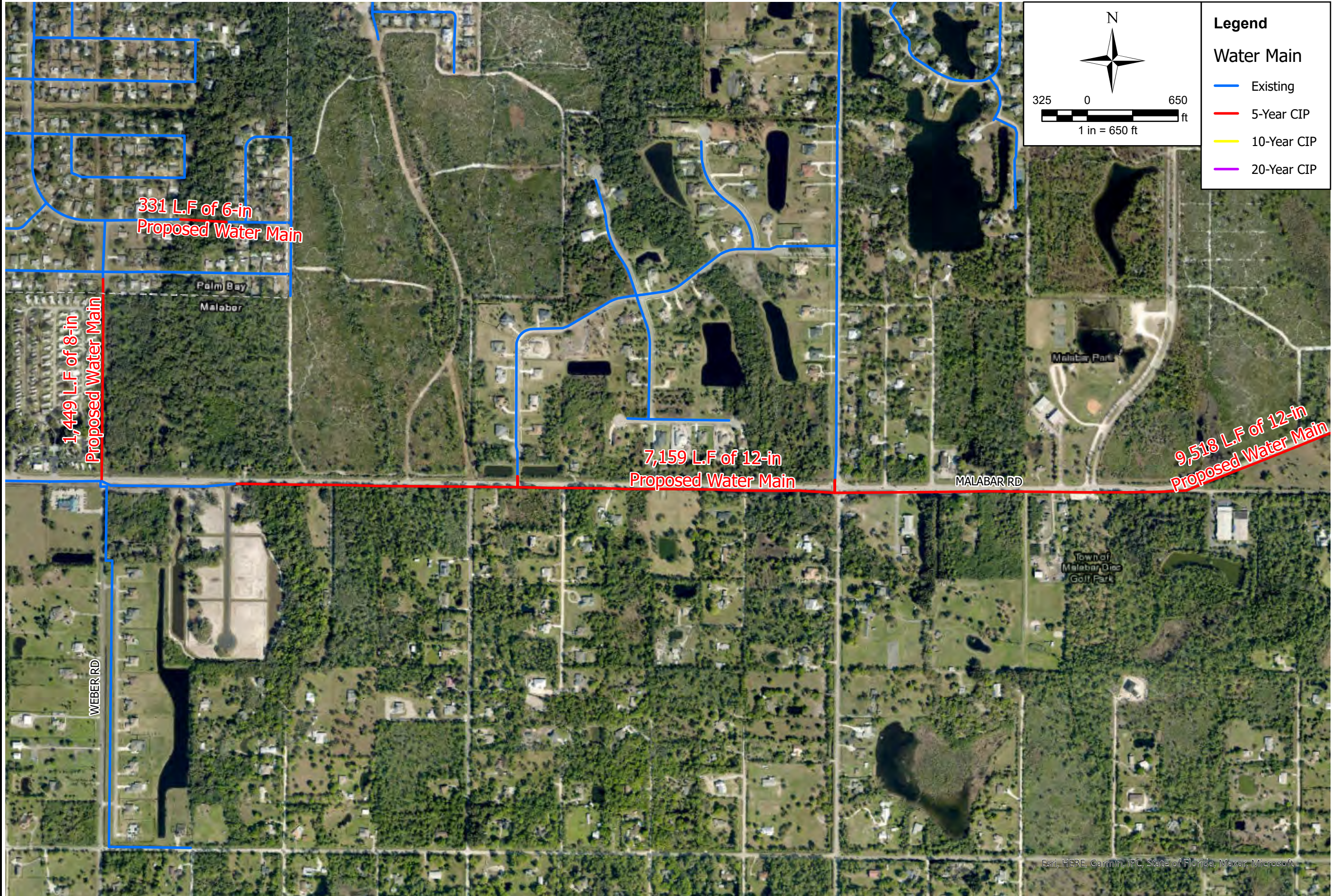
Five-Year Water System Capital Improvement Needs

CIP No. 17: 12" WM Extension on US-1 (Breezy Palms RV Park Malabar Rd) for Town of Malabar

Estimated By: JFN
Checked By: CEM
Project Manager: CEM

No.	Specification Division Code or Class	Item Description	Quantity	Unit	Unit Cost	Item Total	Subtotal
General							
1		Mobilization/Demobilization	7.5%	Allow	\$ 2,430,360	\$ 182,277	
2		General Requirements, Bonds, and Insurance	5%	Allow	\$ 2,430,360	\$ 121,518	
3		Temporary Erosion Control & Protection		LS	\$ 10,000	\$ 10,000	
4		Testing Allowance		LS	\$ 5,000	\$ 5,000	
6		Maintenance of Traffic		LS	\$ 15,000	\$ 15,000	
7		Survey and Record Drawings		LS	\$ 5,000	\$ 5,000	\$ 338,795
Demolition							
8		Conduct Demo of Existing Asphalt Pavement	290	SY	\$ 30	\$ 8,700	
9		Conduct Demo of Existing Sidewalk Pavement	30	SY	\$ 20	\$ 600	
10		Conduct Demo of Existing Driveway Pavement	800	SY	\$ 20	\$ 16,000	
11		Conduct Clearing and Grubbing (Miscellaneous)		LS	\$ 10,000	\$ 10,000	\$ 35,300
Water Main Extension							
12		Furnish & Install 12" PVC via Open-Cut Trenching with Testing & Chlorination	9218	LF	\$ 170	\$ 1,567,060	
13		Furnish & Install 16" Water Main (HDPE HDD) with Testing & Chlorination	300	LF	\$ 300	\$ 90,000	
14		Furnish & Install 12" Gate Valves with Valve Box and Conc. Pad	20	EA	\$ 15,000	\$ 300,000	
15		Furnish & Install Fire Hydrant Assembly	9	EA	\$ 12,000	\$ 108,000	
16		Conduct Temporary Jumper Connection at Specified Locations	10	EA	\$ 2,500	\$ 25,000	
17		Conduct Bacterial Sampling of Line at Specified Locations	8	EA	\$ 1,800	\$ 14,400	\$ 2,104,460
Civil/Site Restoration							
18		Conduct Final Grading & Restoration		LS	\$ 40,000	\$ 40,000	
19		Construct Driveway Pavement (in entirety)	800	SY	\$ 70	\$ 56,000	
20		Construct Sidewalk Pavement (in entirety)	30	SY	\$ 70	\$ 2,100	
21		Construct Asphalt Pavement (in entirety)	2100	SY	\$ 75	\$ 157,500	\$ 255,600
ESTIMATE SUBTOTAL							\$ 2,734,155
C		Planning Level Contingency		%	25%	\$ 683,539	
ESTIMATE TOTAL							\$ 3,500,000

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5-Year Water CIP No. 18
Water Master Plan
City of Palm Bay Utilities Department

PROJECT NO.:
PBU009

DATE:
JUN 2024

FIGURE NO.

12" WM Loop on Malabar Rd
(US-1 to Weber Rd)
for Town of Malabar



INFRASTRUCTURE SOLUTION SERVICES ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PBU009 | Water Master Plan Update

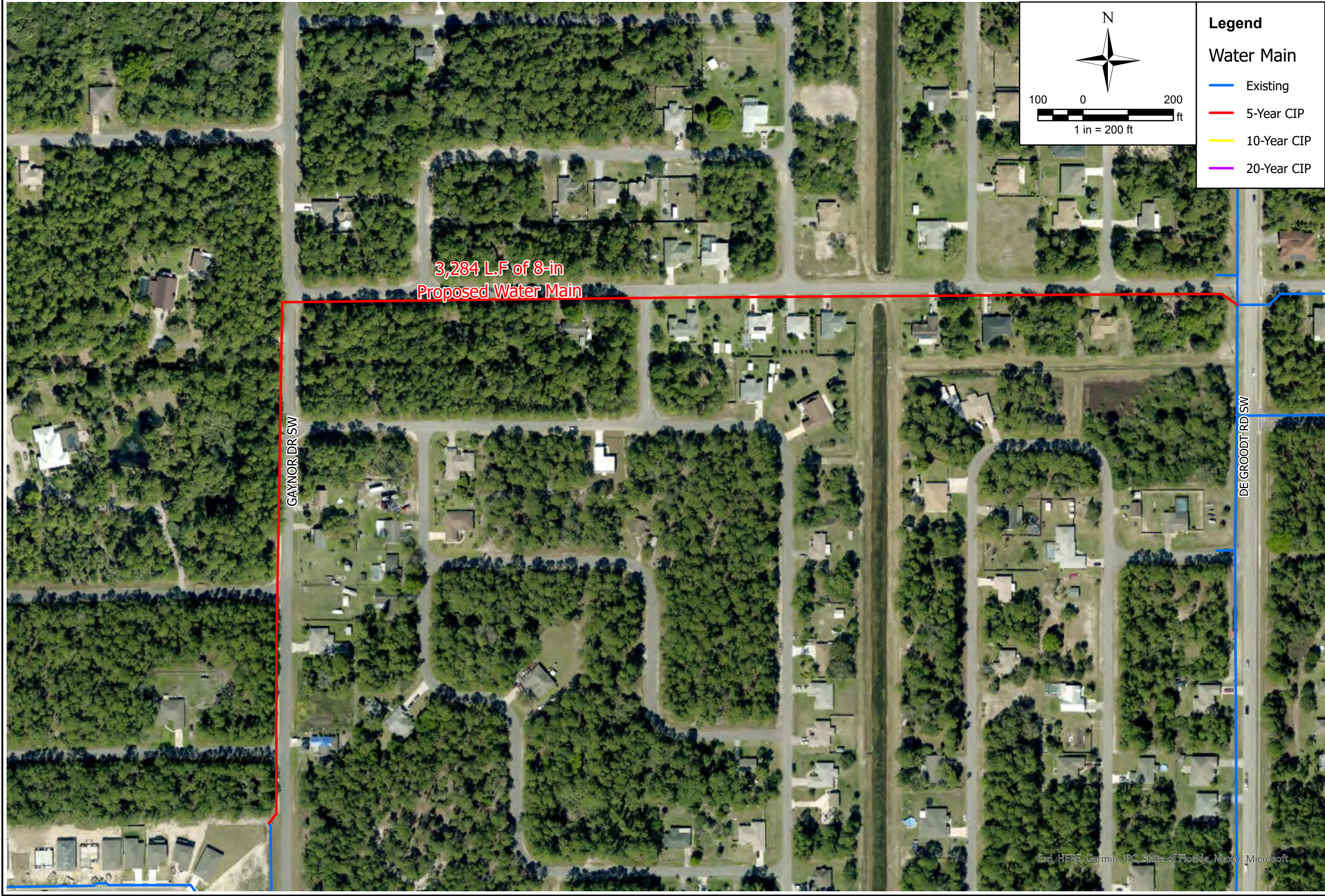
5/30/2024
Infrastructure Solution Services, LLC

Five-Year Water System Capital Improvement Needs

CIP No. 18: 12" WM Loop on Malabar Rd (US-1 to Weber Rd) for Town of Malabar

Estimated By: JFN
Checked By: CEM
Project Manager: CEM

Specification Division Code or Class		Item Description	Quantity	Unit	Unit Cost	Item Total	Subtotal
No.	General						
1		Mobilization/Demobilization	7.5%	Allow	\$ 1,826,630	\$ 136,997	
2		General Requirements, Bonds, and Insurance	5%	Allow	\$ 1,826,630	\$ 91,332	
3		Temporary Erosion Control & Protection		LS	\$ 10,000	\$ 10,000	
4		Testing Allowance		LS	\$ 5,000	\$ 5,000	
5		Maintenance of Traffic		LS	\$ 20,000	\$ 20,000	
6		Survey and Record Drawings		LS	\$ 7,500	\$ 7,500	\$ 270,829
Demolition							
7		Conduct Demo of Existing Asphalt Pavement	140	SY	\$ 30	\$ 4,200	
8		Conduct Demo of Existing Driveway Pavement	150	SY	\$ 20	\$ 3,000	
9		Conduct Clearing and Grubbing (Miscellaneous)		LS	\$ 35,000	\$ 35,000	\$ 42,200
Water Main Extension							
10		Furnish & Install 12" PVC via Open-Cut Trenching with Testing & Chlorination	6999	LF	\$ 170	\$ 1,189,830	
11		Furnish & Install 16" Water Main (HDPE HDD) with Testing & Chlorination	160	LF	\$ 300	\$ 48,000	
12		Furnish & Install 12" Gate Valves with Valve Box and Conc. Pad	15	EA	\$ 15,000	\$ 225,000	
13		Furnish & Install Fire Hydrant Assembly	8	EA	\$ 12,000	\$ 96,000	
14		Conduct Temporary Jumper Connection at Specified Locations	8	EA	\$ 2,500	\$ 20,000	
15		Conduct Bacterial Sampling of Line at Specified Locations	7	EA	\$ 1,800	\$ 12,600	\$ 1,591,430
Civil/Site Restoration							
16		Conduct Final Grading & Restoration		LS	\$ 50,000	\$ 50,000	
17		Construct Driveway Pavement (in entirety)	150	SY	\$ 70	\$ 10,500	
18		Construct Asphalt Pavement (in entirety)	1200	SY	\$ 75	\$ 90,000	\$ 150,500
ESTIMATE SUBTOTAL							\$ 2,054,959
C	Planning Level Contingency			%	25%	\$ 513,740	
ESTIMATE TOTAL							\$ 2,600,000





INFRASTRUCTURE SOLUTION SERVICES ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PBU009 | Water Master Plan Update

5/30/2024
Infrastructure Solution Services, LLC

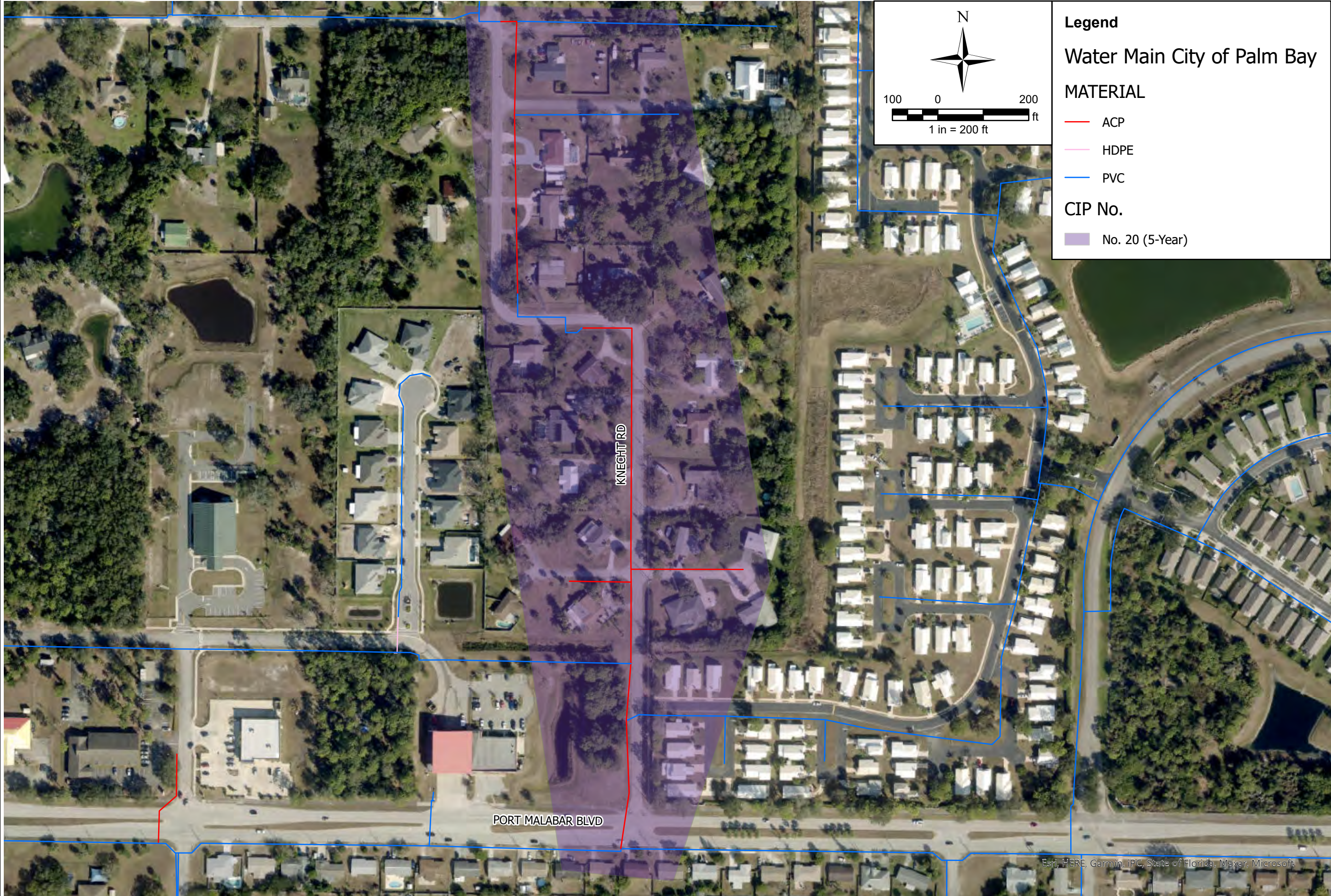
Five-Year Water System Capital Improvement Needs

Estimated By: JFN
Checked By: CEM
Project Manager: CEM

CIP No. 19: 8" WM Extension on Falls Church St SW (W of Degroodt Rd SW) for Bayridge Development

Specification Division Code or Class		Item Description	Quantity	Unit	Unit Cost	Item Total	Subtotal
No.		General					
1		Mobilization/Demobilization	7.5%	Allow	\$ 731,850	\$ 54,889	
2		General Requirements, Bonds, and Insurance	5%	Allow	\$ 731,850	\$ 36,593	
3		Temporary Erosion Control & Protection		LS	\$ 5,000	\$ 5,000	
4		Testing Allowance		LS	\$ 5,000	\$ 5,000	
5		Maintenance of Traffic		LS	\$ 15,000	\$ 15,000	
6		Survey and Record Drawings		LS	\$ 3,500	\$ 3,500	\$ 119,981
		Demolition					
7		Conduct Demo of Existing Asphalt Pavement	100	SY	\$ 30	\$ 3,000	
8		Conduct Demo of Existing Driveway Pavement	90	SY	\$ 20	\$ 1,800	
9		Conduct Clearing and Grubbing (Miscellaneous)		LS	\$ 40,000	\$ 40,000	\$ 44,800
		Water Main Extension					
10		Furnish & Install 8" PVC via Open-Cut Trenching with Testing & Chlorination	3184	LF	\$ 150	\$ 477,600	
11		Furnish & Install 10" Water Main (HDPE HDD) with Testing & Chlorination	100	LF	\$ 200	\$ 20,000	
12		Furnish & Install 8" Gate Valves with Valve Box and Conc. Pad	10	EA	\$ 3,500	\$ 35,000	
13		Furnish & Install Fire Hydrant Assembly	4	EA	\$ 12,000	\$ 48,000	
14		Conduct Temporary Jumper Connection at Specified Locations	4	EA	\$ 2,500	\$ 10,000	
15		Conduct Bacterial Sampling of Line at Specified Locations	3	EA	\$ 1,800	\$ 5,400	\$ 596,000
		Civil/Site Restoration					
16		Conduct Final Grading & Restoration		LS	\$ 15,000	\$ 15,000	
17		Construct Driveway Pavement (in entirety)	90	SY	\$ 70	\$ 6,300	
18		Construct Asphalt Pavement (in entirety)	550	SY	\$ 75	\$ 41,250	\$ 62,550
ESTIMATE SUBTOTAL							\$ 823,331
C		Planning Level Contingency		%	25%	\$ 205,833	
ESTIMATE TOTAL							\$ 1,100,000

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5-Year Water CIP No. 20
Water Master Plan
City of Palm Bay Utilities Department

PROJECT NO.:
PBU009

DATE:
JUN 2024

FIGURE NO.

ACP Water Main
Replacement near Palm Bay
Fire Station No. 1



INFRASTRUCTURE SOLUTION SERVICES ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PBU009 | Water Master Plan Update

5/30/2024
Infrastructure Solution Services, LLC

Five-Year Water System Capital Improvement Needs
CIP No. 20: ACP WM Replacement near Palm Bay Fire Station No. 1

Estimated By: *NRV*
Checked By: *CEM*
Project Manager: *CEM*

Specification Division Code or Class		Item Description	Quantity	Unit	Unit Cost	Item Total	Subtotal
No.		General					
		Mobilization/Demobilization	7.5%	Allow	\$ 383,400	\$ 28,755	
		General Requirements, Bonds, and Insurance	5%	Allow	\$ 383,400	\$ 19,170	
		Temporary Erosion Control & Protection		LS	\$ 10,000	\$ 10,000	
		Testing Allowance		LS	\$ 5,000	\$ 5,000	
		Maintenance of Traffic		LS	\$ 2,500	\$ 2,500	
		Survey and Record Drawings		LS	\$ 5,000	\$ 5,000	\$ 70,425
		Demolition					
		Conduct Demo of Existing Asphalt Pavement	50	SY	\$ 30	\$ 1,500	
		Conduct Demo of Existing Sidewalk Pavement and Driveways	360	SY	\$ 20	\$ 7,200	
		Conduct Clearing and Grubbing (Miscellaneous)		LS	\$ 5,000	\$ 5,000	
		Grout Fill and Abandon in Place Existing 6" ACP	1900	LF	\$ 50	\$ 95,000	\$ 108,700
		ACP Pipe Replacement					
		Furnish & Install 6" PVC via Open-Cut Trenching with Testing & Chlorination	1800	LF	\$ 90	\$ 162,000	
		Furnish & Install 8" HDPE via HDD	100	LF	\$ 150	\$ 15,000	\$ 177,000
		Civil/Site Restoration					
		Conduct Final Grading		LS	\$ 20,000	\$ 20,000	
		Construct Sidewalk Pavement and Driveways (in entirety)	360	SY	\$ 70	\$ 25,200	
		Construct Asphalt Pavement (in entirety)	400	SY	\$ 75	\$ 30,000	\$ 75,200
ESTIMATE SUBTOTAL							\$ 431,325
C		Planning Level Contingency		%	30%	\$ 129,398	
ESTIMATE TOTAL							\$ 600,000

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5-Year Water CIP No. 21
Water Master Plan
City of Palm Bay Utilities Department

ACP Replacement at North
Regional Utilities Campus



INFRASTRUCTURE SOLUTION SERVICES ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PBU009 | Water Master Plan Update

5/30/2024
Infrastructure Solution Services, LLC

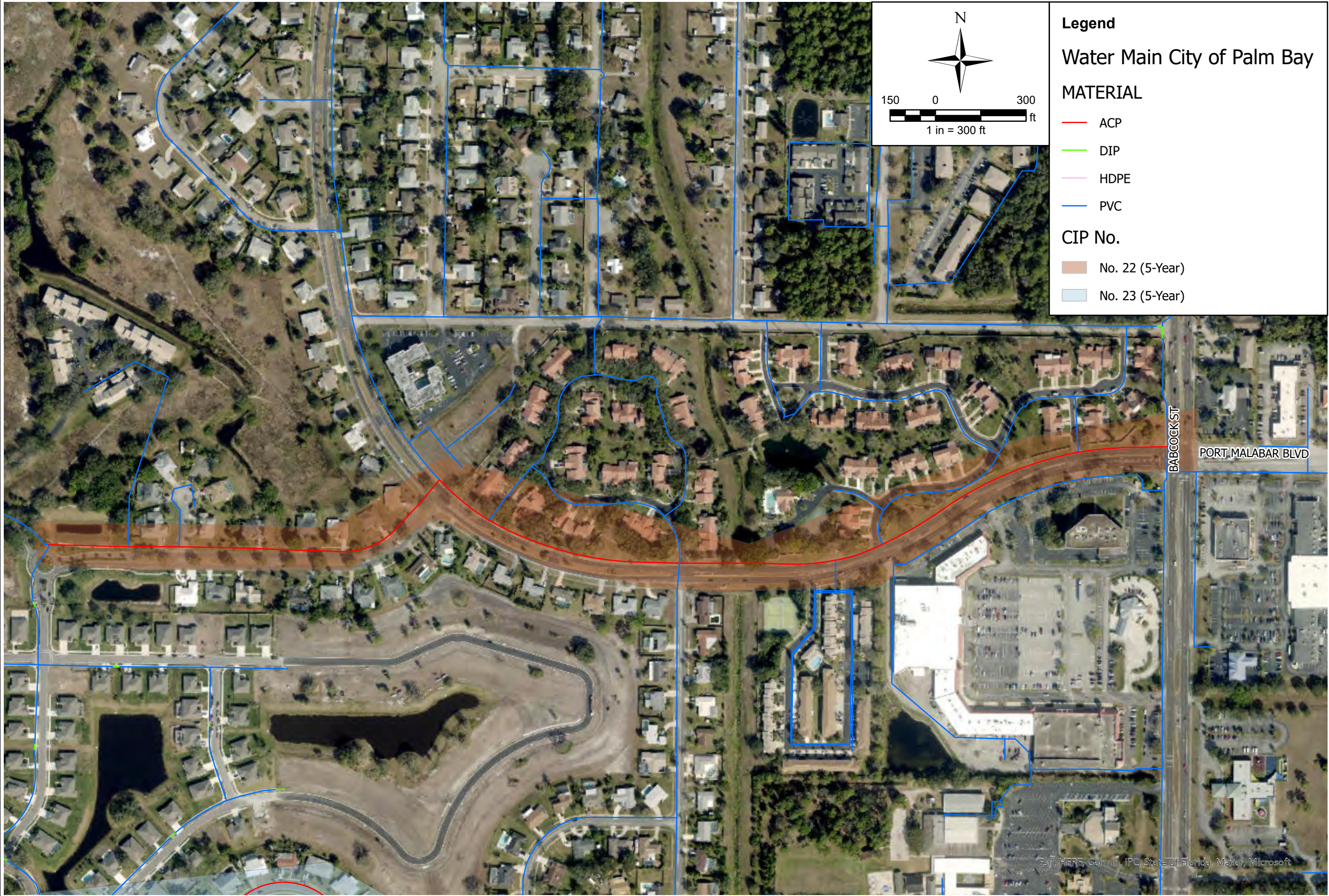
Five-Year Water System Capital Improvement Needs

CIP No. 21: ACP WM Replacement at North Regional Utilities Campus

Estimated By: *NRV*
Checked By: *CEM*
Project Manager: *CEM*

Specification Division Code or Class		Item Description	Quantity	Unit	Unit Cost	Item Total	Subtotal
No.		General					
		Mobilization/Demobilization	7.5%	Allow	\$ 689,000	\$ 51,675	
		General Requirements, Bonds, and Insurance	5%	Allow	\$ 689,000	\$ 34,450	
		Temporary Erosion Control & Protection		LS	\$ 10,000	\$ 10,000	
		Testing Allowance		LS	\$ 5,000	\$ 5,000	
		Maintenance of Traffic		LS	\$ 2,500	\$ 2,500	
		Survey and Record Drawings		LS	\$ 5,000	\$ 5,000	\$ 108,625
		Demolition					
		Conduct Demo of Existing Asphalt Pavement	50	SY	\$ 30	\$ 1,500	
		Conduct Demo of Existing Sidewalk Pavement and Driveways	450	SY	\$ 20	\$ 9,000	
		Conduct Clearing and Grubbing (Miscellaneous)		LS	\$ 5,000	\$ 5,000	
		Grout Fill and Abandon in Place Existing 16" ACP	2100	LF	\$ 120	\$ 252,000	\$ 267,500
		ACP Pipe Replacement					
		Furnish & Install 16" PVC via Open-Cut Trenching with Testing & Chlorination	2100	LF	\$ 190	\$ 399,000	\$ 399,000
		Civil/Site Restoration					
		Conduct Final Grading		LS	\$ 20,000	\$ 20,000	
		Construct Sidewalk Pavement and Driveways (in entirety)	450	SY	\$ 70	\$ 31,500	
		Construct Asphalt Pavement (in entirety)	300	SY	\$ 75	\$ 22,500	\$ 74,000
		ESTIMATE SUBTOTAL					\$ 849,125
C		Planning Level Contingency		%	30%	\$ 254,738	
		ESTIMATE TOTAL					\$ 1,200,000

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Legend

Water Main City of Palm Bay

MATERIAL

— ACP

— DIP

— HDPE

— PVC

CIP No.

— No. 22 (5-Year)

— No. 23 (5-Year)



INFRASTRUCTURE SOLUTION SERVICES ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PBU009 | Water Master Plan Update

5/30/2024
Infrastructure Solution Services, LLC

Five-Year Water System Capital Improvement Needs
CIP No. 22: ACP WM Replacement adjacent to BEALLS Outlet

Estimated By: *NRV*
Checked By: *CEM*
Project Manager: *CEM*

Specification Division Code or Class		Item Description	Quantity	Unit	Unit Cost	Item Total	Subtotal
No.		General					
		Mobilization/Demobilization	7.5%	Allow	\$ 1,279,700	\$ 95,978	
		General Requirements, Bonds, and Insurance	5%	Allow	\$ 1,279,700	\$ 63,985	
		Temporary Erosion Control & Protection		LS	\$ 10,000	\$ 10,000	
		Testing Allowance		LS	\$ 5,000	\$ 5,000	
		Maintenance of Traffic		LS	\$ 2,500	\$ 2,500	
		Survey and Record Drawings		LS	\$ 5,000	\$ 5,000	\$ 182,463
		Demolition					
		Conduct Demo of Existing Asphalt Pavement	190	SY	\$ 30	\$ 5,700	
		Conduct Demo of Existing Sidewalk Pavement and Driveways	400	SY	\$ 20	\$ 8,000	
		Conduct Clearing and Grubbing (Miscellaneous)		LS	\$ 5,000	\$ 5,000	
		Grout Fill and Abandon in Place Existing 8" ACP	1400	LF	\$ 75	\$ 105,000	
		Grout Fill and Abandon in Place Existing 12" ACP	2600	LF	\$ 110	\$ 286,000	\$ 409,700
		ACP Pipe Replacement					
		Furnish & Install 8" PVC via Open-Cut Trenching with Testing & Chlorination	1300	LF	\$ 150	\$ 195,000	
		Furnish & Install 10" HDPE via HDD	100	LF	\$ 200	\$ 20,000	
		Furnish & Install 12" PVC via Open-Cut Trenching with Testing & Chlorination	2600	LF	\$ 170	\$ 442,000	\$ 657,000
		Civil/Site Restoration					
		Conduct Final Grading		LS	\$ 20,000	\$ 20,000	
		Construct Sidewalk Pavement and Driveways (in entirety)	400	SY	\$ 70	\$ 28,000	
		Construct Asphalt Pavement (in entirety)	1900	SY	\$ 75	\$ 142,500	\$ 190,500
		ESTIMATE SUBTOTAL					\$ 1,439,663
C		Planning Level Contingency		%	30%	\$ 431,899	
		ESTIMATE TOTAL					\$ 1,900,000

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5-Year Water CIP No. 23
Water Master Plan
City of Palm Bay Utilities Department

PROJECT NO.:
PBU009

DATE:
JUN 2024

FIGURE NO.

ACP Water Main Replacement
along Meadowbrook Rd NE



INFRASTRUCTURE SOLUTION SERVICES ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PBU009 | Water Master Plan Update

5/30/2024
Infrastructure Solution Services, LLC

Five-Year Water System Capital Improvement Needs
CIP No. 23: ACP WM Replacement along Meadowbrooks Rd NE

Estimated By: *NRV*
Checked By: *CEM*
Project Manager: *CEM*

Specification Division Code or Class		Item Description	Quantity	Unit	Unit Cost	Item Total	Subtotal
No.		General					
		Mobilization/Demobilization	7.5%	Allow	\$ 957,000	\$ 71,775	
		General Requirements, Bonds, and Insurance	5%	Allow	\$ 957,000	\$ 47,850	
		Temporary Erosion Control & Protection		LS	\$ 10,000	\$ 10,000	
		Testing Allowance		LS	\$ 5,000	\$ 5,000	
		Maintenance of Traffic		LS	\$ 2,500	\$ 2,500	
		Survey and Record Drawings		LS	\$ 5,000	\$ 5,000	\$ 142,125
		Demolition					
		Conduct Demo of Existing Asphalt Pavement	440	SY	\$ 30	\$ 13,200	
		Conduct Demo of Existing Sidewalk Pavement and Driveways	700	SY	\$ 20	\$ 14,000	
		Conduct Clearing and Grubbing (Miscellaneous)		LS	\$ 5,000	\$ 5,000	
		Grout Fill and Abandon in Place Existing 4" ACP	910	LF	\$ 40	\$ 36,400	
		Grout Fill and Abandon in Place Existing 6" ACP	2750	LF	\$ 50	\$ 137,500	\$ 206,100
		ACP Pipe Replacement					
		Furnish & Install 6" PVC via Open-Cut Trenching with Testing & Chlorination	3660	LF	\$ 90	\$ 329,400	\$ 329,400
		Civil/Site Restoration					
		Conduct Final Grading		LS	\$ 20,000	\$ 20,000	
		Construct Sidewalk Pavement and Driveways (in entirety)	700	SY	\$ 70	\$ 49,000	
		Construct Asphalt Pavement (in entirety)	4400	SY	\$ 75	\$ 330,000	\$ 399,000
ESTIMATE SUBTOTAL							\$ 1,076,625
C		Planning Level Contingency		%	30%	\$ 322,988	
ESTIMATE TOTAL							\$ 1,400,000



INFRASTRUCTURE SOLUTION SERVICES ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PBU009 | Water Master Plan Update

5/30/2024
Infrastructure Solution Services, LLC

Five-Year Water System Capital Improvement Needs

Estimated By: CEM
Checked By: CEM
Project Manager: CEM

CIP No. 24: SRWTP Additional Floridan Aquifer Groundwater Supply Well (SRO-5)

Specification Division Code or Class		Item Description	Quantity	Unit	Unit Cost	Item Total	Subtotal
No.		General					
		Mobilization/Demobilization	7.5%	Allow	\$ 1,207,688	\$ 90,577	
		General Requirements, Bonds, and Insurance	5%	Allow	\$ 1,207,688	\$ 60,384	
		Testing Allowance		LS	\$ 25,000	\$ 25,000	
		Survey and Record Drawings		LS	\$ 10,000	\$ 10,000	\$ 185,961
		SRWTP FLORIDIAN SUPPLY WELL - SRO-5					
		Floridian Supply Well - Well Drilling		LS	\$ 460,000	\$ 460,000	
		Floridian Supply Well - Furnish and Install Well Pump & Motor		LS	\$ 172,500	\$ 172,500	
		Floridian Supply Well - Site Work		LS	\$ 143,750	\$ 143,750	
		Raw Water Transmission Line - SRO-5 to Raw Water Header Conection (24" PVC WM)	800	LF	\$ 350	\$ 280,000	
		Electrical/I&C		LS	\$ 116,438	\$ 116,438	\$ 1,172,688
ESTIMATE SUBTOTAL							\$ 1,358,648
C		Planning Level Contingency		%	25%	\$ 339,662	
ESTIMATE TOTAL							\$ 1,700,000

<div><div><div>ISs</div></div><div><div>5/30/2024</div><div>Infrastructure Solution Services, LLC</div></div></div> <div>INFRASTRUCTURE SOLUTION SERVICES ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST</div> <div>PBU009 Water Master Plan Update</div> <div>Five-Year Water System Capital Improvement Needs</div> <div>Estimated By: CEM Checked By: CEM Project Manager: CEM</div>							
CIP No. 25: Replace One 60 HP with 125 HP High Service Pump at SRWTP							
Specification Division Code or Class		Item Description	Quantity	Unit	Unit Cost	Item Total	Subtotal
No.	General						
		Mobilization/Demobilization	7.5%	Allow	\$ 345,500	\$ 25,913	\$ 78,188
		General Requirements, Bonds, and Insurance	5%	Allow	\$ 345,500	\$ 17,275	
		Testing Allowance		LS	\$ 25,000	\$ 25,000	
		Survey and Record Drawings		LS	\$ 10,000	\$ 10,000	
	REPLACE 60 HP with 125 HP HIGH SERVICE PUMP						
		Remove 60 HP High Service Pump		LS	\$ 28,750	\$ 28,750	\$ 310,500
		Furnish 125 HP High Service Pump		LS	\$ 115,000	\$ 115,000	
		Install 125 HP High Service Pump		LS	\$ 86,250	\$ 86,250	
		Piping & Valve		LS	\$ 28,750	\$ 28,750	
		Electrical/I&C		LS	\$ 51,750	\$ 51,750	
	ESTIMATE SUBTOTAL						\$ 388,688
C	Planning Level Contingency			%	25%	\$ 97,172	
ESTIMATE TOTAL						\$ 500,000	



INFRASTRUCTURE SOLUTION SERVICES ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PBU009 | Water Master Plan Update

5/30/2024
Infrastructure Solution Services, LLC

Five-Year Water System Capital Improvement Needs
CIP No. 26: SRWTP Expansion from 6 MGD to 8 MGD

Estimated By: CEM
Checked By: CEM
Project Manager: CEM

Specification Division Code or Class		Item Description	Quantity	Unit	Unit Cost	Item Total	Subtotal
No.		General					
		Mobilization/Demobilization	7.5%	Allow	\$ 1,777,250	\$ 133,294	
		General Requirements, Bonds, and Insurance	5%	Allow	\$ 1,777,250	\$ 88,863	
		Testing Allowance		LS	\$ 25,000	\$ 25,000	
		Survey and Record Drawings		LS	\$ 10,000	\$ 10,000	\$ 257,156
		NEW REVERSE OSMOSIS FEED PUMP					
		Furnish 300 HP RO Feed Pump		LS	\$ 143,750	\$ 143,750	
		Install RO Feed Pump		LS	\$ 143,750	\$ 143,750	
		Electrical/I&C		LS	\$ 57,500	\$ 57,500	\$ 345,000
		NEW 3rd DEGASIFIER					
		Furnish Force Draft Degasifier with 15,000 CFM Fan for 5 MGD		LS	\$ 632,500	\$ 632,500	
		Install Force Draft Degasifier with 15,000 CFM Fan for 5 MGD		LS	\$ 474,375	\$ 474,375	
		FRP Duct		LS	\$ 57,500	\$ 57,500	
		Electrical/I&C		LS	\$ 232,875	\$ 232,875	\$ 1,397,250
		ESTIMATE SUBTOTAL					\$ 1,999,406
C		Planning Level Contingency		%	25%	\$ 499,852	
		ESTIMATE TOTAL					\$ 2,500,000



INFRASTRUCTURE SOLUTION SERVICES ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PBU009 | Water Master Plan Update

5/30/2024
Infrastructure Solution Services, LLC

Five-Year Water System Capital Improvement Needs
CIP No. 27: SRWTP Rehabilitation

Estimated By: CEM
Checked By: CEM
Project Manager: CEM

No.	Specification Division Code or Class	Item Description	Quantity	Unit	Unit Cost	Item Total	Subtotal
	General						
		Mobilization/Demobilization	7.5%	Allow	\$ 3,055,625	\$ 229,172	
		General Requirements, Bonds, and Insurance	5%	Allow	\$ 3,055,625	\$ 152,781	
		Testing Allowance		LS	\$ 25,000	\$ 25,000	
		Survey and Record Drawings		LS	\$ 10,000	\$ 10,000	\$ 416,953
	REPLACE SRWTP WELL NOS. 1, 2, & 3 PUMP & MOTORS						
		Floridian Supply Well - Furnish and Install Well Pump & Motor	3	EACH	\$ 172,500	\$ 517,500	
		Electrical/I&C		LS	\$ 77,625	\$ 77,625	\$ 595,125
	REPLACE CHEMICAL FEED SYSTEMS						
		Replace Caustic Bulk Storage Tank (15,000 gal RFP)	1	EACH	\$ 120,000	\$ 120,000	
		Replace Caustic Day Tank (1,000 gal PE)	1	EACH	\$ 17,500	\$ 17,500	
		Replace Caustic Feed Pumps & Accessories	4	EACH	\$ 32,500	\$ 130,000	
		Replace Caustic Chem Feed Piping		LS	\$ 50,000	\$ 50,000	
		Replace Acid Bulk Storage Tank (7,500 gal FRP)	1	EACH	\$ 90,000	\$ 90,000	
		Replace Acid Day Tank (500 gal PE)	1	EACH	\$ 15,000	\$ 15,000	
		Replace Acid Feed Pumps	4	EACH	\$ 32,500	\$ 130,000	
		Replace Acid Chem Feed Piping		LS	\$ 50,000	\$ 50,000	
		Replace Antiscalant Day Tank (200 gal)	1	EACH	\$ 12,500	\$ 12,500	
		Replace Antiscalant Feed Pumps	2	EACH	\$ 22,500	\$ 45,000	
		Replace Antiscalant Chem Feed Piping		LS	\$ 30,000	\$ 30,000	
		Replace Phosphate Day Tank	1	EACH	\$ 12,500	\$ 12,500	
		Replace Phosphate Feed Pumps	2	EACH	\$ 22,500	\$ 45,000	
		Replace Phosphate Chem Feed Piping		LS	\$ 30,000	\$ 30,000	
		Replace Fluoride Bulk Storage Tank (5,300 gal)	1	EACH	\$ 75,000	\$ 75,000	
		Replace Fluoride Day Tank (110 gal)	1	EACH	\$ 12,500	\$ 12,500	
		Replace Fluoride Feed Pumps	2	EACH	\$ 2,500	\$ 5,000	
		Replace Fluoride Chem Feed Piping		LS	\$ 50,000	\$ 50,000	
		Replace Hypochlorite Storage Tank (6,000 gal Double Wall PE)	2	EACH	\$ 60,000	\$ 120,000	
		Replace Hypochlorite Transfer Pump	2	EACH	\$ 15,000	\$ 30,000	
		Replace Hypochlorite Day Tank (1,500 gal)	1	EACH	\$ 25,000	\$ 25,000	
		Replace Hypochlorite Feed Pumps	4	EACH	\$ 32,500	\$ 130,000	
		Replace Hypochlorite Chem Feed Piping		LS	\$ 60,000	\$ 60,000	
		Misc Electrcial & Instrumentation & Controls		LS	\$ 128,500	\$ 128,500	\$ 1,413,500
	REPLACE POND LINER						
		Remove Exist Pond Liner		LS	\$ 52,000	\$ 52,000	
		Furnish and Install PE Pond Liner	SF	130000	\$ 4	\$ 520,000	
		Misc Site Work		LS	\$ 50,000	\$ 50,000	\$ 622,000
	REPLACE IN-PLANT LIFT STATION SUBMERSIBLE PUMPS						
		Replace Submersible Pumps		LS	\$ 50,000	\$ 50,000	
		Replace Wet Well Liner		LS	\$ 25,000	\$ 25,000	
		Replace Misc Piping/Valves		LS	\$ 45,000	\$ 45,000	
		Replace Control Panel		LS	\$ 40,000	\$ 40,000	\$ 160,000
	REPLACE CONTROL SYSTEM COMPONENTS						
		Replace PLC 4 (DIW)	1	EACH	\$ 50,000	\$ 50,000	
		Replace PLC 5/6/7 (Wells)	3	EACH	\$ 50,000	\$ 150,000	
		Replace Ethernet Switch		LS	\$ 30,000	\$ 30,000	\$ 230,000
ESTIMATE SUBTOTAL							\$ 3,437,578
C	Planning Level Contingency				%	25%	\$ 859,395
ESTIMATE TOTAL							\$ 4,300,000

<div><div><div>ISs</div></div><div>5/30/2024 Infrastructure Solution Services, LLC</div></div> <div>INFRASTRUCTURE SOLUTION SERVICES ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST</div> <div>PBU009 Water Master Plan Update</div>							
Five-Year Water System Capital Improvement Needs						Estimated By:	CEM
CIP No. 28: NRWTP Backwash Ponds and Drying Beds Nos. 3/4/5 Rehabilitation						Checked By:	CEM
						Project Manager:	CEM
Specification Division Code or Class		Item Description	Quantity	Unit	Unit Cost	Item Total	Subtotal
No.	General						
		Mobilization/Demobilization	7.5%	Allow	\$ 385,250	\$ 28,894	\$ 73,156
		General Requirements, Bonds, and Insurance	5%	Allow	\$ 385,250	\$ 19,263	
		Testing Allowance		LS	\$ 15,000	\$ 15,000	
		Survey and Record Drawings		LS	\$ 10,000	\$ 10,000	
	Empty, Clean, Reslope, and Line Backwash Ponds						
		Empty and Clean Pond 1	450	SF	\$ 100	\$ 45,000	\$ 85,250
		Regrade Bottom of Pond 1	450	SF	\$ 25	\$ 11,250	
		Regrade Side Sloped of Pond 1	500	LF	\$ 40	\$ 20,000	
		Furnish and Install HDPE Membrane Liner for Pond 1	600	SF	\$ 15	\$ 9,000	
	Empty, Clean, Reslope, and Line Save All Ponds						
		Empty and Clean Save All Pond	300	SF	\$ 100	\$ 30,000	\$ 56,250
		Regrade Bottom of Save All Pond	300	SF	\$ 25	\$ 7,500	
		Regrade Side Sloped of Save All Pond	300	LF	\$ 40	\$ 12,000	
		Furnish and Install HDPE Membrane Liner for Save All Pond	450	SF	\$ 15	\$ 6,750	
	Replace Underdrain Lines & Replace Stop Logs in Beds Nos. 3, 4, & 5						
		Replace 4" PVC Underdrain Line - Bed No. 3	900	LF	\$ 50	\$ 45,000	\$ 218,750
		Replace 4" PVC Underdrain Line - Bed No. 4	725	LF	\$ 50	\$ 36,250	
		Replace 4" PVC Underdrain Line - Bed No. 5	650	LF	\$ 50	\$ 32,500	
		Repalce 4" Inlet Valves at Each Bed	7	EACH	\$ 2,500	\$ 17,500	
		Furnish and Install Stop Logs	3	EACH	\$ 22,500	\$ 67,500	
		Replace Filtrate Submersible Pump		LS	\$ 20,000	\$ 20,000	
	ESTIMATE SUBTOTAL						
C	Planning Level Contingency				%	25%	\$ 108,352
ESTIMATE TOTAL							\$ 600,000



INFRASTRUCTURE SOLUTION SERVICES ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PBU009 | Water Master Plan Update

5/30/2024
Infrastructure Solution Services, LLC

Five-Year Water System Capital Improvement Needs

CIP No. 29: NRWTP Rehabilitation, Electrical & Control System Improvements

Estimated By: CEM
Checked By: CEM
Project Manager: CEM

Specification Division Code or Class		Item Description	Quantity	Unit	Unit Cost	Item Total	Subtotal
No.		General					
		Mobilization/Demobilization	7.5%	Allow	\$ 1,758,500	\$ 131,888	
		General Requirements, Bonds, and Insurance	5%	Allow	\$ 1,758,500	\$ 87,925	
		Testing Allowance		LS	\$ 25,000	\$ 25,000	
		Survey and Record Drawings		LS	\$ 10,000	\$ 10,000	\$ 254,813
		REPLACE LIME SLURRY CHEMICAL FEED PUMPS					
		Replace Lime Slurry Chemical Feed Hose Pumps	3	EACH	\$ 40,000	\$ 120,000	
		Replace Misc Piping		LS	\$ 20,000	\$ 20,000	
		Misc Electrical & Controls		LS	\$ 12,000	\$ 12,000	\$ 152,000
		REPLACE ACID CHEMICAL FEED PUMPS					
		Replace Acid Feed Pumps	2	EACH	\$ 32,500	\$ 65,000	
		Replace Acid Chem Feed Piping		LS	\$ 35,000	\$ 35,000	
		Misc Electrical & Controls		LS	\$ 6,500	\$ 6,500	\$ 106,500
		REPLACE TRANSFER SWITCH AND MOTOR CONTROL CENTERS					
		Replace Main Transfer Switch		LS	\$ 75,000	\$ 75,000	
		Replace MCC-1 (5 Sections)		LS	\$ 375,000	\$ 375,000	
		Replace MCC-2 (9-Sections)		LS	\$ 675,000	\$ 675,000	\$ 1,125,000
		REPLACE PLCs					
		Replace Main Plant PLC	1	EACH	\$ 80,000	\$ 80,000	
		Replace Filter 1/2/3/4 PLCs	4	EACH	\$ 65,000	\$ 260,000	\$ 340,000
		ESTIMATE SUBTOTAL				\$	1,978,313
C		Planning Level Contingency		%	25%	\$	494,578
		ESTIMATE TOTAL				\$	2,500,000



INFRASTRUCTURE SOLUTION SERVICES ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PBU009 | Water Master Plan Update

05/30/24

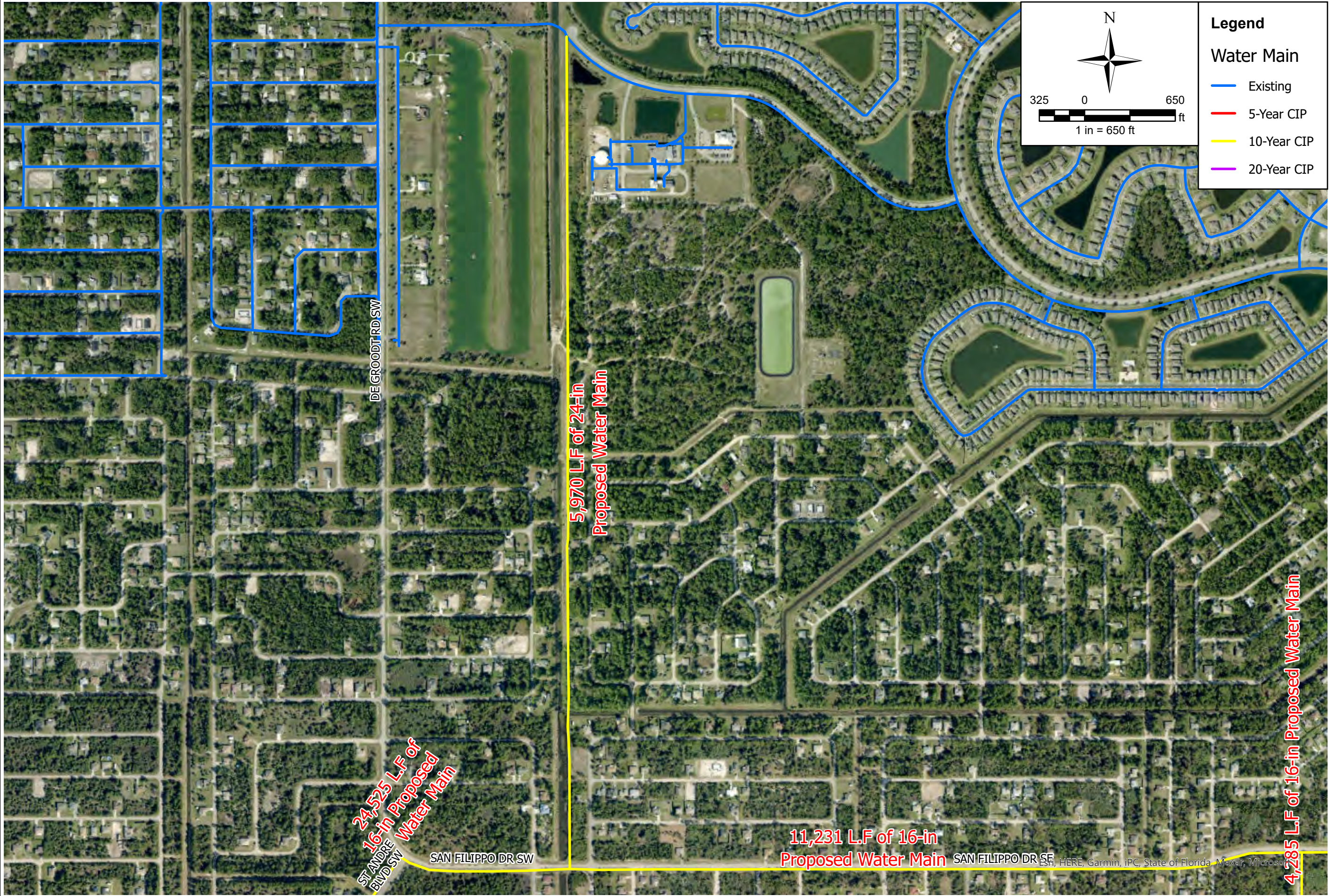
Infrastructure Solution Services, LLC

Ten-Year Capital Improvement Needs

Project Manager: CEM

No.	Item Description	Line Item Total	Subtotal
	PBU009 Water Master Plan Update		
	CIP No. 1: 24" WM Loop from SRWTP to San Filippo Dr SE	\$ 4,100,000	
	CIP No. 2: 16" WM Loop on San Filippo Dr SE (Degroodt Ed SW to FPL)	\$ 6,100,000	
	CIP No. 3: 16" WM Loop on St. Andre Blvd to Willowbrook Development	\$ 8,900,000	
	CIP No. 4: 16" WM Loop from San Filippo Sr SE to Rolling Meadows	\$ 1,800,000	
	CIP No. 5: Replace Exist. 6"-10" WM w/ 12" WM on US-1 (Pospisi Ave NE to S of University Blvd)	\$ 7,400,000	
	CIP No. 6: 8" WM Extension S of Malabar Rd for Lennar South Development	\$ 600,000	
	CIP No. 7: 16" WM Extension Babcock St (Davis Ln to Micco Rd)	\$ 3,200,000	
	CIP No. 8: 12" WM Loop on Micco Rd (Babcock St to Micco Village Development)	\$ 4,800,000	
	CIP No. 9: 16" WM Extension on Micco Rd for Micco Village Development	\$ 5,300,000	
	CIP No. 10: 16" WM Loop in FPL Easement (Cogan Dr SE -Malabar Rd)	\$ 12,000,000	
	CIP No. 11: 6" WM Loop from Pilgrim Ln SE to Satz St NE for Las Palmas Development	\$ 600,000	
	CIP No. 12: 16" WM Loop through Pete Holdings (Emerald Lake to Micco Village)	\$ 2,200,000	
	CIP No. 13: South Water Booster Station - First Phase	\$ 6,500,000	
	CIP No. 14: ACP WM Replacement adjacent to Veteran's Memorial Park	\$ 10,400,000	
	CIP No. 15: ACP WM Replacement near Indian River Flats	\$ 1,800,000	
	CIP No. 16: ACP WM Replacement Adjacent to Abeto St. NE	\$ 2,000,000	
	CIP No. 17: ACP WM Replacement along Main St NE Area	\$ 2,400,000	
	CIP No. 18: ACP WM Replacement within Highland Shores Turkey River Estates	\$ 3,300,000	
	CIP No. 19: SRWTP Additional Floridan Aquifer Groundwater Supply Well (SRO-6)	\$ 1,700,000	
	CIP No. 20: Replace One 60 HP with 125 HP High Service Pump at SRWTP	\$ 500,000	
	CIP No. 21: SRWTP Expansion from 8 MGD to 10 MGD	\$ 3,000,000	
	CIP No. 22: SRWTP Rehabilitation and Electrical System Improvements	\$ 14,000,000	
	CIP No. 23: Construct NRROWTP to 3.33 MGD with RO Wells & Deep Injection Well	Cost Est by Other	
		ESTIMATE TOTAL	\$ 102,600,000

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INFRASTRUCTURE SOLUTION SERVICES ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PBU009 | Water Master Plan Update

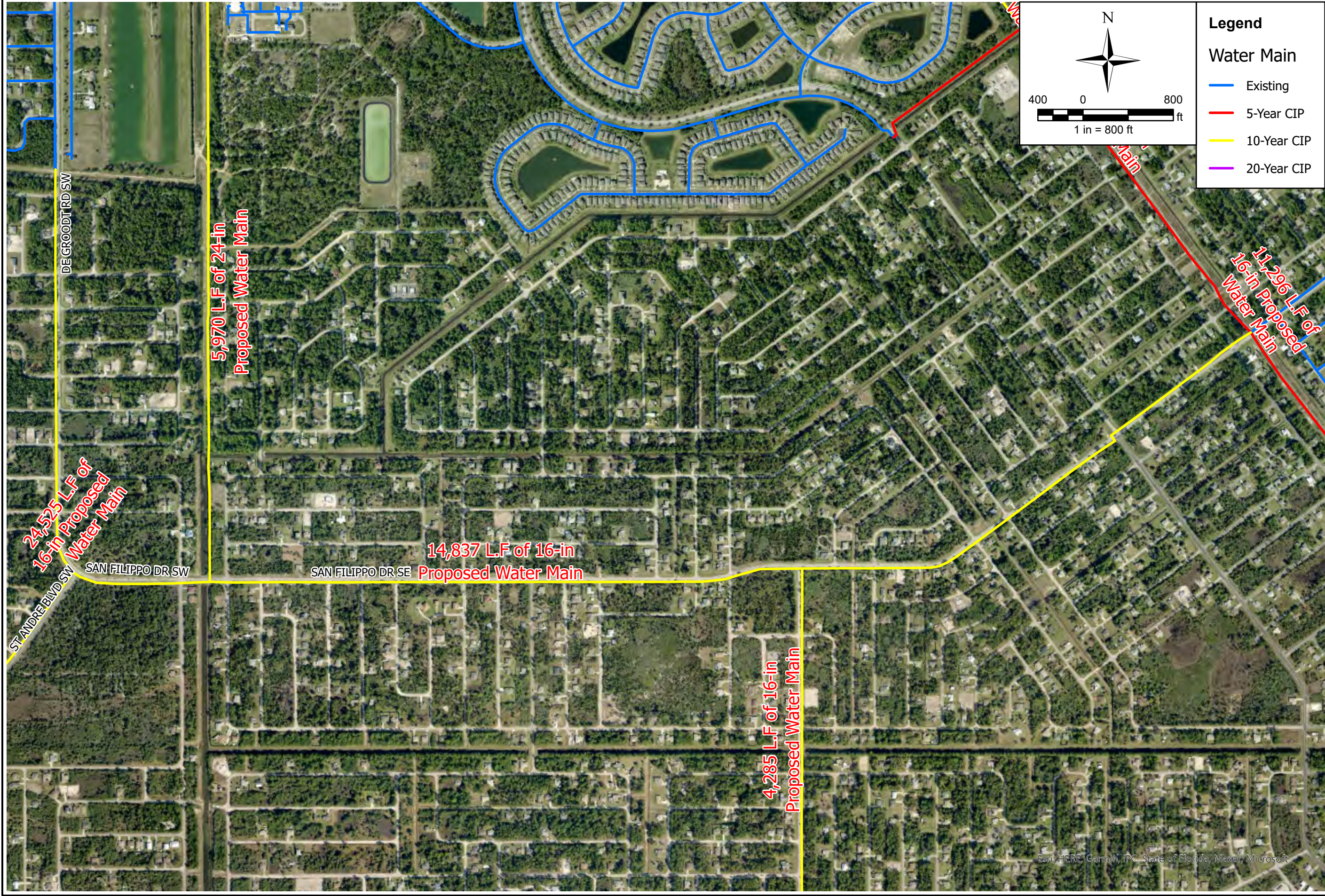
05/30/24
Infrastructure Solution Services, LLC

Ten-Year Capital Improvement Needs

CIP No. 1: 24" WM Loop from SRWTP to San Filippo Dr SE

Estimated By: JFN
Checked By: CEM
Project Manager: CEM

Specification Division Code or Class		Item Description	Quantity	Unit	Unit Cost	Item Total	Subtotal
No.	General						
1		Mobilization/Demobilization	7.5%	Allow	\$ 2,864,700	\$ 214,853	
2		General Requirements, Bonds, and Insurance	5%	Allow	\$ 2,864,700	\$ 143,235	
3		Temporary Erosion Control & Protection		LS	\$ 10,000	\$ 10,000	
4		Testing Allowance		LS	\$ 5,000	\$ 5,000	
5		Maintenance of Traffic		LS	\$ 15,000	\$ 15,000	
6		Survey and Record Drawings		LS	\$ 5,000	\$ 5,000	\$ 393,088
Demolition							
7		Conduct Demo of Existing Asphalt Pavement	15	SY	\$ 30	\$ 450	
8		Conduct Clearing and Grubbing (Miscellaneous)		LS	\$ 20,000	\$ 20,000	\$ 20,450
Water Main Extension							
9		Furnish & Install 24" PVC via Open-Cut Trenching with Testing & Chlorination	5850	LF	\$ 350	\$ 2,047,500	
10		Furnish & Install 30" Water Main (HDPE HDD) with Testing & Chlorination	120	LF	\$ 1,000	\$ 120,000	
11		Furnish & Install 24" Gate Valves with Valve Box and Conc. Pad	14	EA	\$ 35,000	\$ 490,000	
12		Furnish & Install Fire Hydrant Assembly	6	EA	\$ 12,000	\$ 72,000	
13		Conduct Temporary Jumper Connection at Specified Locations	7	EA	\$ 2,500	\$ 17,500	
14		Conduct Bacterial Sampling of Line at Specified Locations	5	EA	\$ 1,800	\$ 9,000	\$ 2,756,000
Civil/Site Restoration							
15		Conduct Final Grading & Restoration		LS	\$ 45,000	\$ 45,000	
16		Construct Asphalt Pavement (in entirety)	110	SY	\$ 75	\$ 8,250	\$ 53,250
ESTIMATE SUBTOTAL							\$ 3,222,788
C	Planning Level Contingency			%	25%	\$ 805,697	
ESTIMATE TOTAL							\$ 4,100,000



10-Year Water CIP No. 2
Water Master Plan
City of Palm Bay Utilities Department

PROJECT NO.:
PBU009

DATE:
JUN 2024

FIGURE NO.

16" WM Loop on San Filippo
(Degroot to FPL)



INFRASTRUCTURE SOLUTION SERVICES ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PBU009 | Water Master Plan Update

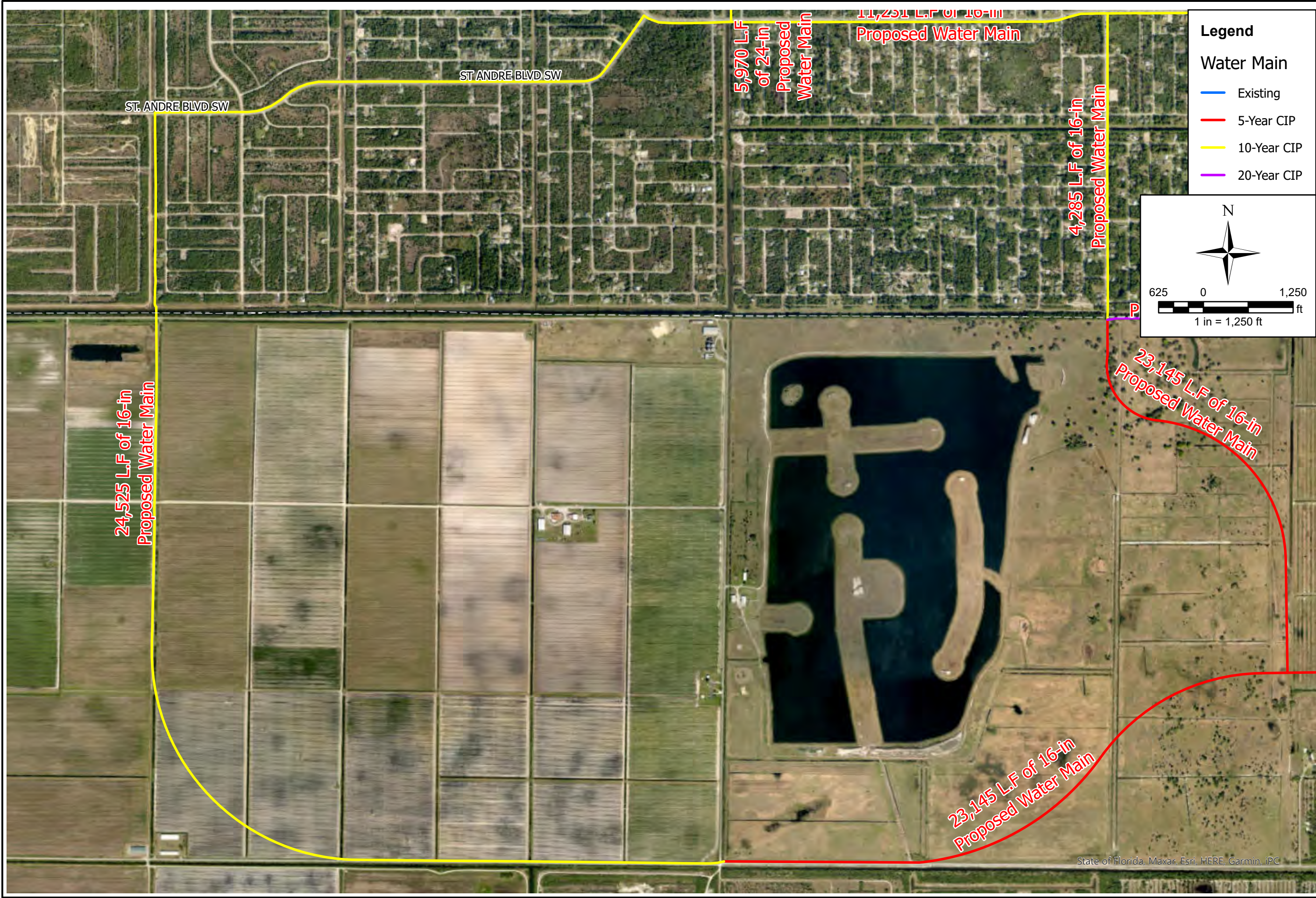
05/30/24
Infrastructure Solution Services, LLC

Ten-Year Capital Improvement Needs

Estimated By: JFN
Checked By: CEM
Project Manager: CEM

CIP No. 2: 16" WM Loop on San Filippo Dr SE (Degroodt Ed SW to FPL)

Specification Division Code or Class		Item Description	Quantity	Unit	Unit Cost	Item Total	Subtotal
No.	General						
1		Mobilization/Demobilization	7.5%	Allow	\$ 4,332,630	\$ 324,947	
2		General Requirements, Bonds, and Insurance	5%	Allow	\$ 4,332,630	\$ 216,632	
3		Temporary Erosion Control & Protection		LS	\$ 25,000	\$ 25,000	
4		Testing Allowance		LS	\$ 5,000	\$ 5,000	
5		Maintenance of Traffic		LS	\$ 19,000	\$ 19,000	
6		Survey and Record Drawings		LS	\$ 5,000	\$ 5,000	\$ 595,579
Demolition							
7		Conduct Demo of Existing Asphalt Pavement	700	SY	\$ 30	\$ 21,000	
8		Conduct Demo of Existing Driveway Pavement	425	SY	\$ 20	\$ 8,500	
9		Conduct Clearing and Grubbing (Miscellaneous)		LS	\$ 8,000	\$ 8,000	\$ 37,500
Water Main Extension							
10		Furnish & Install 16" PVC via Open-Cut Trenching with Testing & Chlorination	14837	LF	\$ 190	\$ 2,819,030	
11		Furnish & Install 16" Gate Valves with Valve Box and Conc. Pad	34	EA	\$ 20,000	\$ 680,000	
12		Furnish & Install Fire Hydrant Assembly	15	EA	\$ 12,000	\$ 180,000	
13		Conduct Temporary Jumper Connection at Specified Locations	18	EA	\$ 2,500	\$ 45,000	
14		Conduct Bacterial Sampling of Line at Specified Locations	12	EA	\$ 1,800	\$ 21,600	\$ 3,745,630
Civil/Site Restoration							
15		Conduct Final Grading & Restoration		LS	\$ 45,000	\$ 45,000	
16		Construct Driveway Pavement (in entirety)	425	SY	\$ 70	\$ 29,750	
17		Construct Asphalt Pavement (in entirety)	5610	SY	\$ 75	\$ 420,750	\$ 495,500
ESTIMATE SUBTOTAL							\$ 4,874,209
C	Planning Level Contingency			%	25%	\$ 1,218,552	
ESTIMATE TOTAL							\$ 6,100,000



10-Year Water CIP No. 3 Water Master Plan City of Palm Bay Utilities Department	PROJECT NO.: PBU009
	DATE: JUN 2024
FIGURE NO.	

16" WM Loop on St. Andre to Willowbrook
--

Meibourne | Sarasota | Panama City Beach



INFRASTRUCTURE SOLUTION SERVICES ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PBU009 | Water Master Plan Update

05/30/24
Infrastructure Solution Services, LLC

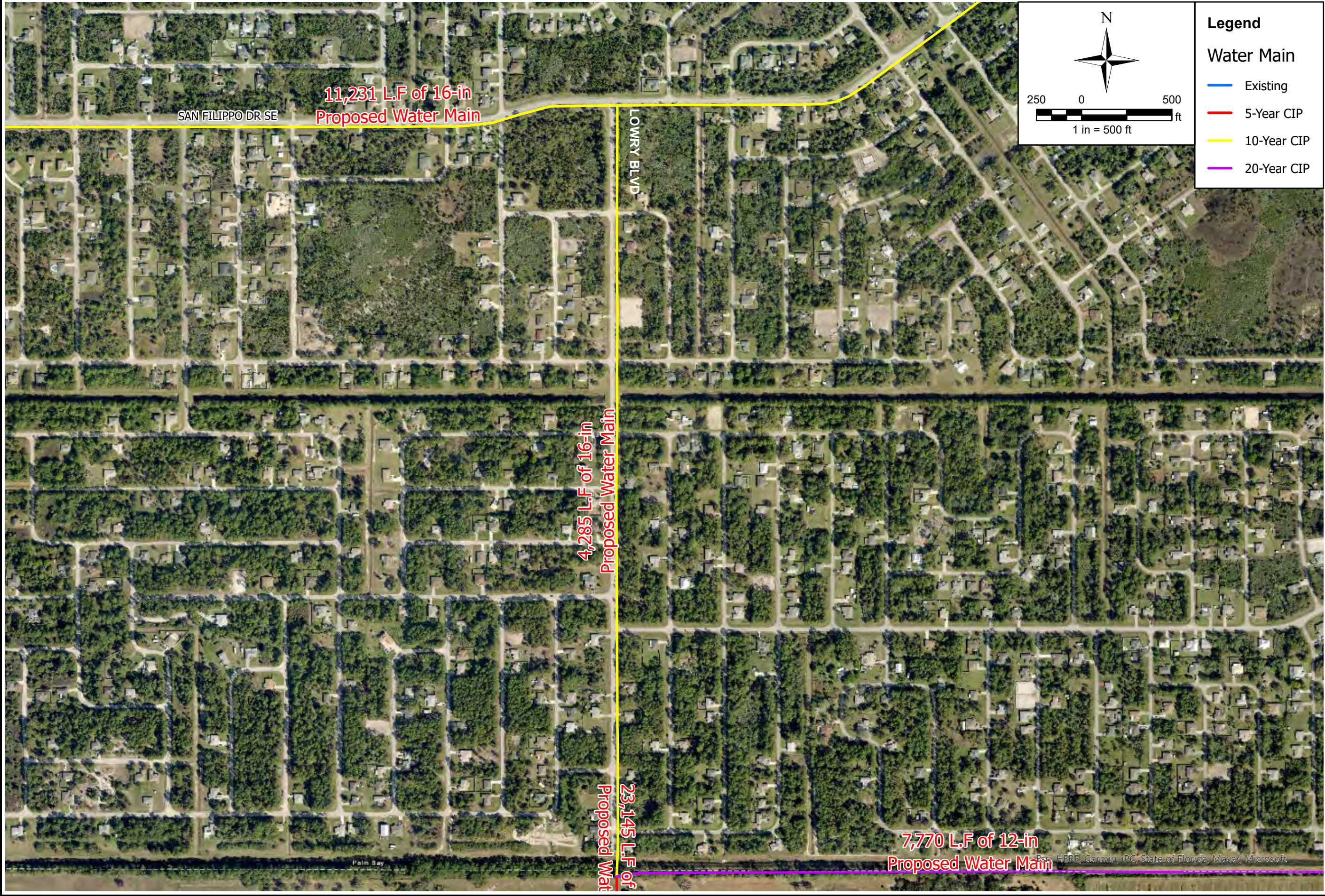
Ten-Year Capital Improvement Needs

CIP No. 3: 16" WM Loop on St. Andre Blvd to Willowbrook Development

Estimated By: JFN
Checked By: CEM
Project Manager: CEM

Specification Division Code or Class		Item Description	Quantity	Unit	Unit Cost	Item Total	Subtotal
No.	General						
1		Mobilization/Demobilization	7.5%	Allow	\$ 6,302,250	\$ 472,669	
2		General Requirements, Bonds, and Insurance	5%	Allow	\$ 6,302,250	\$ 315,113	
3		Temporary Erosion Control & Protection		LS	\$ 30,000	\$ 30,000	
4		Testing Allowance		LS	\$ 7,500	\$ 7,500	
5		Maintenance of Traffic		LS	\$ 25,000	\$ 25,000	
6		Survey and Record Drawings		LS	\$ 10,000	\$ 10,000	\$ 860,281
Demolition							
7		Conduct Demo of Existing Asphalt Pavement	180	SY	\$ 30	\$ 5,400	
8		Conduct Demo of Existing Driveway Pavement	90	SY	\$ 20	\$ 1,800	
9		Conduct Clearing and Grubbing (Miscellaneous)		LS	\$ 25,000	\$ 25,000	\$ 32,200
Water Main Extension							
10		Furnish & Install 16" PVC via Open-Cut Trenching with Testing & Chlorination	24125	LF	\$ 190	\$ 4,583,750	
11		Furnish & Install 20" Water Main (HDPE HDD) with Testing & Chlorination	400	LF	\$ 400	\$ 160,000	
12		Furnish & Install 16" Gate Valves with Valve Box and Conc. Pad	46	EA	\$ 20,000	\$ 920,000	
13		Furnish & Install Fire Hydrant Assembly	23	EA	\$ 12,000	\$ 276,000	
14		Conduct Temporary Jumper Connection at Specified Locations	23	EA	\$ 2,500	\$ 57,500	
15		Conduct Bacterial Sampling of Line at Specified Locations	20	EA	\$ 1,800	\$ 36,000	\$ 6,033,250
Civil/Site Restoration							
16		Conduct Final Grading & Restoration		LS	\$ 50,000	\$ 50,000	
17		Construct Driveway Pavement (in entirety)	90	SY	\$ 70	\$ 6,300	
18		Construct Asphalt Pavement (in entirety)	1440	SY	\$ 75	\$ 108,000	\$ 164,300
ESTIMATE SUBTOTAL							\$ 7,090,031
C	Planning Level Contingency			%	25%	\$ 1,772,508	
ESTIMATE TOTAL							\$ 8,900,000

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10-Year Water CIP No. 4
Water Master Plan
City of Palm Bay Utilities Department

PROJECT NO.:
PBU009
DATE:
JUN 2024
FIGURE NO.

16" WM Loop from San Filippo
to Rolling Meadows



INFRASTRUCTURE SOLUTION SERVICES ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PBU009 | Water Master Plan Update

05/30/24
Infrastructure Solution Services, LLC

Ten-Year Capital Improvement Needs
CIP No. 4: 16" WM Loop from San Filippo Sr SE to Rolling Meadows

Estimated By: JFN
Checked By: CEM
Project Manager: CEM

Specification Division Code or Class		Item Description	Quantity	Unit	Unit Cost	Item Total	Subtotal
No.	General Items						
1		Mobilization/Demobilization	7.5%	Allow	\$ 1,242,790	\$ 93,209	
2		General Requirements, Bonds, and Insurance	5%	Allow	\$ 1,242,790	\$ 62,140	
3		Temporary Erosion Control & Protection		LS	\$ 10,000	\$ 10,000	
4		Testing Allowance		LS	\$ 5,000	\$ 5,000	
5		Maintenance of Traffic		LS	\$ 15,000	\$ 15,000	
6		Survey and Record Drawings		LS	\$ 5,000	\$ 5,000	
Demolition							
7		Conduct Demo of Existing Asphalt Pavement	68	SY	\$ 30	\$ 2,040	
8		Conduct Demo of Existing Driveway Pavement	100	SY	\$ 20	\$ 2,000	
9		Conduct Clearing and Grubbing (Miscellaneous)		LS	\$ 5,000	\$ 5,000	
Water Main Extension							
10		Furnish & Install 16" PVC via Open-Cut Trenching with Testing & Chlorination	4135	LF	\$ 190	\$ 785,650	
11		Furnish & Install 20" Water Main (HDPE HDD) with Testing & Chlorination	150	LF	\$ 400	\$ 60,000	
12		Furnish & Install 16" Gate Valves with Valve Box and Conc. Pad	11	EA	\$ 20,000	\$ 220,000	
13		Furnish & Install Fire Hydrant Assembly	4	EA	\$ 12,000	\$ 48,000	
14		Conduct Temporary Jumper Connection at Specified Locations	6	EA	\$ 2,500	\$ 15,000	
15		Conduct Bacterial Sampling of Line at Specified Locations	4	EA	\$ 1,800	\$ 7,200	
Civil/Site Restoration							
16		Conduct Final Grading & Restoration		LS	\$ 10,000	\$ 10,000	
17		Construct Driveway Pavement (in entirety)	100	SY	\$ 70	\$ 7,000	
18		Construct Asphalt Pavement (in entirety)	612	SY	\$ 75	\$ 45,900	
ESTIMATE SUBTOTAL							\$ 1,398,139
C	Planning Level Contingency			%	25%	\$ 349,535	
ESTIMATE TOTAL							\$ 1,800,000

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Replace Exist. 6"-10" WM w/
12" WM on US-1 (Pospisil-
S of University)



INFRASTRUCTURE SOLUTION SERVICES ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PBU009 | Water Master Plan Update

05/30/24

Infrastructure Solution Services, LLC

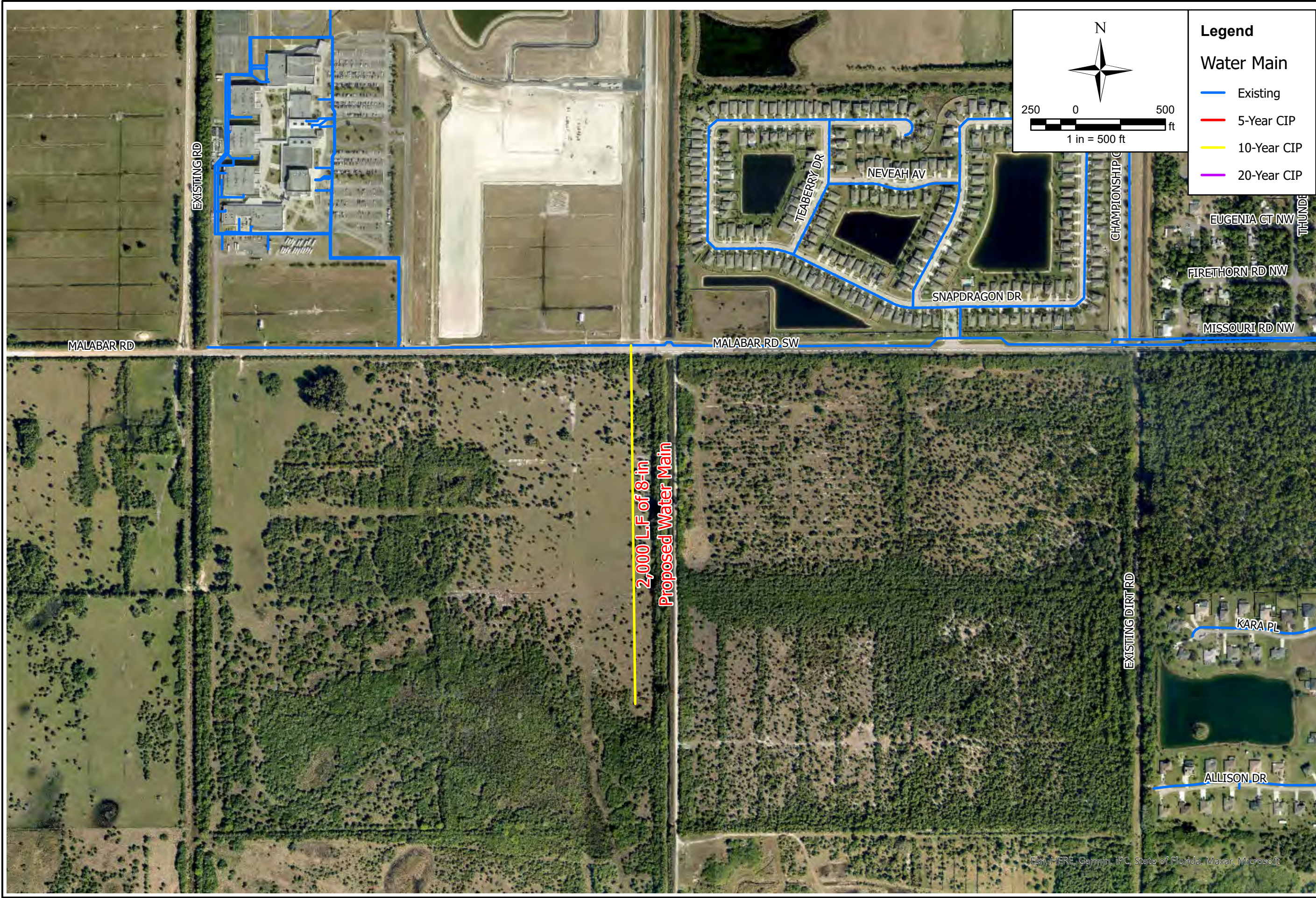
Ten-Year Capital Improvement Needs

CIP No. 5: Replace Exist. 6"-10" WM w/ 12" WM on US-1 (Pospisi Ave NE to S of University Blvd)

Estimated By: JFN
Checked By: CEM
Project Manager: CEM

Specification Division Code or Class		Item Description	Quantity	Unit	Unit Cost	Item Total	Subtotal
No.	General						
1		Mobilization/Demobilization	7.5%	Allow	\$ 5,235,950	\$ 392,696	
2		General Requirements, Bonds, and Insurance	5%	Allow	\$ 5,235,950	\$ 261,798	
3		Temporary Erosion Control & Protection		LS	\$ 25,000	\$ 25,000	
4		Testing Allowance		LS	\$ 7,500	\$ 7,500	
5		Maintenance of Traffic		LS	\$ 50,000	\$ 50,000	
6		Survey and Record Drawings		LS	\$ 7,500	\$ 7,500	\$ 744,494
Demolition							
7		Conduct Demo of Existing Asphalt Pavement	750	SY	\$ 30	\$ 22,500	
8		Conduct Demo of Existing Driveway Pavement	450	SY	\$ 20	\$ 9,000	
9		Conduct Demo of Existing Sidewalk Pavement	200	SY	\$ 20	\$ 4,000	
10		Conduct Clearing and Grubbing (Miscellaneous)		LS	\$ 75,000	\$ 75,000	\$ 110,500
Water Main Extension							
11		Furnish & Install 12" PVC via Open-Cut Trenching with Testing & Chlorination	4420	LF	\$ 170	\$ 751,400	
12		Furnish & Install 16" Water Main (HDPE HDD) with Testing & Chlorination	9355	LF	\$ 300	\$ 2,806,500	
13		Furnish & Install 12" Gate Valves with Valve Box and Conc. Pad	50	EA	\$ 15,000	\$ 750,000	
14		Furnish & Install Fire Hydrant Assembly	13	EA	\$ 12,000	\$ 156,000	
15		Conduct Temporary Jumper Connection at Specified Locations	25	EA	\$ 2,500	\$ 62,500	
16		Conduct Bacterial Sampling of Line at Specified Locations	11	EA	\$ 1,800	\$ 19,800	\$ 4,546,200
Civil/Site Restoration							
17		Conduct Final Grading & Restoration		LS	\$ 50,000	\$ 50,000	
18		Construct Driveway Pavement (in entirety)	450	SY	\$ 70	\$ 31,500	
19		Construct Sidewalk Pavement (in entirety)	200	SY	\$ 70	\$ 14,000	
20		Construct Asphalt Pavement (in entirety)	5250	SY	\$ 75	\$ 393,750	\$ 489,250
ESTIMATE SUBTOTAL							\$ 5,890,444
C	Planning Level Contingency			%	25%	\$ 1,472,611	
ESTIMATE TOTAL							\$ 7,400,000

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INFRASTRUCTURE SOLUTION SERVICES ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PBU009 | Water Master Plan Update

05/30/24

Infrastructure Solution Services, LLC

Ten-Year Capital Improvement Needs

CIP No. 6: 8" WM Extension S of Malabar Rd for Lennar South Development

Estimated By:

JFN

Checked By:

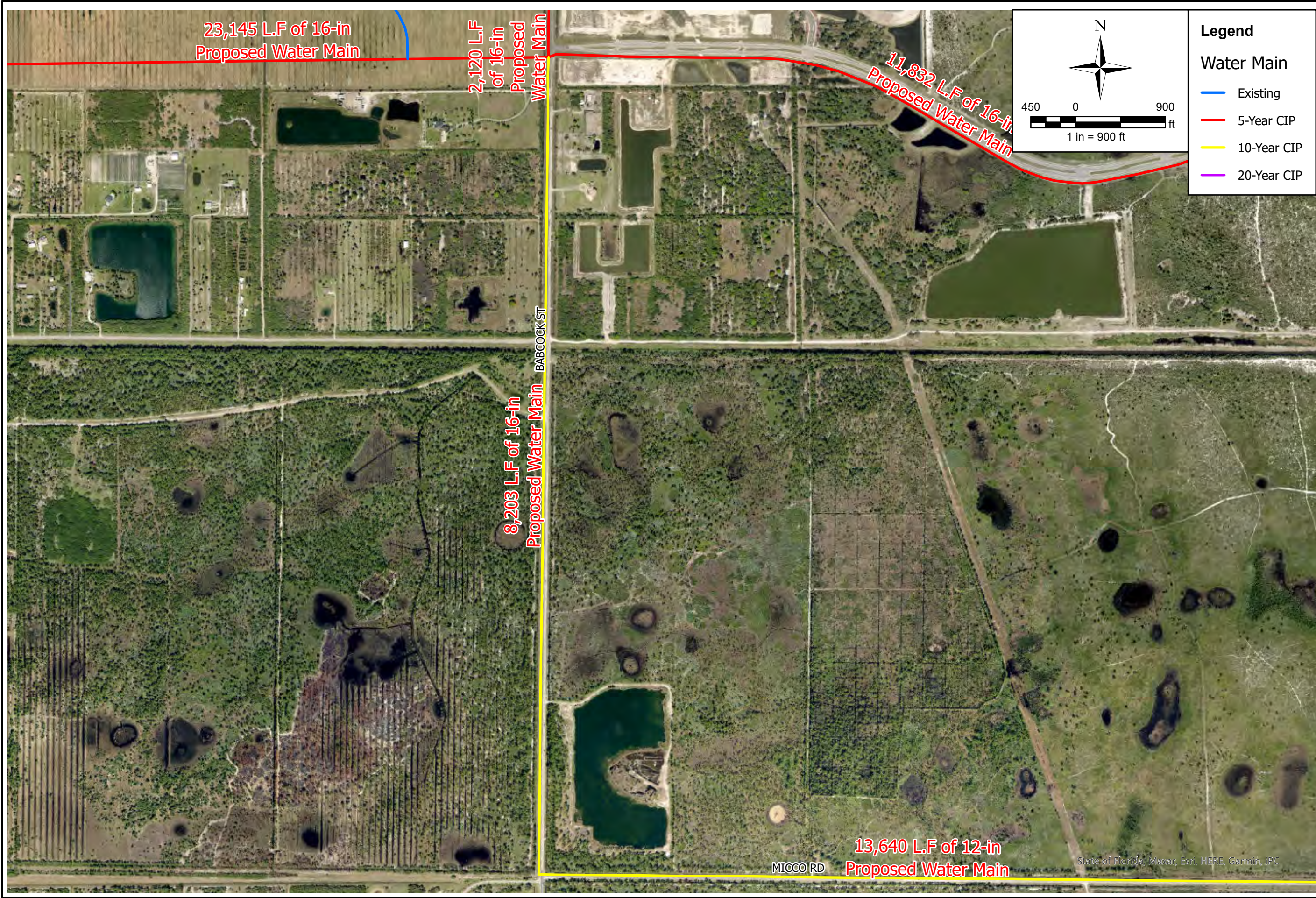
CEM

Project Manager:

CEM

No.	Specification Division Code or Class	Item Description	Quantity	Unit	Unit Cost	Item Total	Subtotal
General							
1		Mobilization/Demobilization	7.5%	Allow	\$ 424,100	\$ 31,808	
2		General Requirements, Bonds, and Insurance	5%	Allow	\$ 424,100	\$ 21,205	
3		Temporary Erosion Control & Protection		LS	\$ 10,000	\$ 10,000	
4		Testing Allowance		LS	\$ 5,000	\$ 5,000	
5		Maintenance of Traffic		LS	\$ 10,000	\$ 10,000	
6		Survey and Record Drawings		LS	\$ 3,500	\$ 3,500	\$ 81,513
Demolition							
7		Conduct Clearing and Grubbing (Miscellaneous)		LS	\$ 15,000	\$ 15,000	\$ 15,000
Water Main Extension							
8		Furnish & Install 8" PVC via Open-Cut Trenching with Testing & Chlorination	1920	LF	\$ 150	\$ 288,000	
9		Furnish & Install 10" Water Main (HDPE HDD) with Testing & Chlorination	80	LF	\$ 200	\$ 16,000	
10		Furnish & Install 8" Gate Valves with Valve Box and Conc. Pad	4	EA	\$ 3,500	\$ 14,000	
11		Furnish & Install Fire Hydrant Assembly	2	EA	\$ 12,000	\$ 24,000	
12		Conduct Temporary Jumper Connection at Specified Locations	2	EA	\$ 2,500	\$ 5,000	
13		Conduct Bacterial Sampling of Line at Specified Locations	2	EA	\$ 1,800	\$ 3,600	\$ 350,600
Civil/Site Restoration							
14		Conduct Final Grading & Restoration		LS	\$ 30,000	\$ 30,000	\$ 30,000
ESTIMATE SUBTOTAL							\$ 477,113
C		Planning Level Contingency		%	25%	\$ 119,278	
ESTIMATE TOTAL							\$ 600,000

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10-Year Water CIP No. 7
Water Master Plan
City of Palm Bay Utilities Department

PROJECT NO.:
PBU009
DATE:
JUN 2024
FIGURE NO.

16" WM Extension Babcock
(Davis Micco)



INFRASTRUCTURE SOLUTION SERVICES ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PBU009 | Water Master Plan Update

05/30/24
Infrastructure Solution Services, LLC

Ten-Year Capital Improvement Needs
CIP No. 7: 16" WM Extension Babcock St (Davis Ln to Micco Rd)

Estimated By: JFN
Checked By: CEM
Project Manager: CEM

Specification Division Code or Class		Item Description	Quantity	Unit	Unit Cost	Item Total	Subtotal
No.	General						
1		Mobilization/Demobilization	7.5%	Allow	\$ 2,264,070	\$ 169,805	\$ 328,009
2		General Requirements, Bonds, and Insurance	5%	Allow	\$ 2,264,070	\$ 113,204	
3		Temporary Erosion Control & Protection		LS	\$ 15,000	\$ 15,000	
4		Testing Allowance		LS	\$ 5,000	\$ 5,000	
5		Maintenance of Traffic		LS	\$ 20,000	\$ 20,000	
6		Survey and Record Drawings		LS	\$ 5,000	\$ 5,000	
Demolition							
7		Conduct Demo of Existing Asphalt Pavement	80	SY	\$ 30	\$ 2,400	\$ 7,400
8		Conduct Clearing and Grubbing (Miscellaneous)		LS	\$ 5,000	\$ 5,000	
Water Main Extension							
9		Furnish & Install 16" PVC via Open-Cut Trenching with Testing & Chlorination	8003	LF	\$ 190	\$ 1,520,570	\$ 2,134,170
10		Furnish & Install 20" Water Main (HDPE HDD) with Testing & Chlorination	200	LF	\$ 400	\$ 80,000	
11		Furnish & Install 16" Gate Valves with Valve Box and Conc. Pad	20	EA	\$ 20,000	\$ 400,000	
12		Furnish & Install Fire Hydrant Assembly	8	EA	\$ 12,000	\$ 96,000	
13		Conduct Temporary Jumper Connection at Specified Locations	10	EA	\$ 2,500	\$ 25,000	
14		Conduct Bacterial Sampling of Line at Specified Locations	7	EA	\$ 1,800	\$ 12,600	
Civil/Site Restoration							
15		Conduct Final Grading & Restoration		LS	\$ 10,000	\$ 10,000	\$ 77,500
16		Construct Asphalt Pavement (in entirety)	900	SY	\$ 75	\$ 67,500	
ESTIMATE SUBTOTAL							\$ 2,547,079
C	Planning Level Contingency			%	25%	\$ 636,770	
ESTIMATE TOTAL							\$ 3,200,000

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State of Florida, Maxar, Esri, HERE, Garmin, iPC



INFRASTRUCTURE SOLUTION SERVICES ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PBU009 | Water Master Plan Update

05/30/24

Infrastructure Solution Services, LLC

Ten-Year Capital Improvement Needs

CIP No. 8: 12" WM Loop on Micco Rd (Babcock St to Micco Village Development)

Estimated By:

JFN

Checked By:

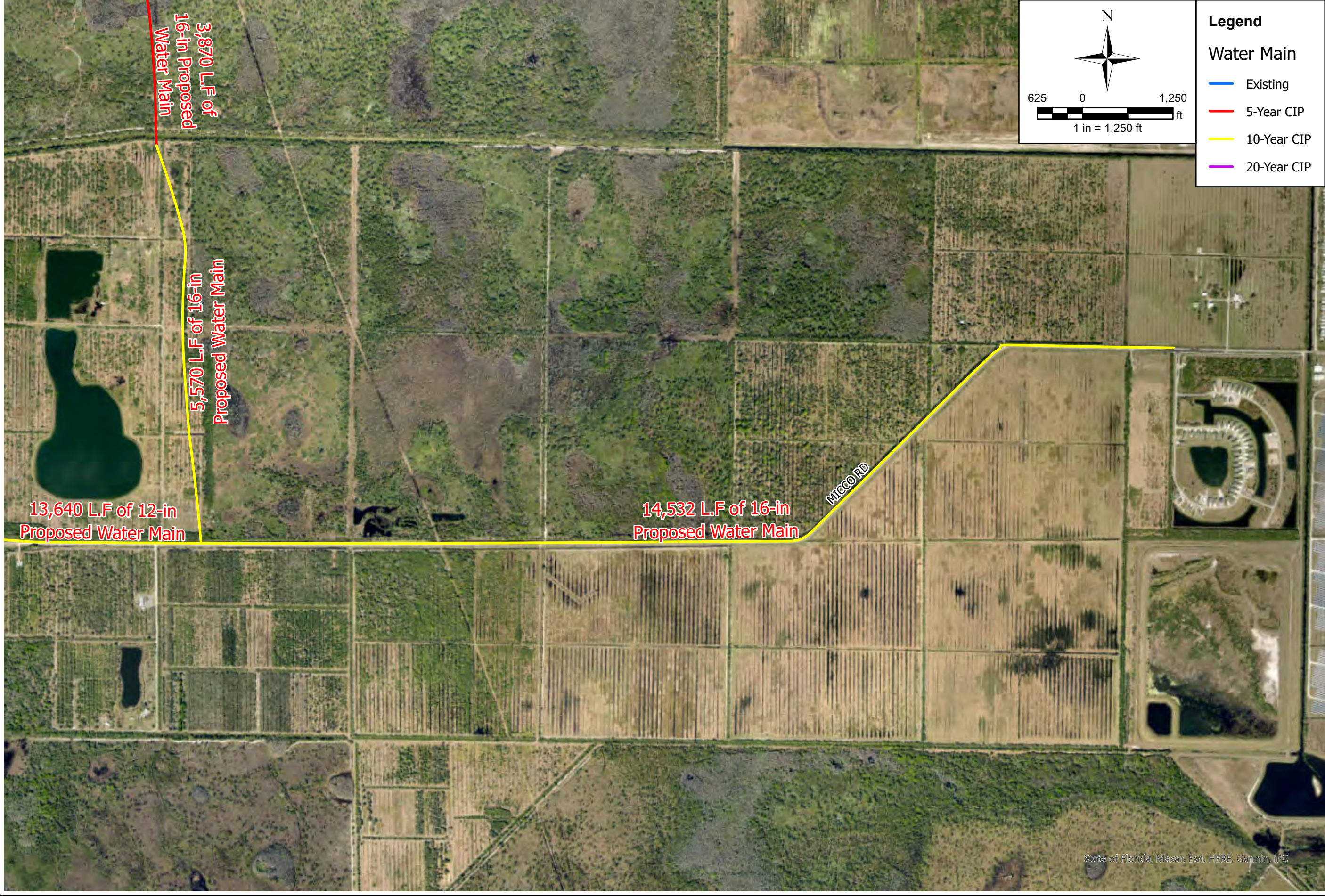
CEM

Project Manager:

CEM

Specification Division Code or Class		Item Description	Quantity	Unit	Unit Cost	Item Total	Subtotal
No.	General						
1		Mobilization/Demobilization	7.5%	Allow	\$ 3,388,250	\$ 254,119	
2		General Requirements, Bonds, and Insurance	5%	Allow	\$ 3,388,250	\$ 169,413	
3		Temporary Erosion Control & Protection		LS	\$ 30,000	\$ 30,000	
4		Testing Allowance		LS	\$ 5,000	\$ 5,000	
5		Maintenance of Traffic		LS	\$ 20,000	\$ 20,000	
6		Survey and Record Drawings		LS	\$ 7,500	\$ 7,500	\$ 486,031
Demolition							
7		Conduct Demo of Existing Asphalt Pavement	55	SY	\$ 30	\$ 1,650	
8		Conduct Clearing and Grubbing (Miscellaneous)		LS	\$ 15,000	\$ 15,000	\$ 16,650
Water Main Extension							
9		Furnish & Install 12" PVC via Open-Cut Trenching with Testing & Chlorination	13590	LF	\$ 170	\$ 2,310,300	
10		Furnish & Install 16" Water Main (HDPE HDD) with Testing & Chlorination	1050	LF	\$ 300	\$ 315,000	
11		Furnish & Install 12" Gate Valves with Valve Box and Conc. Pad	28	EA	\$ 15,000	\$ 420,000	
12		Furnish & Install Fire Hydrant Assembly	13	EA	\$ 12,000	\$ 156,000	
13		Conduct Temporary Jumper Connection at Specified Locations	14	EA	\$ 2,500	\$ 35,000	
14		Conduct Bacterial Sampling of Line at Specified Locations	11	EA	\$ 1,800	\$ 19,800	\$ 3,256,100
Civil/Site Restoration							
15		Conduct Final Grading & Restoration		LS	\$ 20,000	\$ 20,000	
16		Construct Asphalt Pavement (in entirety)	440	SY	\$ 75	\$ 33,000	\$ 53,000
ESTIMATE SUBTOTAL							\$ 3,811,781
C	Planning Level Contingency			%	25%	\$ 952,945	
ESTIMATE TOTAL							\$ 4,800,000

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10-Year Water CIP No. 9
Water Master Plan
City of Palm Bay Utilities Department

PROJECT NO.:
PBU009
DATE:
JUN 2024
FIGURE NO.

16" WM Extension on Micco
for Micco Village
Development



INFRASTRUCTURE SOLUTION SERVICES ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PBU009 | Water Master Plan Update

05/30/24

Infrastructure Solution Services, LLC

Ten-Year Capital Improvement Needs

CIP No. 9: 16" WM Extension on Micco Rd for Micco Village Development

Estimated By:

JFN

Checked By:

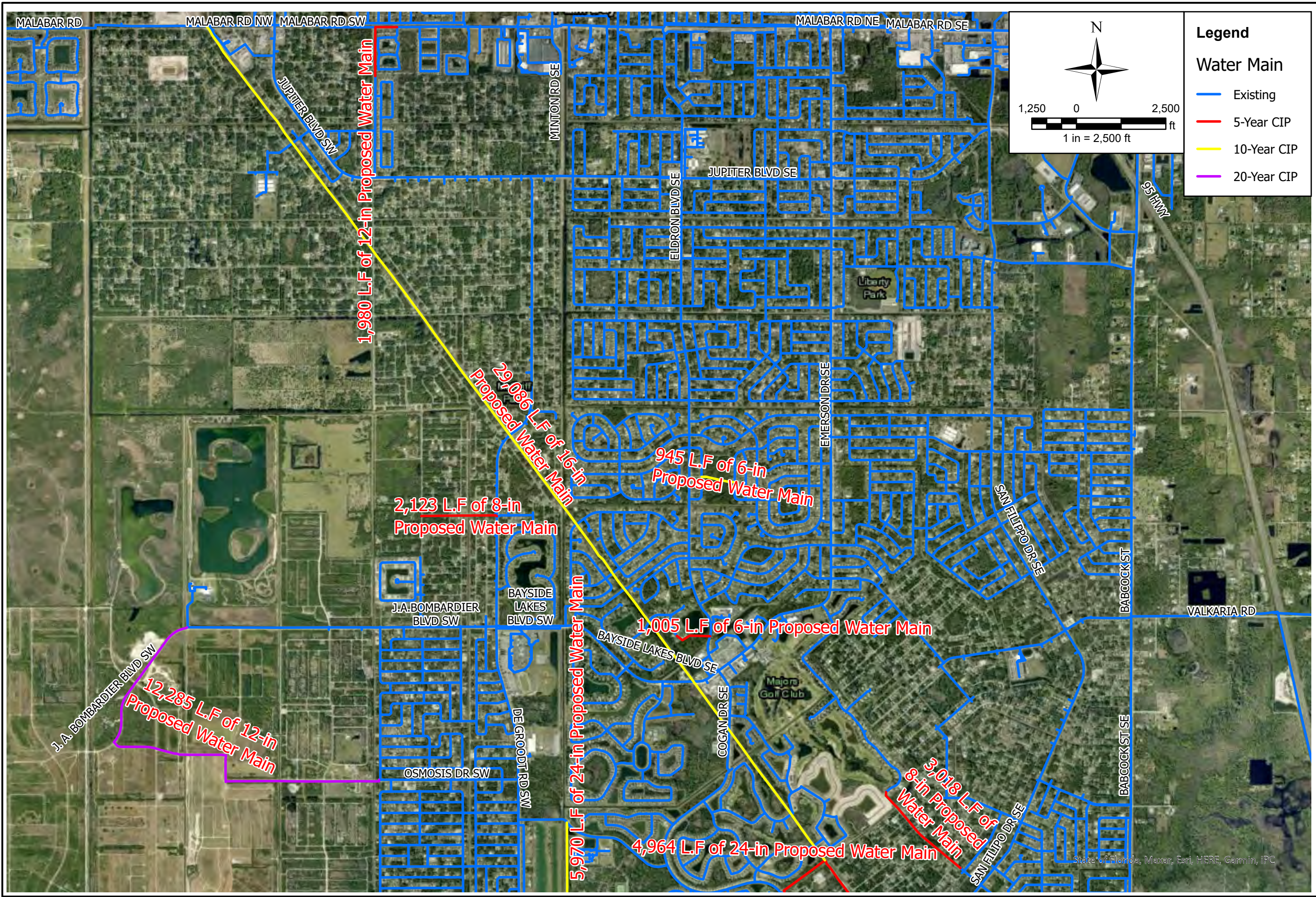
CEM

Project Manager:

CEM

Specification Division Code or Class		Item Description	Quantity	Unit	Unit Cost	Item Total	Subtotal
No.	General						
1		Mobilization/Demobilization	7.5%	Allow	\$ 3,731,880	\$ 279,891	
2		General Requirements, Bonds, and Insurance	5%	Allow	\$ 3,731,880	\$ 186,594	
3		Temporary Erosion Control & Protection		LS	\$ 30,000	\$ 30,000	
4		Testing Allowance		LS	\$ 7,500	\$ 7,500	
5		Maintenance of Traffic		LS	\$ 20,000	\$ 20,000	
6		Survey and Record Drawings		LS	\$ 7,500	\$ 7,500	
\$ 531,485							
Demolition							
7		Conduct Demo of Existing Asphalt Pavement	15	SY	\$ 30	\$ 450	\$ 25,450
8		Conduct Clearing and Grubbing (Miscellaneous)		LS	\$ 25,000	\$ 25,000	
Water Main Extension							
9		Furnish & Install 16" PVC via Open-Cut Trenching with Testing & Chlorination	14532	LF	\$ 190	\$ 2,761,080	\$ 3,588,180
10		Furnish & Install 16" Gate Valves with Valve Box and Conc. Pad	30	EA	\$ 20,000	\$ 600,000	
11		Furnish & Install Fire Hydrant Assembly	14	EA	\$ 12,000	\$ 168,000	
12		Conduct Temporary Jumper Connection at Specified Locations	15	EA	\$ 2,500	\$ 37,500	
13		Conduct Bacterial Sampling of Line at Specified Locations	12	EA	\$ 1,800	\$ 21,600	
Civil/Site Restoration							
14		Conduct Final Grading & Restoration		LS	\$ 45,000	\$ 45,000	\$ 53,250
15		Construct Asphalt Pavement (in entirety)	110	SY	\$ 75	\$ 8,250	
ESTIMATE SUBTOTAL							\$ 4,198,365
C	Planning Level Contingency			%	25%	\$ 1,049,591	
ESTIMATE TOTAL							\$ 5,300,000

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10-Year Water CIP No. 10
Water Master Plan
City of Palm Bay Utilities Department

PROJECT NO.:
PBU009
DATE:
JUN 2024
FIGURE NO.

16" WM Loop in FPL
Easement (Cogan-Malabar)



INFRASTRUCTURE SOLUTION SERVICES ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PBU009 | Water Master Plan Update

05/30/24

Infrastructure Solution Services, LLC

Ten-Year Capital Improvement Needs

CIP No. 10: 16" WM Loop in FPL Easement (Cogan Dr SE -Malabar Rd)

Estimated By:

JFN

Checked By:

CEM

Project Manager:

CEM

Specification Division Code or Class		Item Description	Quantity	Unit	Unit Cost	Item Total	Subtotal
No.	General						
1		Mobilization/Demobilization	7.5%	Allow	\$ 8,487,390	\$ 636,554	
2		General Requirements, Bonds, and Insurance	5%	Allow	\$ 8,487,390	\$ 424,370	
3		Temporary Erosion Control & Protection		LS	\$ 50,000	\$ 50,000	
4		Testing Allowance		LS	\$ 10,000	\$ 10,000	
6		Maintenance of Traffic		LS	\$ 35,000	\$ 35,000	
7		Survey and Record Drawings		LS	\$ 10,000	\$ 10,000	\$ 1,165,924
Demolition							
8		Conduct Demo of Existing Asphalt Pavement	270	SY	\$ 30	\$ 8,100	
9		Conduct Clearing and Grubbing (Miscellaneous)		LS	\$ 35,000	\$ 35,000	\$ 43,100
Water Main Extension							
10		Furnish & Install 16" PVC via Open-Cut Trenching with Testing & Chlorination	26536	LF	\$ 190	\$ 5,041,840	
11		Furnish & Install 20" Water Main (HDPE HDD) with Testing & Chlorination	2550	LF	\$ 400	\$ 1,020,000	
12		Furnish & Install 16" Gate Valves with Valve Box and Conc. Pad	80	EA	\$ 20,000	\$ 1,600,000	
13		Furnish & Install Fire Hydrant Assembly	26	EA	\$ 12,000	\$ 312,000	
14		Conduct Temporary Jumper Connection at Specified Locations	40	EA	\$ 2,500	\$ 100,000	
15		Conduct Bacterial Sampling of Line at Specified Locations	24	EA	\$ 1,800	\$ 43,200	\$ 8,117,040
Civil/Site Restoration							
16		Conduct Final Grading & Restoration		LS	\$ 40,000	\$ 40,000	
17		Construct Asphalt Pavement (in entirety)	2430	SY	\$ 75	\$ 182,250	\$ 222,250
ESTIMATE SUBTOTAL							\$ 9,548,314
C	Planning Level Contingency			%	25%	\$ 2,387,078	
ESTIMATE TOTAL							\$ 12,000,000

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Esri, HERE, Garmin, IPC, State of Florida, Mexar, Microsoft

10-Year Water CIP No. 11
Water Master Plan
City of Palm Bay Utilities Department

PROJECT NO.:
PBU009
DATE:
JUN 2024
FIGURE NO.

6" WM Loop from Pilgrim to
Satz for Las Palmas
Development



INFRASTRUCTURE SOLUTION SERVICES ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PBU009 | Water Master Plan Update

05/30/24

Infrastructure Solution Services, LLC

Ten-Year Capital Improvement Needs

CIP No. 11: 6" WM Loop from Pilgrim Ln SE to Satz St NE for Las Palmas Development

Estimated By:

JFN

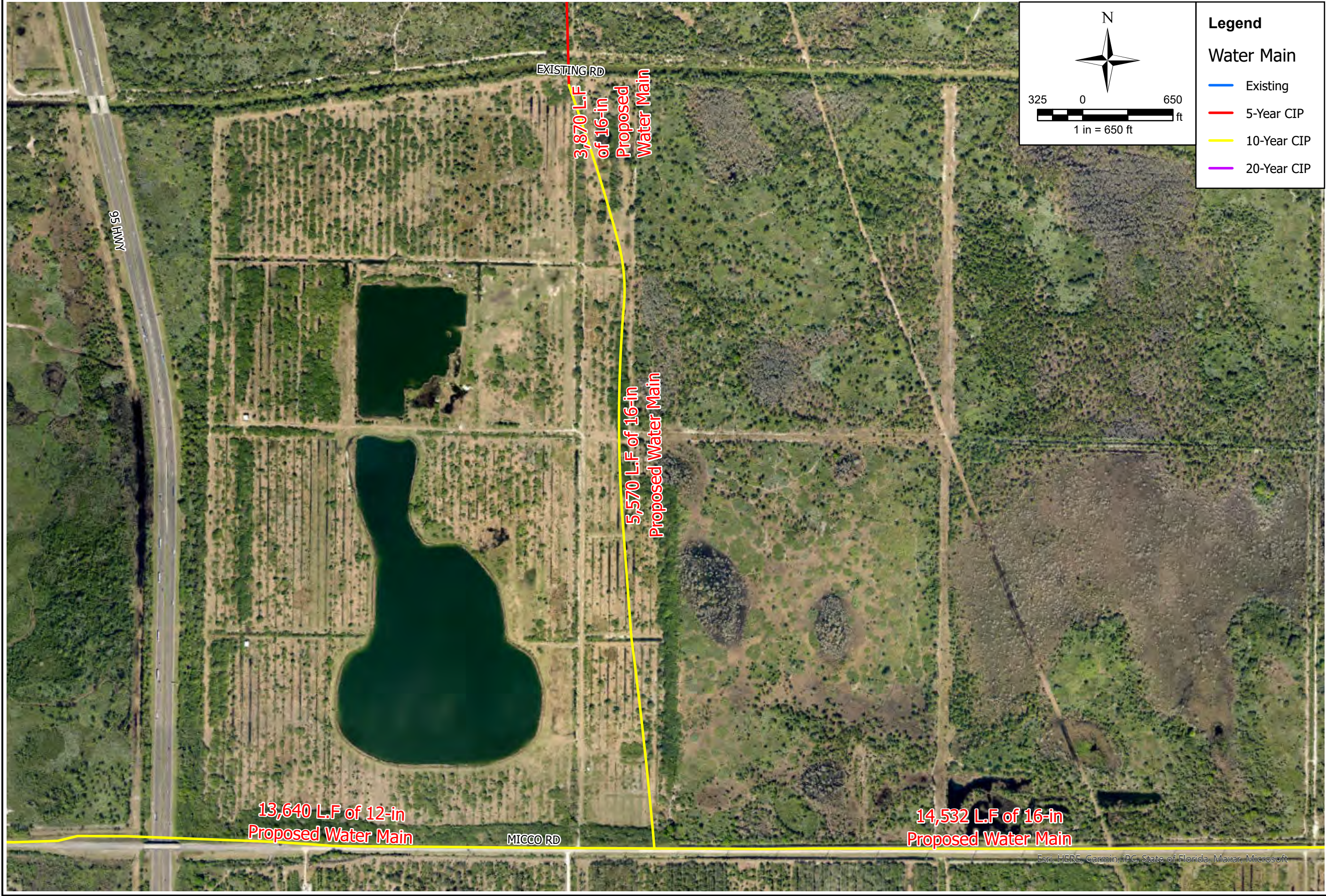
Checked By:

CEM

Project Manager:

CEM

Specification Division Code or Class		Item Description	Quantity	Unit	Unit Cost	Item Total	Subtotal
No.	General						
1		Mobilization/Demobilization	7.5%	Allow	\$ 423,050	\$ 31,729	
2		General Requirements, Bonds, and Insurance	5%	Allow	\$ 423,050	\$ 21,153	
3		Temporary Erosion Control & Protection		LS	\$ 10,000	\$ 10,000	
4		Testing Allowance		LS	\$ 2,500	\$ 2,500	
5		Maintenance of Traffic		LS	\$ 2,500	\$ 2,500	
6		Survey and Record Drawings		LS	\$ 3,500	\$ 3,500	\$ 71,381
	Demolition						
7		Conduct Demo of Existing Asphalt Pavement	600	SY	\$ 30	\$ 18,000	
8		Conduct Clearing and Grubbing (Miscellaneous)		LS	\$ 30,000	\$ 30,000	\$ 48,000
	Water Main Extension						
9		Furnish & Install 6" PVC via Open-Cut Trenching with Testing & Chlorination	945	LF	\$ 90	\$ 85,050	
10		Furnish & Install 6" Gate Valves with Valve Box and Conc. Pad	2	EA	\$ 2,600	\$ 5,200	
11		Furnish & Install Fire Hydrant Assembly	1	EA	\$ 12,000	\$ 12,000	
12		Conduct Temporary Jumper Connection at Specified Locations	1	EA	\$ 2,500	\$ 2,500	
13		Conduct Bacterial Sampling of Line at Specified Locations	1	EA	\$ 1,800	\$ 1,800	\$ 106,550
	Civil/Site Restoration						
14		Conduct Final Grading & Restoration		LS	\$ 25,000	\$ 25,000	
15		Construct Asphalt Pavement (in entirety)	3000	SY	\$ 75	\$ 225,000	\$ 250,000
ESTIMATE SUBTOTAL							\$ 475,931
C		Planning Level Contingency		%	25%	\$ 118,983	
ESTIMATE TOTAL							\$ 600,000





INFRASTRUCTURE SOLUTION SERVICES ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PBU009 | Water Master Plan Update

05/30/24

Infrastructure Solution Services, LLC

Ten-Year Capital Improvement Needs

CIP No. 12: 16" WM Loop through Pete Holdings (Emerald Lake to Micco Village)

Estimated By:

JFN

Checked By:

CEM

Project Manager:

CEM

Specification Division Code or Class		Item Description	Quantity	Unit	Unit Cost	Item Total	Subtotal
No.	General						
1		Mobilization/Demobilization	7.5%	Allow	\$ 1,524,300	\$ 114,323	
2		General Requirements, Bonds, and Insurance	5%	Allow	\$ 1,524,300	\$ 76,215	
3		Temporary Erosion Control & Protection		LS	\$ 20,000	\$ 20,000	
4		Testing Allowance		LS	\$ 5,000	\$ 5,000	
5		Maintenance of Traffic		LS	\$ 10,000	\$ 10,000	
6		Survey and Record Drawings		LS	\$ 7,500	\$ 7,500	\$ 233,038
Demolition							
7		Conduct Clearing and Grubbing (Miscellaneous)		LS	\$ 40,000	\$ 40,000	\$ 40,000
Water Main Extension							
8		Furnish & Install 16" PVC via Open-Cut Trenching with Testing & Chlorination	5370	LF	\$ 190	\$ 1,020,300	
9		Furnish & Install 20" Water Main (HDPE HDD) with Testing & Chlorination	200	LF	\$ 400	\$ 80,000	
10		Furnish & Install 16" Gate Valves with Valve Box and Conc. Pad	11	EA	\$ 20,000	\$ 220,000	
11		Furnish & Install Fire Hydrant Assembly	5	EA	\$ 12,000	\$ 60,000	
12		Conduct Temporary Jumper Connection at Specified Locations	5	EA	\$ 2,500	\$ 12,500	
13		Conduct Bacterial Sampling of Line at Specified Locations	5	EA	\$ 1,800	\$ 9,000	\$ 1,401,800
Civil/Site Restoration							
14		Conduct Final Grading & Restoration		LS	\$ 40,000	\$ 40,000	\$ 40,000
ESTIMATE SUBTOTAL							\$ 1,714,838
C	Planning Level Contingency			%	25%	\$ 428,709	
ESTIMATE TOTAL							\$ 2,200,000



INFRASTRUCTURE SOLUTION SERVICES ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PBU009 | Water Master Plan Update

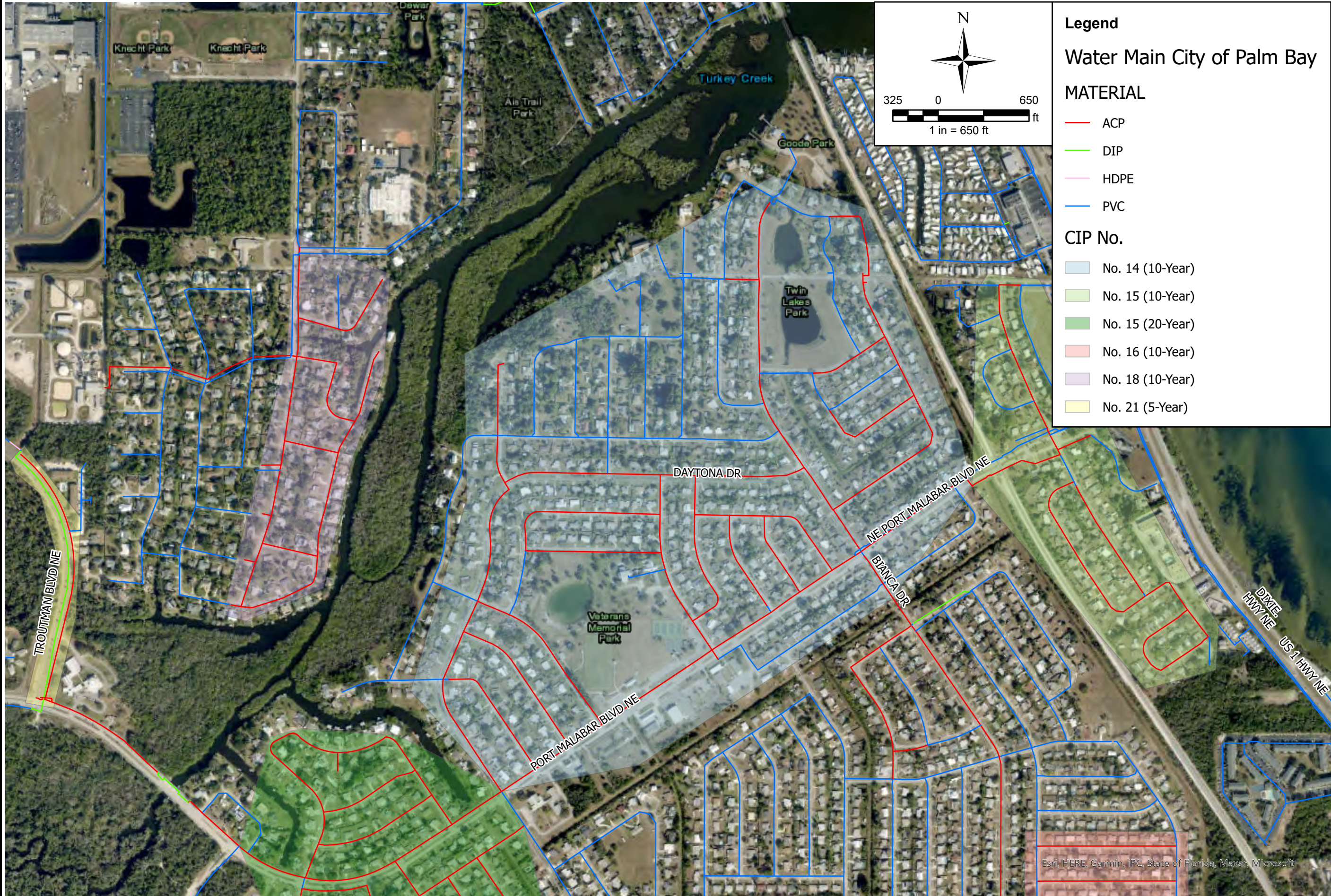
05/30/24
Infrastructure Solution Services, LLC

Ten-Year Capital Improvement Needs
CIP No. 13: South Water Booster Station - First Phase

Estimated By: CEM
Checked By: CEM
Project Manager: CEM

Specification Division Code or Class		Item Description	Quantity	Unit	Unit Cost	Item Total	Subtotal
C	General						
		Mobilization/Demobilization	7.5%	Allow	\$ 4,557,639	\$ 341,823	
		General Requirements, Bonds, and Insurance	5%	Allow	\$ 4,557,639	\$ 227,882	
		Temporary Erosion Control & Protection		LS	\$ 25,000	\$ 25,000	
		Testing Allowance		LS	\$ 25,000	\$ 25,000	
		Survey and Record Drawings		LS	\$ 10,000	\$ 10,000	\$ 629,705
	Civil						
		Site Preparation & Rough Grading	2	AC	\$ 10,000	\$ 20,000	
		Site Access Drive & Parking (8,000 SF)	889	SY	\$ 100	\$ 88,889	
		Furnish and Install 16" DIP WM to GST O/C	250	LF	\$ 200	\$ 50,000	
		Furnish and Install 24" DIP WM to Pump Station Header O/C	100	LF	\$ 350	\$ 35,000	
		Furnish and Install 16" DIP WM to System	250	LF	\$ 200	\$ 50,000	
		Furnish and Install 12" DIP Gravity Drain	150	LF	\$ 170	\$ 25,500	
		Furnish and Install Yard Piping Misc Valves		LS	\$ 50,000	\$ 50,000	
		Furnish and Install Gravity Sewer to nearest LS		LS	\$ 25,000	\$ 25,000	
		Site Finish Grade & Sod	1.5	AC	\$ 7,500	\$ 11,250	
		Landscaping		LS	\$ 25,000	\$ 25,000	
		Fence/Site Security (FDOT Type B)	1500	LF	\$ 40	\$ 60,000	\$ 440,639
	Structural						
		Prestressed Concrete Tank (One 1.5 MG Or Two 0.75 MG)	1,000,000	GAL	\$ 1	\$ 1,100,000	
		Control Building Complete (75 ft by 40 ft)	2,800	SF	\$ 250	\$ 700,000	\$ 1,800,000
	Mechanical						
		Furnish & Install High Service Pump - Small (40 HP Split Case Centrifugal)	2	EACH	\$ 100,000	\$ 200,000	
		Furnish & Install High Service Pump - Large (75 HP Split Case Centrifugal)	2	EACH	\$ 150,000	\$ 300,000	
		Furnish & Install Pump Suction and Discharge Header Piping & Valve	4	EACH	\$ 100,000	\$ 400,000	
		Furnish & Install 24" Mag Meter in Vault	1	EACH	\$ 40,000	\$ 40,000	
		Furnish & Install Sodium Hypochlorite Bulk Storage Tank and Chem Feed System Skid		LS	\$ 100,000	\$ 100,000	
		Furnish & Install Sodium Ammonium Sulfate Storage Tank and Chem Feed System Skid		LS	\$ 75,000	\$ 75,000	
		Furnish & Install Chem Feed Piping from Chem Feed Skids to Injection Points		LS	\$ 15,000	\$ 15,000	\$ 1,130,000
	Electrical and I&C						
		Furnish & Install 400 kW Indoor Diesel Emergency Generator and Fuel Storage		LS	\$ 200,000	\$ 200,000	
		Electrical System		LS	\$ 505,596	\$ 506,000	
		Controls, Instrumentaiton & SCADA		LS	\$ 421,330	\$ 421,000	\$ 1,127,000
ESTIMATE SUBTOTAL							\$ 5,127,344
	Planning Level Contingency			%	25%	\$ 1,281,836	
ESTIMATE TOTAL							\$ 6,500,000

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10-Year Water CIP No. 14
Water Master Plan
City of Palm Bay Utilities Department

PROJECT NO.:
PBU009

DATE:
JUN 2024

FIGURE NO.

ACP Water Main Replacement
adjacent to Veteran's
Memorial Park



INFRASTRUCTURE SOLUTION SERVICES ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PBU009 | Water Master Plan Update

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Infrastructure Solution Services, LLC

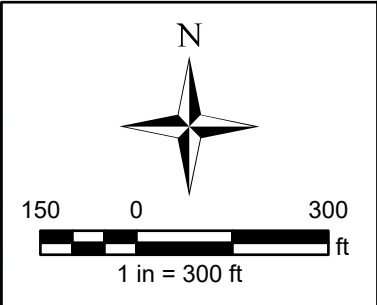
Ten-Year Capital Improvement Needs

CIP No. 14: ACP WM Replacement adjacent to Veteran's Memorial Park

Estimated By: **NRV**
Checked By: **CEM**
Project Manager: **CEM**

Specification Division Code or Class		Item Description	Quantity	Unit	Unit Cost	Item Total	Subtotal
C	General						
		Mobilization/Demobilization	7.5%	Allow	\$ 7,085,000	\$ 531,375	
		General Requirements, Bonds, and Insurance	5%	Allow	\$ 7,085,000	\$ 354,250	
		Temporary Erosion Control & Protection		LS	\$ 10,000	\$ 10,000	
		Testing Allowance		LS	\$ 5,000	\$ 5,000	
		Maintenance of Traffic		LS	\$ 2,500	\$ 2,500	
		Survey and Record Drawings		LS	\$ 5,000	\$ 5,000	\$ 908,125
	Demolition						
		Conduct Demo of Existing Asphalt Pavement	3500	SY	\$ 30	\$ 105,000	
		Conduct Demo of Existing Sidewalk Pavement and Driveways	3000	SY	\$ 20	\$ 60,000	
		Conduct Clearing and Grubbing (Miscellaneous)		LS	\$ 5,000	\$ 5,000	
		Grout Fill and Abandon in Place Existing 2" ACP	2000	LF	\$ 30	\$ 60,000	
		Grout Fill and Abandon in Place Existing 4" ACP	7800	LF	\$ 40	\$ 312,000	
		Grout Fill and Abandon in Place Existing 6" ACP	12100	LF	\$ 50	\$ 605,000	
		Grout Fill and Abandon in Place Existing 8" ACP	4500	LF	\$ 75	\$ 337,500	
		Grout Fill and Abandon in Place Existing 12" ACP	450	LF	\$ 110	\$ 49,500	\$ 1,534,000
	ACP Pipe Replacement						
		Furnish & Install 2" PVC via Open-Cut Trenching with Testing & Chlorination	2000	LF	\$ 50	\$ 100,000	
		Furnish & Install 6" HDPE via HDD	100	LF	\$ 110	\$ 11,000	
		Furnish & Install 6" PVC via Open-Cut Trenching with Testing & Chlorination	19900	LF	\$ 90	\$ 1,791,000	
		Furnish & Install 8" PVC via Open-Cut Trenching with Testing & Chlorination	4500	LF	\$ 150	\$ 675,000	
		Furnish & Install 10" HPDE via HDD	100	LF	\$ 200	\$ 20,000	
		Furnish & Install 12" PVC via Open-Cut Trenching with Testing & Chlorination	450	LF	\$ 170	\$ 76,500	\$ 2,673,500
	Civil/Site Restoration						
		Conduct Final Grading		LS	\$ 20,000	\$ 20,000	
		Construct Sidewalk Pavement and Driveways (in entirety)	3000	SY	\$ 70	\$ 210,000	
		Construct Asphalt Pavement (in entirety)	35000	SY	\$ 75	\$ 2,625,000	\$ 2,855,000
ESTIMATE SUBTOTAL							\$ 7,970,625
C	Planning Level Contingency			%	30%	\$ 2,391,188	
ESTIMATE TOTAL							\$ 10,400,000

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Legend

Water Main City of Palm Bay

MATERIAL

- ACP
- DIP
- PVC

CIP No.

- No. 14 (10-Year)
- No. 15 (10-Year)



INFRASTRUCTURE SOLUTION SERVICES ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

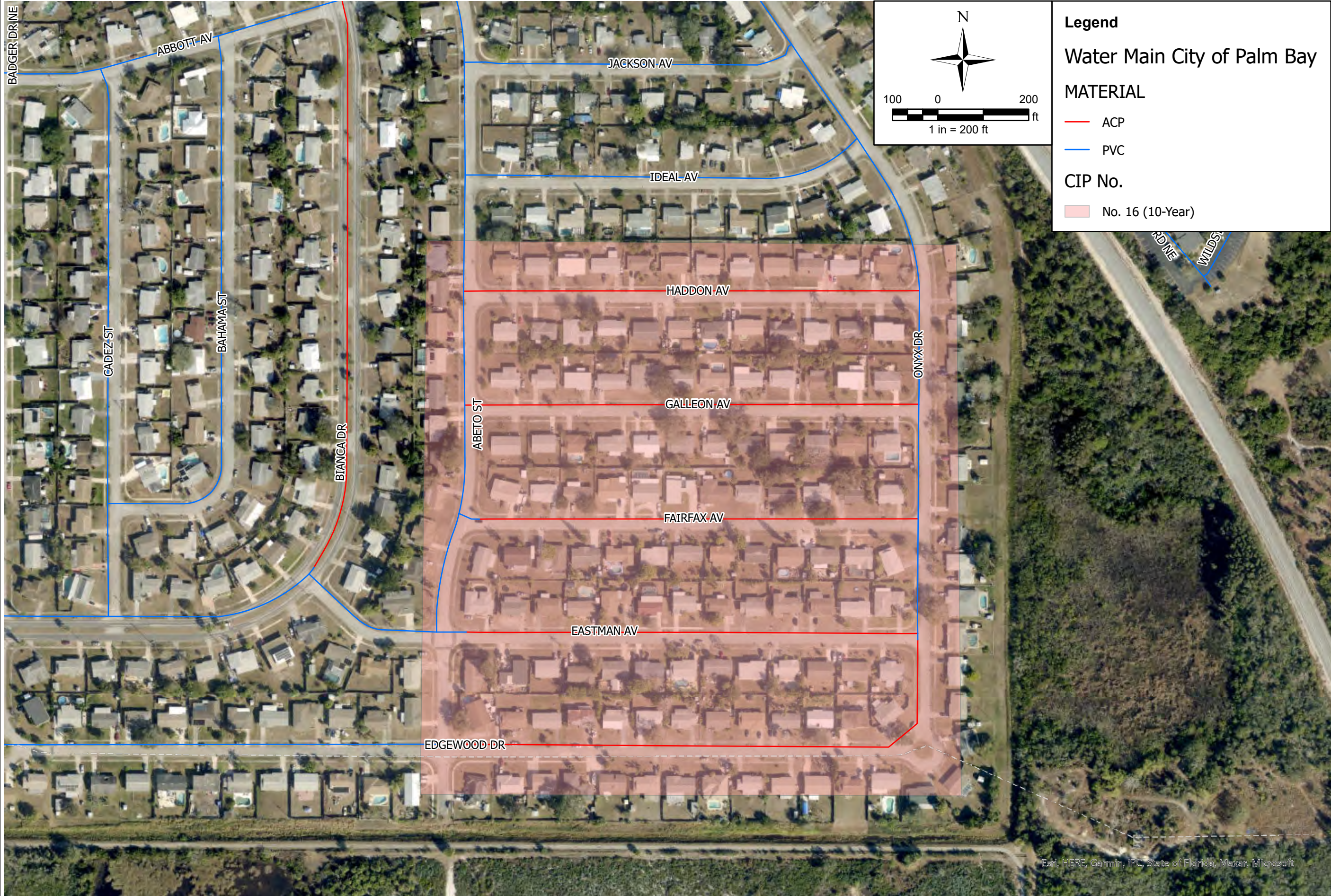
PBU009 | Water Master Plan Update

05/30/24
Infrastructure Solution Services, LLC

Ten-Year Capital Improvement Needs
CIP No. 15: ACP WM Replacement near Indian River Flats

Estimated By: *NRV*
Checked By: *CEM*
Project Manager: *CEM*

Specification Division Code or Class		Item Description	Quantity	Unit	Unit Cost	Item Total	Subtotal
No.		General					
		Mobilization/Demobilization	7.5%	Allow	\$ 1,224,900	\$ 91,868	
		General Requirements, Bonds, and Insurance	5%	Allow	\$ 1,224,900	\$ 61,245	
		Temporary Erosion Control & Protection		LS	\$ 10,000	\$ 10,000	
		Testing Allowance		LS	\$ 5,000	\$ 5,000	
		Maintenance of Traffic		LS	\$ 2,500	\$ 2,500	
		Survey and Record Drawings		LS	\$ 5,000	\$ 5,000	\$ 175,613
		Demolition					
		Conduct Demo of Existing Asphalt Pavement	500	SY	\$ 30	\$ 15,000	
		Conduct Demo of Existing Sidewalk Pavement and Driveways	1500	SY	\$ 20	\$ 30,000	
		Conduct Clearing and Grubbing (Miscellaneous)		LS	\$ 5,000	\$ 5,000	
		Grout Fill and Abandon in Place Existing 4" ACP	2300	LF	\$ 40	\$ 92,000	
		Grout Fill and Abandon in Place Existing 6" ACP	2510	LF	\$ 50	\$ 125,500	\$ 267,500
		ACP Pipe Replacement					
		Furnish & Install 6" HDPE via HDD	100	LF	\$ 110	\$ 11,000	
		Furnish & Install 6" PVC via Open-Cut Trenching with Testing & Chlorination	4710	LF	\$ 90	\$ 423,900	\$ 434,900
		Civil/Site Restoration					
		Conduct Final Grading		LS	\$ 20,000	\$ 20,000	
		Construct Sidewalk Pavement and Driveways (in entirety)	1500	SY	\$ 70	\$ 105,000	
		Construct Asphalt Pavement (in entirety)	5000	SY	\$ 75	\$ 375,000	\$ 500,000
		ESTIMATE SUBTOTAL					\$ 1,378,013
C		Planning Level Contingency		%	30%	\$ 413,404	
		ESTIMATE TOTAL					\$ 1,800,000





INFRASTRUCTURE SOLUTION SERVICES ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

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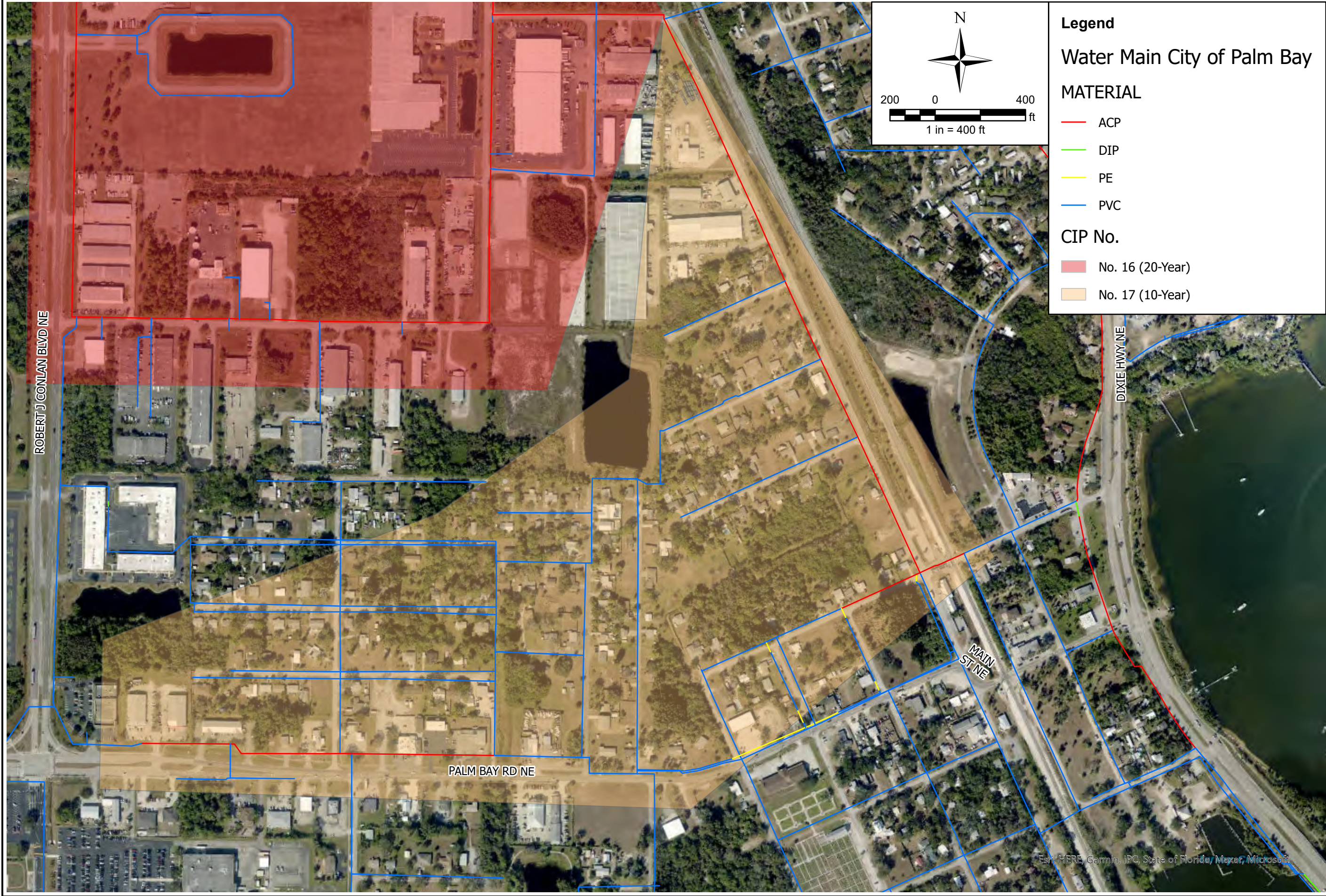
05/30/24
Infrastructure Solution Services, LLC

Ten-Year Capital Improvement Needs
CIP No. 16: ACP WM Replacement Adjacent to Abeto St. NE

Estimated By: *NRV*
Checked By: *CEM*
Project Manager: *CEM*

Specification Division Code or Class		Item Description	Quantity	Unit	Unit Cost	Item Total	Subtotal
No.	General						
		Mobilization/Demobilization	7.5%	Allow	\$ 1,303,500	\$ 97,763	
		General Requirements, Bonds, and Insurance	5%	Allow	\$ 1,303,500	\$ 65,175	
		Temporary Erosion Control & Protection		LS	\$ 10,000	\$ 10,000	
		Testing Allowance		LS	\$ 5,000	\$ 5,000	
		Maintenance of Traffic		LS	\$ 2,500	\$ 2,500	
		Survey and Record Drawings		LS	\$ 5,000	\$ 5,000	
	Demolition						
		Conduct Demo of Existing Asphalt Pavement	500	SY	\$ 30	\$ 15,000	
		Conduct Demo of Existing Sidewalk Pavement and Driveways	2000	SY	\$ 20	\$ 40,000	
		Conduct Clearing and Grubbing (Miscellaneous)		LS	\$ 5,000	\$ 5,000	
		Grout Fill and Abandon in Place Existing 4" ACP	4200	LF	\$ 40	\$ 168,000	
		Grout Fill and Abandon in Place Existing 6" ACP	1000	LF	\$ 50	\$ 50,000	
	ACP Pipe Replacement						
		Furnish & Install 6" PVC via Open-Cut Trenching with Testing & Chlorination	5200	LF	\$ 90	\$ 468,000	\$ 468,000
	Civil/Site Restoration						
		Conduct Final Grading		LS	\$ 20,000	\$ 20,000	
		Construct Sidewalk Pavement and Driveways (in entirety)	2000	SY	\$ 70	\$ 140,000	
		Construct Asphalt Pavement (in entirety)	5000	SY	\$ 75	\$ 375,000	
	ESTIMATE SUBTOTAL						
C	Planning Level Contingency			%	30%	\$ 439,931	
ESTIMATE TOTAL							\$ 2,000,000

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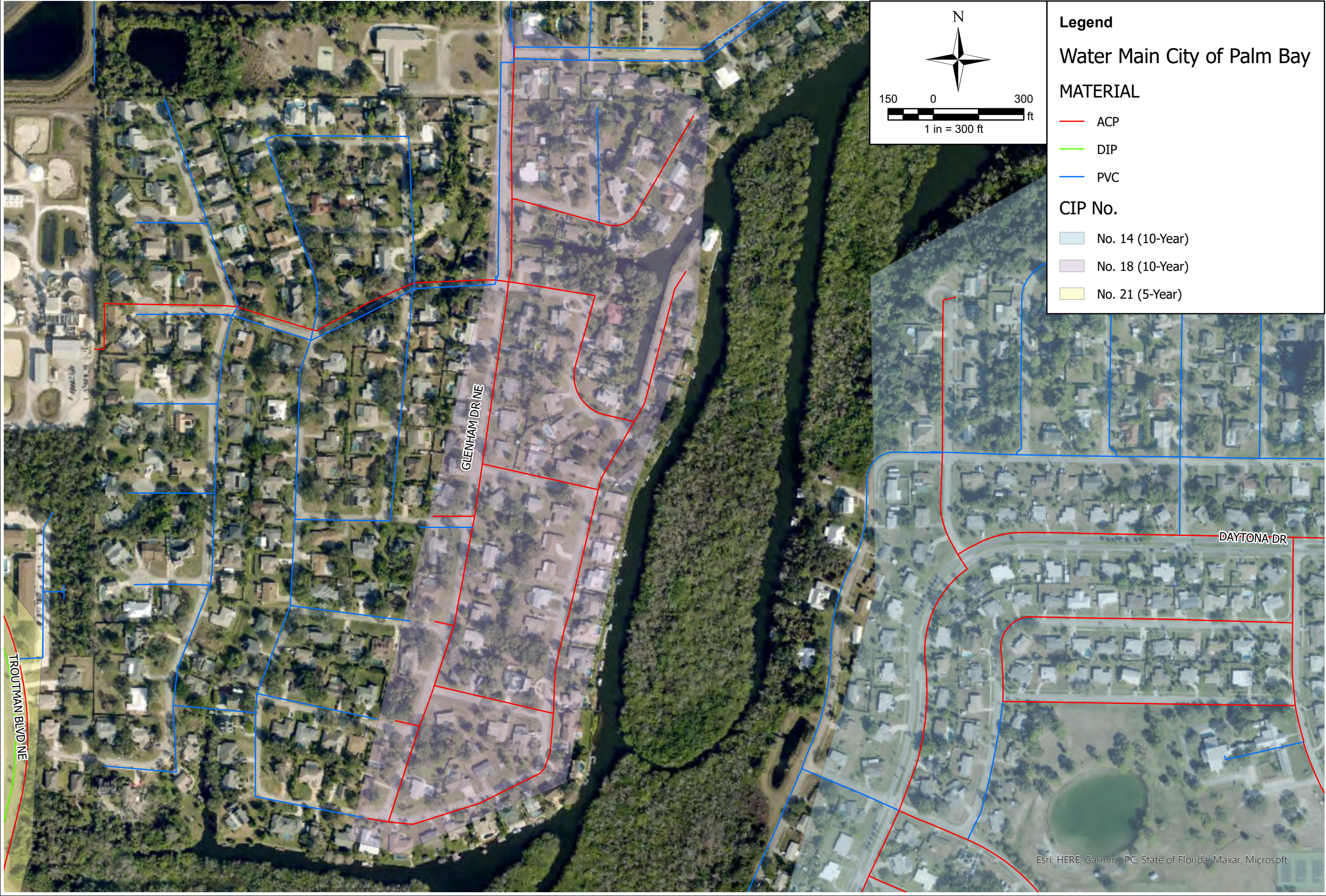
PBU009 | Water Master Plan Update

05/30/24
Infrastructure Solution Services, LLC

Ten-Year Capital Improvement Needs
CIP No. 17: ACP WM Replacement along Main St NE Area

Estimated By: *NRV*
Checked By: *CEM*
Project Manager: *CEM*

Specification Division Code or Class		Item Description	Quantity	Unit	Unit Cost	Item Total	Subtotal
No.		General					
		Mobilization/Demobilization	7.5%	Allow	\$ 1,638,100	\$ 122,858	
		General Requirements, Bonds, and Insurance	5%	Allow	\$ 1,638,100	\$ 81,905	
		Temporary Erosion Control & Protection		LS	\$ 10,000	\$ 10,000	
		Testing Allowance		LS	\$ 5,000	\$ 5,000	
		Maintenance of Traffic		LS	\$ 2,500	\$ 2,500	
		Survey and Record Drawings		LS	\$ 5,000	\$ 5,000	\$ 227,263
		Demolition					
		Conduct Demo of Existing Asphalt Pavement	420	SY	\$ 30	\$ 12,600	
		Conduct Demo of Existing Sidewalk Pavement and Driveways	200	SY	\$ 20	\$ 4,000	
		Conduct Clearing and Grubbing (Miscellaneous)		LS	\$ 5,000	\$ 5,000	
		Grout Fill and Abandon in Place Existing 8" ACP	1000	LF	\$ 75	\$ 75,000	
		Grout Fill and Abandon in Place Existing 10" ACP	4000	LF	\$ 90	\$ 360,000	\$ 456,600
		ACP Pipe Replacement					
		Furnish & Install 8" PVC via Open-Cut Trenching with Testing & Chlorination	1000	LF	\$ 150	\$ 150,000	
		Furnish & Install 10" PVC via Open-Cut Trenching with Testing & Chlorination	4000	LF	\$ 165	\$ 660,000	\$ 810,000
		Civil/Site Restoration					
		Conduct Final Grading		LS	\$ 20,000	\$ 20,000	
		Construct Sidewalk Pavement and Driveways (in entirety)	200	SY	\$ 70	\$ 14,000	
		Construct Asphalt Pavement (in entirety)	4200	SY	\$ 75	\$ 315,000	\$ 349,000
		ESTIMATE SUBTOTAL					\$ 1,842,863
C		Planning Level Contingency		%	30%	\$ 552,859	
		ESTIMATE TOTAL					\$ 2,400,000



Legend

Water Main City of Palm Bay

MATERIAL

- ACP
- DIP
- PVC

CIP No.

- No. 14 (10-Year)
- No. 18 (10-Year)
- No. 21 (5-Year)



INFRASTRUCTURE SOLUTION SERVICES ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PBU009 | Water Master Plan Update

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Infrastructure Solution Services, LLC

Ten-Year Capital Improvement Needs

Estimated By: *NRV*
Checked By: *CEM*
Project Manager: *CEM*

CIP No. 18: ACP WM Replacement within Highland Shores Turkey River Estates

Specification Division Code or Class		Item Description	Quantity	Unit	Unit Cost	Item Total	Subtotal
No.		General					
		Mobilization/Demobilization	7.5%	Allow	\$ 2,222,000	\$ 166,650	
		General Requirements, Bonds, and Insurance	5%	Allow	\$ 2,222,000	\$ 111,100	
		Temporary Erosion Control & Protection		LS	\$ 10,000	\$ 10,000	
		Testing Allowance		LS	\$ 5,000	\$ 5,000	
		Maintenance of Traffic		LS	\$ 2,500	\$ 2,500	
		Survey and Record Drawings		LS	\$ 5,000	\$ 5,000	\$ 300,250
		Demolition					
		Conduct Demo of Existing Asphalt Pavement	750	SY	\$ 30	\$ 22,500	
		Conduct Demo of Existing Sidewalk Pavement and Driveways	1500	SY	\$ 20	\$ 30,000	
		Conduct Clearing and Grubbing (Miscellaneous)		LS	\$ 5,000	\$ 5,000	
		Grout Fill and Abandon in Place Existing 2" ACP	150	LF	\$ 30	\$ 4,500	
		Grout Fill and Abandon in Place Existing 4" ACP	5650	LF	\$ 40	\$ 226,000	
		Grout Fill and Abandon in Place Existing 6" ACP	1200	LF	\$ 50	\$ 60,000	
		Grout Fill and Abandon in Place Existing 8" ACP	2400	LF	\$ 75	\$ 180,000	\$ 528,000
		ACP Pipe Replacement					
		Furnish & Install 2" PVC via Open-Cut Trenching with Testing & Chlorination	150	LF	\$ 50	\$ 7,500	
		Furnish & Install 6" PVC via Open-Cut Trenching with Testing & Chlorination	6850	LF	\$ 90	\$ 616,500	
		Furnish & Install 8" PVC via Open-Cut Trenching with Testing & Chlorination	2400	LF	\$ 150	\$ 360,000	\$ 984,000
		Civil/Site Restoration					
		Conduct Final Grading		LS	\$ 20,000	\$ 20,000	
		Construct Sidewalk Pavement and Driveways (in entirety)	1500	SY	\$ 70	\$ 105,000	
		Construct Asphalt Pavement (in entirety)	7500	SY	\$ 75	\$ 562,500	\$ 687,500
		ESTIMATE SUBTOTAL					\$ 2,499,750
C		Planning Level Contingency		%	30%	\$ 749,925	
		ESTIMATE TOTAL					\$ 3,300,000



INFRASTRUCTURE SOLUTION SERVICES ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PBU009 | Water Master Plan Update

05/30/24

Infrastructure Solution Services, LLC

Ten-Year Capital Improvement Needs

CIP No. 19: SRWTP Additional Floridian Aquifer Groundwater Supply Well (SRO-6)

Estimated By: CEM

Checked By: CEM

Project Manager: CEM

Specification Division Code or Class		Item Description	Quantity	Unit	Unit Cost	Item Total	Subtotal
No.	General						
		Mobilization/Demobilization	7.5%	Allow	\$ 1,178,000	\$ 88,350	\$ 182,250
		General Requirements, Bonds, and Insurance	5%	Allow	\$ 1,178,000	\$ 58,900	
		Testing Allowance		LS	\$ 25,000	\$ 25,000	
		Survey and Record Drawings		LS	\$ 10,000	\$ 10,000	
	SRWTP FLORIDIAN SUPPLY WELL - SRO-6						
		Floridian Supply Well - Well Drilling		LS	\$ 402,500	\$ 402,500	\$ 1,143,000
		Floridian Supply Well - Furnish and Install Well Pump		LS	\$ 172,500	\$ 172,500	
		Floridian Supply Well - Site Work		LS	\$ 115,000	\$ 115,000	
		Raw Water Transmission Line - SRO-5 to Raw Water Header Conection (16" PVC WM)	1500	LF	\$ 210	\$ 315,000	
		Electrical/I&C		LS	\$ 138,000	\$ 138,000	
ESTIMATE SUBTOTAL							\$ 1,325,250
C	Planning Level Contingency			%	25%	\$ 331,313	
ESTIMATE TOTAL							\$ 1,700,000



INFRASTRUCTURE SOLUTION SERVICES ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PBU009 | Water Master Plan Update

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Infrastructure Solution Services, LLC

Ten-Year Capital Improvement Needs

Estimated By: CEM
Checked By: CEM
Project Manager: CEM

CIP No. 20: Replace One 60 HP with 125 HP High Service Pump at SRWTP

Specification Division Code or Class		Item Description	Quantity	Unit	Unit Cost	Item Total	Subtotal
No.	General						
		Mobilization/Demobilization	7.5%	Allow	\$ 345,500	\$ 25,913	\$ 78,188
		General Requirements, Bonds, and Insurance	5%	Allow	\$ 345,500	\$ 17,275	
		Testing Allowance		LS	\$ 25,000	\$ 25,000	
		Survey and Record Drawings		LS	\$ 10,000	\$ 10,000	
	REPLACE 60 HP with 125 HP HIGH SERVICE PUMPS						
		Remove 60 HP High Service Pump		LS	\$ 28,750	\$ 28,750	\$ 310,500
		Furnish 125 HP High Service Pump		LS	\$ 115,000	\$ 115,000	
		Install 125 HP High Service Pump		LS	\$ 86,250	\$ 86,250	
		Piping & Valve		LS	\$ 28,750	\$ 28,750	
		Electrical/I&C		LS	\$ 51,750	\$ 51,750	
ESTIMATE SUBTOTAL							\$ 388,688
C	Planning Level Contingency			%	25%	\$ 97,172	
ESTIMATE TOTAL							\$ 500,000



INFRASTRUCTURE SOLUTION SERVICES ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PBU009 | Water Master Plan Update

05/30/24
Infrastructure Solution Services, LLC

Ten-Year Capital Improvement Needs
CIP No. 21: SRWTP Expansion from 8 MGD to 10 MGD

Estimated By: CEM
Checked By: CEM
Project Manager: CEM

Specification Division Code or Class		Item Description	Quantity	Unit	Unit Cost	Item Total	Subtotal
No.	General						
		Mobilization/Demobilization	7.5%	Allow	\$ 2,086,500	\$ 156,488	\$ 295,813
		General Requirements, Bonds, and Insurance	5%	Allow	\$ 2,086,500	\$ 104,325	
		Testing Allowance		LS	\$ 25,000	\$ 25,000	
		Survey and Record Drawings		LS	\$ 10,000	\$ 10,000	
	NEW CARTRIDGE FILTERS						
		Furnish Cartridge Filter		LS	\$ 46,000	\$ 46,000	\$ 117,000
		Install Cartridge Filters		LS	\$ 46,000	\$ 46,000	
		Misc Piping Mod		LS	\$ 25,000	\$ 25,000	
	NEW REVERSE OSMOSIS FEED PUMP						
		Furnish 300 HP RO Feed Pump		LS	\$ 143,750	\$ 143,750	\$ 345,000
		Install RO Feed Pump		LS	\$ 143,750	\$ 143,750	
		Electrical/I&C		LS	\$ 57,500	\$ 57,500	
	NEW 5th RO SKID						
		Furnish 2 MGD RO Skid		LS	\$ 805,000	\$ 805,000	\$ 1,589,500
		Install 2 MGD RO Skid		LS	\$ 603,750	\$ 603,750	
		Process Piping & Valves		LS	\$ 50,000	\$ 50,000	
		Electrical/I&C		LS	\$ 130,750	\$ 130,750	
ESTIMATE SUBTOTAL							\$ 2,347,313
C	Planning Level Contingency			%	25%	\$ 586,828	
ESTIMATE TOTAL							\$ 3,000,000



INFRASTRUCTURE SOLUTION SERVICES ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PBU009 | Water Master Plan Update

05/30/24
Infrastructure Solution Services, LLC

Ten-Year Capital Improvement Needs
CIP No. 22: SRWTP Rehabilitation and Electrical System Improvements

Estimated By: CEM
Checked By: CEM
Project Manager: CEM

No.	Specification Division Code or Class	Item Description	Quantity	Unit	Unit Cost	Item Total	Subtotal
		General					
		Mobilization/Demobilization	7.5%	Allow	\$ 8,566,850	\$ 642,514	
		General Requirements, Bonds, and Insurance	5%	Allow	\$ 8,566,850	\$ 428,343	
		Testing Allowance		LS	\$ 25,000	\$ 25,000	
		Survey and Record Drawings		LS	\$ 10,000	\$ 10,000	\$ 1,105,856
		REPLACE BLEND AND RO CARTRIDGE FILTERS					
		Furnish Cartridge Filter	5	EACH	\$ 46,000	\$ 230,000	
		Install Cartridge Filters	5	EACH	\$ 46,000	\$ 230,000	
		Misc Piping Mod	5	EACH	\$ 25,000	\$ 125,000	\$ 585,000
		REPLACE REVERSE OSMOSIS FEED PUMPS NOS. 1 & 2					
		Furnish 300 HP RO Feed Pump & Motor	2	EACH	\$ 143,750	\$ 287,500	
		Install RO Feed Pump & Motor	2	EACH	\$ 143,750	\$ 287,500	
		Electrical/I&C		LS	\$ 115,000	\$ 115,000	\$ 690,000
		REPLACE DEGASIFIER TOWERS AND ODOR CONTROL SCRUBBERS					
		Furnish Force Draft Degasifier with 15,000 CFM Fan for 5 MGD	2	EACH	\$ 632,500	\$ 1,265,000	
		Install Force Draft Degasifier with 15,000 CFM Fan for 5 MGD	2	EACH	\$ 474,375	\$ 948,750	
		FRP Duct		LS	\$ 115,000	\$ 115,000	
		Furnish First and Second Stage Odor Control		LS	\$ 500,000	\$ 500,000	
		Install Odor Control		LS	\$ 375,000	\$ 375,000	
		Electrical/I&C		LS	\$ 640,750	\$ 640,750	\$ 3,844,500
		REPLACE TRANSFER PUMP NOS 1 & 3 PUMP & MOTORS					
		Furnish Transfer Pump & Motor	1	EACH	\$ 103,500	\$ 103,500	
		Install Transfer Pump & Motor	1	EACH	\$ 77,625	\$ 77,625	
		Electrical/I&C		LS	\$ 36,225	\$ 36,225	\$ 217,350
		REPLACE HIGH SERVICE PUMPS NOS. 3 & 4 PUMPS & MOTORS					
		Furnish High Service Pump & Motor	2	EACH	\$ 201,250	\$ 402,500	
		Install High Service Pump & Motors	2	EACH	\$ 150,938	\$ 301,875	
		Electrical/I&C		LS	\$ 140,875	\$ 140,875	\$ 845,250
		REPLACE DEEP INJECTION WELL PUMPS & MOTORS					
		Furnish 40 HP DIW Pump & Motor	2	EACH	\$ 69,000	\$ 138,000	
		Install Deep Injection Well Pump & Motor	2	EACH	\$ 51,750	\$ 103,500	
		Misc Piping/Valve Replacemetn		LS	\$ 50,000	\$ 50,000	
		Electrical/I&C		LS	\$ 58,300	\$ 58,300	\$ 349,800
		REPLACE EMERGENCY GENERATOR AND MOTOR CONTROL CENTERS					
		Furnish 1250 kW Standby Generators		LS	\$ 700,000	\$ 700,000	
		Install Emergency Generator		LS	\$ 100,000	\$ 700,000	
		Furnish and Install Fuel System		LS	\$ 85,000	\$ 85,000	
		Furnish and Install MCC-1		LS	\$ 450,000	\$ 450,000	
		Furnish and Install MCC-3		LS	\$ 450,000	\$ 450,000	
		Furnish and Install MCC-3		LS	\$ 450,000	\$ 450,000	
		Furnish and Install MCC-4		LS	\$ 360,000	\$ 360,000	\$ 3,195,000
		ESTIMATE SUBTOTAL				\$ 10,832,756	
C		Planning Level Contingency		%	25%	\$ 2,708,189	
		ESTIMATE TOTAL				\$ 14,000,000	



INFRASTRUCTURE SOLUTION SERVICES ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PBU009 | Water Master Plan Update

05/30/24
Infrastructure Solution Services, LLC

Twenty-Year Capital Improvement Needs

Project Manager: CEM

No.	Item Description	Line Item Total	Subtotal
	PBU009 Water Master Plan Update		
	CIP No. 1: 8" WM Loop on Pace Dr (Gillma Dr to St Johns Heritage Pkwy)	\$ 550,000	
	CIP No. 2: 12" WM Loop on Mara Loma Extended to Lowry Extended	\$ 2,500,000	
	CIP No. 3: Replace 8" WM w/ 12" WM on Palm Bay Rd (Babcock St S NE - Clearmont St NE)	\$ 4,400,000	
	CIP No. 4: 12" WM Loop on Palm Bay Rd across Babcock St	\$ 340,000	
	CIP No. 5: Replace 8" WM w/ 16" WM on Emerson Dr (W of Medina Ave NE - W of Amador Ave NE)	\$ 4,700,000	
	CIP No. 6: Replace 12" WM w/ 16" WM on Emerson Dr (Nash Repump Station-W of Minton Dr)	\$ 6,000,000	
	CIP No. 7: Replace 8" WM w/ 12" WM on Culver Dr (N of Emerson Dr)	\$ 300,000	
	CIP NO. 8: Replace 20" WM w/ 24" WM Along Canal (NE of Clearmont-NRWTP)	\$ 720,000	
	CIP No. 9: Replace 8" WM w/ 12" WM on Port Malabar Blvd (Daytona Dr NE-Bianca Dr NE)	\$ 820,000	
	CIP No. 10: Replace 10" WM w/ 12" WM on Conlan/Northview/Florida/Kingswood (Palm Bay Rd-US-1)	\$ 5,400,000	
	CIP No. 11: Replace 6" & 8" WM w/ 12" WM on Clearmont St NE (Franklin St NE -Palm Bay Rd NE)	\$ 1,300,000	
	CIP No. 12: 12" WM Loop from JA Bombardier Blvd SW dead-end to Osmosis Dr SW /O'Connel Ave SW	\$ 4,300,000	
	CIP No. 13: South Booster Station -- Second Phase	\$ 2,700,000	
	CIP No. 14: ACP WM Replacement in Holiday Park MHP	\$ 14,300,000	
	CIP No. 15: ACP WM Replacement adjacent to Glenbrooke Senior Living	\$ 4,700,000	
	CIP No. 16: ACP WM Replacement within Vincent Kirby Industrial Park	\$ 3,900,000	
	CIP No. 17: ACP Pipe Replacment near Lipscomb Park	\$ 4,950,000	
	CIP No. 18: Expand NRROWTP from 3.33 MGD to 10 MGD	Cost Est by Others	
	CIP No. 19: Expand SRWTP from 10 MGD to 14 MGD	\$ 35,000,000	
		ESTIMATE TOTAL	\$ 96,880,000





INFRASTRUCTURE SOLUTION SERVICES ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PBU009 | Water Master Plan Update

05/30/24

Infrastructure Solution Services, LLC

Twenty-Year Capital Improvement Needs

CIP No. 1: 8" WM Loop on Pace Dr (Gillma Dr to St Johns Heritage Pkwy)

Estimated By:

JFN

Checked By:

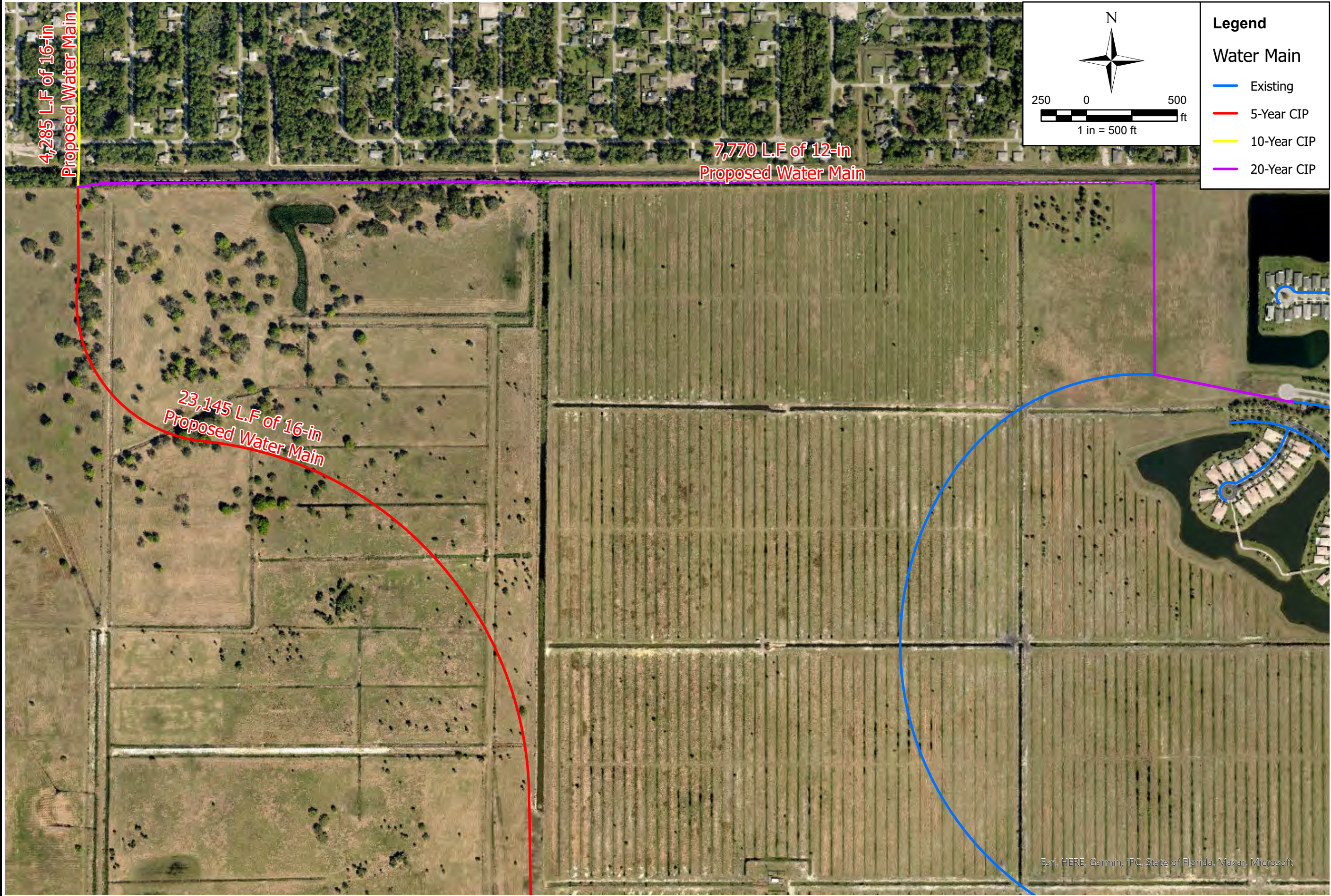
CEM

Project Manager:

CEM

No.	Specification Division Code or Class	Item Description	Quantity	Unit	Unit Cost	Item Total	Subtotal
General							
1		Mobilization/Demobilization	7.5%	Allow	\$ 388,450	\$ 29,134	
2		General Requirements, Bonds, and Insurance	5%	Allow	\$ 388,450	\$ 19,423	
3		Temporary Erosion Control & Protection		LS	\$ 10,000	\$ 10,000	
4		Testing Allowance		LS	\$ 5,000	\$ 5,000	
5		Maintenance of Traffic		LS	\$ 15,000	\$ 15,000	
6		Survey and Record Drawings		LS	\$ 3,500	\$ 3,500	\$ 82,056
Demolition							
7		Conduct Demo of Existing Asphalt Pavement	15	SY	\$ 30	\$ 450	
8		Conduct Demo of Existing Sidewalk Pavement	15	SY	\$ 20	\$ 300	
9		Conduct Clearing and Grubbing (Miscellaneous)		LS	\$ 2,500	\$ 2,500	\$ 3,250
Water Main Extension							
10		Furnish & Install 8" PVC via Open-Cut Trenching with Testing & Chlorination	1372	LF	\$ 150	\$ 205,800	
11		Furnish & Install 10" Water Main (HDPE HDD) with Testing & Chlorination	170	LF	\$ 200	\$ 34,000	
12		Furnish & Install 8" Gate Valves with Valve Box and Conc. Pad	5	EA	\$ 3,500	\$ 17,500	
13		Furnish & Install Fire Hydrant Assembly	2	EA	\$ 12,000	\$ 24,000	
14		Conduct Temporary Jumper Connection at Specified Locations	3	EA	\$ 2,500	\$ 7,500	
15		Conduct Bacterial Sampling of Line at Specified Locations	2	EA	\$ 1,800	\$ 3,600	\$ 292,400
Civil/Site Restoration							
16		Conduct Final Grading		LS	\$ 50,000	\$ 50,000	
17		Construct Sidewalk Pavement (in entirety)	15	SY	\$ 70	\$ 1,050	
18		Construct Asphalt Pavement (in entirety)	110	SY	\$ 75	\$ 8,250	\$ 59,300
ESTIMATE SUBTOTAL							\$ 437,006
C		Planning Level Contingency		%	25%	\$ 109,252	
ESTIMATE TOTAL							\$ 550,000

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**20-Year Water CIP No. 2
Water Master Plan
City of Palm Bay Utilities Department**

PROJECT NO.:
PBU009

DATE:
JUN 2024

FIGURE NO.

**12" WM Loop on Mara Loma
Extended to Lowry Extend**



INFRASTRUCTURE SOLUTION SERVICES ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PBU009 | Water Master Plan Update

05/30/24

Infrastructure Solution Services, LLC

Twenty-Year Capital Improvement Needs

CIP No. 2: 12" WM Loop on Mara Loma Extended to Lowry Extended

Estimated By:

JFN

Checked By:

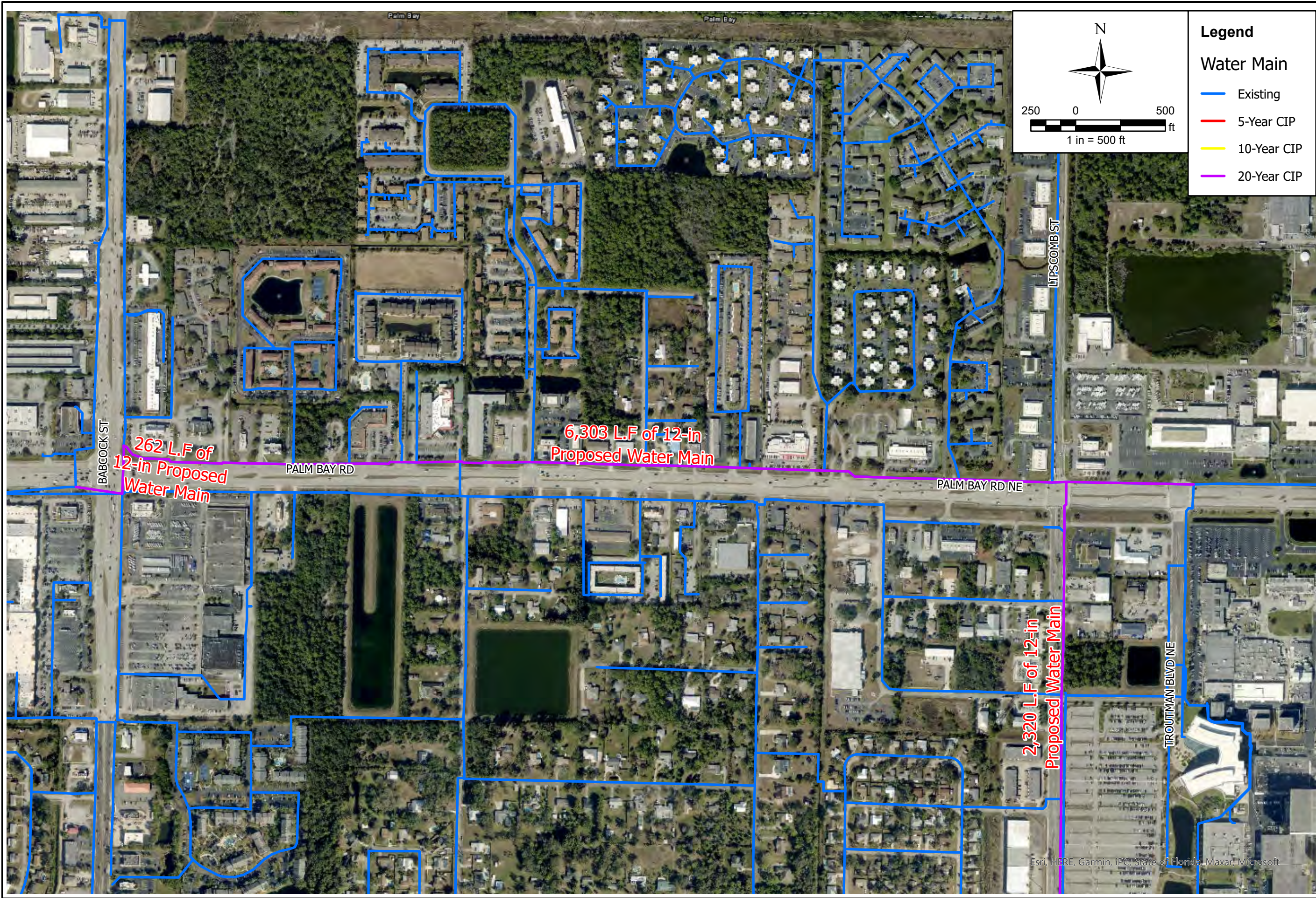
CEM

Project Manager:

CEM

No.	Specification Division Code or Class	Item Description	Quantity	Unit	Unit Cost	Item Total	Subtotal
General							
1		Mobilization/Demobilization	7.5%	Allow	\$ 1,728,200	\$ 129,615	
2		General Requirements, Bonds, and Insurance	5%	Allow	\$ 1,728,200	\$ 86,410	
3		Temporary Erosion Control & Protection		LS	\$ 10,000	\$ 10,000	
4		Testing Allowance		LS	\$ 5,000	\$ 5,000	
5		Maintenance of Traffic		LS	\$ 2,500	\$ 2,500	
6		Survey and Record Drawings		LS	\$ 5,000	\$ 5,000	\$ 238,525
Demolition							
7		Conduct Clearing and Grubbing (Miscellaneous)		LS	\$ 10,000	\$ 10,000	\$ 10,000
Water Main Extension							
8		Furnish & Install 12" PVC via Open-Cut Trenching with Testing & Chlorination	7770	LF	\$ 170	\$ 1,320,900	
9		Furnish & Install 12" Gate Valves with Valve Box and Conc. Pad	16	EA	\$ 15,000	\$ 240,000	
10		Furnish & Install Fire Hydrant Assembly	7	EA	\$ 12,000	\$ 84,000	
11		Conduct Temporary Jumper Connection at Specified Locations	8	EA	\$ 2,500	\$ 20,000	
12		Conduct Bacterial Sampling of Line at Specified Locations	6	EA	\$ 1,800	\$ 10,800	\$ 1,675,700
Civil/Site Restoration							
13		Conduct Final Grading		LS	\$ 20,000	\$ 20,000	\$ 20,000
ESTIMATE SUBTOTAL							\$ 1,944,225
C		Planning Level Contingency		%	25%	\$ 486,056	
ESTIMATE TOTAL							\$ 2,500,000

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INFRASTRUCTURE SOLUTION SERVICES

ISS

Melbourne | Sarasota | Panama City Beach

20-Year Water CIP No. 3

Water Master Plan

City of Palm Bay Utilities Department

PROJECT NO.: **PBU009**

DATE: **JUN 2024**

FIGURE NO.

Replace 8" WM w/ 12" WM on Palm Bay Rd (Babcock-Clearmont St NE)



INFRASTRUCTURE SOLUTION SERVICES ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PBU009 | Water Master Plan Update

05/30/24
Infrastructure Solution Services, LLC

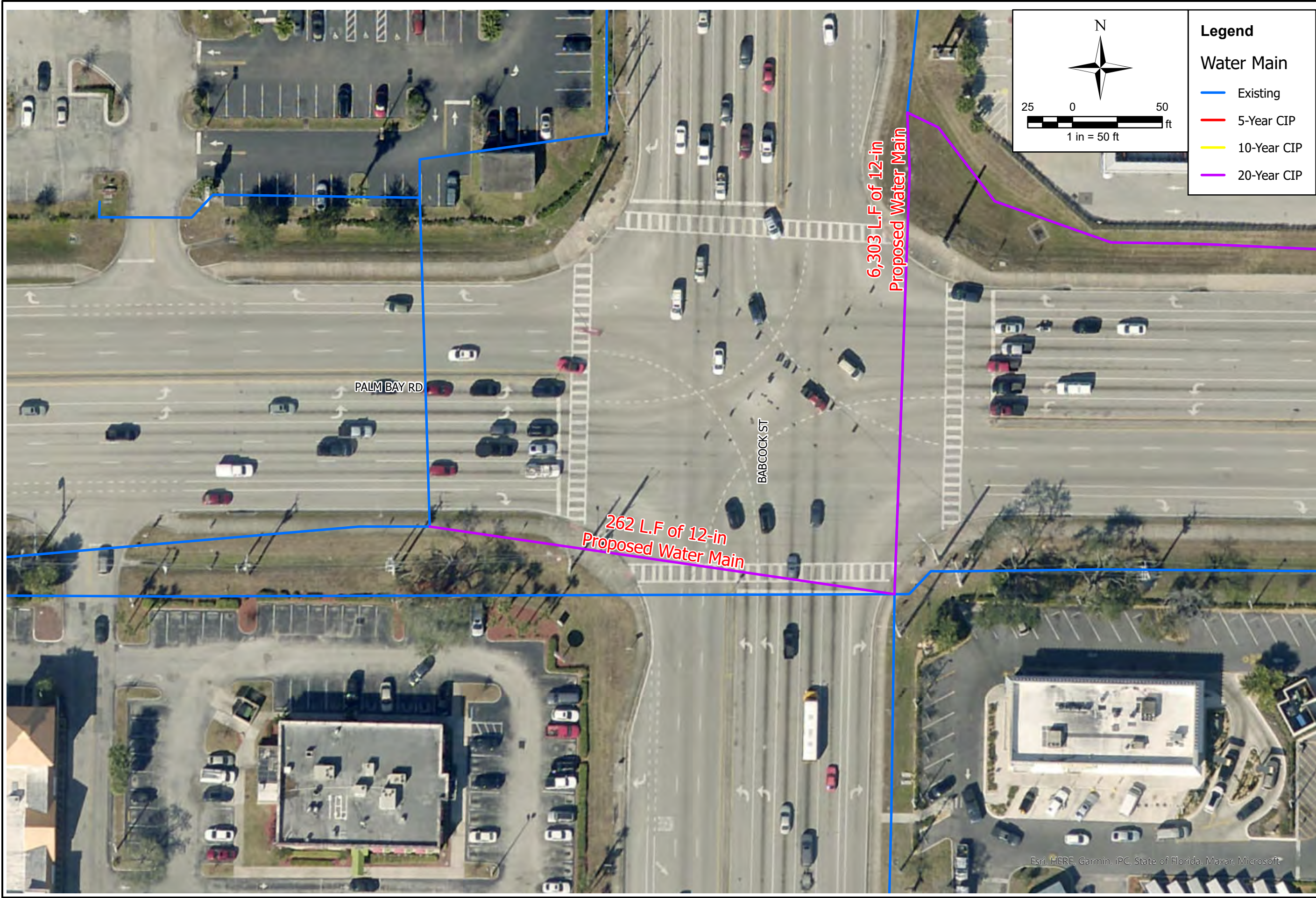
Twenty-Year Capital Improvement Needs

Estimated By: JFN
Checked By: CEM
Project Manager: CEM

CIP No. 3: Replace 8" WM w/ 12" WM on Palm Bay Rd (Babcock St S NE - Clearmont St NE)

Specification Division Code or Class		Item Description	Quantity	Unit	Unit Cost	Item Total	Subtotal
No.	General						
1		Mobilization/Demobilization	7.5%	Allow	\$ 3,058,300	\$ 229,373	
2		General Requirements, Bonds, and Insurance	5%	Allow	\$ 3,058,300	\$ 152,915	
3		Temporary Erosion Control & Protection		LS	\$ 10,000	\$ 10,000	
4		Testing Allowance		LS	\$ 7,500	\$ 7,500	
5		Maintenance of Traffic		LS	\$ 50,000	\$ 50,000	
6		Survey and Record Drawings		LS	\$ 10,000	\$ 10,000	\$ 459,788
Demolition							
7		Conduct Demo of Existing Asphalt Pavement	630	SY	\$ 30	\$ 18,900	
8		Conduct Demo of Existing Sidewalk Pavement	250	SY	\$ 20	\$ 5,000	
9		Conduct Clearing and Grubbing (Miscellaneous)		LS	\$ 10,000	\$ 10,000	\$ 33,900
Water Main Extension							
11		Furnish & Install 16" Water Main (HDPE HDD) with Testing & Chlorination	6303	LF	\$ 300	\$ 1,890,900	
12		Furnish & Install 12" Gate Valves with Valve Box and Conc. Pad	34	EA	\$ 15,000	\$ 510,000	
13		Furnish & Install Fire Hydrant Assembly	6	EA	\$ 12,000	\$ 72,000	
14		Conduct Temporary Jumper Connection at Specified Locations	17	EA	\$ 2,500	\$ 42,500	
15		Conduct Bacterial Sampling of Line at Specified Locations	5	EA	\$ 1,800	\$ 9,000	\$ 2,524,400
Civil/Site Restoration							
16		Conduct Final Grading		LS	\$ 45,000	\$ 45,000	
17		Construct Sidewalk Pavement (in entirety)	250	SY	\$ 70	\$ 17,500	
18		Construct Asphalt Pavement (in entirety)	4800	SY	\$ 75	\$ 360,000	\$ 422,500
ESTIMATE SUBTOTAL							\$ 3,440,588
C	Planning Level Contingency			%	25%	\$ 860,147	
ESTIMATE TOTAL							\$ 4,400,000

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INFRASTRUCTURE SOLUTION SERVICES ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PBU009 | Water Master Plan Update

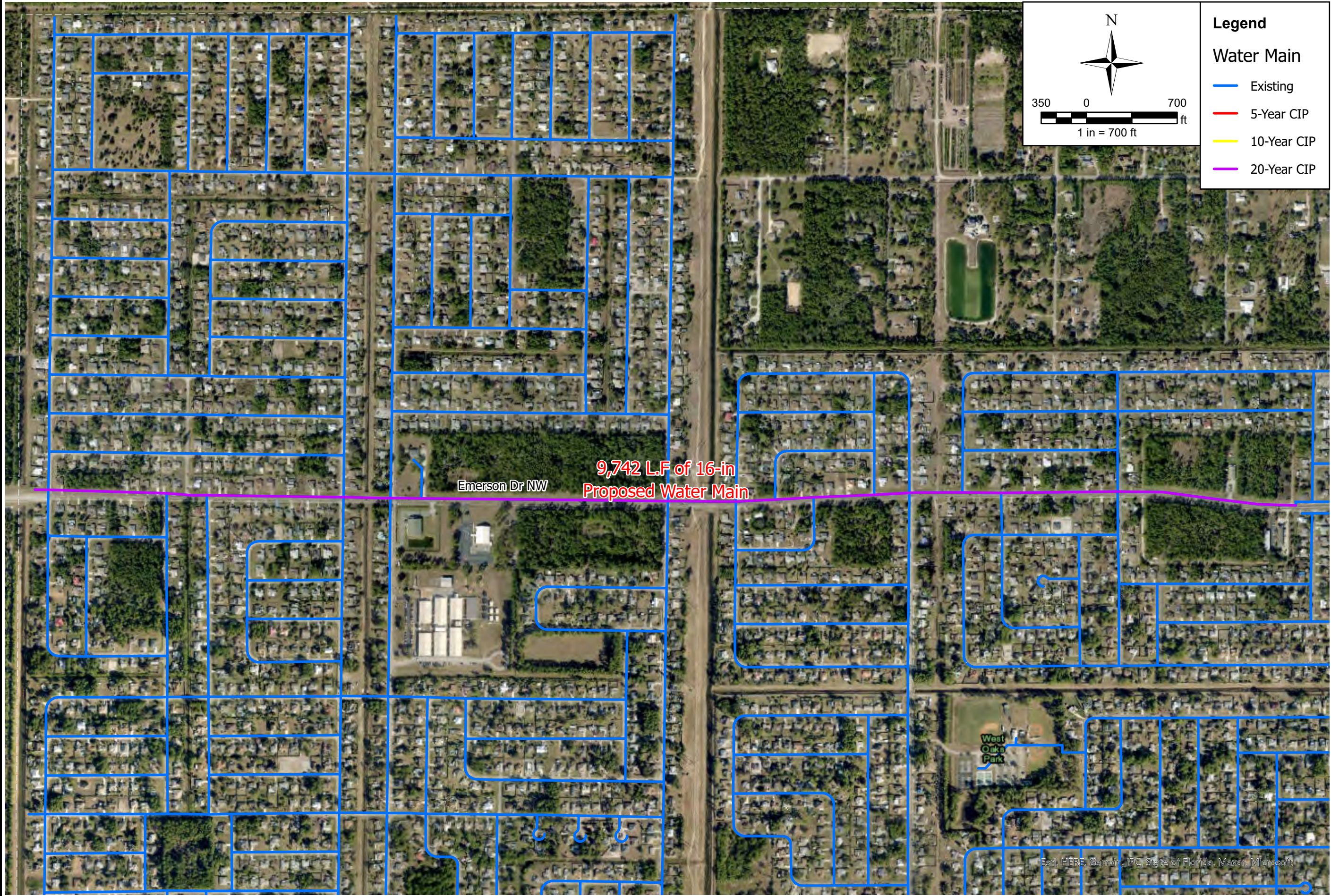
05/30/24
Infrastructure Solution Services, LLC

Twenty-Year Capital Improvement Needs
CIP No. 4: 12" WM Loop on Palm Bay Rd across Babcock St

Estimated By: JFN
Checked By: CEM
Project Manager: CEM

Specification Division Code or Class		Item Description	Quantity	Unit	Unit Cost	Item Total	Subtotal
No.	General Items						
1		Mobilization/Demobilization	7.5%	Allow	\$ 238,245	\$ 17,868	
2		General Requirements, Bonds, and Insurance	5%	Allow	\$ 238,245	\$ 11,912	
3		Temporary Erosion Control & Protection		LS	\$ 7,500	\$ 7,500	
4		Testing Allowance		LS	\$ 2,000	\$ 2,000	
5		Maintenance of Traffic		LS	\$ 15,000	\$ 15,000	
6		Survey and Record Drawings		LS	\$ 3,500	\$ 3,500	
	Demolition						
7		Conduct Demo of Existing Asphalt Pavement	9	SY	\$ 30	\$ 270	
8		Conduct Demo of Existing Sidewalk Pavement	60	SY	\$ 20	\$ 1,200	
9		Conduct Clearing and Grubbing (Miscellaneous)		LS	\$ 5,000	\$ 5,000	
	Water Main Extension						
10		Furnish & Install 16" Water Main (HDPE HDD) with Testing & Chlorination	262	LF	\$ 300	\$ 78,600	
11		Furnish & Install 16" Gate Valves with Valve Box and Conc. Pad	5	EA	\$ 20,000	\$ 100,000	
12		Conduct Temporary Jumper Connection at Specified Locations	1	EA	\$ 2,500	\$ 2,500	
13		Conduct Bacterial Sampling of Line at Specified Locations	1	EA	\$ 1,800	\$ 1,800	
	Civil/Site Restoration						
14		Conduct Final Grading		LS	\$ 10,000	\$ 10,000	
15		Construct Sidewalk Pavement (in entirety)	60	SY	\$ 75	\$ 4,500	
16		Construct Asphalt Pavement (in entirety)	85	SY	\$ 75	\$ 6,375	
ESTIMATE SUBTOTAL							\$ 268,026
C	Planning Level Contingency			%	25%	\$ 67,006	
ESTIMATE TOTAL							\$ 340,000

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INFRASTRUCTURE SOLUTION SERVICES ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PBU009 | Water Master Plan Update

05/30/24

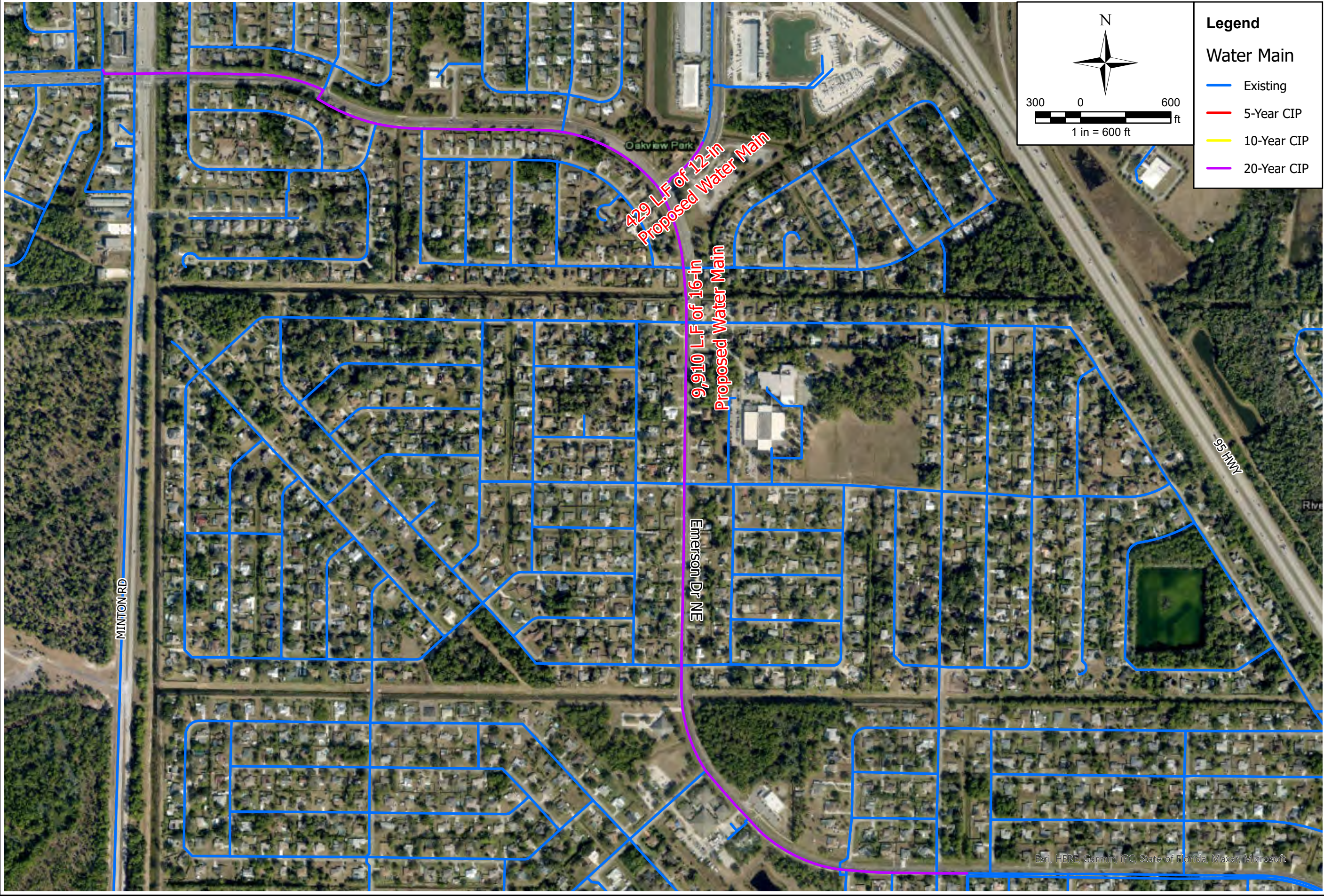
Infrastructure Solution Services, LLC

Twenty-Year Capital Improvement Needs

CIP No. 5: Replace 8" WM w/ 16" WM on Emerson Dr (W of Medina Ave NE - W of Amador Ave NE)

Estimated By: JFN
Checked By: CEM
Project Manager: CEM

Specification	Division Code or Class	Item Description	Quantity	Unit	Unit Cost	Item Total	Subtotal
No.		General					
1		Mobilization/Demobilization	7.5%	Allow	\$ 3,311,630	\$ 248,372	
2		General Requirements, Bonds, and Insurance	5%	Allow	\$ 3,311,630	\$ 165,582	
3		Temporary Erosion Control & Protection		LS	\$ 10,000	\$ 10,000	
4		Testing Allowance		LS	\$ 7,500	\$ 7,500	
5		Maintenance of Traffic		LS	\$ 20,000	\$ 20,000	
6		Survey and Record Drawings		LS	\$ 7,500	\$ 7,500	\$ 458,954
		Demolition					
7		Conduct Demo of Existing Asphalt Pavement	350	SY	\$ 30	\$ 10,500	
8		Conduct Demo of Existing Driveway Pavement	350	SY	\$ 20	\$ 7,000	
9		Conduct Clearing and Grubbing (Miscellaneous)		LS	\$ 5,000	\$ 5,000	\$ 22,500
		Water Main Extension					
10		Furnish & Install 16" PVC via Open-Cut Trenching with Testing & Chlorination	9242	LF	\$ 190	\$ 1,755,980	
11		Furnish & Install 20" Water Main (HDPE HDD) with Testing & Chlorination	500	LF	\$ 400	\$ 200,000	
12		Furnish & Install 16" Gate Valves with Valve Box and Conc. Pad	42	EA	\$ 20,000	\$ 840,000	
13		Furnish & Install Fire Hydrant Assembly	9	EA	\$ 12,000	\$ 108,000	
14		Conduct Temporary Jumper Connection at Specified Locations	21	EA	\$ 2,500	\$ 52,500	
15		Conduct Bacterial Sampling of Line at Specified Locations	8	EA	\$ 1,800	\$ 14,400	\$ 2,970,880
		Civil/Site Restoration					
16		Conduct Final Grading		LS	\$ 65,000	\$ 65,000	
17		Construct Driveway Pavement (in entirety)	350	SY	\$ 70	\$ 24,500	
18		Construct Asphalt Pavement (in entirety)	2450	SY	\$ 75	\$ 183,750	\$ 273,250
		ESTIMATE SUBTOTAL				\$ 3,725,584	
C		Planning Level Contingency		%	25%	\$ 931,396	
		ESTIMATE TOTAL				\$ 4,700,000	



20-Year Water CIP No. 6
Water Master Plan
City of Palm Bay Utilities Department

PROJECT NO.:
PBU009
DATE:
JUN 2024
FIGURE NO.

Replace 12" WM w/ 16" WM
on Emerson (Nash Repump
Station-W of Minton)



INFRASTRUCTURE SOLUTION SERVICES ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PBU009 | Water Master Plan Update

05/30/24

Infrastructure Solution Services, LLC

Twenty-Year Capital Improvement Needs

CIP No. 6: Replace 12" WM w/ 16" WM on Emerson Dr (Nash Repump Station-W of Minton Dr)

Estimated By: JFN
Checked By: CEM
Project Manager: CEM

Specification Division Code or Class		Item Description	Quantity	Unit	Unit Cost	Item Total	Subtotal
No.	General						
1		Mobilization/Demobilization	7.5%	Allow	\$ 4,217,100	\$ 316,283	
2		General Requirements, Bonds, and Insurance	5%	Allow	\$ 4,217,100	\$ 210,855	
3		Temporary Erosion Control & Protection		LS	\$ 20,000	\$ 20,000	
4		Testing Allowance		LS	\$ 7,500	\$ 7,500	
5		Maintenance of Traffic		LS	\$ 30,000	\$ 30,000	
6		Survey and Record Drawings		LS	\$ 7,500	\$ 7,500	\$ 592,138
Demolition							
7		Conduct Demo of Existing Asphalt Pavement	1000	SY	\$ 30	\$ 30,000	
8		Conduct Demo of Existing Driveway Pavement	120	SY	\$ 20	\$ 2,400	
9		Conduct Demo of Existing Sidewalk Pavement	1200	SY	\$ 20	\$ 24,000	
10		Conduct Clearing and Grubbing (Miscellaneous)		LS	\$ 15,000	\$ 15,000	\$ 71,400
Water Main Extension							
11		Furnish & Install 16" PVC via Open-Cut Trenching with Testing & Chlorination	8610	LF	\$ 190	\$ 1,635,900	
12		Furnish & Install 20" Water Main (HDPE HDD) with Testing & Chlorination	1300	LF	\$ 400	\$ 520,000	
13		Furnish & Install 16" Gate Valves with Valve Box and Conc. Pad	47	EA	\$ 20,000	\$ 940,000	
14		Furnish & Install Fire Hydrant Assembly	9	EA	\$ 12,000	\$ 108,000	
15		Conduct Temporary Jumper Connection at Specified Locations	23	EA	\$ 2,500	\$ 57,500	
16		Conduct Bacterial Sampling of Line at Specified Locations	8	EA	\$ 1,800	\$ 14,400	\$ 3,275,800
Civil/Site Restoration							
17		Conduct Final Grading		LS	\$ 75,000	\$ 75,000	
18		Construct Driveway Pavement (in entirety)	120	SY	\$ 70	\$ 8,400	
19		Construct Sidewalk Pavement (in entirety)	1200	SY	\$ 70	\$ 84,000	
20		Construct Asphalt Pavement (in entirety)	8500	SY	\$ 75	\$ 637,500	\$ 804,900
ESTIMATE SUBTOTAL							\$ 4,744,238
C	Planning Level Contingency			%	25%	\$ 1,186,059	
ESTIMATE TOTAL							\$ 6,000,000

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Legend

Water Main

- Existing
- 5-Year CIP
- 10-Year CIP
- 20-Year CIP



INFRASTRUCTURE SOLUTION SERVICES ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

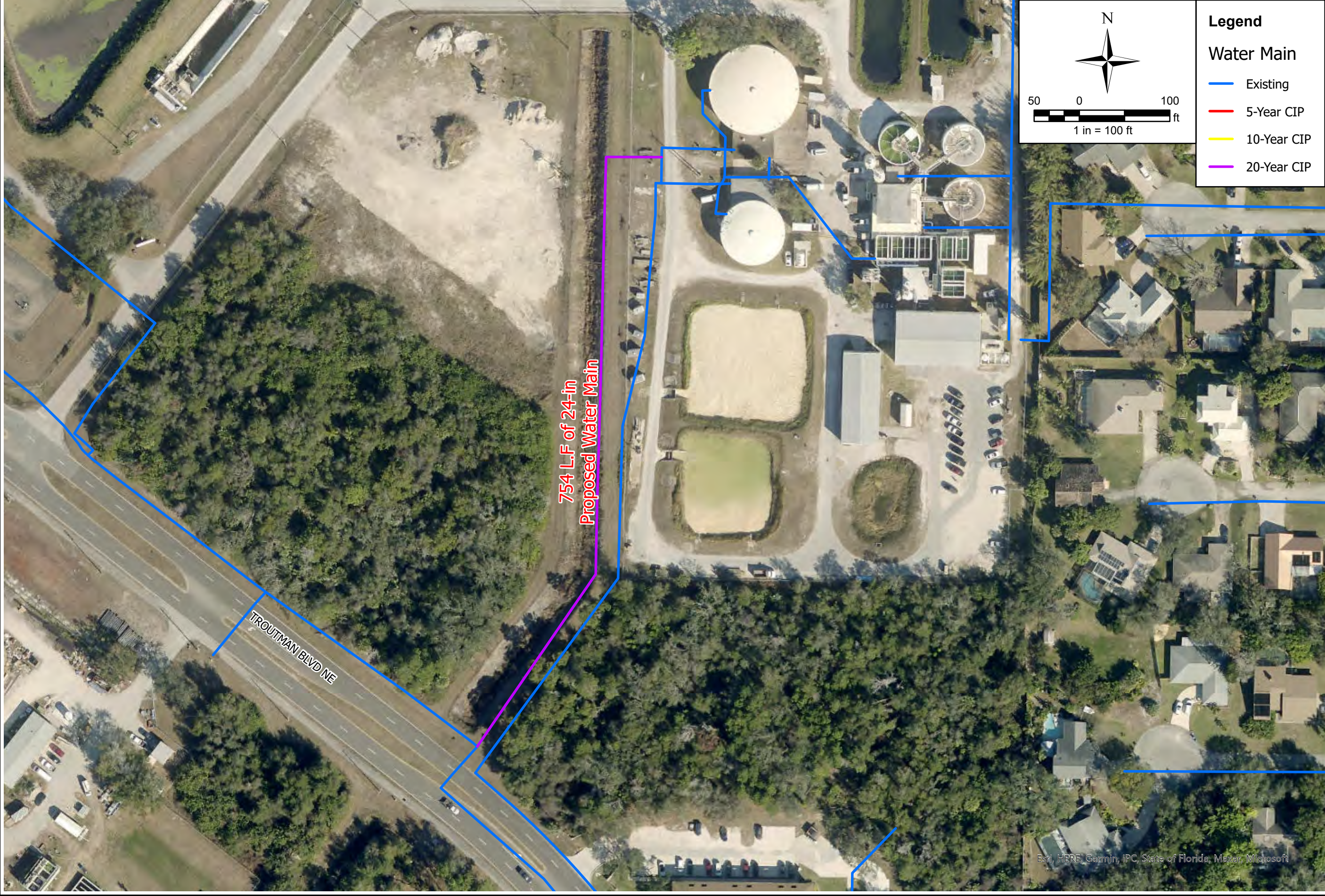
PBU009 | Water Master Plan Update

05/30/24
Infrastructure Solution Services, LLC

Twenty-Year Capital Improvement Needs
CIP No. 7: Replace 8" WM w/ 12" WM on Culver Dr (N of Emerson Dr)

Estimated By: JFN
Checked By: CEM
Project Manager: CEM

Specification Division Code or Class		Item Description	Quantity	Unit	Unit Cost	Item Total	Subtotal
No.	General						
1		Mobilization/Demobilization	7.5%	Allow	\$ 204,480	\$ 15,336	
2		General Requirements, Bonds, and Insurance	5%	Allow	\$ 204,480	\$ 10,224	
3		Temporary Erosion Control & Protection		LS	\$ 7,500	\$ 7,500	
4		Testing Allowance		LS	\$ 2,500	\$ 2,500	
5		Maintenance of Traffic		LS	\$ 15,000	\$ 15,000	
6		Survey and Record Drawings		LS	\$ 2,500	\$ 2,500	\$ 53,060
Demolition							
7		Conduct Demo of Existing Asphalt Pavement	25	SY	\$ 30	\$ 750	
8		Conduct Demo of Existing Sidewalk Pavement	50	SY	\$ 20	\$ 1,000	
9		Conduct Clearing and Grubbing (Miscellaneous)		LS	\$ 2,500	\$ 2,500	\$ 4,250
Water Main Extension							
10		Furnish & Install 12" PVC via Open-Cut Trenching with Testing & Chlorination	329	LF	\$ 170	\$ 55,930	
		Furnish & Install 16" Water Main (HDPE HDD) with Testing & Chlorination	100	LF	\$ 300	\$ 30,000	
11		Furnish & Install 12" Gate Valves with Valve Box and Conc. Pad	2	EA	\$ 15,000	\$ 30,000	
12		Furnish & Install Fire Hydrant Assembly	1	EA	\$ 12,000	\$ 12,000	
13		Conduct Temporary Jumper Connection at Specified Locations	1	EA	\$ 2,500	\$ 2,500	
14		Conduct Bacterial Sampling of Line at Specified Locations	1	EA	\$ 1,800	\$ 1,800	\$ 132,230
Civil/Site Restoration							
15		Conduct Final Grading		LS	\$ 25,000	\$ 25,000	
16		Construct Sidewalk Pavement (in entirety)	50	SY	\$ 70	\$ 3,500	
17		Construct Asphalt Pavement (in entirety)	160	SY	\$ 75	\$ 12,000	\$ 40,500
ESTIMATE SUBTOTAL							\$ 230,040
C	Planning Level Contingency			%	25%	\$ 57,510	
ESTIMATE TOTAL							\$ 300,000



PROJECT NO.:
PBU009
DATE:
JUN 2024
FIGURE NO.

20-Year Water CIP No. 8
Water Master Plan
City of Palm Bay Utilities Department

Replace 20" WM w/ 24" WM
Along Canal (NE of
Clearmont-NRWTP)



INFRASTRUCTURE SOLUTION SERVICES ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PBU009 | Water Master Plan Update

05/30/24

Infrastructure Solution Services, LLC

Twenty-Year Capital Improvement Needs

CIP NO. 8: Replace 20" WM w/ 24" WM Along Canal (NE of Clearmont-NRWTP)

Estimated By:

JFN

Checked By:

CEM

Project Manager:

CEM

Specification Division Code or Class		Item Description	Quantity	Unit	Unit Cost	Item Total	Subtotal
No.	General						
1		Mobilization/Demobilization	7.5%	Allow	\$ 506,650	\$ 37,999	
2		General Requirements, Bonds, and Insurance	5%	Allow	\$ 506,650	\$ 25,333	
3		Temporary Erosion Control & Protection		LS	\$ 7,500	\$ 7,500	
4		Testing Allowance		LS	\$ 2,500	\$ 2,500	
5		Maintenance of Traffic		LS	\$ 5,000	\$ 5,000	
6		Survey and Record Drawings		LS	\$ 3,500	\$ 3,500	\$ 81,831
Demolition							
7		Conduct Demo of Existing Asphalt Pavement	15	SY	\$ 30	\$ 450	
8		Conduct Clearing and Grubbing (Miscellaneous)		LS	\$ 5,000	\$ 5,000	\$ 5,450
Water Main Extension							
9		Furnish & Install 24" PVC via Open-Cut Trenching with Testing & Chlorination	754	LF	\$ 350	\$ 263,900	
10		Furnish & Install 24" Gate Valves with Valve Box and Conc. Pad	5	EA	\$ 35,000	\$ 175,000	
11		Furnish & Install Fire Hydrant Assembly	1	EA	\$ 12,000	\$ 12,000	
12		Conduct Temporary Jumper Connection at Specified Locations	3	EA	\$ 2,500	\$ 7,500	
13		Conduct Bacterial Sampling of Line at Specified Locations	1	EA	\$ 1,800	\$ 1,800	\$ 460,200
Civil/Site Restoration							
14		Conduct Final Grading		LS	\$ 15,000	\$ 15,000	
15		Construct Asphalt Pavement (in entirety)	100	SY	\$ 75	\$ 7,500	\$ 22,500
ESTIMATE SUBTOTAL							\$ 569,981
C	Planning Level Contingency			%	25%	\$ 142,495	
ESTIMATE TOTAL							\$ 720,000

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Esri, HERE, Garmin, iPC, State of Florida, Maxar, Microsoft

Legend

Water Main

- Existing
- 5-Year CIP
- 10-Year CIP
- 20-Year CIP

Replace 8" WM w/ 12" WM
on Port Malabar Blvd
(Daytona-Bianca)

20-Year Water CIP No. 9
Water Master Plan
City of Palm Bay Utilities Department

PROJECT NO.:
PBU009

DATE:
JUN 2024

FIGURE NO.



INFRASTRUCTURE SOLUTION SERVICES ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PBU009 | Water Master Plan Update

05/30/24

Infrastructure Solution Services, LLC

Twenty-Year Capital Improvement Needs

CIP No. 9: Replace 8" WM w/ 12" WM on Port Malabar Blvd (Daytona Dr NE-Bianca Dr NE)

Estimated By:

JFN

Checked By:

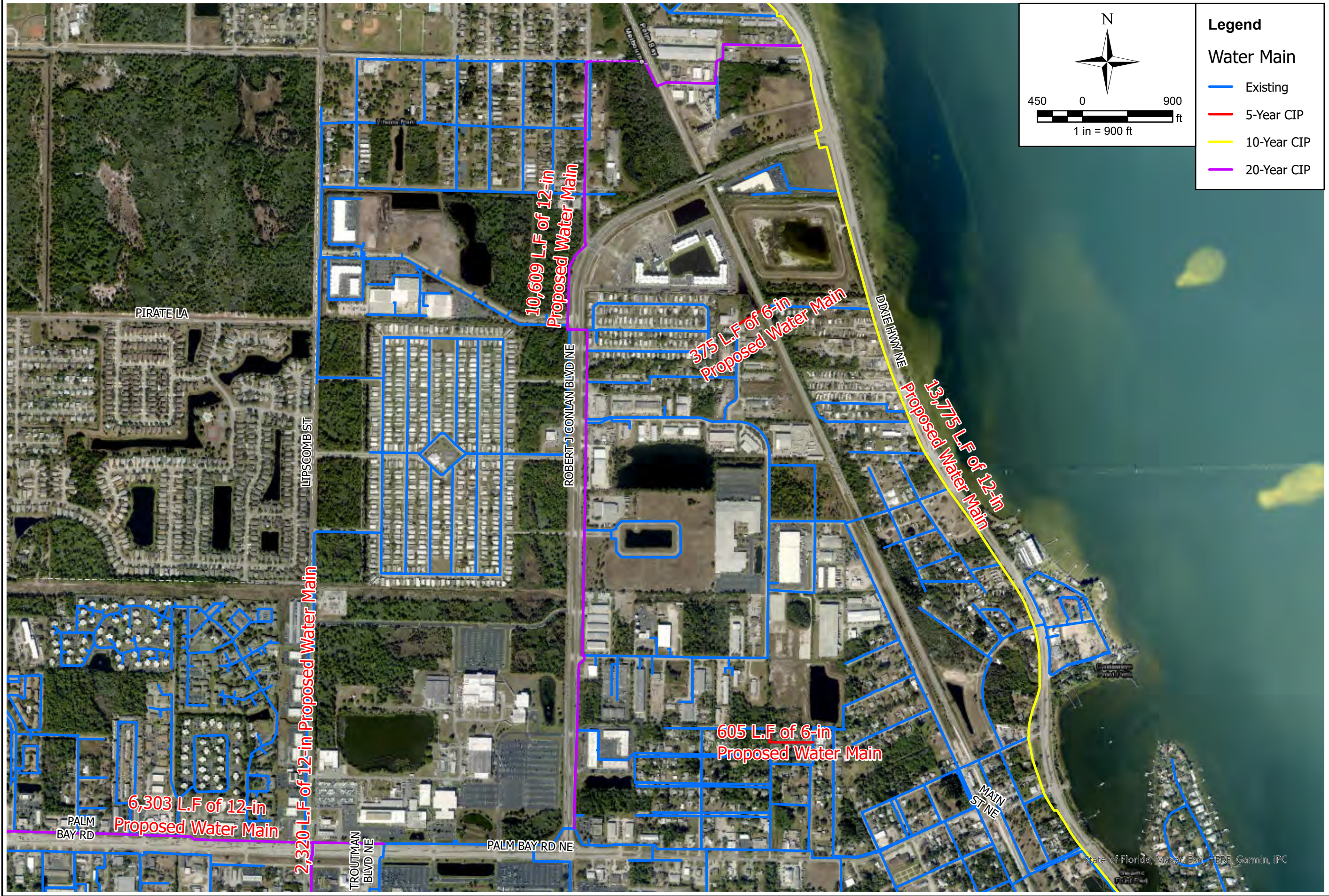
CEM

Project Manager:

CEM

Specification Division Code or Class		Item Description	Quantity	Unit	Unit Cost	Item Total	Subtotal
No.	General						
1		Mobilization/Demobilization	7.5%	Allow	\$ 577,915	\$ 43,344	
2		General Requirements, Bonds, and Insurance	5%	Allow	\$ 577,915	\$ 28,896	
3		Temporary Erosion Control & Protection		LS	\$ 7,500	\$ 7,500	
4		Testing Allowance		LS	\$ 5,500	\$ 5,500	
5		Maintenance of Traffic		LS	\$ 15,000	\$ 15,000	
6		Survey and Record Drawings		LS	\$ 2,500	\$ 2,500	\$ 102,739
Demolition							
7		Conduct Demo of Existing Asphalt Pavement	140	SY	\$ 30	\$ 4,200	
8		Conduct Demo of Existing Driveway Pavement	35	SY	\$ 20	\$ 700	
9		Conduct Demo of Existing Sidewalk Pavement	10	SY	\$ 20	\$ 200	
10		Conduct Clearing and Grubbing (Miscellaneous)		LS	\$ 2,500	\$ 2,500	\$ 7,600
Water Main Extension							
11		Furnish & Install 12" PVC via Open-Cut Trenching with Testing & Chlorination	1232	LF	\$ 170	\$ 209,440	
12		Furnish & Install 12" Gate Valves with Valve Box and Conc. Pad	9	EA	\$ 15,000	\$ 135,000	
13		Furnish & Install Fire Hydrant Assembly	2	EA	\$ 12,000	\$ 24,000	
14		Conduct Temporary Jumper Connection at Specified Locations	4	EA	\$ 2,500	\$ 10,000	
15		Conduct Bacterial Sampling of Line at Specified Locations	2	EA	\$ 1,800	\$ 3,600	\$ 382,040
Civil/Site Restoration							
16		Conduct Final Grading		LS	\$ 50,000	\$ 50,000	
17		Construct Driveway Pavement (in entirety)	35	SY	\$ 70	\$ 2,450	
18		Construct Sidewalk Pavement (in entirety)	10	SY	\$ 70	\$ 700	
19		Construct Asphalt Pavement (in entirety)	1395	SY	\$ 75	\$ 104,625	\$ 157,775
ESTIMATE SUBTOTAL							\$ 650,154
C	Planning Level Contingency			%	25%	\$ 162,539	
ESTIMATE TOTAL							\$ 820,000

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20-Year Water CIP No. 10
Water Master Plan
City of Palm Bay Utilities Department

PROJECT NO.:
PBU009
DATE:
JUN 2024
FIGURE NO.

Replace 10" WM w/ 12" WM on
Conlan/Northview/Florida/Kingswood
(Palm Bay Rd - US-1)



INFRASTRUCTURE SOLUTION SERVICES ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PBU009 | Water Master Plan Update

05/30/24
Infrastructure Solution Services, LLC

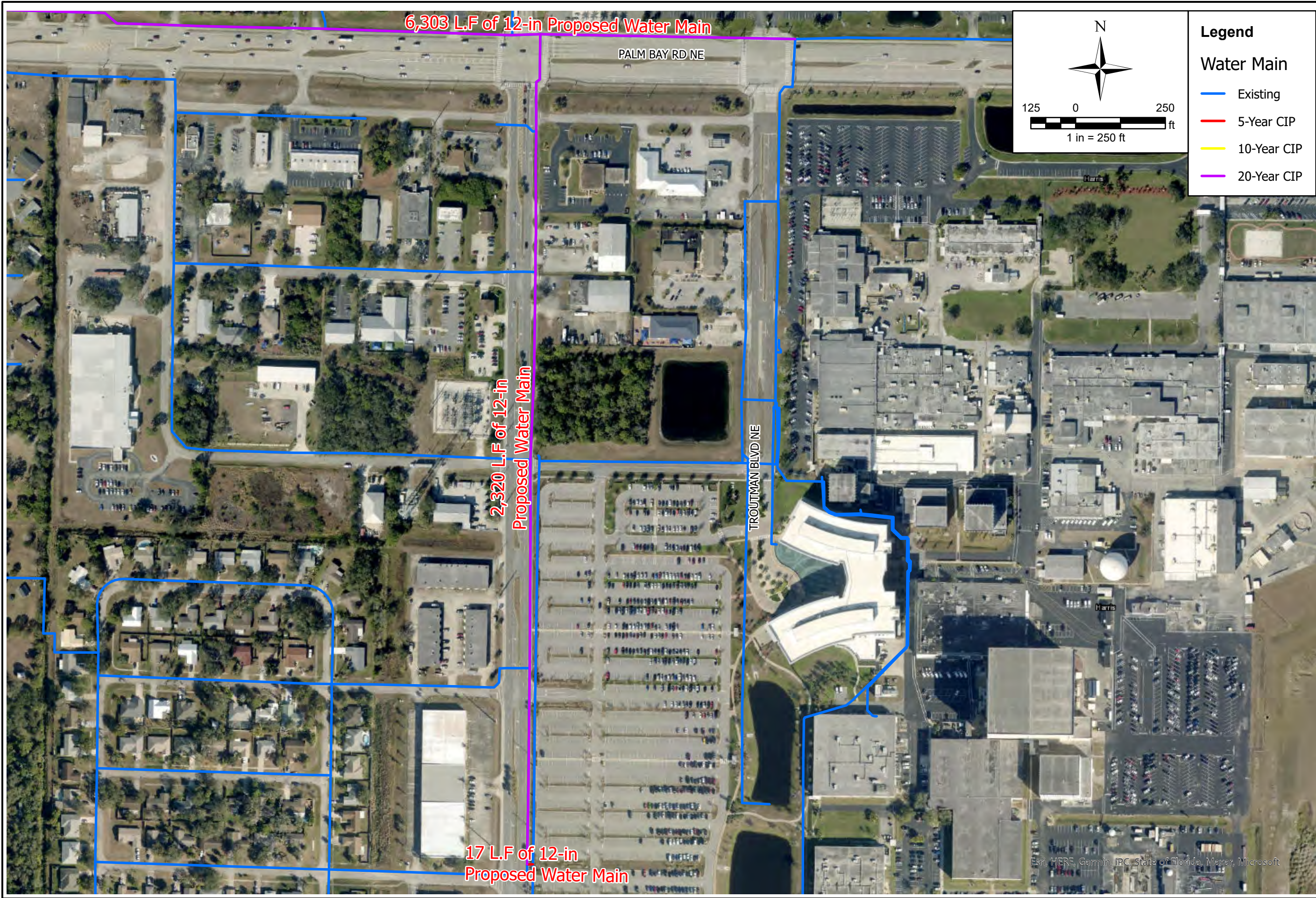
Twenty-Year Capital Improvement Needs

Estimated By: JFN
Checked By: CEM
Project Manager: CEM

CIP No. 10: Replace 10" WM w/ 12" WM on Conlan/Northview/Florida/Kingswood (Palm Bay Rd-US-1)

Specification Division Code or Class		Item Description	Quantity	Unit	Unit Cost	Item Total	Subtotal
No.		General					
1		Mobilization/Demobilization	7.5%	Allow	\$ 3,778,980	\$ 283,424	
2		General Requirements, Bonds, and Insurance	5%	Allow	\$ 3,778,980	\$ 188,949	
3		Temporary Erosion Control & Protection		LS	\$ 25,000	\$ 25,000	
4		Testing Allowance		LS	\$ 10,000	\$ 10,000	
5		Maintenance of Traffic		LS	\$ 30,000	\$ 30,000	
6		Survey and Record Drawings		LS	\$ 7,500	\$ 7,500	\$ 544,873
		Demolition					
7		Conduct Demo of Existing Asphalt Pavement	1195	SY	\$ 30	\$ 35,850	
8		Conduct Demo of Existing Sidewalk Pavement	60	SY	\$ 20	\$ 1,200	
9		Conduct Demo of Existing Driveway Pavement	500	SY	\$ 20	\$ 10,000	
10		Conduct Clearing and Grubbing (Miscellaneous)		LS	\$ 25,000	\$ 25,000	\$ 72,050
		Water Main Extension					
11		Furnish & Install 12" PVC via Open-Cut Trenching with Testing & Chlorination	10409	LF	\$ 170	\$ 1,769,530	
12		Furnish & Install 16" Water Main (HDPE HDD) with Testing & Chlorination	200	LF	\$ 300	\$ 60,000	
13		Furnish & Install 12" Gate Valves with Valve Box and Conc. Pad	50	EA	\$ 15,000	\$ 750,000	
14		Furnish & Install Fire Hydrant Assembly	10	EA	\$ 12,000	\$ 120,000	
15		Conduct Temporary Jumper Connection at Specified Locations	25	EA	\$ 2,500	\$ 62,500	
16		Conduct Bacterial Sampling of Line at Specified Locations	9	EA	\$ 1,800	\$ 16,200	\$ 2,778,230
		Civil/Site Restoration					
17		Conduct Final Grading		LS	\$ 100,000	\$ 100,000	
18		Construct Driveway Pavement (in entirety)	500	SY	\$ 70	\$ 35,000	
19		Construct Sidewalk Pavement (in entirety)	60	SY	\$ 70	\$ 4,200	
20		Construct Asphalt Pavement (in entirety)	9560	SY	\$ 75	\$ 717,000	\$ 856,200
ESTIMATE SUBTOTAL							\$ 4,251,353
C		Planning Level Contingency		%	25%	\$ 1,062,838	
ESTIMATE TOTAL							\$ 5,400,000

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INFRASTRUCTURE SOLUTION SERVICES ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PBU009 | Water Master Plan Update

05/30/24
Infrastructure Solution Services, LLC

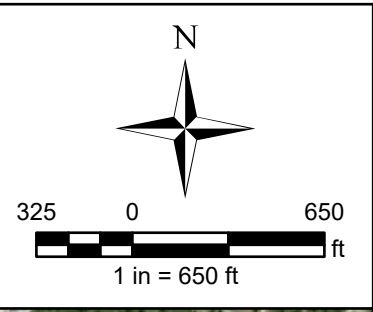
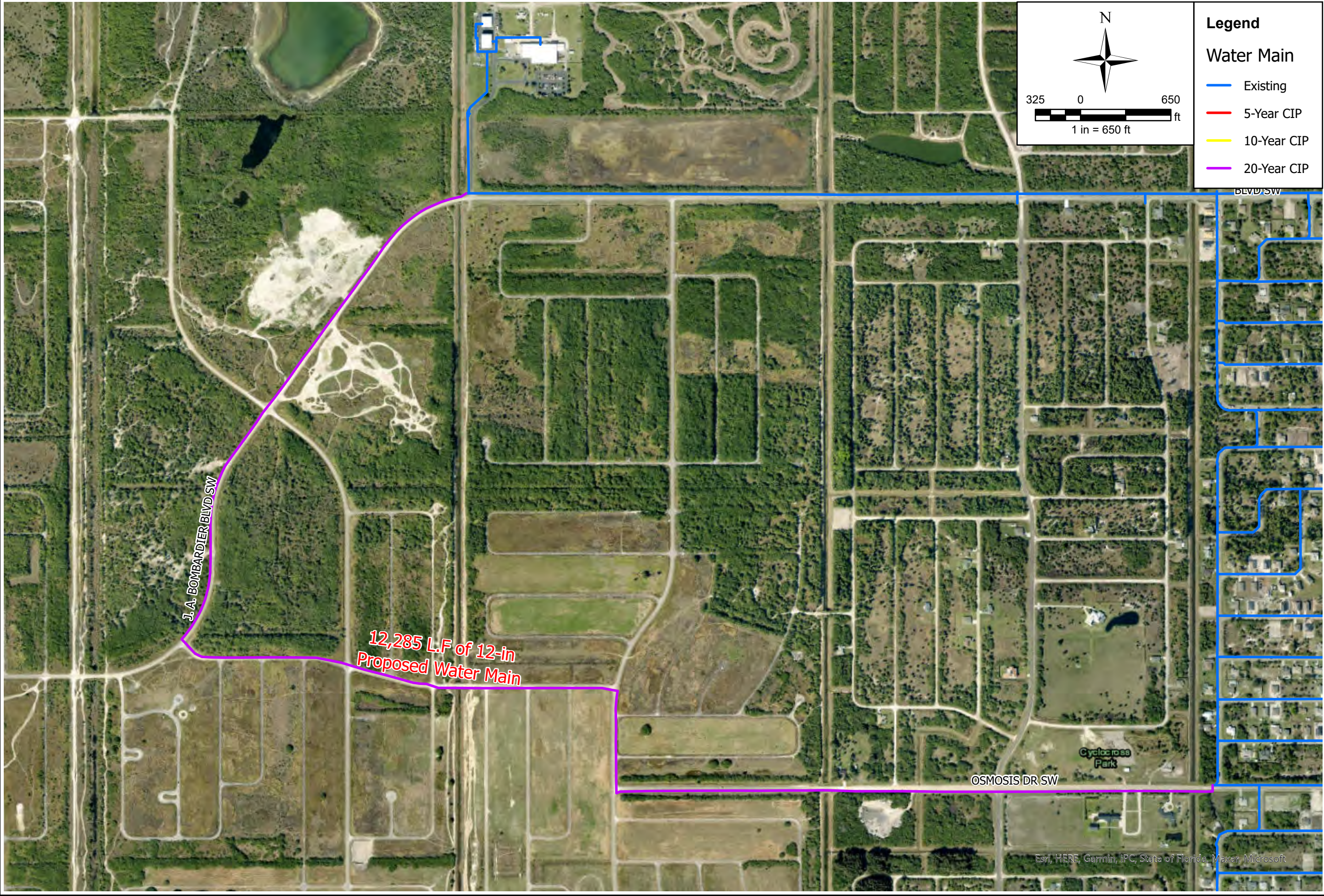
Twenty-Year Capital Improvement Needs

Estimated By: JFN
Checked By: CEM
Project Manager: CEM

CIP No. 11: Replace 6" & 8" WM w/ 12" WM on Clearmont St NE (Franklin St NE -Palm Bay Rd NE)

Specification Division Code or Class		Item Description	Quantity	Unit	Unit Cost	Item Total	Subtotal
No.		General					
1		Mobilization/Demobilization	7.5%	Allow	\$ 908,600	\$ 68,145	
2		General Requirements, Bonds, and Insurance	5%	Allow	\$ 908,600	\$ 45,430	
3		Temporary Erosion Control & Protection		LS	\$ 10,000	\$ 10,000	
4		Testing Allowance		LS	\$ 5,000	\$ 5,000	
5		Maintenance of Traffic		LS	\$ 25,000	\$ 25,000	
6		Survey and Record Drawings		LS	\$ 5,000	\$ 5,000	\$ 158,575
		Demolition					
7		Conduct Demo of Existing Asphalt Pavement	210	SY	\$ 50	\$ 10,500	
8		Conduct Demo of Existing Sidewalk Pavement	600	SY	\$ 35	\$ 21,000	
9		Conduct Clearing and Grubbing (Miscellaneous)		LS	\$ 5,000	\$ 5,000	\$ 36,500
		Water Main Extension					
10		Furnish & Install 12" PVC via Open-Cut Trenching with Testing & Chlorination	2150	LF	\$ 170	\$ 365,500	
11		Furnish & Install 16" Water Main (HDPE HDD) with Testing & Chlorination	170	LF	\$ 300	\$ 51,000	
12		Furnish & Install 12" Gate Valves with Valve Box and Conc. Pad	12	EA	\$ 15,000	\$ 180,000	
13		Furnish & Install Fire Hydrant Assembly	2	EA	\$ 12,000	\$ 24,000	
14		Conduct Temporary Jumper Connection at Specified Locations	6	EA	\$ 2,500	\$ 15,000	
15		Conduct Bacterial Sampling of Line at Specified Locations	2	EA	\$ 1,800	\$ 3,600	\$ 639,100
		Civil/Site Restoration					
16		Conduct Final Grading		LS	\$ 20,000	\$ 20,000	
17		Construct Sidewalk Pavement (in entirety)	600	SY	\$ 70	\$ 42,000	
18		Construct Asphalt Pavement (in entirety)	1680	SY	\$ 75	\$ 126,000	\$ 188,000
ESTIMATE SUBTOTAL							\$ 1,022,175
C		Planning Level Contingency		%	25%	\$ 255,544	
ESTIMATE TOTAL							\$ 1,300,000

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Legend

Water Main

- Existing
- 5-Year CIP
- 10-Year CIP
- 20-Year CIP



INFRASTRUCTURE SOLUTION SERVICES ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PBU009 | Water Master Plan Update

05/30/24
Infrastructure Solution Services, LLC

Twenty-Year Capital Improvement Needs

Estimated By: JFN
Checked By: CEM
Project Manager: CEM

CIP No. 12: 12" WM Loop from JA Bombardier Blvd SW dead-end to Osmosis Dr SW /O'Connel Ave SW

Specification Division Code or Class		Item Description	Quantity	Unit	Unit Cost	Item Total	Subtotal
No.	General						
1		Mobilization/Demobilization	7.5%	Allow	\$ 3,026,975	\$ 227,023	
2		General Requirements, Bonds, and Insurance	5%	Allow	\$ 3,026,975	\$ 151,349	
3		Temporary Erosion Control & Protection		LS	\$ 20,000	\$ 20,000	
4		Testing Allowance		LS	\$ 10,000	\$ 10,000	
5		Maintenance of Traffic		LS	\$ 30,000	\$ 30,000	
6		Survey and Record Drawings		LS	\$ 7,500	\$ 7,500	\$ 445,872
Demolition							
7		Conduct Demo of Existing Asphalt Pavement	150	SY	\$ 30	\$ 4,500	
8		Conduct Demo of Existing Driveway Pavement	15	SY	\$ 20	\$ 300	
9		Conduct Clearing and Grubbing (Miscellaneous)		LS	\$ 30,000	\$ 30,000	\$ 34,800
Water Main Extension							
10		Furnish & Install 12" PVC via Open-Cut Trenching with Testing & Chlorination	11515	LF	\$ 170	\$ 1,957,550	
11		Furnish & Install 16" Water Main (HDPE HDD) with Testing & Chlorination	770	LF	\$ 300	\$ 231,000	
12		Furnish & Install 12" Gate Valves with Valve Box and Conc. Pad	27	EA	\$ 15,000	\$ 405,000	
13		Furnish & Install Fire Hydrant Assembly	11	EA	\$ 12,000	\$ 132,000	
14		Conduct Temporary Jumper Connection at Specified Locations	13	EA	\$ 2,500	\$ 32,500	
15		Conduct Bacterial Sampling of Line at Specified Locations	10	EA	\$ 1,800	\$ 18,000	\$ 2,776,050
Civil/Site Restoration							
16		Conduct Final Grading		LS	\$ 50,000	\$ 50,000	
17		Construct Sidewalk Pavement (in entirety)	15	SY	\$ 75	\$ 1,125	
18		Construct Asphalt Pavement (in entirety)	1300	SY	\$ 75	\$ 97,500	\$ 148,625
ESTIMATE SUBTOTAL							\$ 3,405,347
C		Planning Level Contingency		%	25%	\$ 851,337	
ESTIMATE TOTAL							\$ 4,300,000



INFRASTRUCTURE SOLUTION SERVICES ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PBU009 | Water Master Plan Update

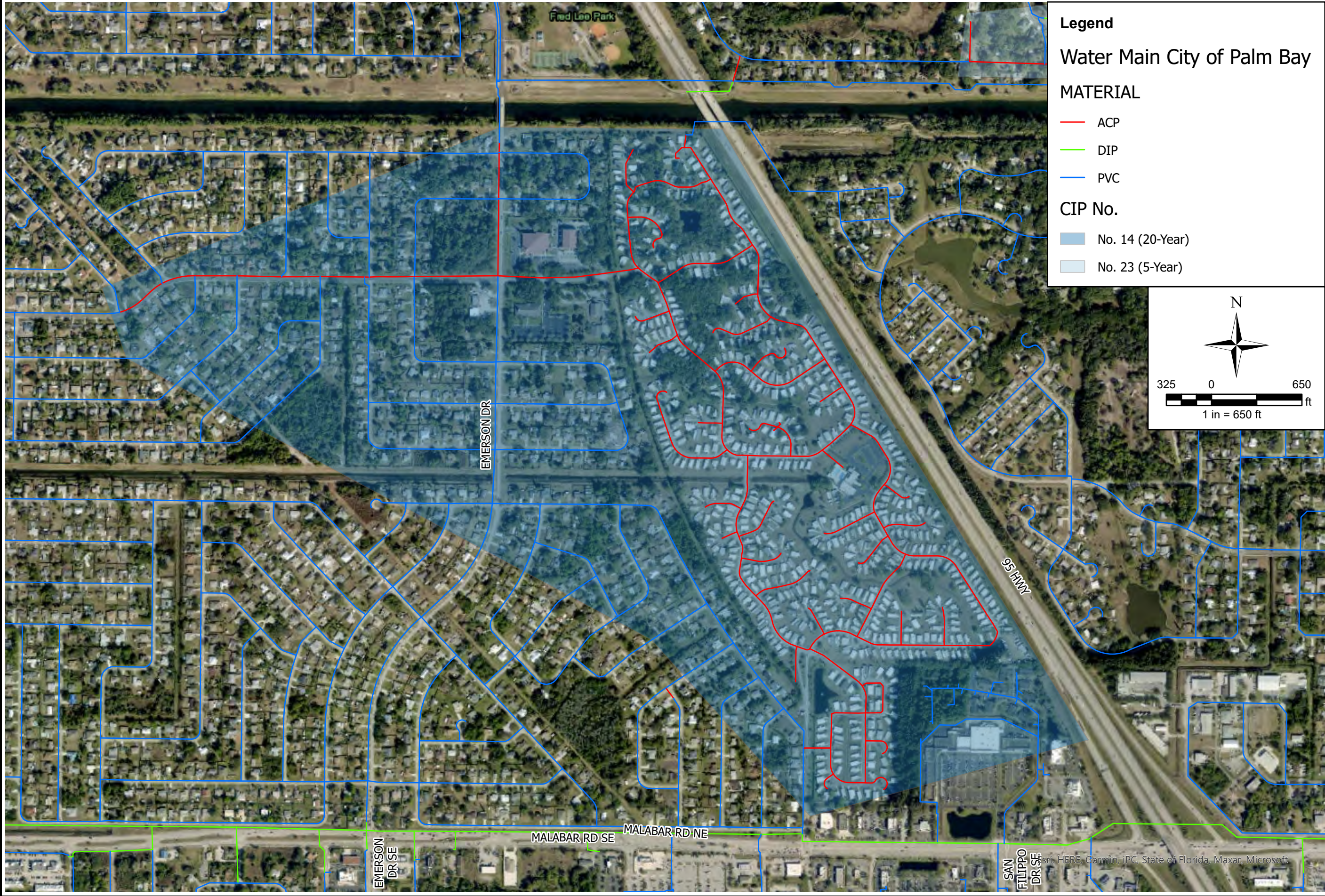
05/30/24
Infrastructure Solution Services, LLC

Twenty-Year Capital Improvement Needs
CIP No. 13: South Booster Station -- Second Phase

Estimated By: CEM
Checked By: CEM
Project Manager: CEM

Specification Division Code or Class		Item Description	Quantity	Unit	Unit Cost	Item Total	Subtotal
No.	General						
		Mobilization/Demobilization	7.5%	Allow	\$ 1,880,750	\$ 141,056	
		General Requirements, Bonds, and Insurance	5%	Allow	\$ 1,880,750	\$ 94,038	
		Temporary Erosion Control & Protection		LS	\$ 20,000	\$ 20,000	
		Testing Allowance		LS	\$ 25,000	\$ 25,000	
		Survey and Record Drawings		LS	\$ 7,500	\$ 7,500	\$ 287,594
	Civil						
		Site Preparation & Rough Grading	1	AC	\$ 15,000	\$ 15,000	
		Furnosh and Install 16" DIP WM to GST O/C	50	LF	\$ 200	\$ 10,000	
		Furnish and Install 24" DIP WM to Pump Station Header O/C	50	LF	\$ 350	\$ 17,500	
		Furnish and Install 12" DIP Gravity Drain	150	LF	\$ 170	\$ 25,500	
		Furnish and Install Yard Piping Misc Valves		LS	\$ 25,000	\$ 25,000	
		Site Finish Grade & Sod	0.5	AC	\$ 7,500	\$ 3,750	\$ 96,750
	Structural						
		Prestressed Concrete Tank (750,000 gal)	750,000	GAL	\$ 1.25	\$ 937,500	\$ 937,500
	Mechanical						
		Furnish & Install High Service Pump - Small (40 HP Split Case Centrifugal)	1	EACH	\$ 100,000	\$ 100,000	
		Furnish & Install High Service Pump - Large (75 HP Split Case Centrifugal)	1	EACH	\$ 150,000	\$ 150,000	
		Furnish & Install Pump Suction and Discharge Header Piping & Valve	2	EACH	\$ 75,000	\$ 150,000	\$ 400,000
	Electrical and I&C						
		Electrical System		LS	\$ 215,138	\$ 215,000	
		Controls, Instrumentaiton & SCADA		LS	\$ 179,281	\$ 179,000	\$ 394,000
ESTIMATE SUBTOTAL							\$ 2,115,844
C	Planning Level Contingency			%	25%	\$ 528,961	
ESTIMATE TOTAL							\$ 2,700,000

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INFRASTRUCTURE SOLUTION SERVICES ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PBU009 | Water Master Plan Update

05/30/24

Infrastructure Solution Services, LLC

Twenty-Year Capital Improvement Needs

CIP No. 14: ACP WM Replacement in Holiday Park MHP

Estimated By:

JFN

Checked By:

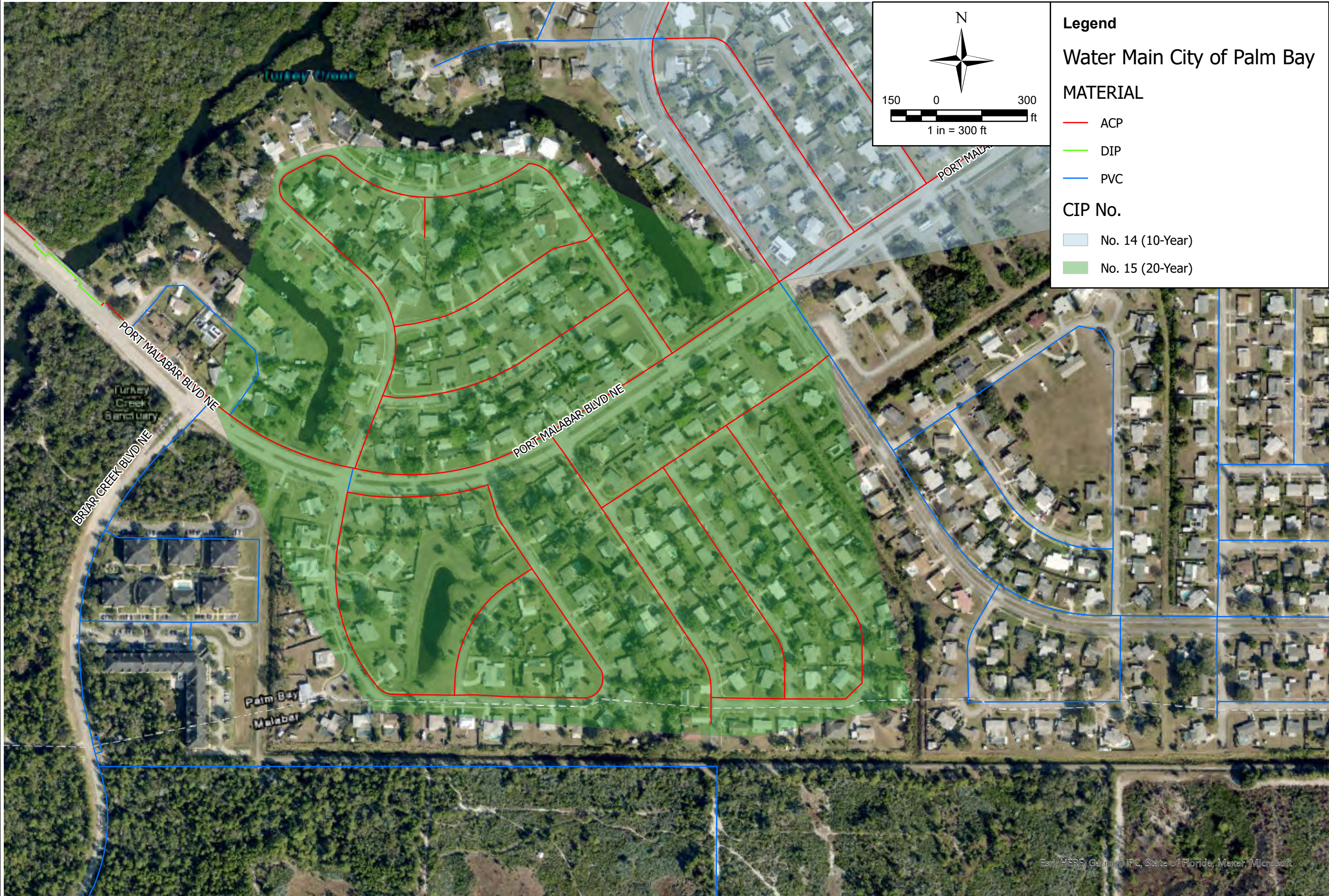
CEM

Project Manager:

CEM

Specification Division Code or Class		Item Description	Quantity	Unit	Unit Cost	Item Total	Subtotal
No.	General						
		Mobilization/Demobilization	7.5%	Allow	\$ 9,757,500	\$ 731,813	
		General Requirements, Bonds, and Insurance	5%	Allow	\$ 9,757,500	\$ 487,875	
		Temporary Erosion Control & Protection		LS	\$ 10,000	\$ 10,000	
		Testing Allowance		LS	\$ 5,000	\$ 5,000	
		Maintenance of Traffic		LS	\$ 2,500	\$ 2,500	
		Survey and Record Drawings		LS	\$ 5,000	\$ 5,000	\$ 1,242,188
	Demolition						
		Conduct Demo of Existing Asphalt Pavement	5000	SY	\$ 30	\$ 150,000	
		Conduct Demo of Existing Sidewalk Pavement and Driveways	10000	SY	\$ 20	\$ 200,000	
		Conduct Clearing and Grubbing (Miscellaneous)		LS	\$ 7,500	\$ 7,500	
		Grout and Abandon in Place Existing 4" ACP	10450	LF	\$ 40	\$ 418,000	
		Grout and Abandon in Place Existing 6" ACP	13250	LF	\$ 50	\$ 662,500	
		Grout and Abandon in Place Existing 10" ACP	2800	LF	\$ 90	\$ 252,000	
		Grout and Abandon in Place Existing 12" ACP	3500	LF	\$ 110	\$ 385,000	\$ 2,075,000
	ACP Pipe Replacement						
		Furnish & Install 6" PVC via Open-Cut Trenching with Testing & Chlorination	23700	LF	\$ 90	\$ 2,133,000	
		Furnish & Install 10" PVC via Open-Cut Trenching with Testing & Chlorination	2800	LF	\$ 165	\$ 462,000	
		Furnish & Install 12" PVC via Open-Cut Trenching with Testing & Chlorination	3500	LF	\$ 170	\$ 595,000	\$ 3,190,000
	Civil/Site Restoration						
		Conduct Final Grading		LS	\$ 20,000	\$ 20,000	
		Construct Sidewalk Pavement and Driveways (in entirety)	10000	SY	\$ 70	\$ 700,000	
		Construct Asphalt Pavement (in entirety)	50000	SY	\$ 75	\$ 3,750,000	\$ 4,470,000
ESTIMATE SUBTOTAL							\$ 10,977,188
C	Planning Level Contingency			%	30%	\$ 3,293,156	
ESTIMATE TOTAL							\$ 14,300,000

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INFRASTRUCTURE SOLUTION SERVICES ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PBU009 | Water Master Plan Update

05/30/24

Infrastructure Solution Services, LLC

Twenty-Year Capital Improvement Needs

CIP No. 15: ACP WM Replacement adjacent to Glenbrooke Senior Living

Estimated By:

JFN

Checked By:

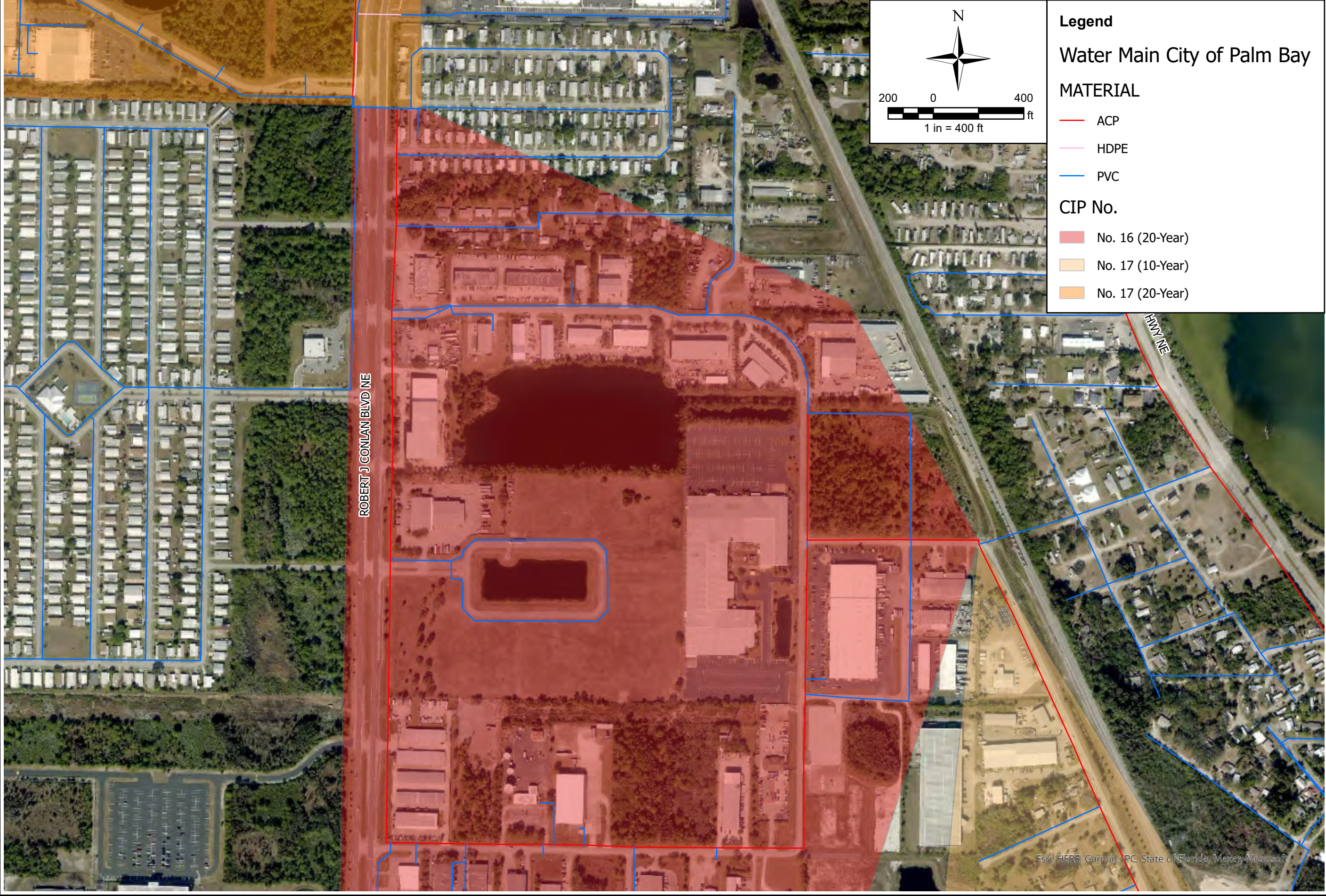
CEM

Project Manager:

CEM

Specification Division Code or Class		Item Description	Quantity	Unit	Unit Cost	Item Total	Subtotal
C	General						
		Mobilization/Demobilization	7.5%	Allow	\$ 3,146,900	\$ 236,018	
		General Requirements, Bonds, and Insurance	5%	Allow	\$ 3,146,900	\$ 157,345	
		Temporary Erosion Control & Protection		LS	\$ 10,000	\$ 10,000	
		Testing Allowance		LS	\$ 5,000	\$ 5,000	
		Maintenance of Traffic		LS	\$ 2,500	\$ 2,500	
		Survey and Record Drawings		LS	\$ 5,000	\$ 5,000	\$ 415,863
	Demolition						
		Conduct Demo of Existing Asphalt Pavement	750	SY	\$ 30	\$ 22,500	
		Conduct Demo of Existing Sidewalk Pavement and Driveways	3000	SY	\$ 20	\$ 60,000	
		Conduct Clearing and Grubbing (Miscellaneous)		LS	\$ 5,000	\$ 5,000	
		Grout and Abandon in Place Existing 4" ACP	7460	LF	\$ 40	\$ 298,400	
		Grout and Abandon in Place Existing 6" ACP	4790	LF	\$ 50	\$ 239,500	
		Grout and Abandon in Place Existing 12" ACP	2050	LF	\$ 110	\$ 225,500	\$ 850,900
	ACP Pipe Replacement						
		Furnish & Install 6" PVC via Open-Cut Trenching with Testing & Chlorination	12250	LF	\$ 90	\$ 1,102,500	
		Furnish & Install 8" HDPE via HDD	200	LF	\$ 150	\$ 30,000	
		Furnish & Install 12" PVC via Open-Cut Trenching with Testing & Chlorination	2050	LF	\$ 170	\$ 348,500	\$ 1,481,000
	Civil/Site Restoration						
		Conduct Final Grading		LS	\$ 20,000	\$ 20,000	
		Construct Sidewalk Pavement and Driveways (in entirety)	3000	SY	\$ 70	\$ 210,000	
		Construct Asphalt Pavement (in entirety)	7500	SY	\$ 75	\$ 562,500	\$ 792,500
ESTIMATE SUBTOTAL							\$ 3,540,263
C	Planning Level Contingency			%	30%	\$ 1,062,079	
ESTIMATE TOTAL							\$ 4,700,000

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INFRASTRUCTURE SOLUTION SERVICES ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PBU009 | Water Master Plan Update

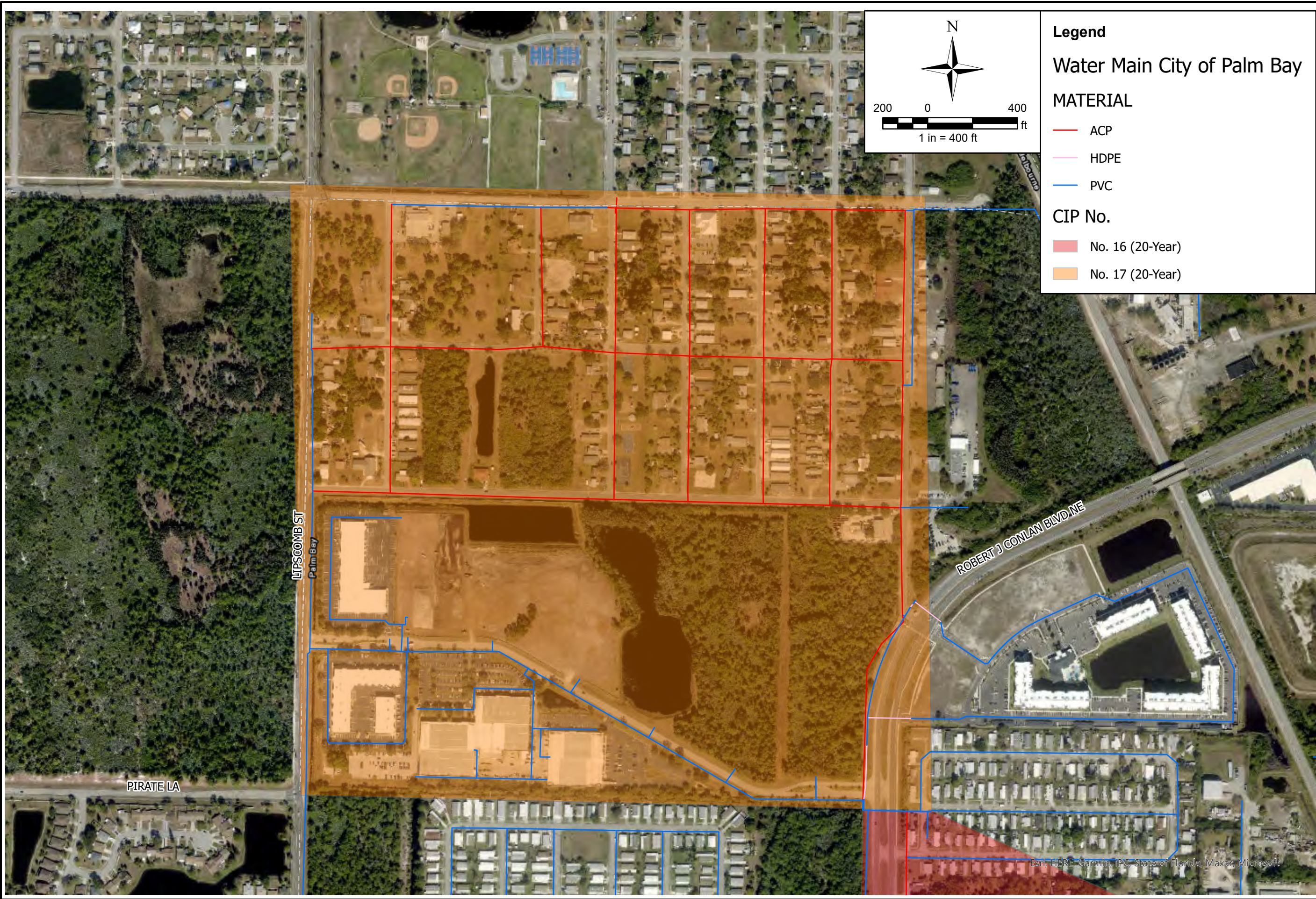
05/30/24
Infrastructure Solution Services, LLC

Twenty-Year Capital Improvement Needs
CIP No. 16: ACP WM Replacement within Vincent Kirby Industrial Park

Estimated By: JFN
Checked By: CEM
Project Manager: CEM

Specification Division Code or Class		Item Description	Quantity	Unit	Unit Cost	Item Total	Subtotal
C	General						
		Mobilization/Demobilization	7.5%	Allow	\$ 2,639,500	\$ 197,963	
		General Requirements, Bonds, and Insurance	5%	Allow	\$ 2,639,500	\$ 131,975	
		Temporary Erosion Control & Protection		LS	\$ 10,000	\$ 10,000	
		Testing Allowance		LS	\$ 5,000	\$ 5,000	
		Maintenance of Traffic		LS	\$ 2,500	\$ 2,500	
		Survey and Record Drawings		LS	\$ 5,000	\$ 5,000	\$ 352,438
	Demolition						
		Conduct Demo of Existing Asphalt Pavement	750	SY	\$ 30	\$ 22,500	
		Conduct Demo of Existing Sidewalk Pavement and Driveways	200	SY	\$ 20	\$ 4,000	
		Conduct Clearing and Grubbing (Miscellaneous)		LS	\$ 5,000	\$ 5,000	
		Conduct Demo and Removal of Existing 10" ACP	7800	LF	\$ 90	\$ 702,000	\$ 733,500
	ACP Pipe Replacement						
		Furnish & Install 10" PVC via Open-Cut Trenching with Testing & Chlorination	7800	LF	\$ 165	\$ 1,287,000	\$ 1,287,000
	Civil/Site Restoration						
		Conduct Final Grading		LS	\$ 20,000	\$ 20,000	
		Construct Sidewalk Pavement and Driveways (in entirety)	200	SY	\$ 70	\$ 14,000	
		Construct Asphalt Pavement (in entirety)	7500	SY	\$ 75	\$ 562,500	\$ 596,500
ESTIMATE SUBTOTAL							\$ 2,969,438
C	Planning Level Contingency			%	30%	\$ 890,831	
ESTIMATE TOTAL							\$ 3,900,000

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INFRASTRUCTURE SOLUTION SERVICES ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PBU009 | Water Master Plan Update

05/30/24
Infrastructure Solution Services, LLC

Twenty-Year Capital Improvement Needs
CIP No. 17: ACP Pipe Replacment near Lipscomb Park

Estimated By: JFN
Checked By: CEM
Project Manager: CEM

Specification Division Code or Class		Item Description	Quantity	Unit	Unit Cost	Item Total	Subtotal
No.		General					
		Mobilization/Demobilization	7.5%	Allow	\$ 3,382,000	\$ 253,650	
		General Requirements, Bonds, and Insurance	5%	Allow	\$ 3,382,000	\$ 169,100	
		Temporary Erosion Control & Protection		LS	\$ 10,000	\$ 10,000	
		Testing Allowance		LS	\$ 5,000	\$ 5,000	
		Maintenance of Traffic		LS	\$ 25,000	\$ 25,000	
		Survey and Record Drawings		LS	\$ 5,000	\$ 5,000	\$ 467,750
		Demolition					
		Conduct Demo of Existing Asphalt Pavement	1100	SY	\$ 30	\$ 300,000	
		Conduct Demo of Existing Sidewalk Pavement and Driveways	1000	SY	\$ 20	\$ 20,000	
		Conduct Clearing and Grubbing (Miscellaneous)		LS	\$ 5,000	\$ 5,000	
		Conduct Demo and Removal of Existing 6" ACP	15300	LF	\$ 50	\$ 765,000	\$ 1,090,000
		AC Pipe Replacement					
		Furnish & Install 6" PVC via Open-Cut Trenching with Testing & Chlorination	15300	LF	\$ 90	\$ 1,377,000	\$ 1,377,000
		Civil/Site Restoration					
		Conduct Final Grading		LS	\$ 50,000	\$ 50,000	
		Construct Sidewalk Pavement and Driveways (in entirety)	1000	SY	\$ 70	\$ 70,000	
		Construct Asphalt Pavement (in entirety)	10000	SY	\$ 75	\$ 750,000	\$ 870,000
		ESTIMATE SUBTOTAL					\$ 3,804,750
C		Planning Level Contingency		%	30%	\$ 1,141,425	
		ESTIMATE TOTAL					\$ 4,950,000



INFRASTRUCTURE SOLUTION SERVICES ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

PBU009 | Water Master Plan Update

05/30/24
Infrastructure Solution Services, LLC

Twenty-Year Capital Improvement Needs
CIP No. 19: Expand SRWTP from 10 MGD to 14 MGD

Estimated By: CEM
Checked By: CEM
Project Manager: CEM

Specification Division Code or Class		Item Description	Quantity	Unit	Unit Cost	Item Total	Subtotal
No.	General						
		Mobilization/Demobilization	7.5%	Allow	\$ 27,934,313	\$ 2,095,073	\$ 3,591,789
		General Requirements, Bonds, and Insurance	5%	Allow	\$ 27,934,313	\$ 1,396,716	
		Testing Allowance		LS	\$ 50,000	\$ 50,000	
		Survey and Record Drawings		LS	\$ 50,000	\$ 50,000	
		Process Building	11000	SF	\$ 350	\$ 3,850,000	\$ 27,834,313
		Chemical Feed Building	1800	SF	\$ 275	\$ 495,000	
		Blend Water Micron Filters	2	EACH	\$ 60,000	\$ 120,000	
		Process Micron Filters	3	EACH	\$ 60,000	\$ 180,000	
		Acid Chemical Storage and Feed System		LS	\$ 300,000	\$ 300,000	
		Antiscalant Chemical Storage and Feed System		LS	\$ 150,000	\$ 150,000	
		High Pressure Pumps	3	EACH	\$ 350,000	\$ 1,050,000	
		RO Membrane Skids	2	EACH	\$ 1,600,000	\$ 3,200,000	
		Process Piping		LS	\$ 1,500,000	\$ 1,500,000	
		CCC/Blending Basin/Wet Well		LS	\$ 1,000,000	\$ 1,000,000	
		Transfer Pumps	3	EACH	\$ 172,500	\$ 517,500	
		Degasifier and Blowers	2	EACH	\$ 1,750,000	\$ 3,500,000	
		Two Stage Odor Control	1	EACH	\$ 750,000	\$ 750,000	
		High Service Pumps with Can	3	EACH	\$ 300,000	\$ 900,000	
		Sodium Hypochlorite Chemical Storage and Feed System		LS	\$ 300,000	\$ 300,000	
		Ammonia Chemical Storage and Feed System		LS	\$ 150,000	\$ 150,000	
		Fluoride Chemical Storage and Feed System		LS	\$ 165,000	\$ 165,000	
		Caustic Chemical Storage and Feed System		LS	\$ 300,000	\$ 300,000	
		Phosphate Chemical Storage and Feed System		LS	\$ 150,000	\$ 150,000	
		2.0 MG Ground Storage Tank		LS	\$ 1,725,000	\$ 1,725,000	
		Yard Piping		LS	\$ 1,250,000	\$ 1,250,000	
		Emergency Generator with ATS & Enclosure	1	EACH	\$ 600,000	\$ 600,000	
		Fuel Storage & Fuel Piping		LS	\$ 100,000	\$ 100,000	
		Electrical		LS	\$ 3,337,875	\$ 3,337,875	
		I&C		LS	\$ 1,668,938	\$ 1,668,938	
		Misc Metals		LS	\$ 250,000	\$ 250,000	
		Pump Room Bridge Crane		LS	\$ 75,000	\$ 75,000	
		Site Work		LS	\$ 250,000	\$ 250,000	
ESTIMATE SUBTOTAL							\$ 27,834,313
C	Planning Level Contingency			%	25%	\$ 6,958,578	
ESTIMATE TOTAL							\$ 35,000,000