Taking a Global Look
Citywide Pump Station Assessment

City of Portsmouth, NH

January 28, 2020

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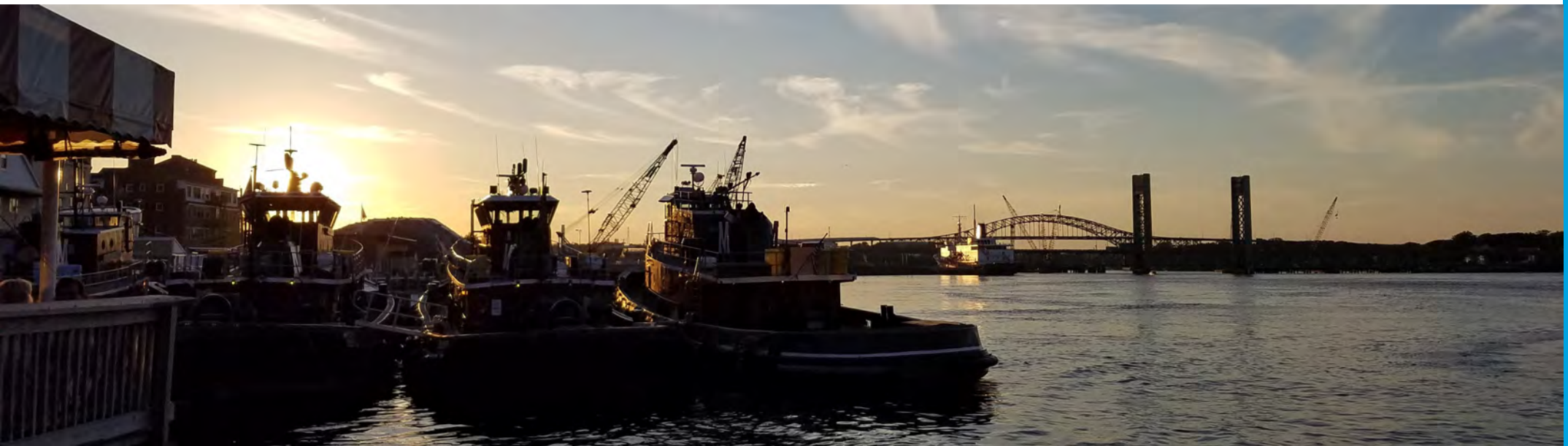

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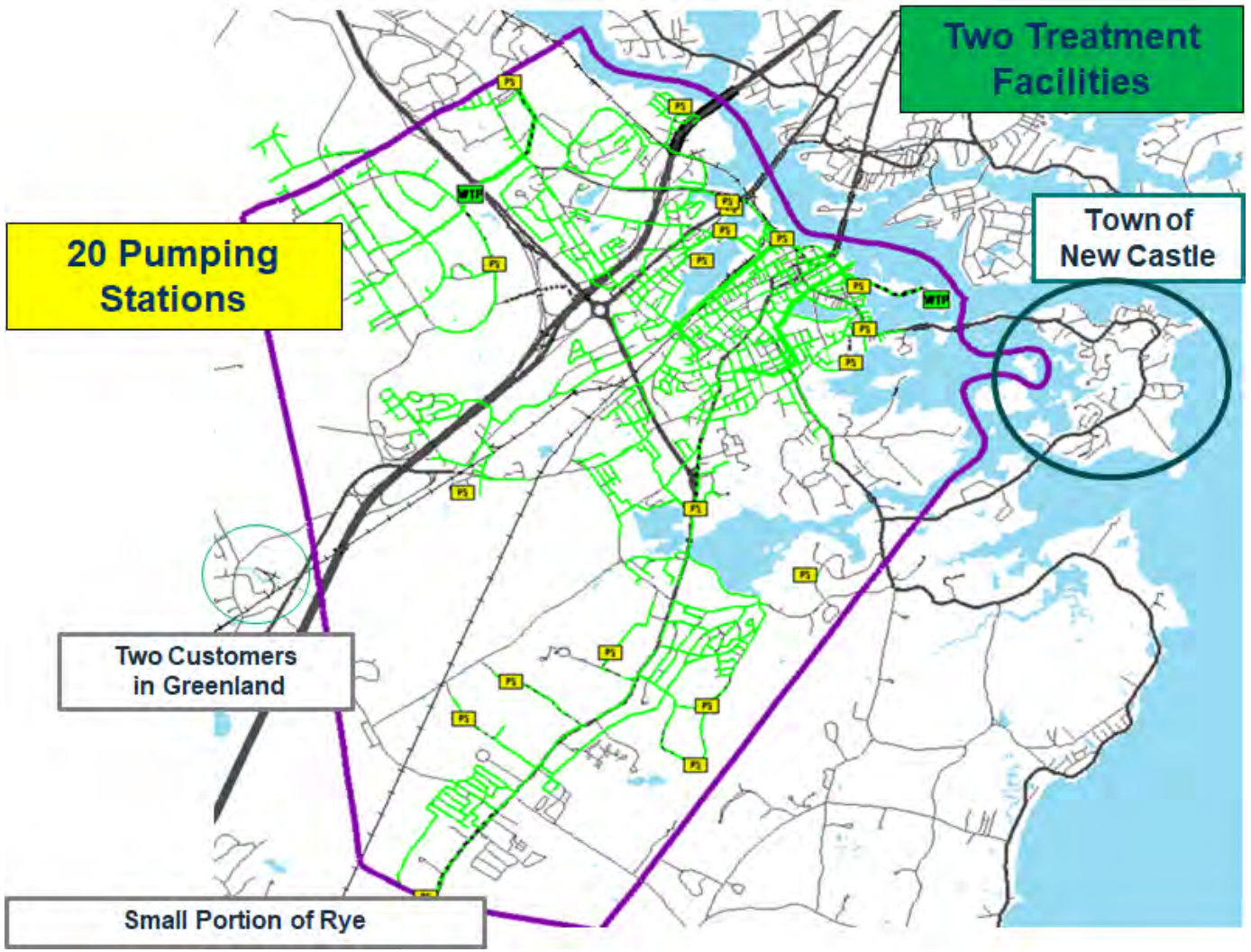
Presentation Overview

- Background
- Project Goals
- Approach
- Results
- Next Steps

Background: City of Portsmouth



- Coastal community
- Population 22,000
- Regional wastewater treatment
- Peirce Island WWTF
  - 6.13 MGD ADF, Biological Aerated Filter
  - 22.0 MGD Peak Wet Weather
- Pease WWTF
  - 1.2 MGD ADF, Sequencing Batch Reactor
- 20 pump stations
- ~110 miles gravity sewer
- ~9 miles force main
- 3 combined sewer overflows

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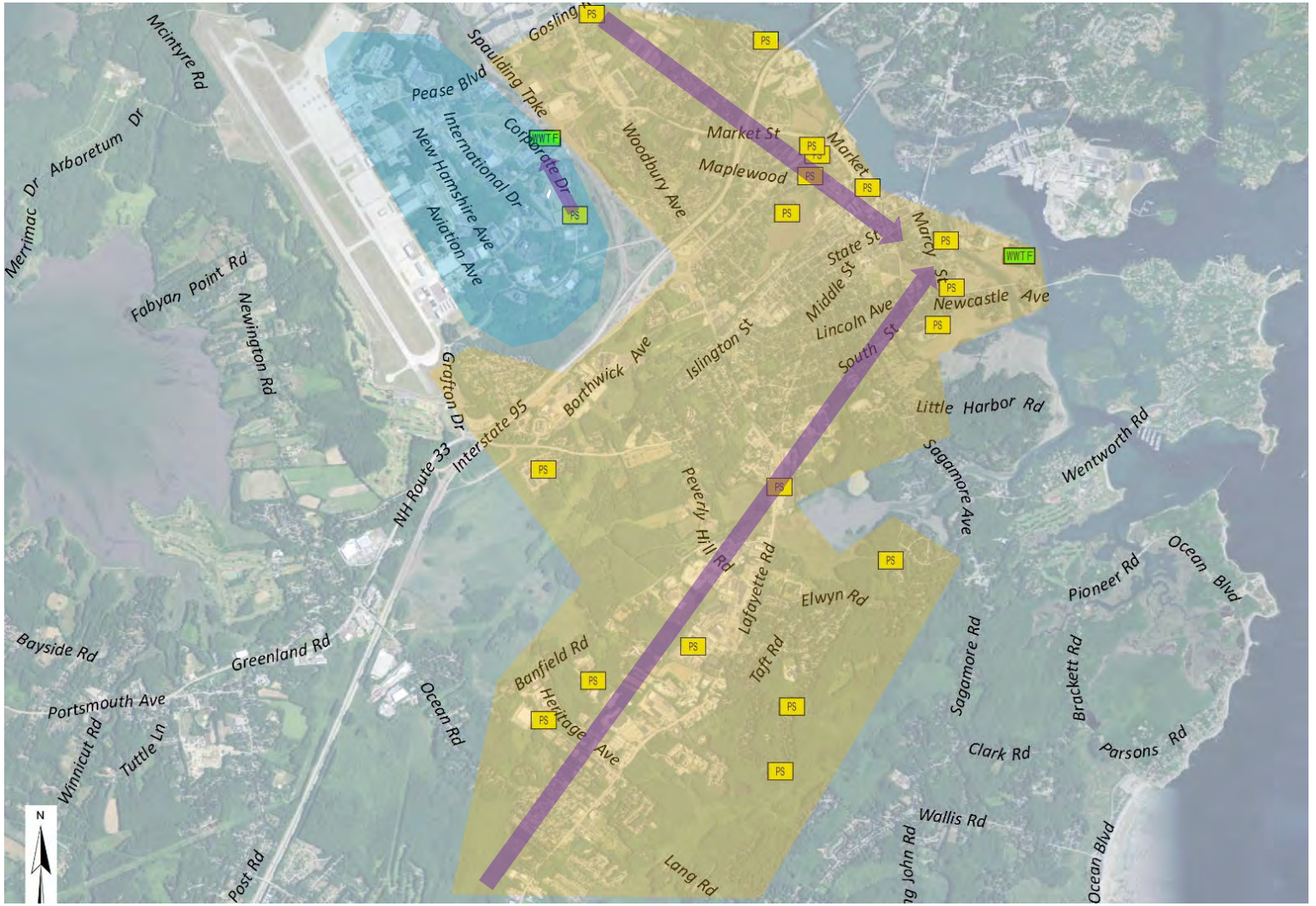
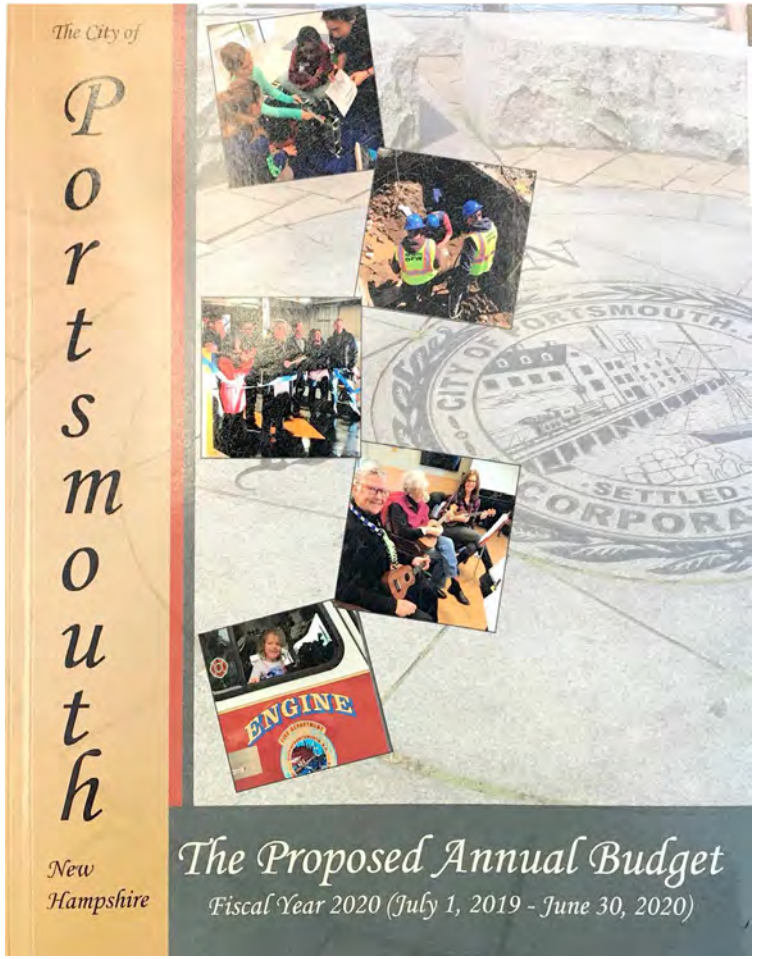
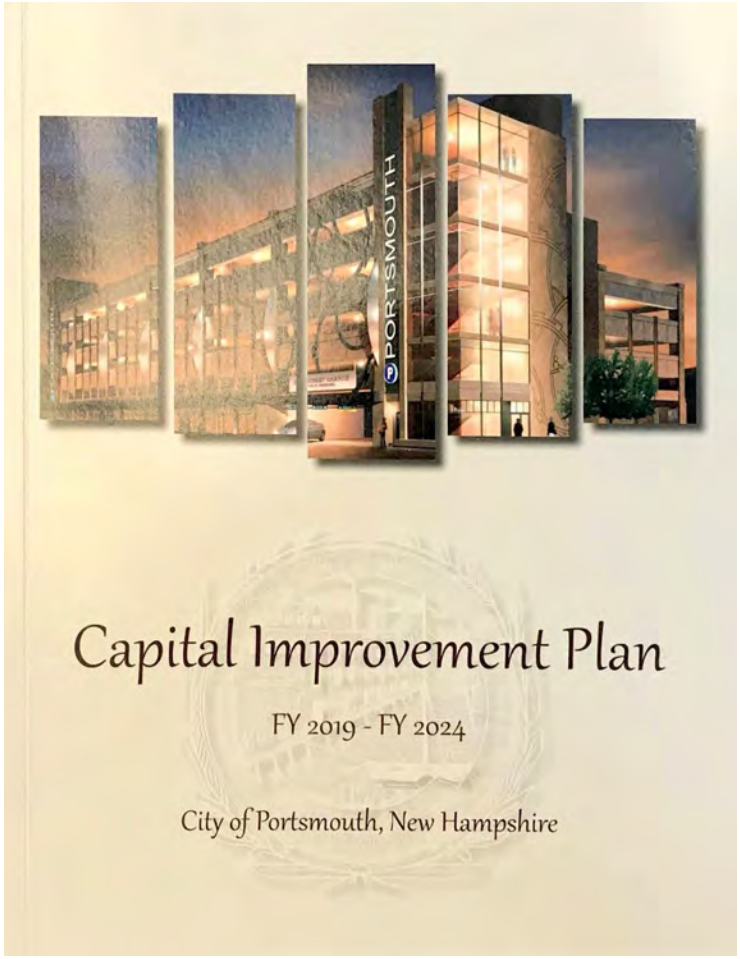
Background: City of Portsmouth



Project Goals





- **Comprehensive planning document**
  - **Annual budget**
  - **City's 6-Year Capital Improvement Plan**
- **Master Plan**
  - **Implementation Tool**
  - **Living Document**
  - **Reference Document**

Project Goals

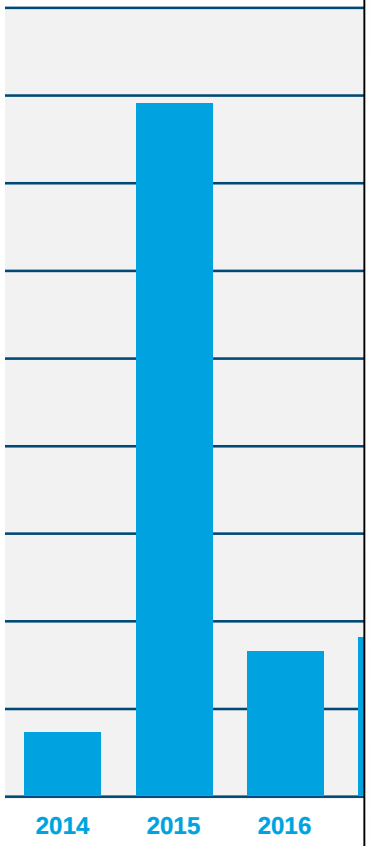
- **"First" Comprehensive Condition Assessment**
  - **Facilities**
  - **MEP**
  - **Pumping Equipment**
  - **Instrumentation and Controls**
  - **Codes**
    - **Building**
    - **Electrical**
    - **NFPA**
    - **DES**
  - **Flood Resiliency**

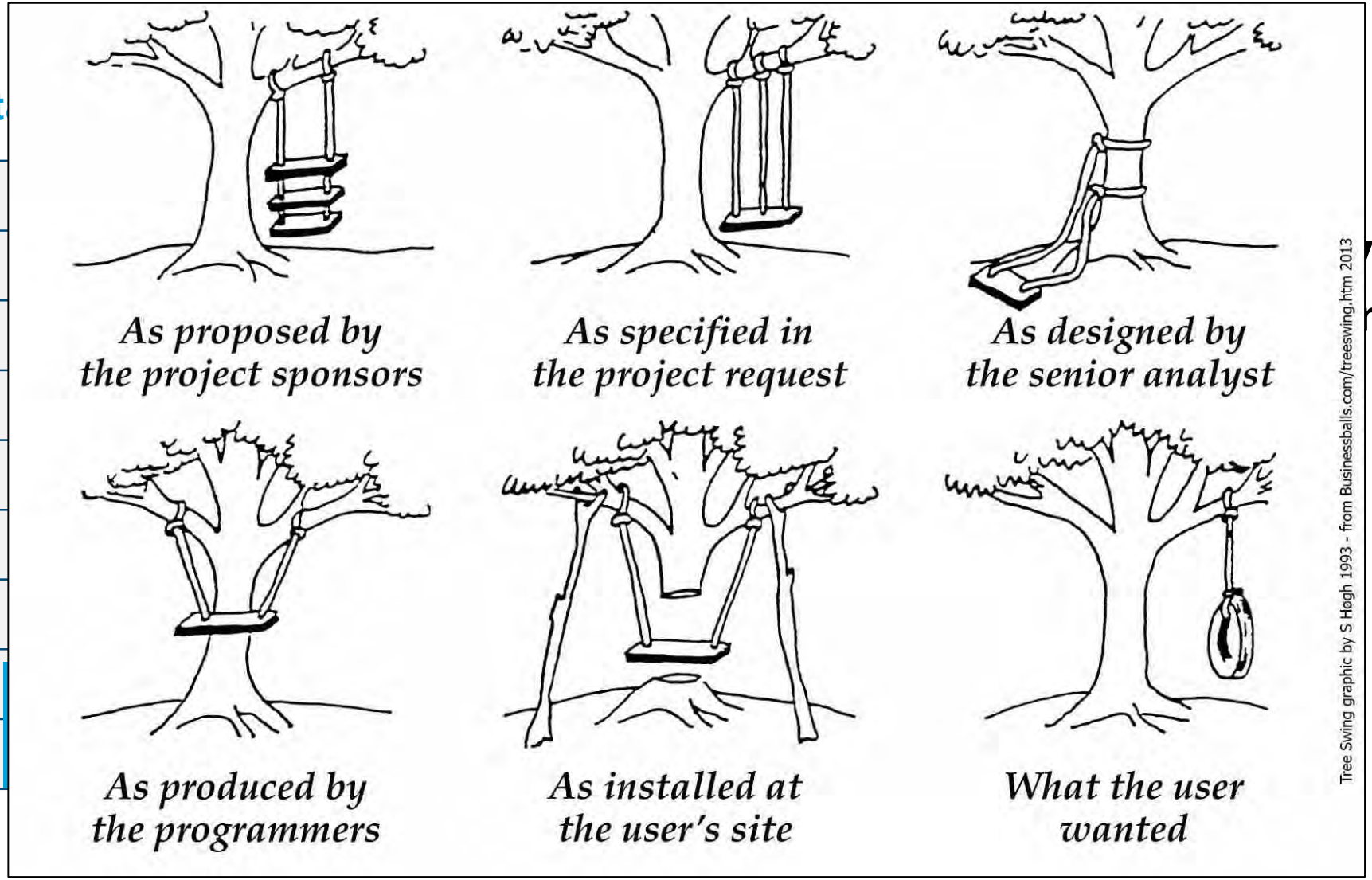
Project Goals

- **Design vs Actual vs Potential Flow Needs**
  - Buildout Projections and Land Use
  - Over/Under-Sized Pump Stations
  - Extraneous Flow and Combined System Influence on Pump Operation and Capacity
- **Benchmark Condition and Performance**
  - Facilities and Pumping Equipment
  - Efficiency
  - Energy use
- **Integration with NH DES Energy Study**
- **Potential Integration For Future Asset Management Approach**

Approach

Annual Pump St





valuation

n criticality

Approach: High Priority Stations

- Critical large stations
- Wet-weather
  - Mechanic St – up to 22 MGD
  - Deer St – up to 12 MGD
- Key mid-sized stations
  - Gosling Rd
  - Leslie Dr
  - Rye Line
- Individualized physical evaluations
- Scheduled upgrades
  - Heritage Ave
  - Lafayette Rd

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Approach: Medium Priority Stations

- Suction lift stations
- 130-400 GPM
- 16-37 years old
- Limited physical evaluation
- Group ‘like stations’ together
  - Age
  - Original construction contract
  - Physical configurations
- Assumptions, desktop analysis for some

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Approach: Low Priority Stations

- Small stations
- < 100 GPM
- 5-13 years old
- Limited physical evaluation
- Assumptions, desktop analysis for some

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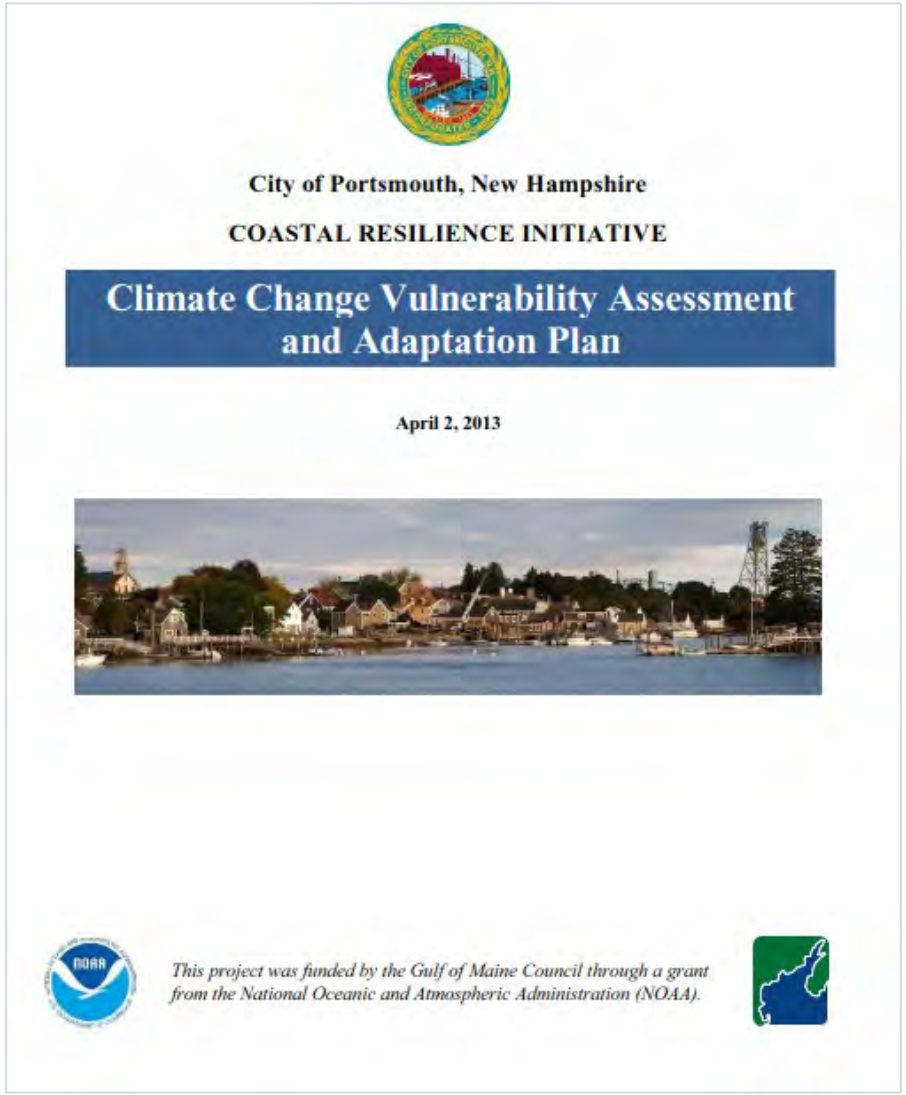
Approach: Project Engineers

- Visit all pump station sites
- Collaborate with City staff
  - History
  - Upgrades
  - Issues
- Maintenance
- Understand service area
  - Future growth, build-out
  - Commercial, Industrial connections
- Inventory all equipment
- Preferences for potential upgrades
- Drawdown testing

Approach: Supporting Engineers

- Architects, Structural, Mechanical HVAC, Electrical, Instrumentation
- Site visits: Economical and cost effective approach
  - Led by team project engineers
  - Collaboration with City staff
  - Critical and high priority stations
  - Group similar stations together
- Desktop evaluation
  - Similar stations not visited
  - Record information
  - Information gathered by project engineers

Approach


City of Portsmouth, New Hampshire

COASTAL RESILIENCE INITIATIVE

Climate Change Vulnerability Assessment and Adaptation Plan

April 2, 2013

This project was funded by the Gulf of Maine Council through a grant from the National Oceanic and Atmospheric Administration (NOAA).

GIS Analysis

- Coastal Resiliency: 2050 and 2100
- Zoning, buildout potential
- Service area mapping

Force Main evaluation

- Age
- Material, soil analysis
- Criticality
- Size, velocities as relates to pump station
- Maintenance, break history
- Recommendations for further evaluation

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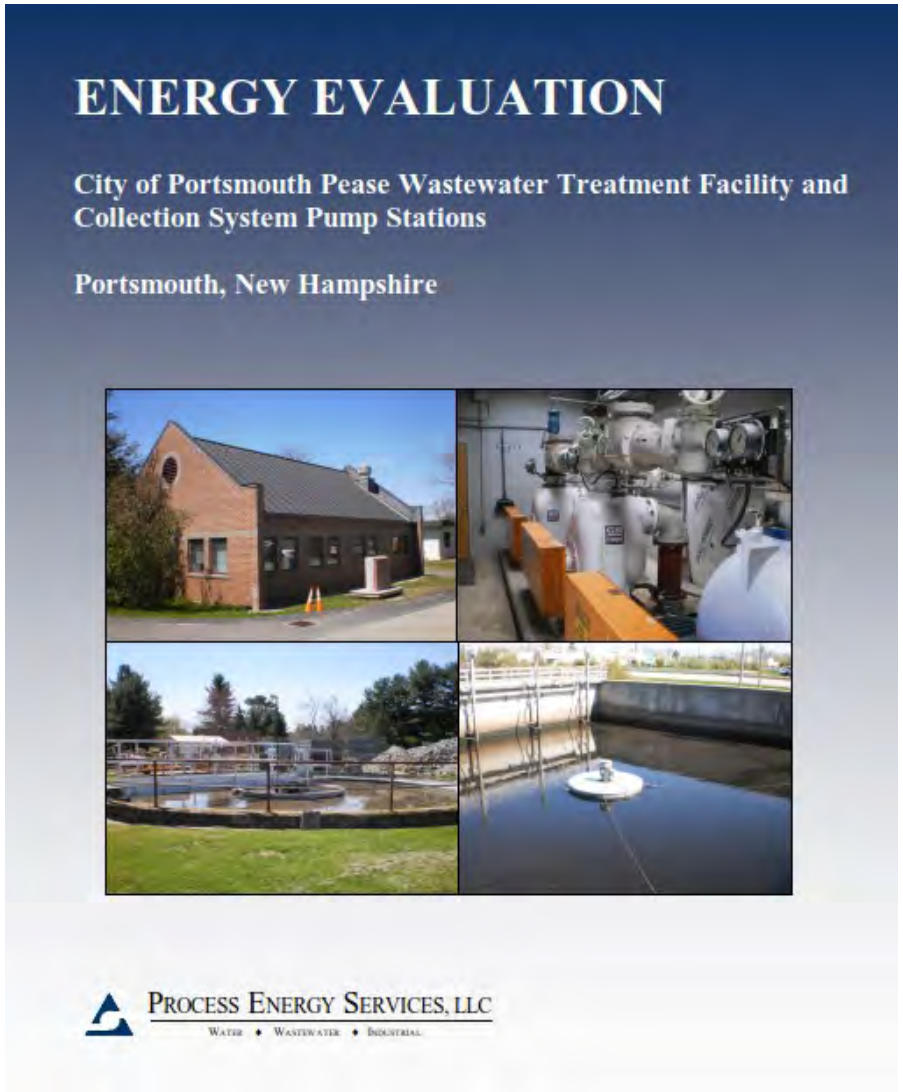
Approach



Energy Evaluation

- **NHDES Funding**
- **Energy Audit**
- **Wrap into the Master Plan document**
- **Many recommendations, City Staff projects**

Asset Management

- **NHDES Funding Opportunities**
- **Requirements parallel Master Plan scope**
  - **Inventory, Condition, Criticality, CIP**
- **Challenges: Software, Staffing**

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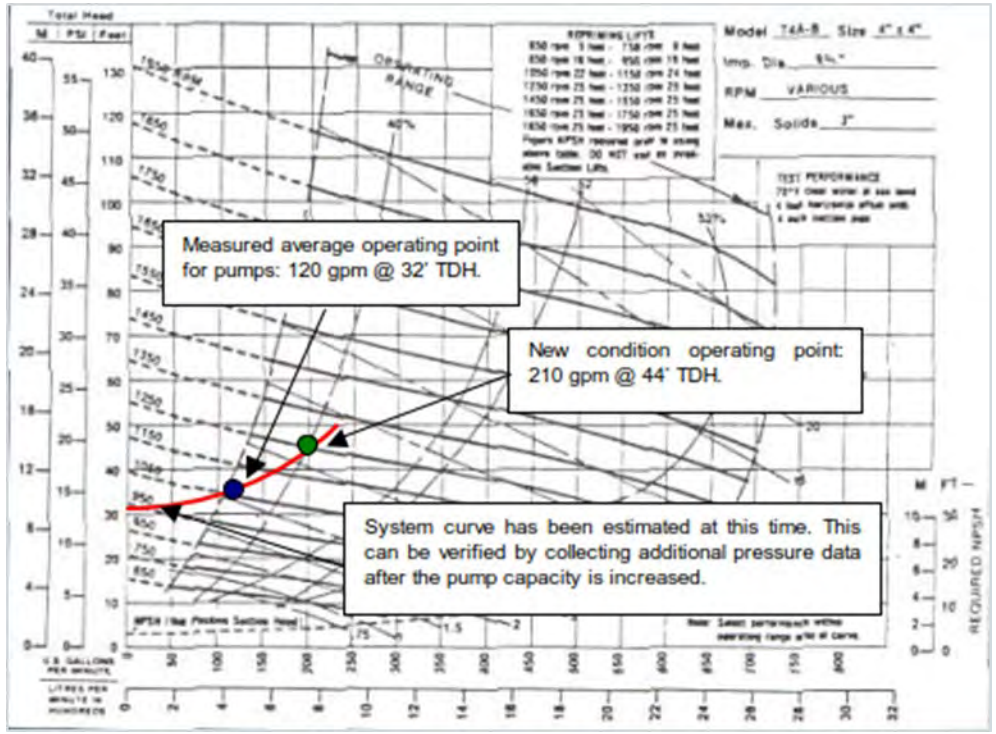
Results



- **Very well maintained, despite age**
- **Aging Infrastructure**
  - **>40 years: 3 stations, 2 pumps**
  - **30-40 years: 9 stations, 16 pumps**
  - **15-30 years: 5 stations, 11 pumps**
- **Diminishing capacity**
  - **2 pumps < 50% of design flow (55 gpm)**
  - **12 pumps 50-60% of design flow (55-320 gpm)**
  - **4 pumps 60-70% of design flow (~400 gpm)**

Results

Immediate Replacement

- Layfette – 2019
- Heritage – 2020
- Mechanic – TBD…$$$$$

Replace within 5-10 years

- Constitution
- West
- Woodlands I
- Woodlands 2

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Results

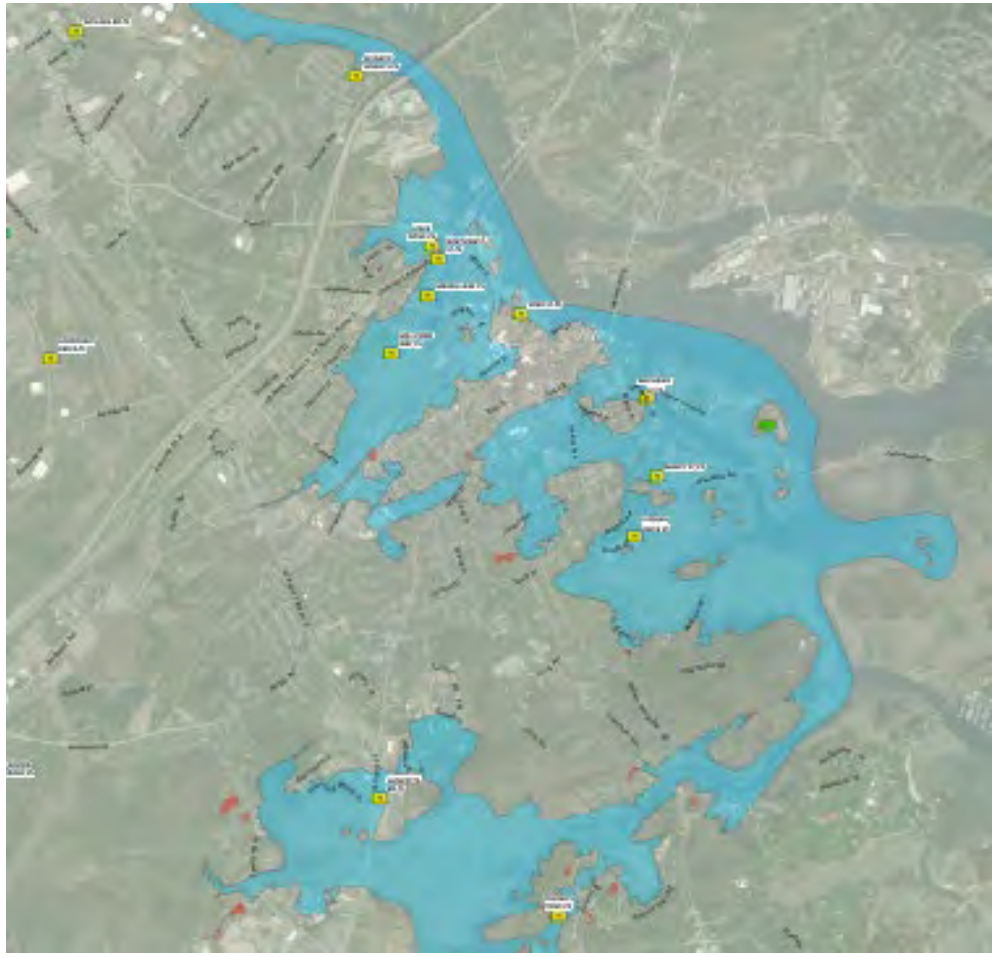
Code Updates, NFPA 37, Electrical:

- **Comprehensive electrical replacement: 14**
- **Instrumentation and controls (0-5 years): 14**
- **Generator relocation; panel, MCC: 3**
- **Generator room fire rating; egress issues: 2**

Code Updates, NFPA 820, Mechanical:

- **Ventilation, declassification**
  - **9 stations**
- **Wetwell penetration seals**
  - **3 stations**

Results



Coastal Resiliency, 100-year coastal flood

- 5 stations; current flood elevation
- 7 stations with 2050 flood elevation
- 9 stations with 2100 flood elevation
- Only 2 stations scheduled for replacement
  - Current Improvement Plan
  - Recommendations

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Results: Mechanic Street Pump Station

Results: Mechanic Street Pump Station

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Results: Mechanic Street Pump Station

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Results: Mechanic Street Pump Station

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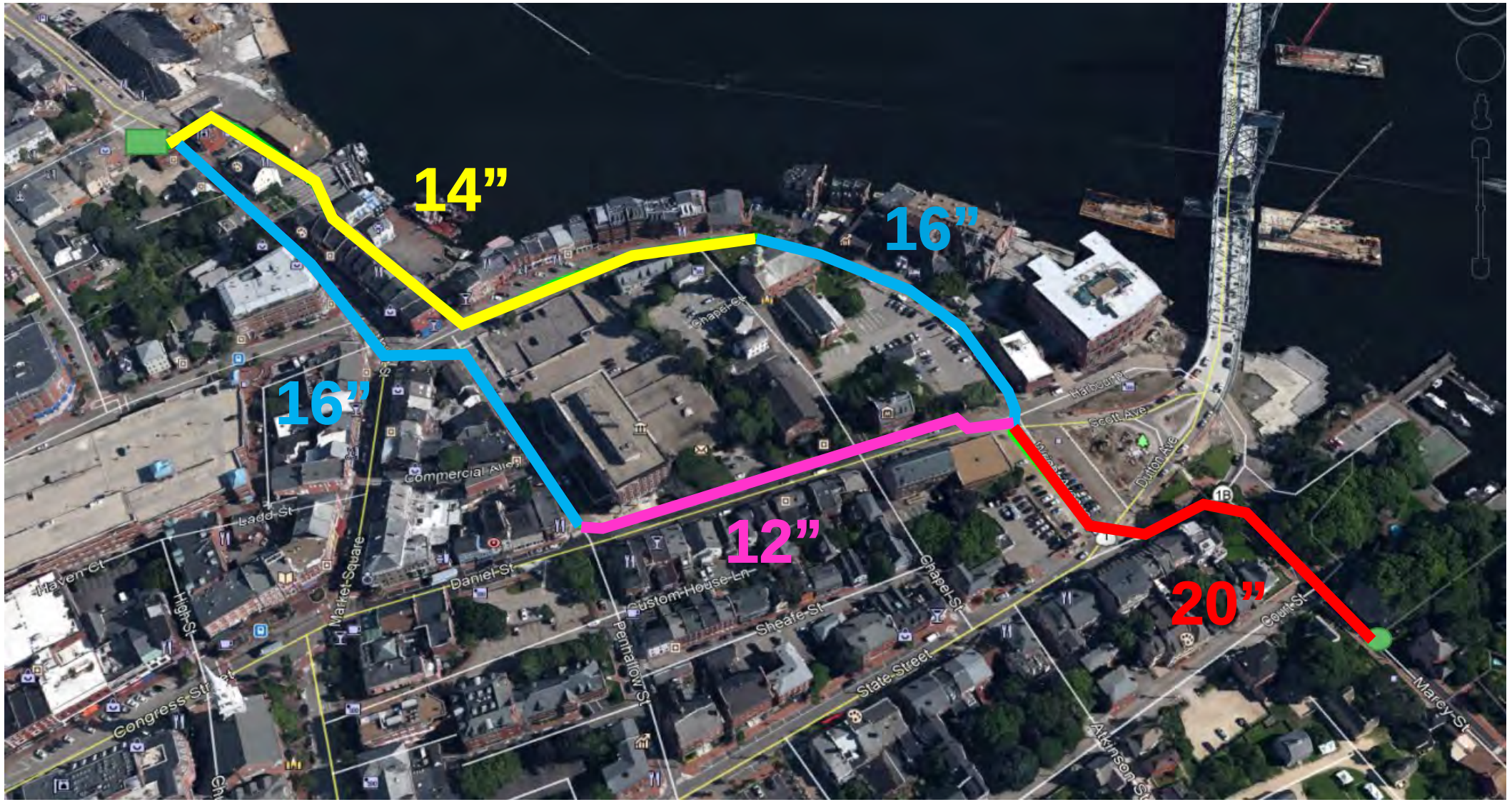
Results: Force Main Priorities

- 10 stations no issues
- 40-60 year old AC: 5 stations
- Low flushing velocities: 5 stations
- Ferrous piping w/ corrosive soil: 5 stations
- Mixed materials/diameters: 4 stations
- Lack of functional valving, isolation: 3 stations
- Twice design TDH: 1 station

Results: Deer Street Pump Station Force Main



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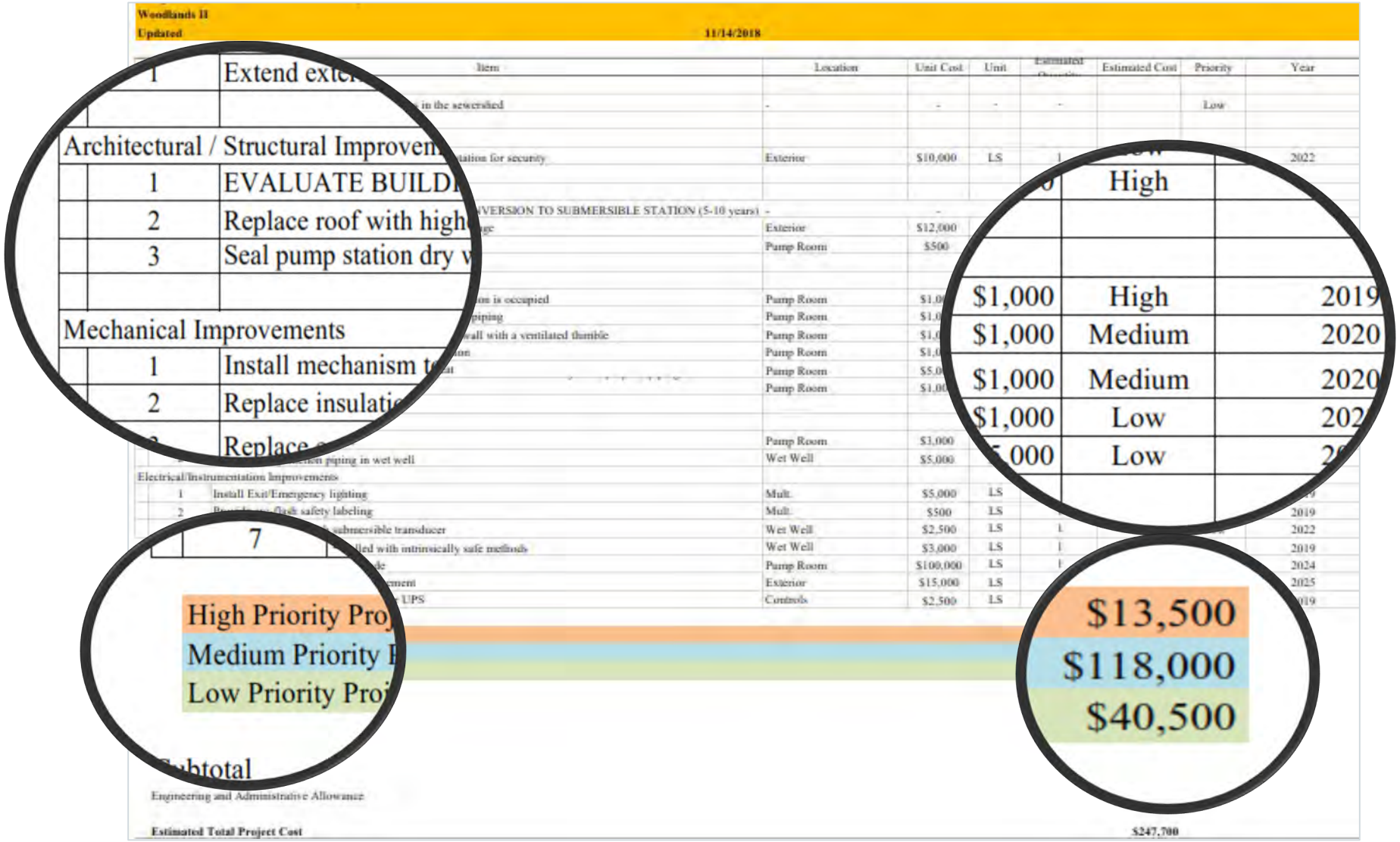
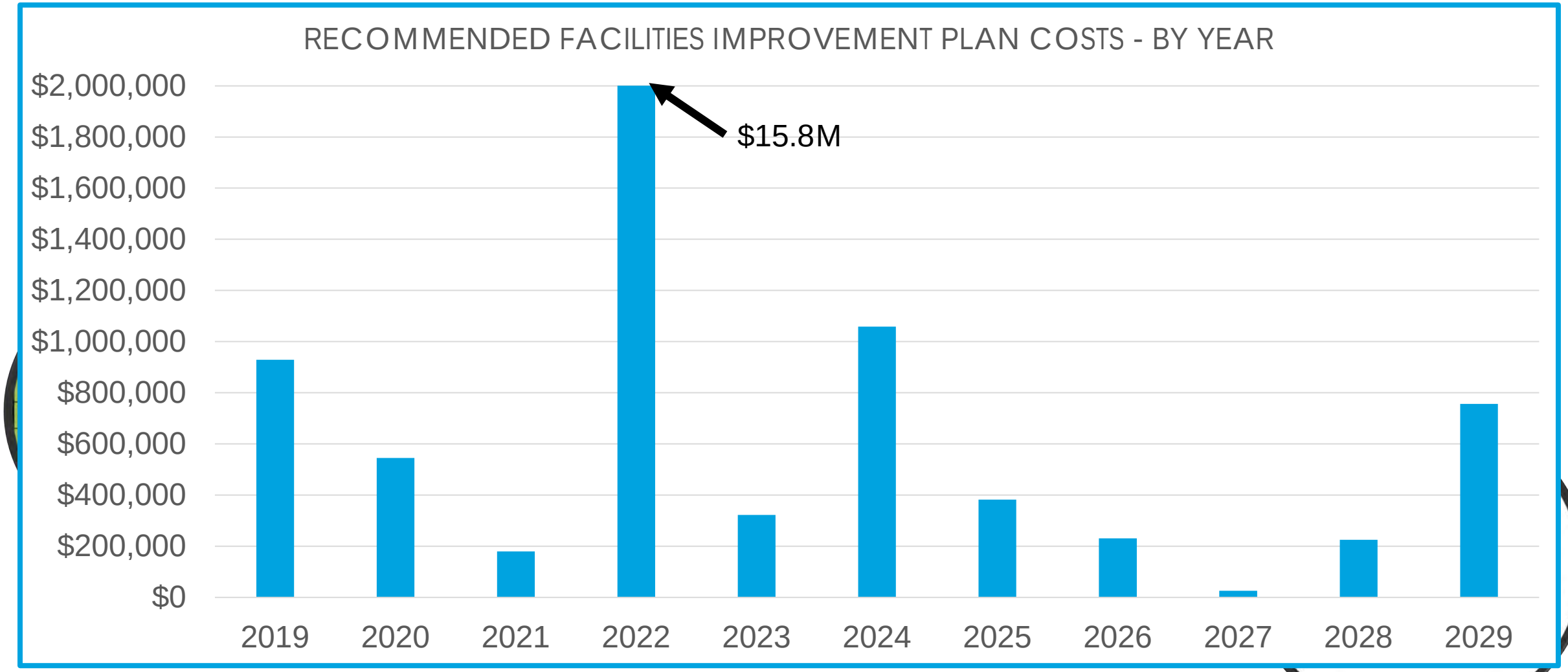
Results


Woodlands II
Updated
11/14/2018
Item
Location
Unit Cost
Unit
Estimated Cost
Priority
Year
Low
Exterior
$10,000
LS
2022
High
Pump Room
$500
$1,000
High
2019
$1,000
Medium
2020
$1,000
Medium
2020
$1,000
Low
Pump Room
$3,000
Wet Well
$5,000
Mult.
$5,000
LS
Mult.
$500
LS
2019
Wet Well
$2,500
LS
2022
Wet Well
$3,000
LS
2019
Pump Room
$100,000
LS
2024
Exterior
$15,000
LS
2025
Controls
$2,500
LS
Architectural / Structural Improvements
Mechanical Improvements
Electrical/Instrumentation Improvements
Install Exit/Emergency lighting
7
High Priority Proj
Medium Priority I
Low Priority Proj
$13,500
$118,000
$40,500
Subtotal
Engineering and Administrative Allowance
Estimated Total Project Cost
$247,700

Results



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Next Steps

- **10-years of identified improvements: $20.5M**
  - **High priority: $15.6M**
  - **Medium: $2.7M**
  - **Low: $2.2M**
- **Organized by station, year of implementation**
  - **Collaboration meetings with City staff**
  - **Prioritized by criticality**
- **City staff improvements, low hanging fruit**
  - **Began implementing immediately**

Mechanic St PS $14.9M

Next Steps

Mechanic St – Interim Improvements

- **$15M a lot at this time**
- **Evaluate option to extend life 5-10 years**
  - **Replace pump(s), controls, electrical, etc.**
  - **Select facilities improvements**
- **Site Challenges and Opportunities**
  - **Waterfront**
  - **Own Adjacent Parcel**
  - **Tight Space, Adjacent Park Coordination**

Next Steps

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Next Steps

Deer St – Interim Improvements

- **Code Related**
  - **Architectural, HVAC**
  - **Generator room fire code**
- **Force Main**
  - **Replace isolation valves**
  - **Pipeline condition assessment**
  - **Replace air relief valves**
  - **Potential replacement alignments**

Next Steps

- **Group like projects at multiple pump stations**
  - **Pump station replacement – 5-10 years: 4**
  - **Electrical, instrumentation, HVAC, generator relocation: 3**
  - **Electrical upgrades: 4**
  - **Miscellaneous – painting, roofing, masonry, etc.**
- **City staff projects**
  - **Vary in complexity and type**
  - **Balance of operations and project time**
- **Update "living" document**
  - **As work is completed**
  - **In preparation for each budget/CIP cycle**
- **Future asset management program**

Acknowledgements

City of Portsmouth
Department of Public Works

- Peter Rice – Director
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- Mike Baker – Pump Station Manager
- James McCarty – GIS Manager

Wright-Pierce

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- Paige Howard
- Jeff Normandin

THANK YOU

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