



# Identification and Removal of Tidal Intrusion Sources in Manchester-by-the-Sea's Wastewater Collection System



TATA & HOWARD

**2019 NEWEA Annual Conference**  
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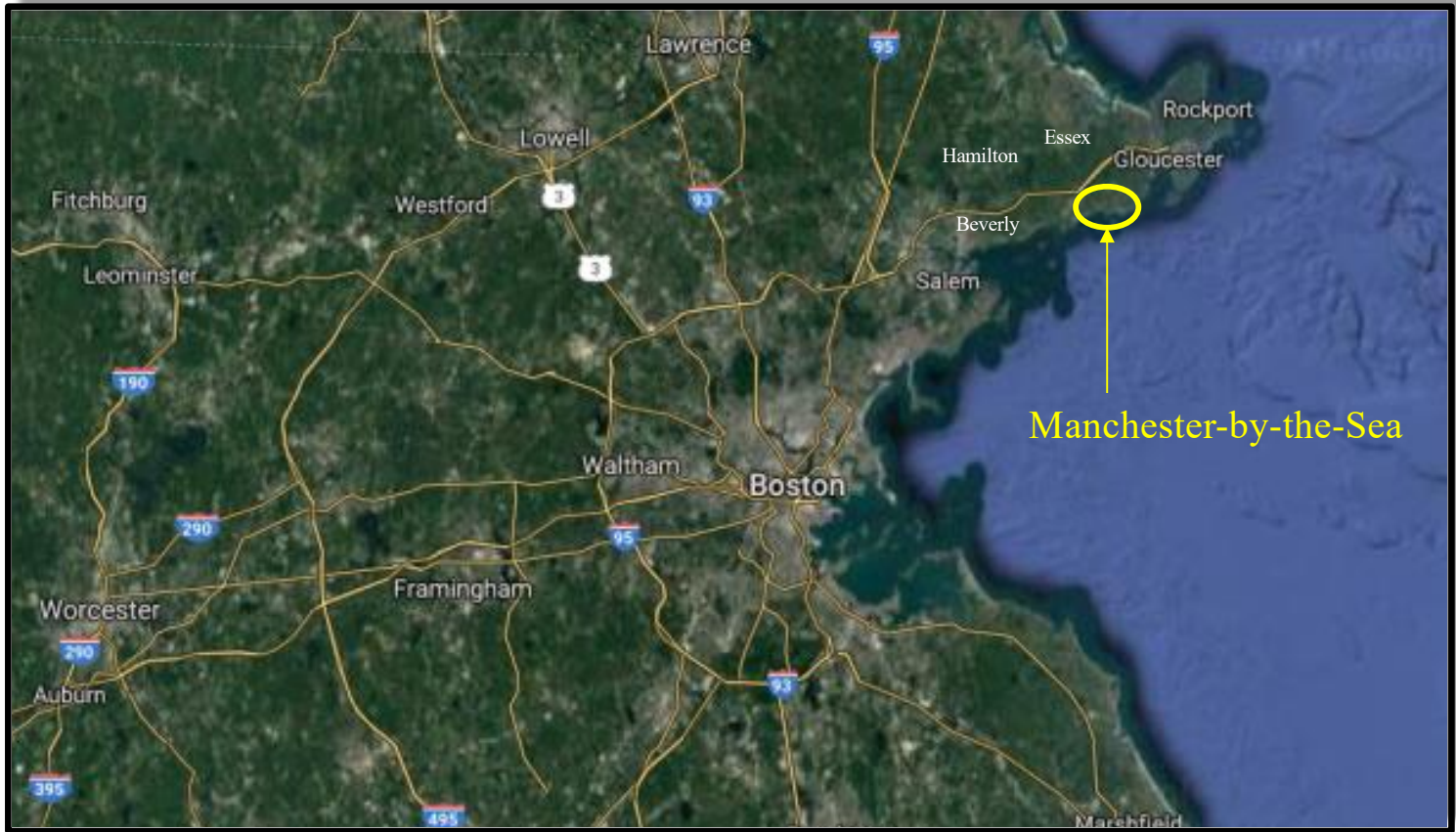
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## Presentation Overview

- Manchester-by-the-Sea collection system
- History of collection system investigations
- 2016 Salinity metering
- Investigation and identification of tidal sources
- Tidal source repairs
- 2018 Salinity metering
- Planned improvements to Harbor Loop sewer



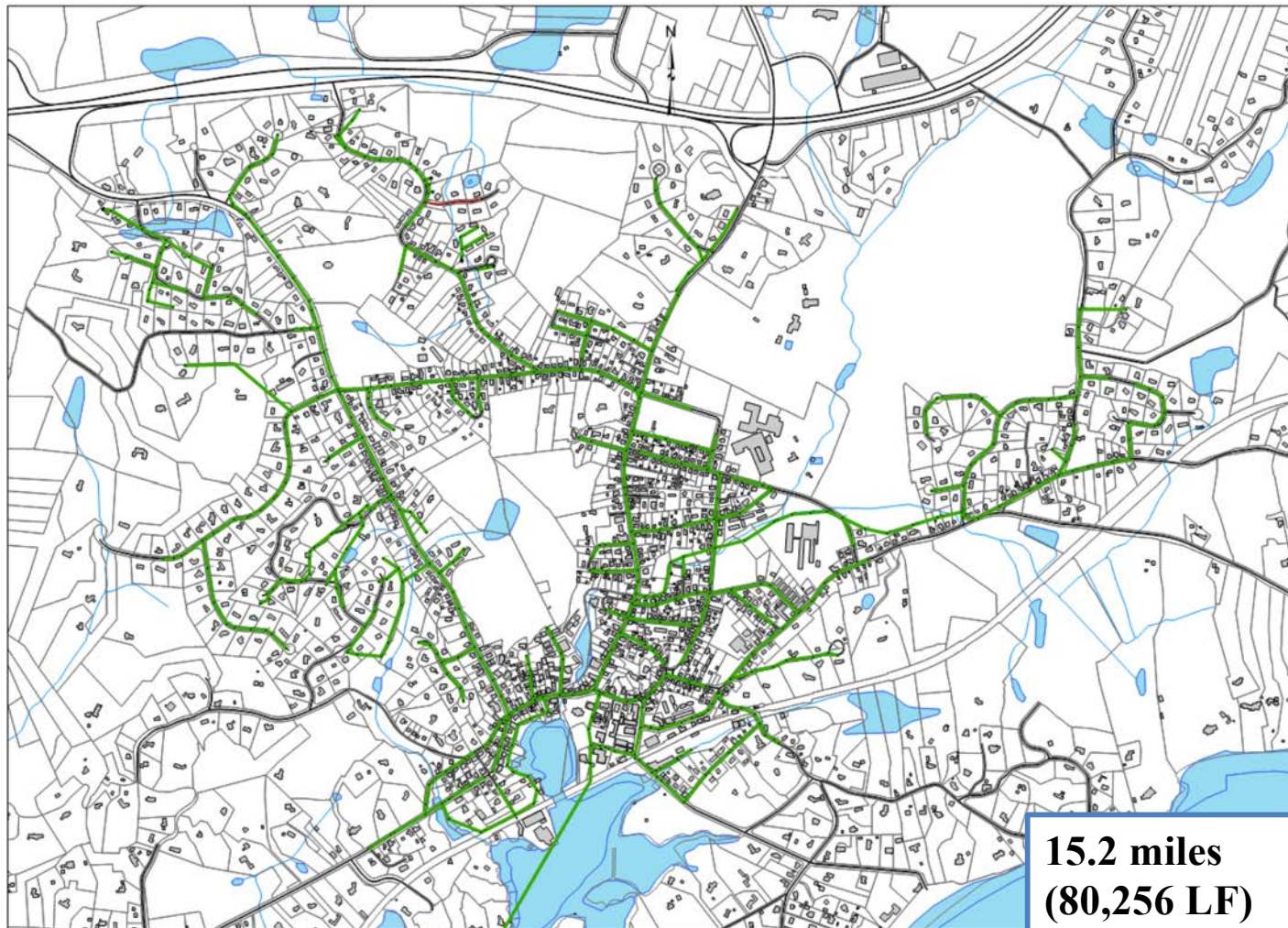
# Manchester-by-the-Sea



# Manchester-by-the-Sea WWTF



# Manchester-by-the-Sea Collection System



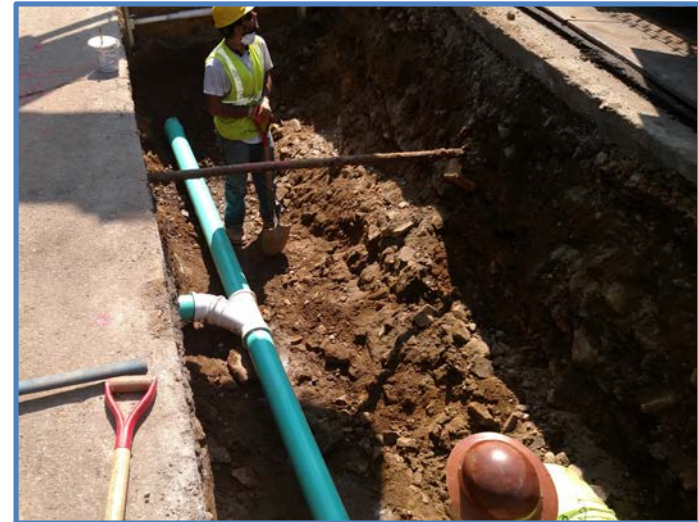


## Collection System Investigations

- 2013 Flow metering program and I/I Analysis
- 2013 and 2015 Smoke testing and dyed water flooding
  - 78,000 LF Tested (97%)
- 2014-2016 Manhole inspections
  - All Manholes in collection system have been inspected
- 2014-2017 CCTV inspections
  - Over 30,000 LF of CCTV completed (37%)

# 2014-2017 Sewer Rehabilitation

- 15,000 LF Sewer Lining
- 550 LF Pipe Replacement
- Over 100 MH Rehabilitations

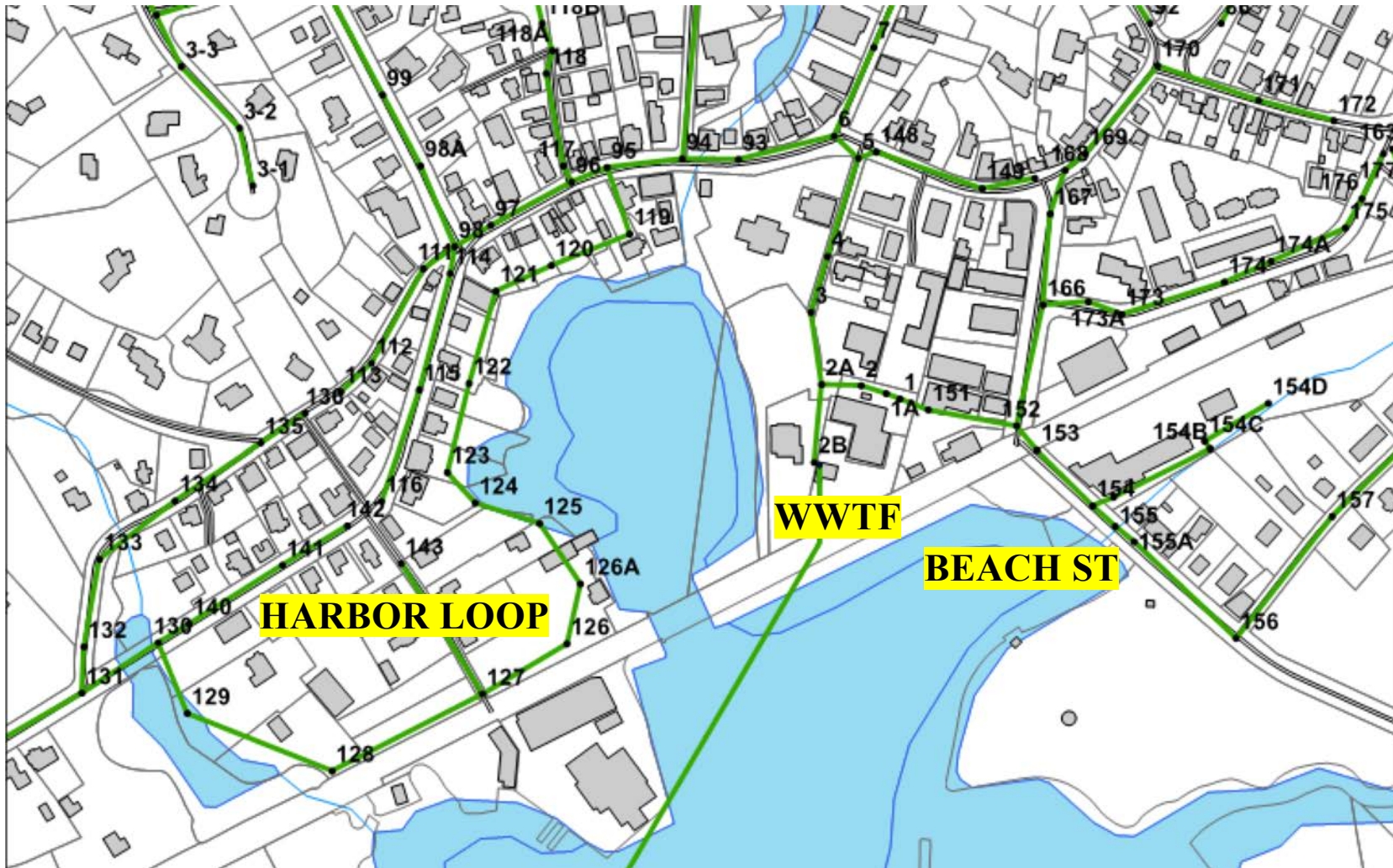




# Impacts of Tidal Intrusion at WWTF



# Shoreline Collection System



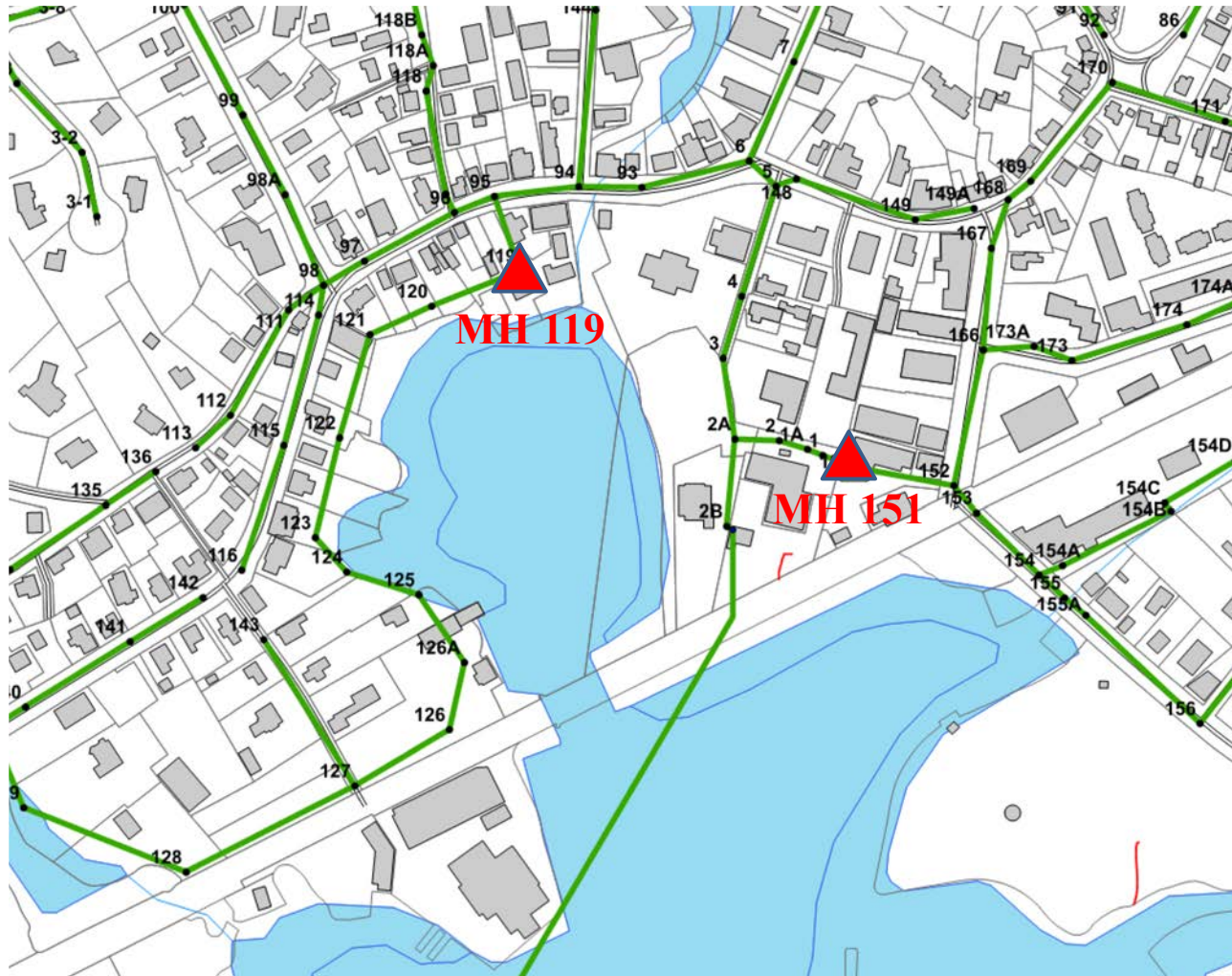
# Harbor Loop



# Beach Street

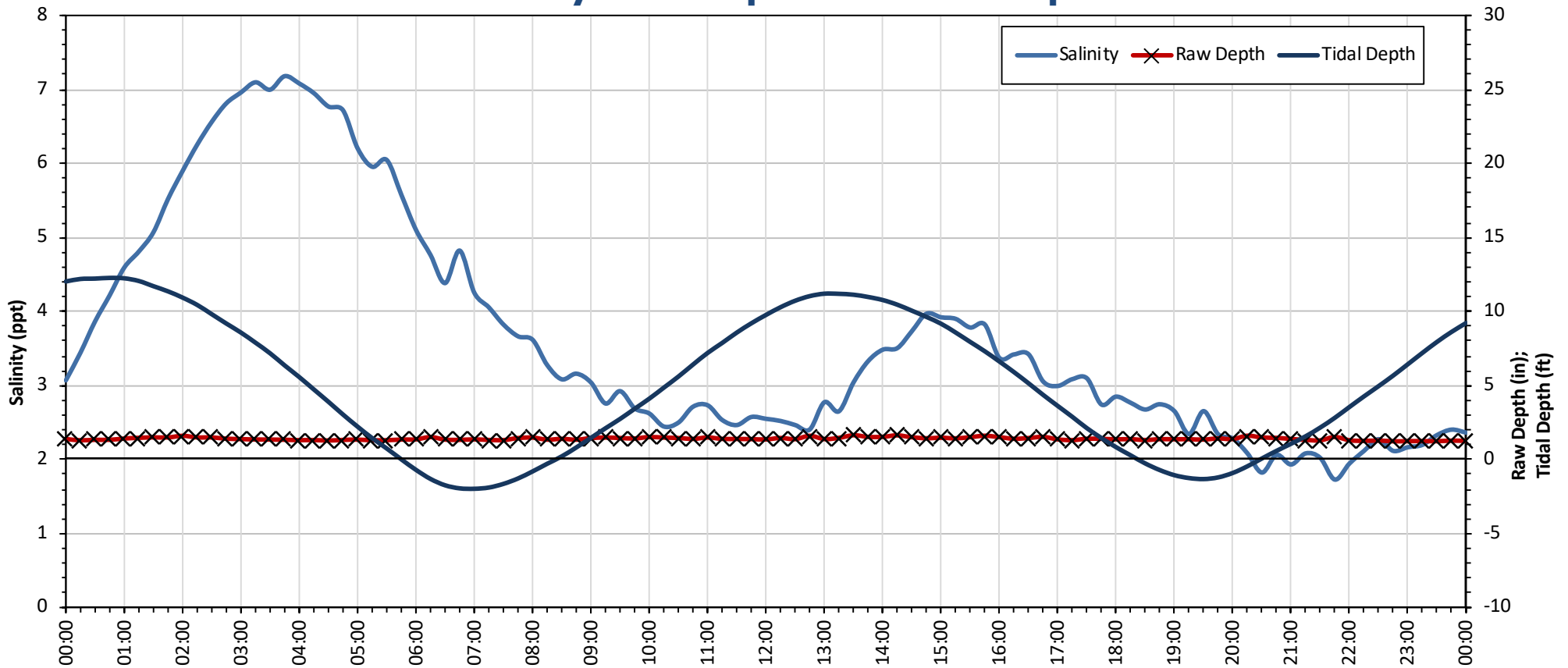


# 2016 Salinity Metering



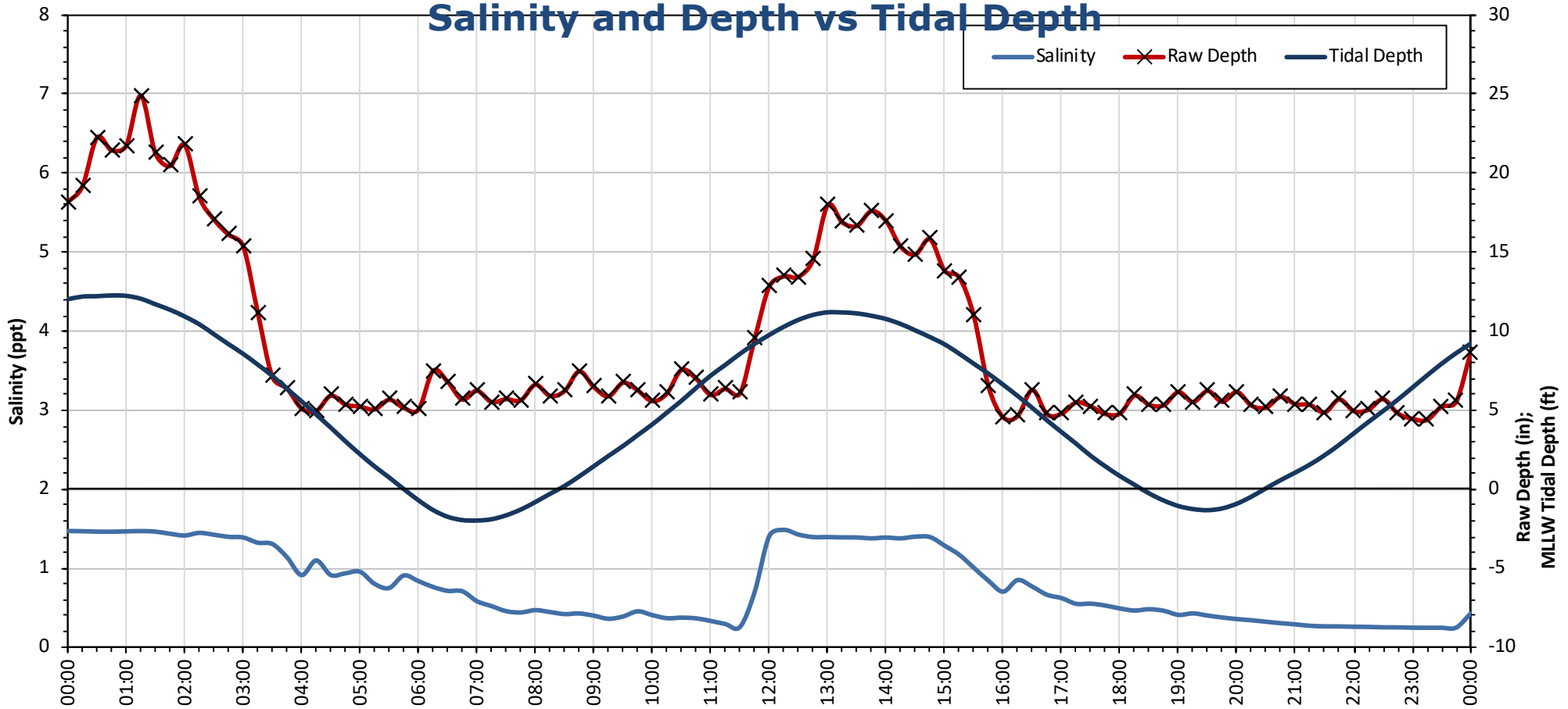
# MH 151 (Beach Street) April 10, 2016 – Spring Tide

## Salinity and Depth vs Tidal Depth



# MH 119 (Harbor Loop) April 10, 2016 – Spring Tide

## Salinity and Depth vs Tidal Depth





## 2016 Salinity Metering Program Conclusions

- Harbor Loop
  - Flow Depth increases as tidal height increases
  - Impact seen at approximately 8.5 ft tidal height
  - > Suspected Tidal Inflow Source
- Beach Street
  - Salinity increases as tidal height increases
  - Salinity increase generally lags tidal height increase
  - Impact greater when tidal height reaches approximately 10 ft
  - > Suspected Tidal Infiltration Source



# Tidal Source Investigation and Identification



# Beach Street CCTV Investigation Results



November 2015

# Beach Street Tidal Infiltration Source

- Downstream of MH 155A
- Estimated Flow: 2,900 gpd
- Repaired in March 2017.



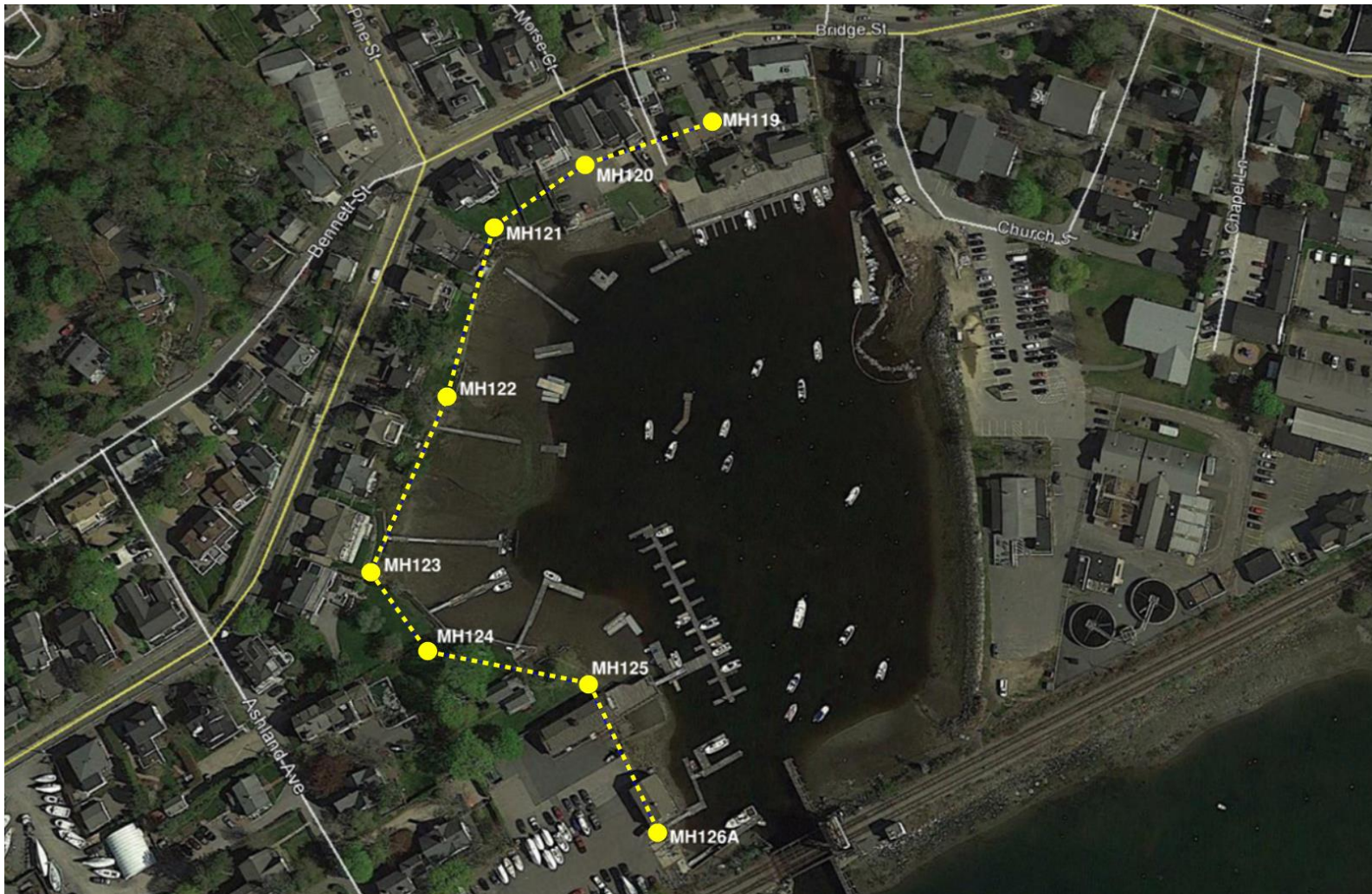
# Beach Street Repair March 2017



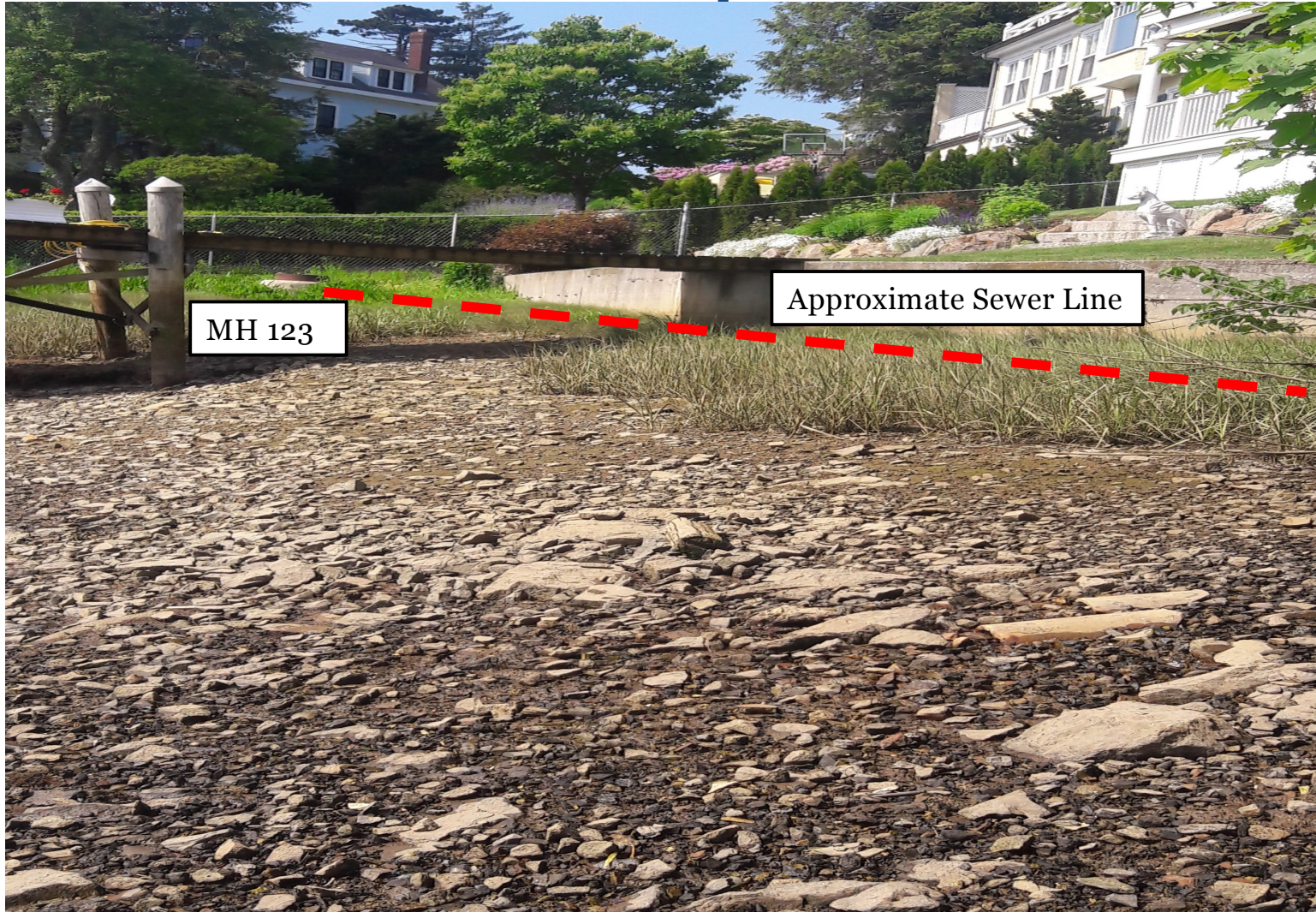
- Emergency Contract
- DI section with Himax couplings



# Harbor Loop Tidal Source Investigations



# Harbor Loop Sewer

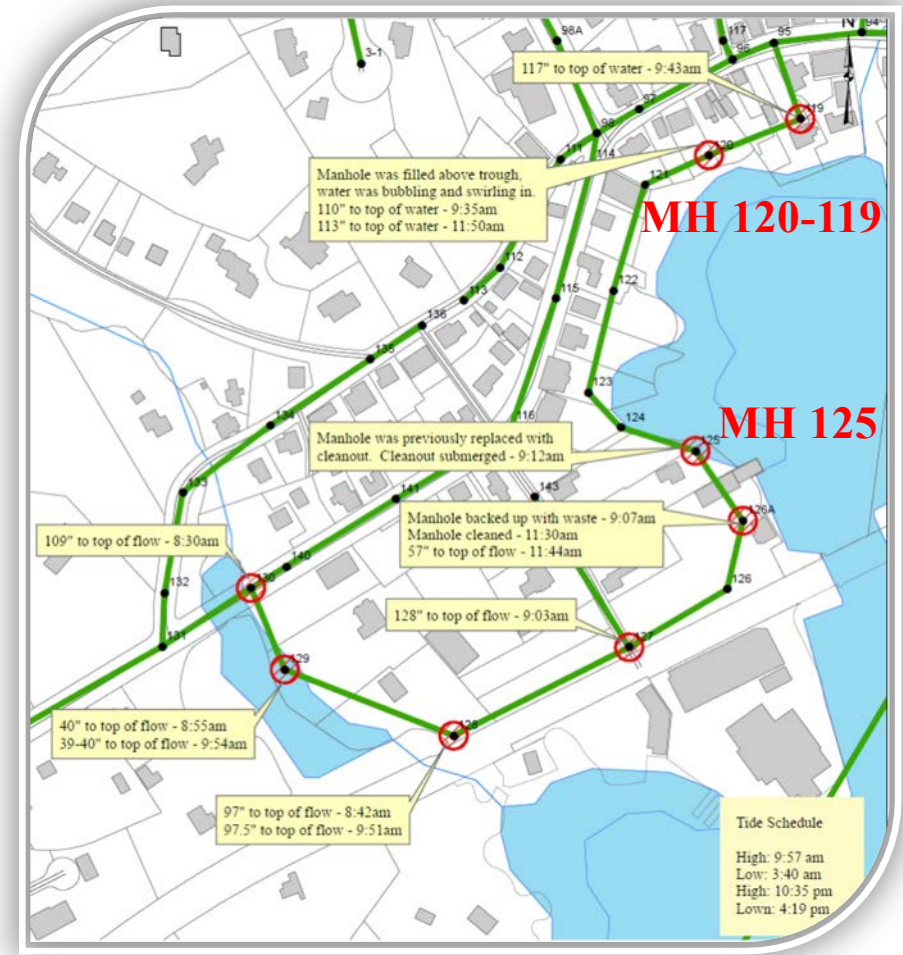


# Harbor Loop Tidal Source Investigations

## December 2016 Harbor Loop

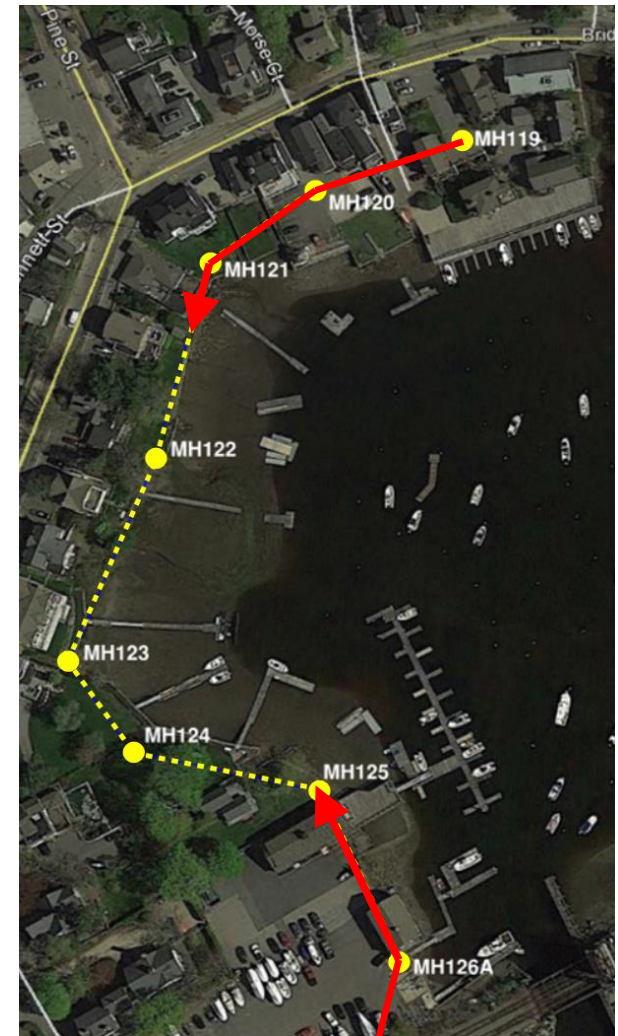
Visual and depth measurements taken before, during, after high tide.

- Results
  - Depth of flow observed to increase during high tide MH's 119-120
  - No significant change in depth of flow upstream of MH 125.
- Recommended CCTV – Low Tide



# Harbor Loop CCTV Investigations

- CCTV work unable to be completed
  - Heavy build-up in sewer between MH 121 and 122.
  - No access to MH 125 to guide CCTV through MH
- New Custom Manhole Installation



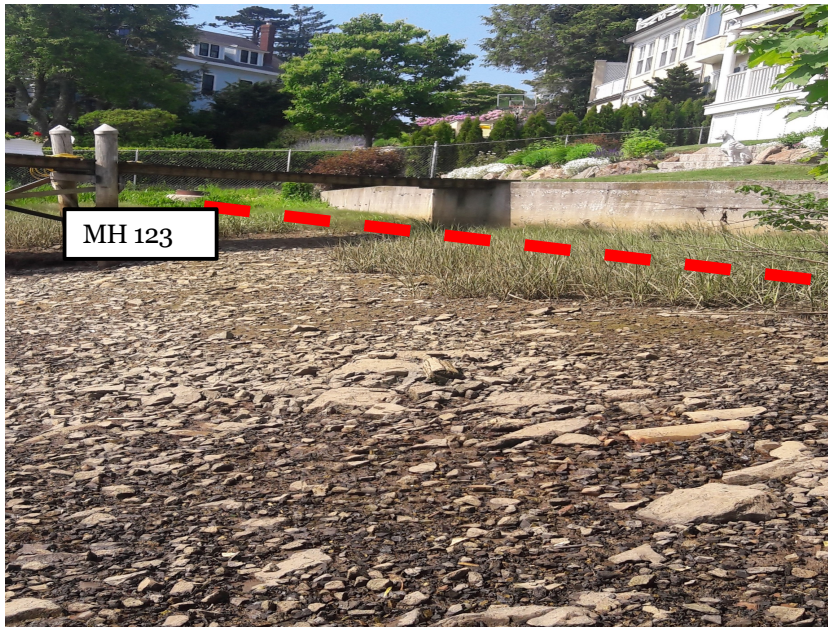


# New Manhole Installation

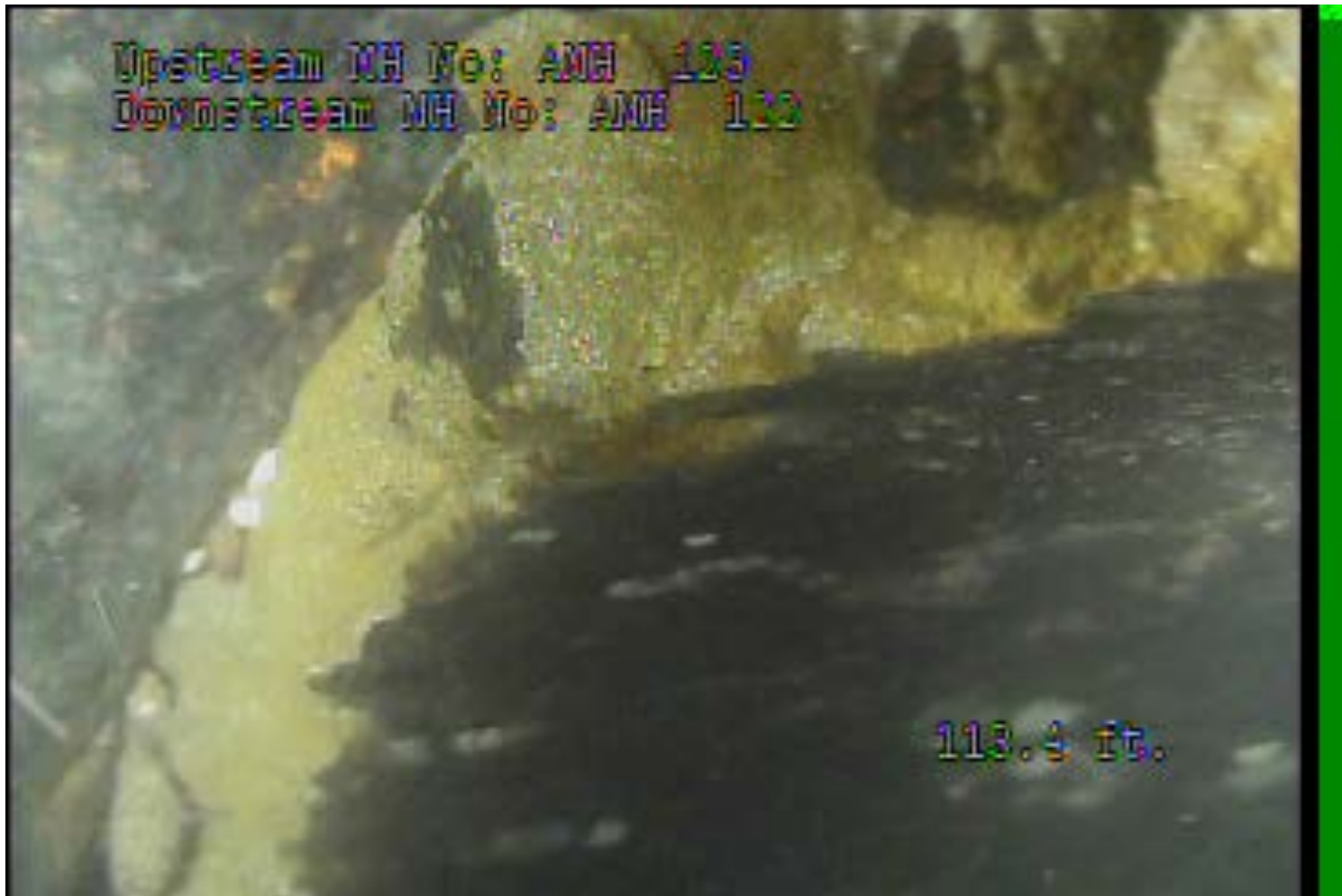


# CCTV Identified Pipe Break

- 8" CI Pipe Located between MH 122 and 123 @ 112'
- Seaweed visible



# CCTV Harbor Loop Pipe Break





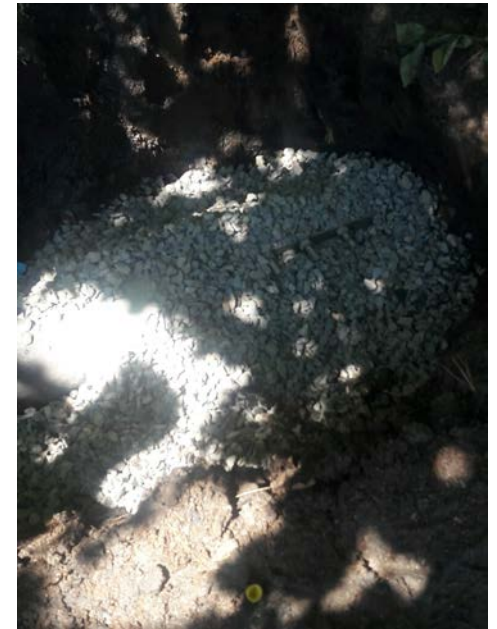
## Emergency Repair

- Meeting with Town – 9/26/17
  - Emergency Permit 9/27/17
- Emergency Repair – 9/28/17
  - Hand dug about 2' below surface
  - 6' DI pipe with cast fittings on each side
  - Cast Iron Pipe broken upon installation-downstream end
    - 2 Stainless Steel wraps used for temporary fix
      - Pipe condition, materials available, limited time - tide

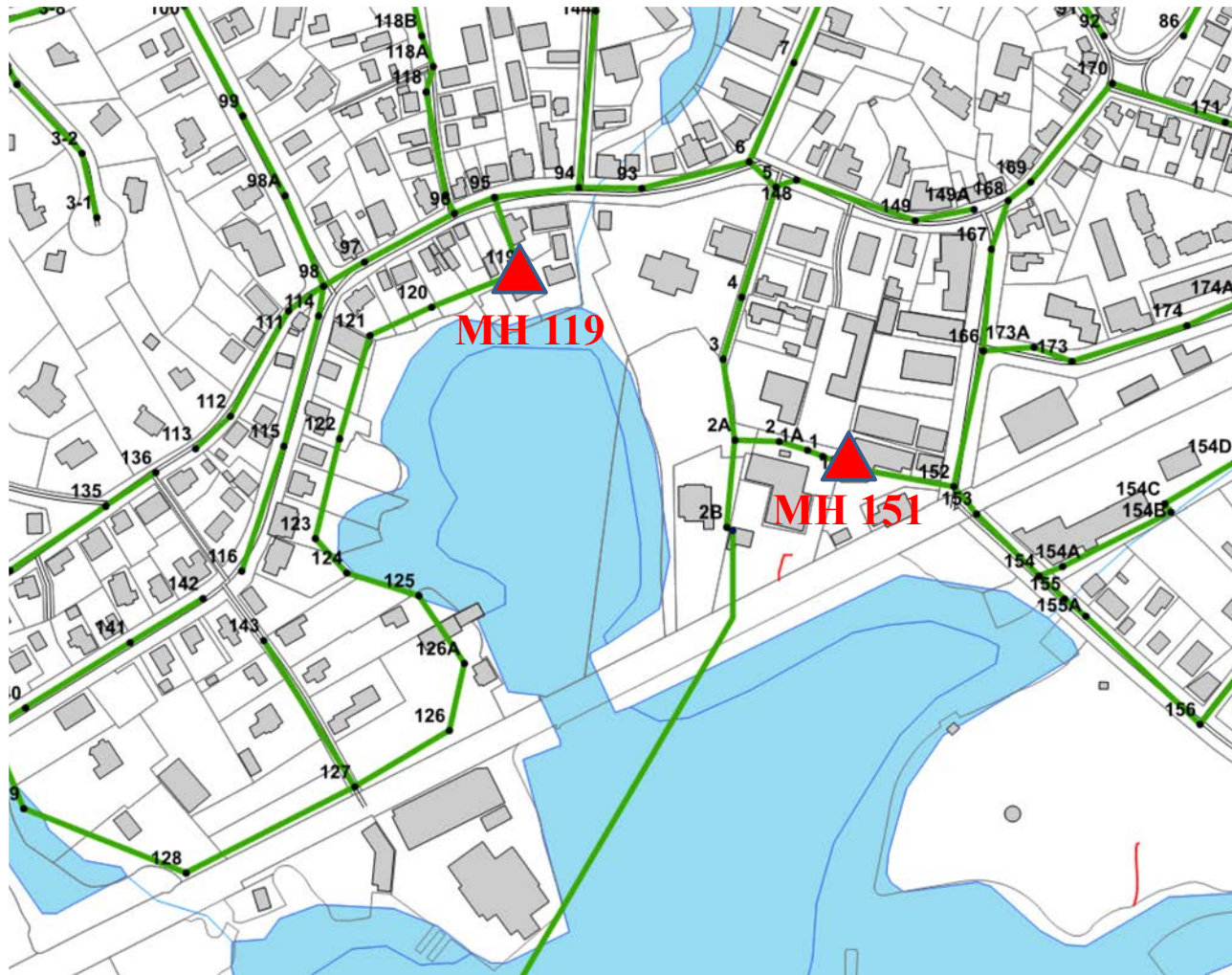
## Results

- Following day plant reported an approx. 55,000 gpd decrease in Flow. ( 23%) From 239,000 to 184,000.

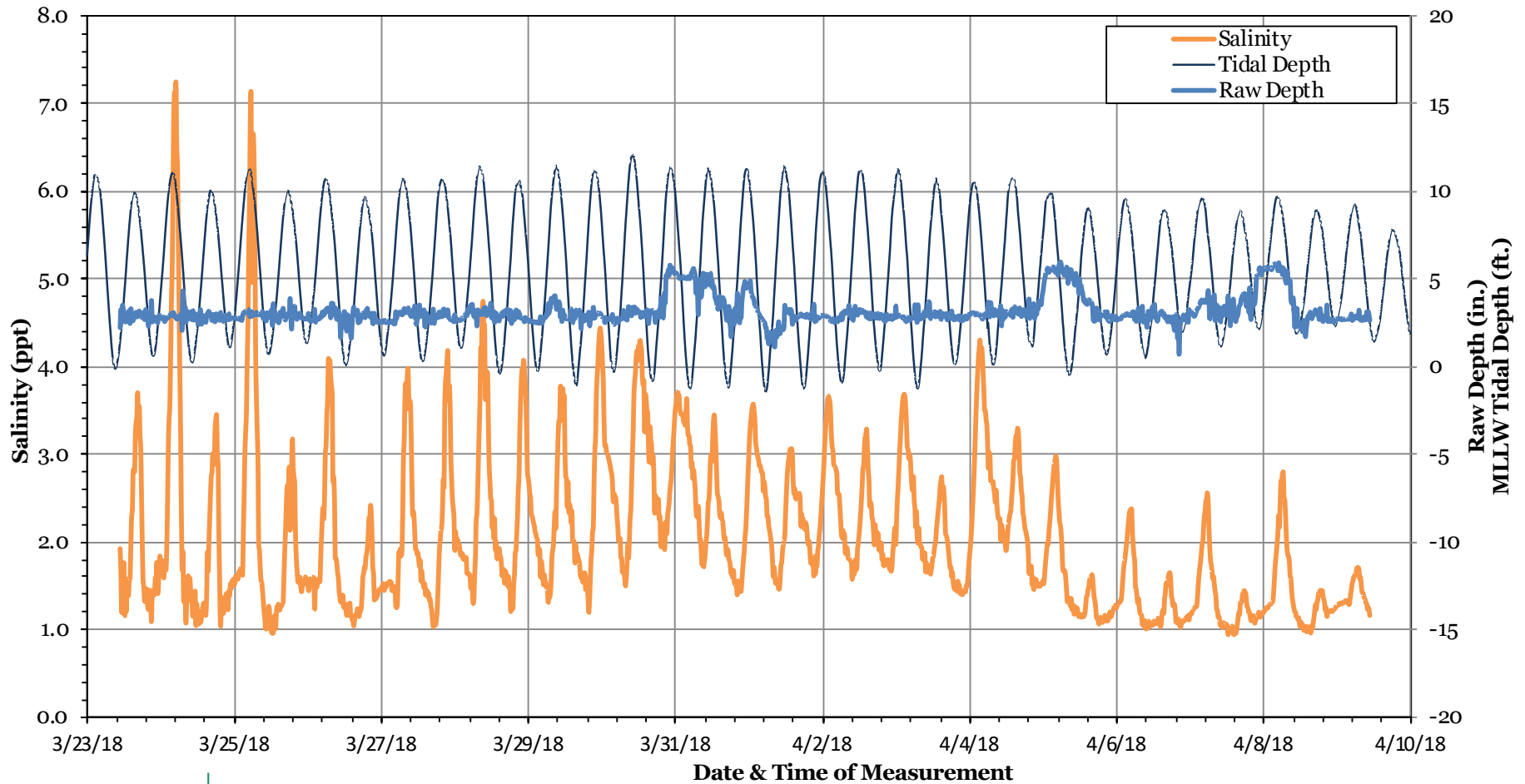
# Harbor Loop Repair



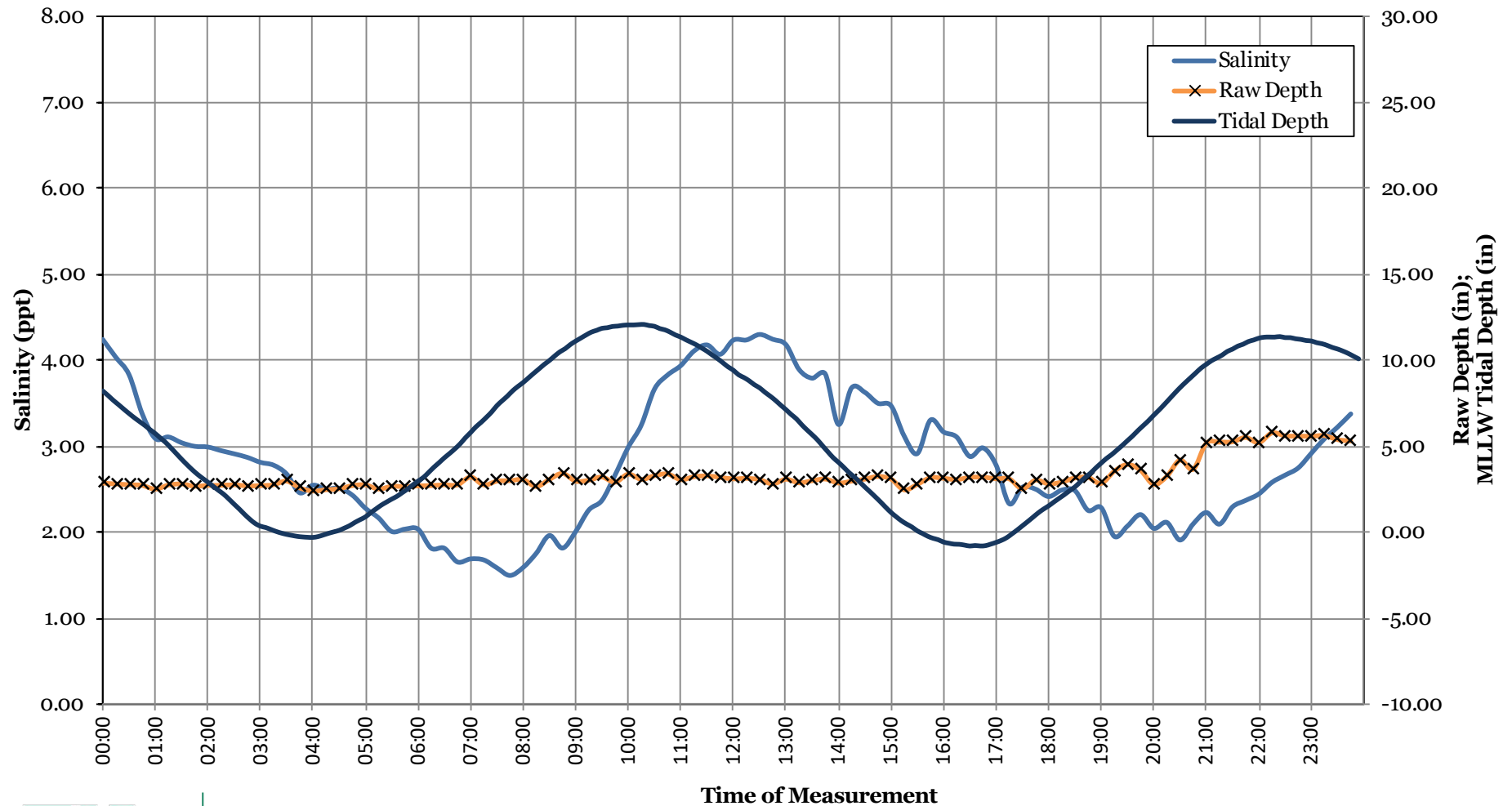
# 2018 Post Repair Salinity Metering



# MH 151 (Beach Street) 2018 Salinity Observed during High and Low Tide Events

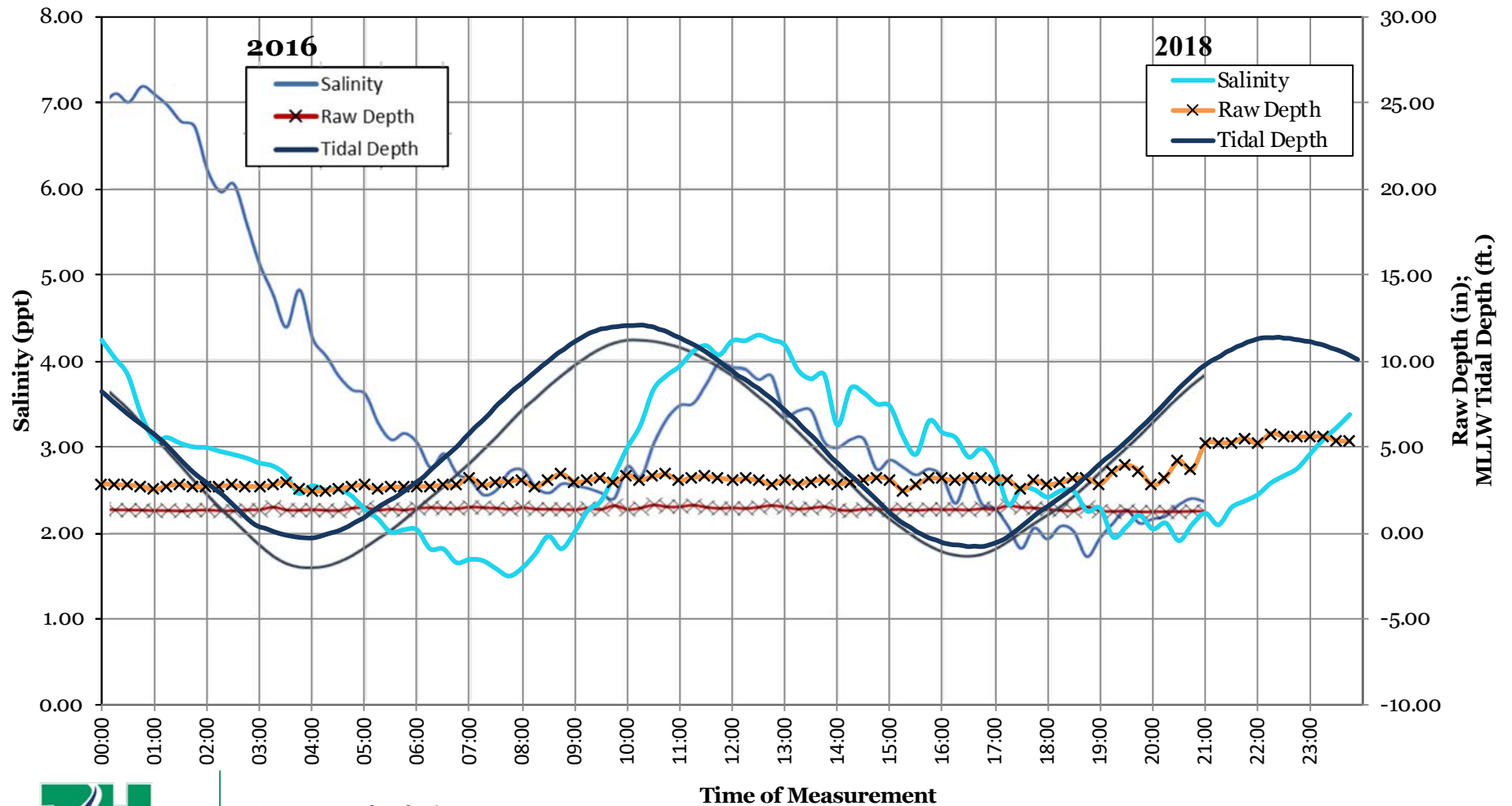


# MH151 (Beach Street) March 30, 2018 – Spring Tide Salinity and Depth vs Tidal Depth

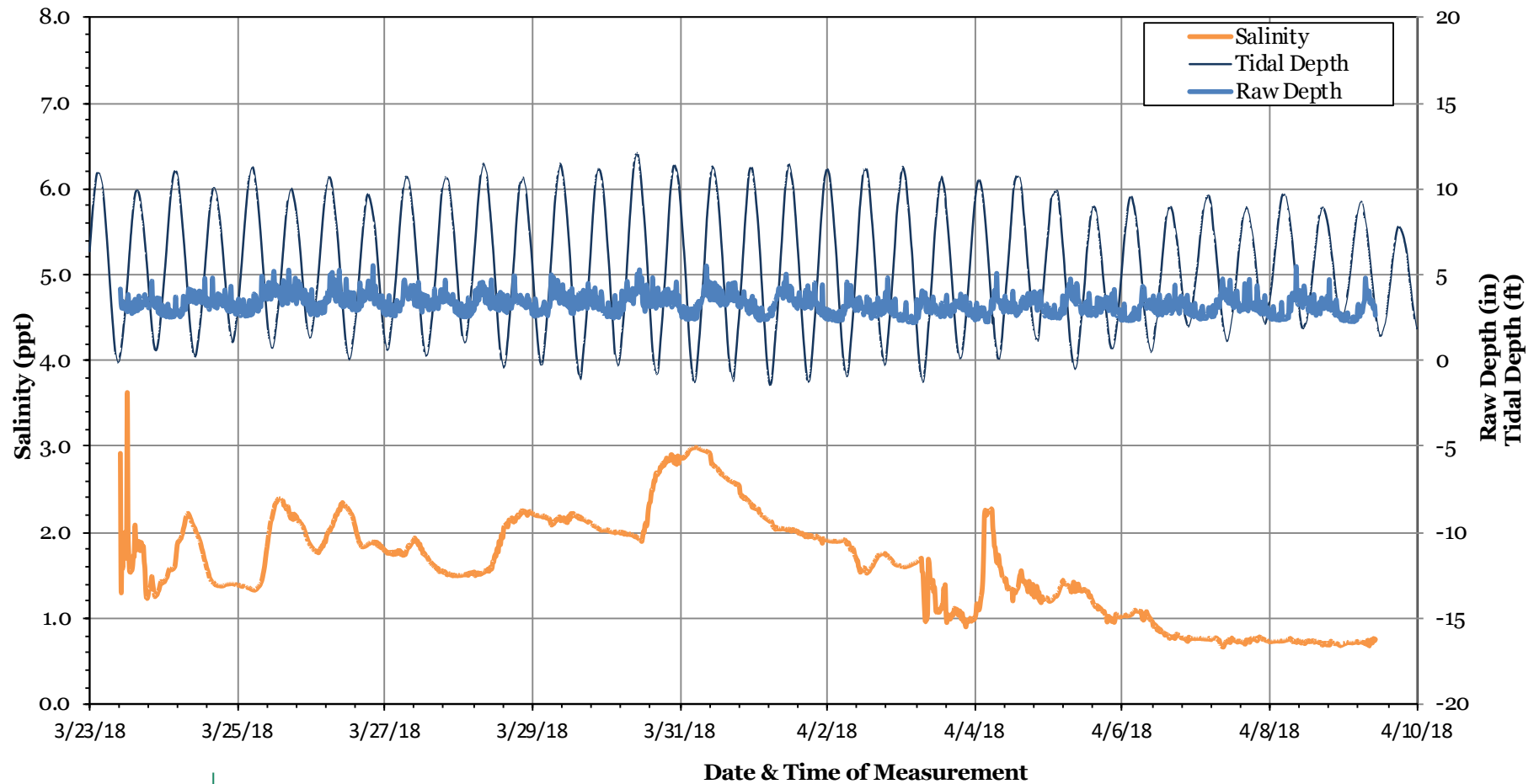




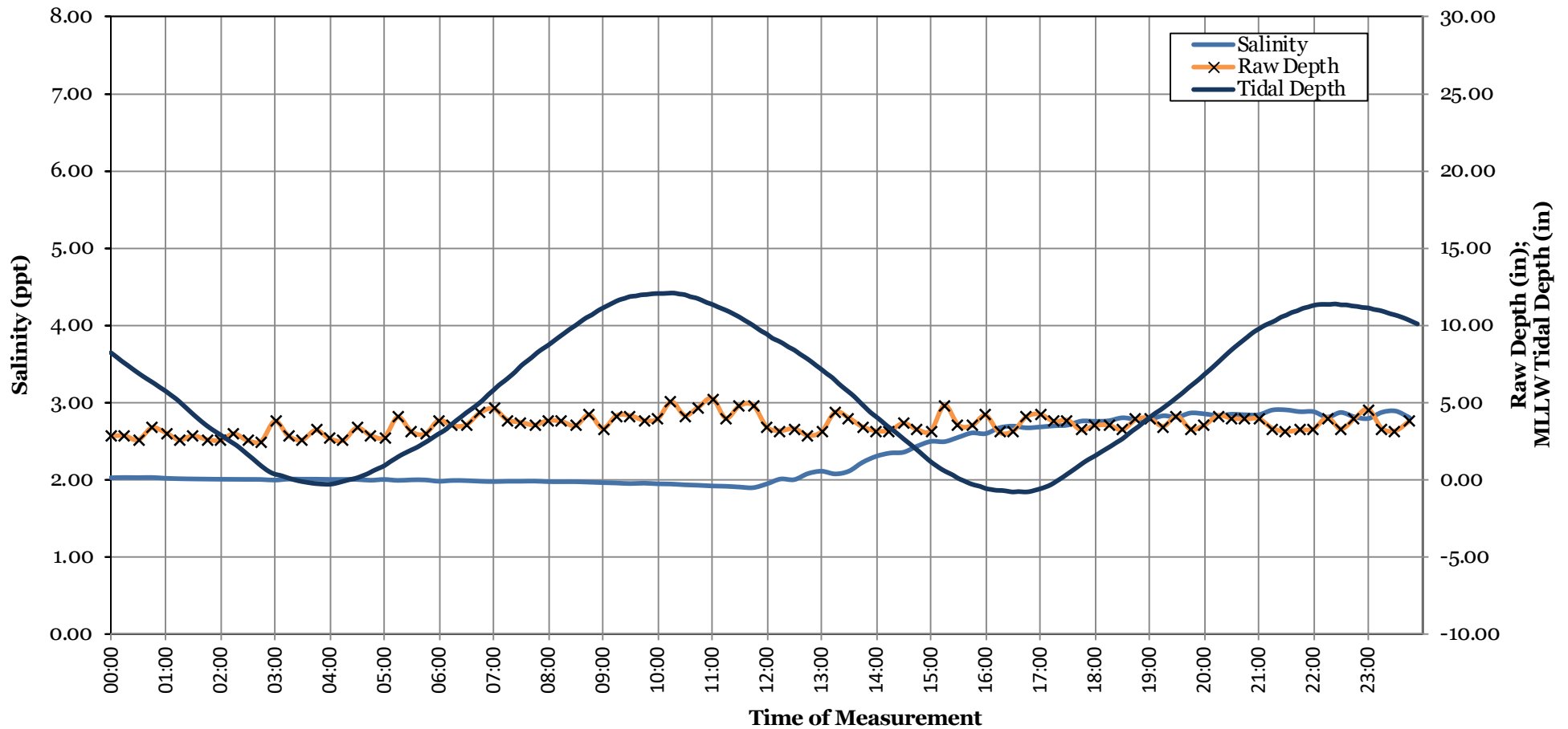
# 2016 vs. 2018 Spring Tide MH 151 (Beach Street)



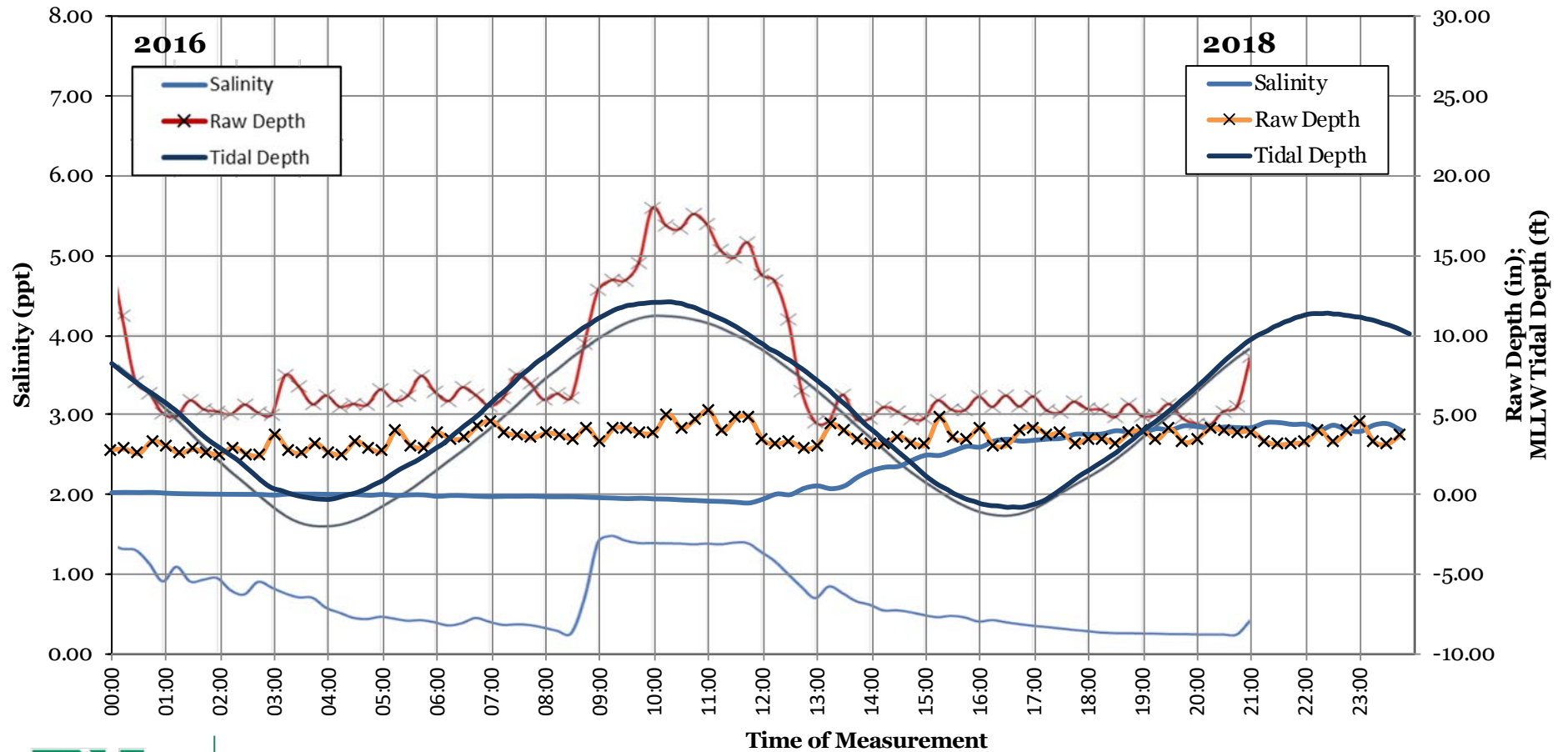
# MH 119 (Harbor Loop) 2018 Salinity Observed during High and Low Tide Events



# MH119 (Harbor Loop) March 30, 2018 – Spring Tide Salinity and Depth vs Tidal Depth



# 2016 vs. 2018 Spring Tide MH 119 (Harbor Loop)





# Harbor Loop Repair Concepts

- Pipe Lining
  - MH 123 to MH 121 as minimum
- Pump Station
  - Divert flow from Harbor Loop sewer and pump to sewer on Bridge Street
  - Individual Grinder Pumps to serve homes

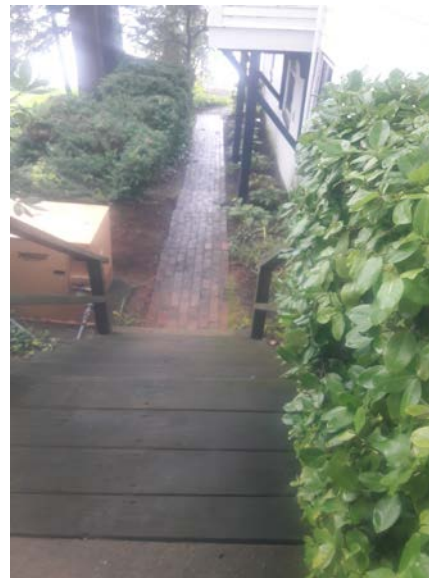
# Homeowner meeting and Home inspections

- Homeowner Meetings
  - Not in favor of grinder pumps
  - Concerns with impacts to property
  - Generally preferred sewer lining option
- Homeowner Inspections
  - Inspected service location and depth
  - Surroundings/obstacles in back yard's
  - Grinder Pump piping locations
- Notable Observations
  - Difficulty of installing grinder pump pressure sewer



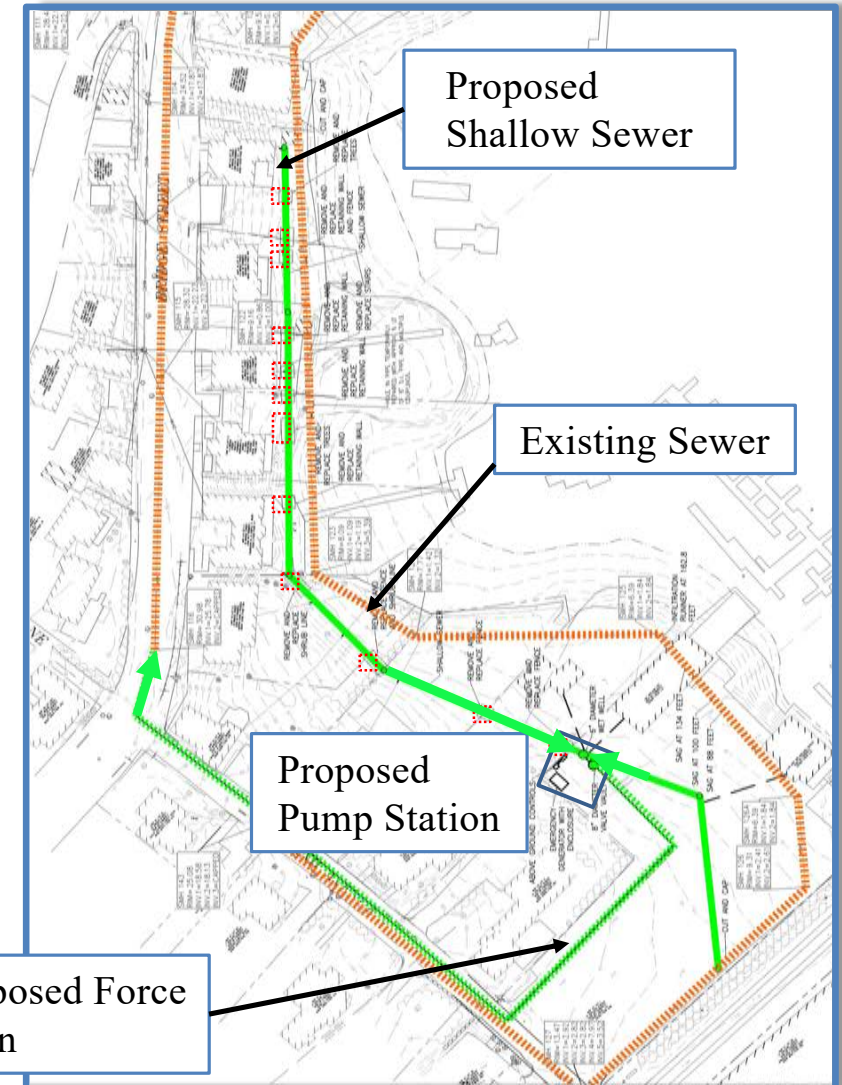
# Grinder Pump Issues

- 7 to 10 foot retaining walls to connect to Bridge Street
  - Possibility of encountering ledge
- Repair to homes/structures/landscaping
- Significant added costs compared to typical grinder installation



# Pump Station Shallow Sewer Alternative

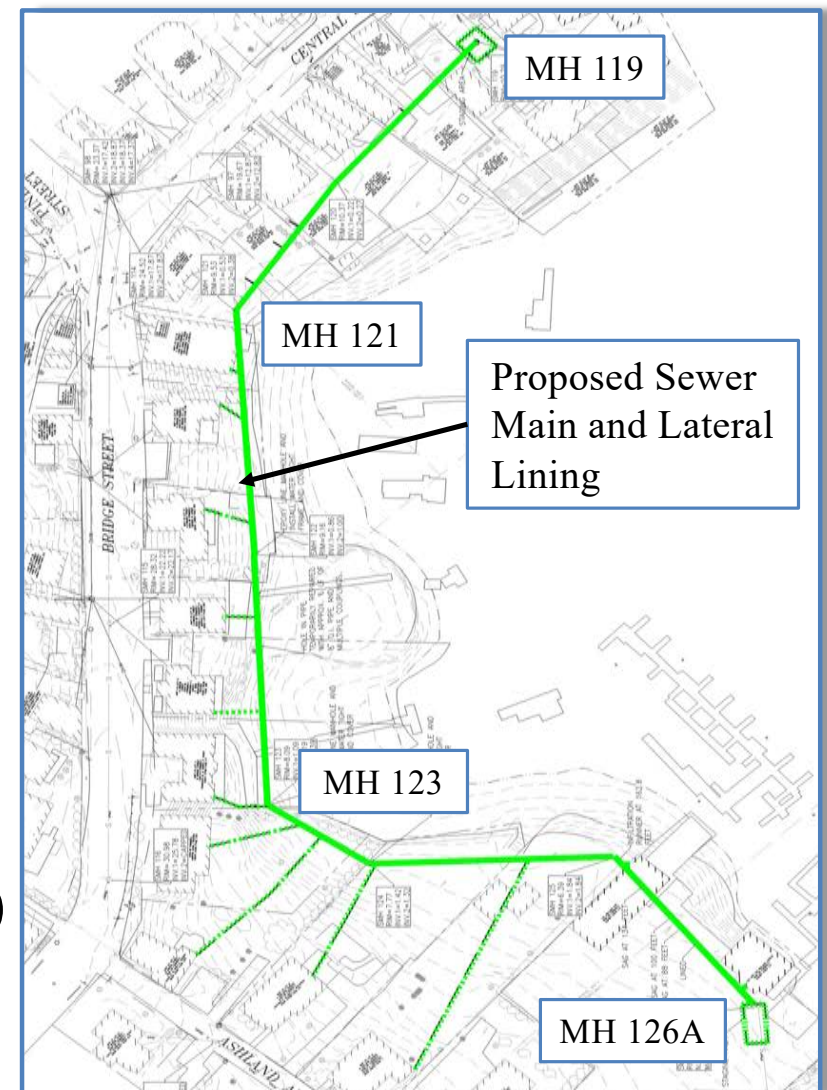
- Shallow sewer through backyards
  - Sewer ~ 4 ft above existing
  - Existing Sewer MH 121 - MH 119 to remain
- Numerous Property impacts
  - fencing, decks, retaining walls, and landscaping
- Significant Disruption to Homeowners
- Pump Station
  - Boat Yard property
  - Land Acquisition, Easements
- More costly than lining





# Sewer Lining

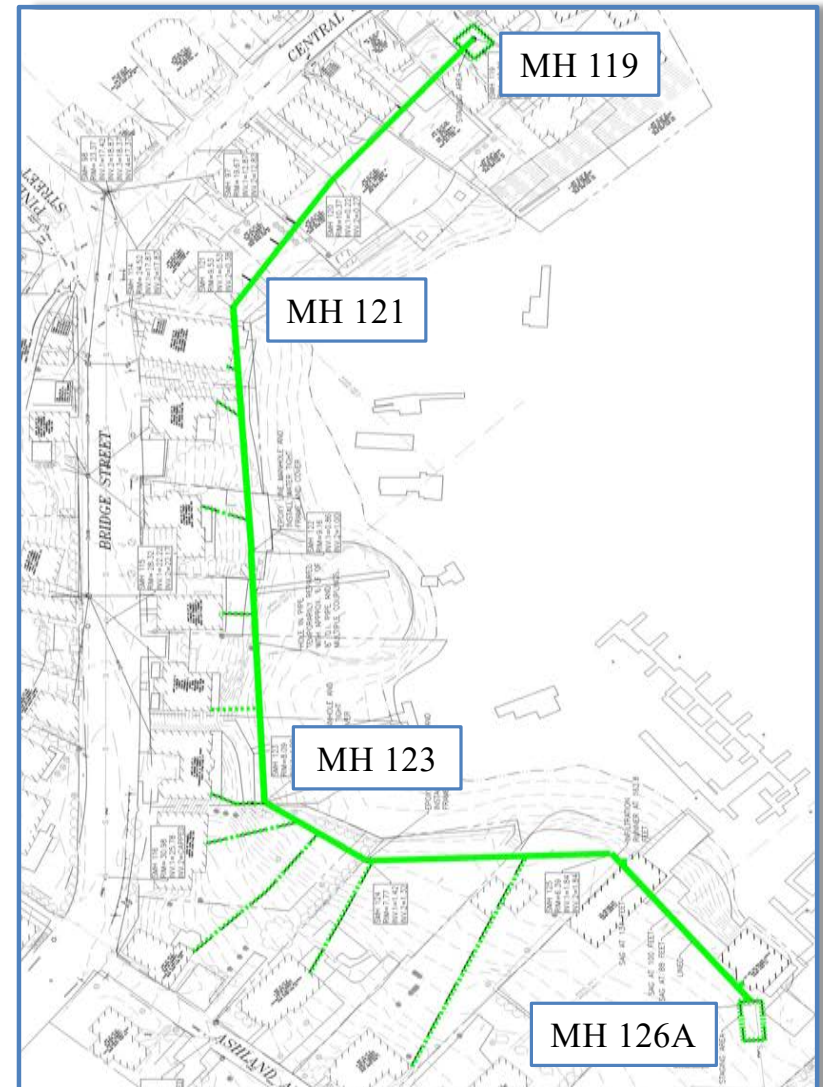
- Access Issues MH121 to MH123
  - Extend Lining to MH 126A
- Pipe Condition
  - Light Cleaning
  - Water inversion, Hot water cure
    - Less Efficient, longer cure
- Concerns
  - Finished pipe takes shape of existing pipes (sags, imperfections)



# Planned Harbor Loop Sewer Repair Project

- Sewer Lining of entire sewer from MH126A to MH 119
  - Light cleaning
  - Water Inversion with Hot Water Cure
- Full service lateral lining
- Manhole Rehabilitation
  - Watertight frames and covers
  - Raise MH 123 above tide level

Schedule: Spring/Early Summer 2019





## Summary

- Continuous Salinity Metering program was very useful in characterizing tidal intrusion.
- Locating and identifying tidal intrusion sources proved to be challenging.
- Repair of broken pipe in Harbor Loop was successful, confirmed by post-repair Salinity Metering.
- Town of Manchester-by-the-Sea continues to address and correct deficiencies in their collection system.



# Questions?

