CLIMATE CHANGE IMPACTS TO WASTEWATER INFRASTRUCTURE

Southington and Ipswich Wastewater Resiliency Projects Features

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NEWEA 2022 Spring Meeting & Exhibit, May 23, 2022

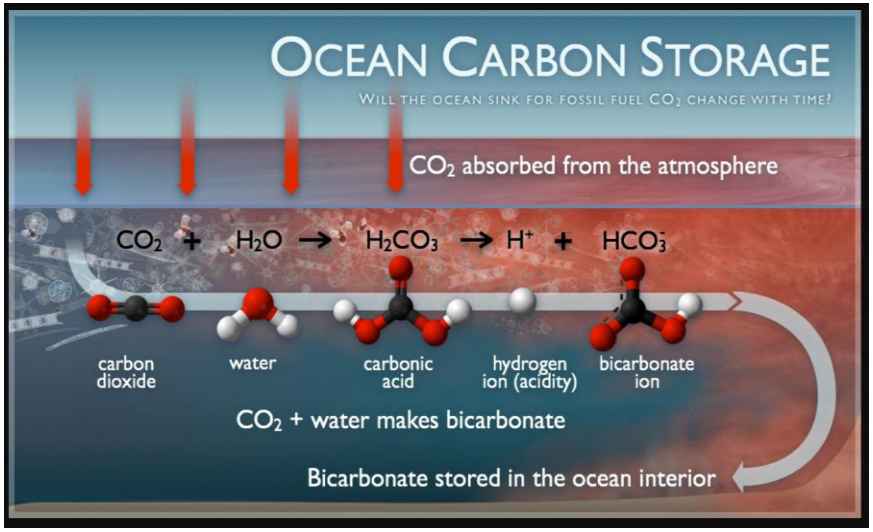
Tighe&Bond

AGENDA

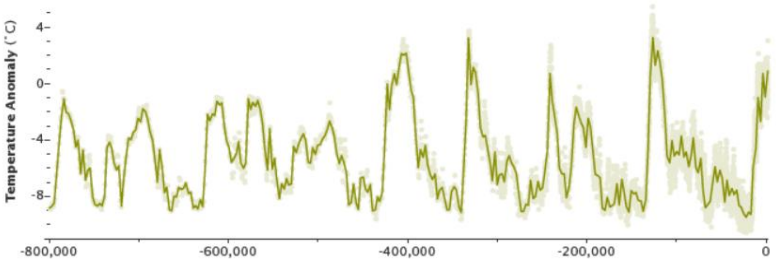
- **Climate Change**
- **Wastewater in Southington**
- **Ipswich**
  1. PS Flood Proofing versus Relocation
  2. Collection System Resiliency
  3. H&H Analysis For Substrate and Rock Bank Sizing
  4. Biostabilization

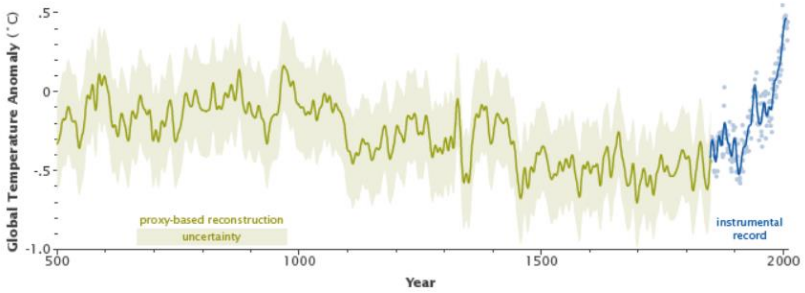
CLIMATE CHANGE

- **Natural & Anthropogenic Drivers**
  - Changing Storms
  - Rising Sea Levels
  - Ocean Acidification
    - CO_2 Absorption
      1. Diffusion from atmosphere
      2. More Photosynthesis in plankton and algae
- **Temperature**



https://www.pmel.noaa.gov/co2/files/pmel-research.004.jpg

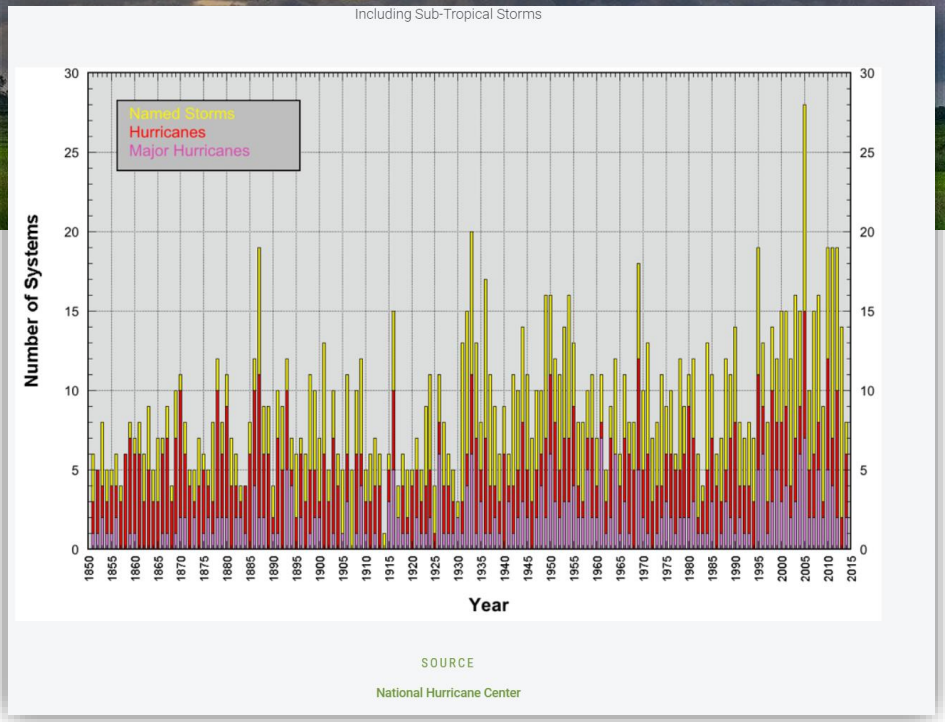




https://earthobservatory.nasa.gov/features/GlobalWarming/page3.php#:~:text=As%20the%20Earth%20moved%20out,ice%2Dage%2Drecovery%20warming.

CLIMATE CHANGE

- **Weather Events**
  - More Frequent
  - More Intense
- **Hurricanes Changing**



Why?

- Warmer Seas
- Sea Level Rise
- Shifting Poles

Impacts:

- Increase of Category 4 & 5
- Wind Speeds up 10%

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IMPACTS TO WASTEWATER

- **Collection System**
  - Inflow
  - Access
- **Pump Stations**
  - Access
  - Capacity
  - Structural Damage
  - Communication Damage
- **Wastewater Treatment Plants**
  - Access
  - Capacity
  - Structural Damage
  - Communication Damage
  - Impacts to temperature sensitive processes
    - Aeration Basins
    - Biological Changes

IMPACTS TO WASTEWATER AT PLANT

- **Southington Water Pollution Control Plant**

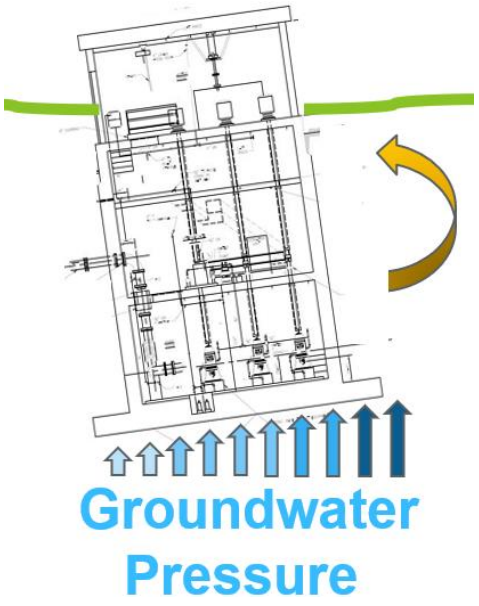
PUMP STATIONS: STRUCTURAL CONCERNS

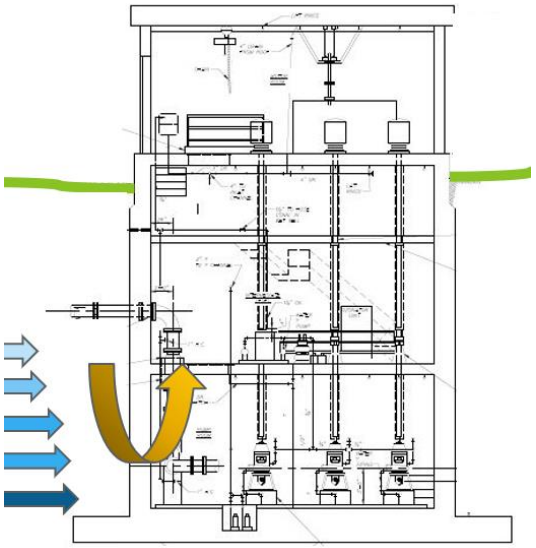
Updated:

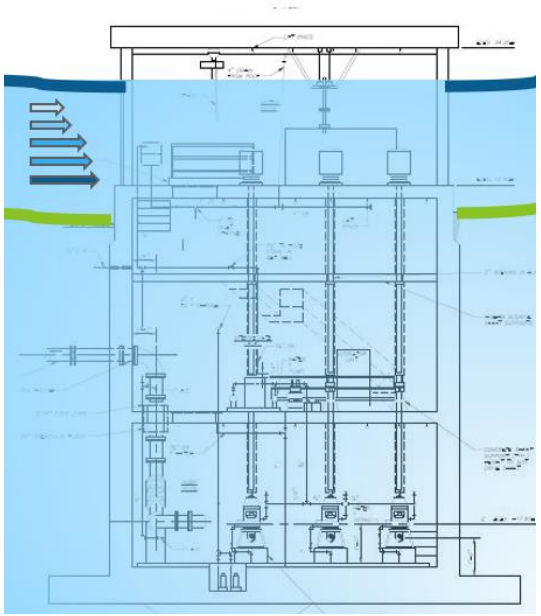
1. Codes 2. Rising Flood Elevations 3. Material Strength

Caused structural concerns:

1. Buoyancy 2. Below Grade Strength 3. Above Grade Strength

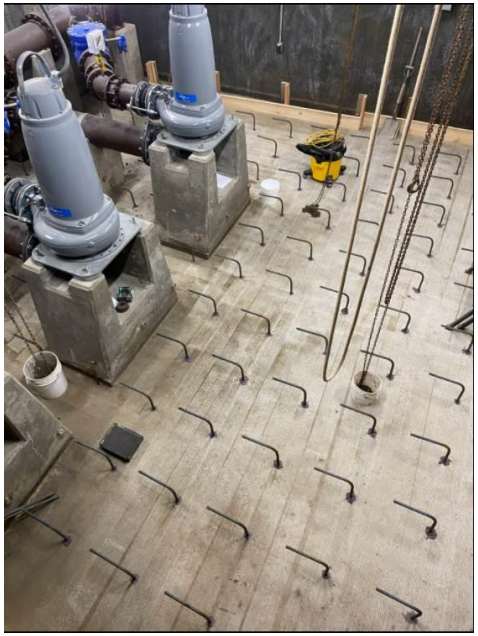






OPTIONS TO RESOLVE STRUCTURAL ISSUES

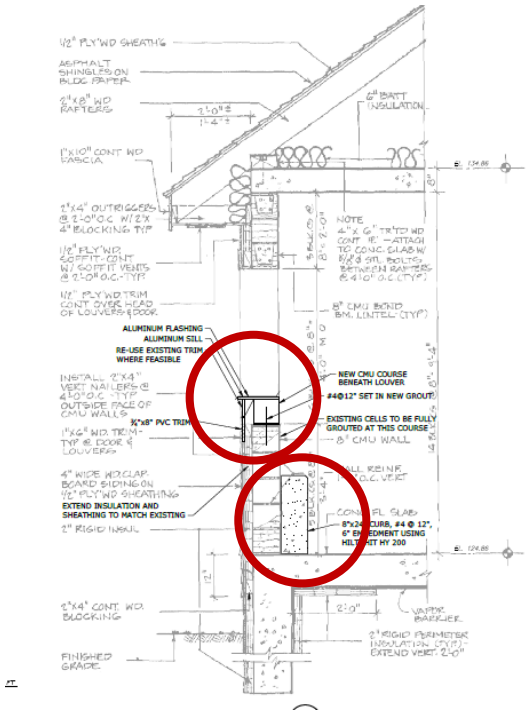
To Counteract Buoyancy: Pilasters; Micropiles; Bottom Mats

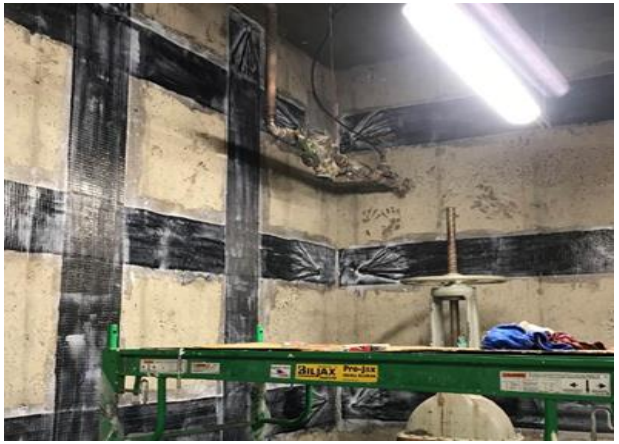


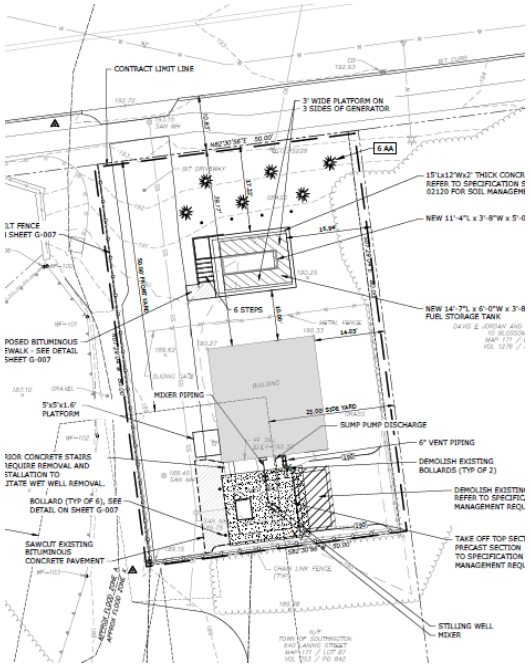
OPTIONS TO RESOLVE STRUCTURAL ISSUES

Hardening:

Reinforce; Replace; Protect







OPTIONS TO IMPROVE RESILIENCY

Raise Generators

- Fill ports and Fuel Storage requirements

Dry Pit Submersible Equipment

-Panels out of flood area

-No splices in wiring

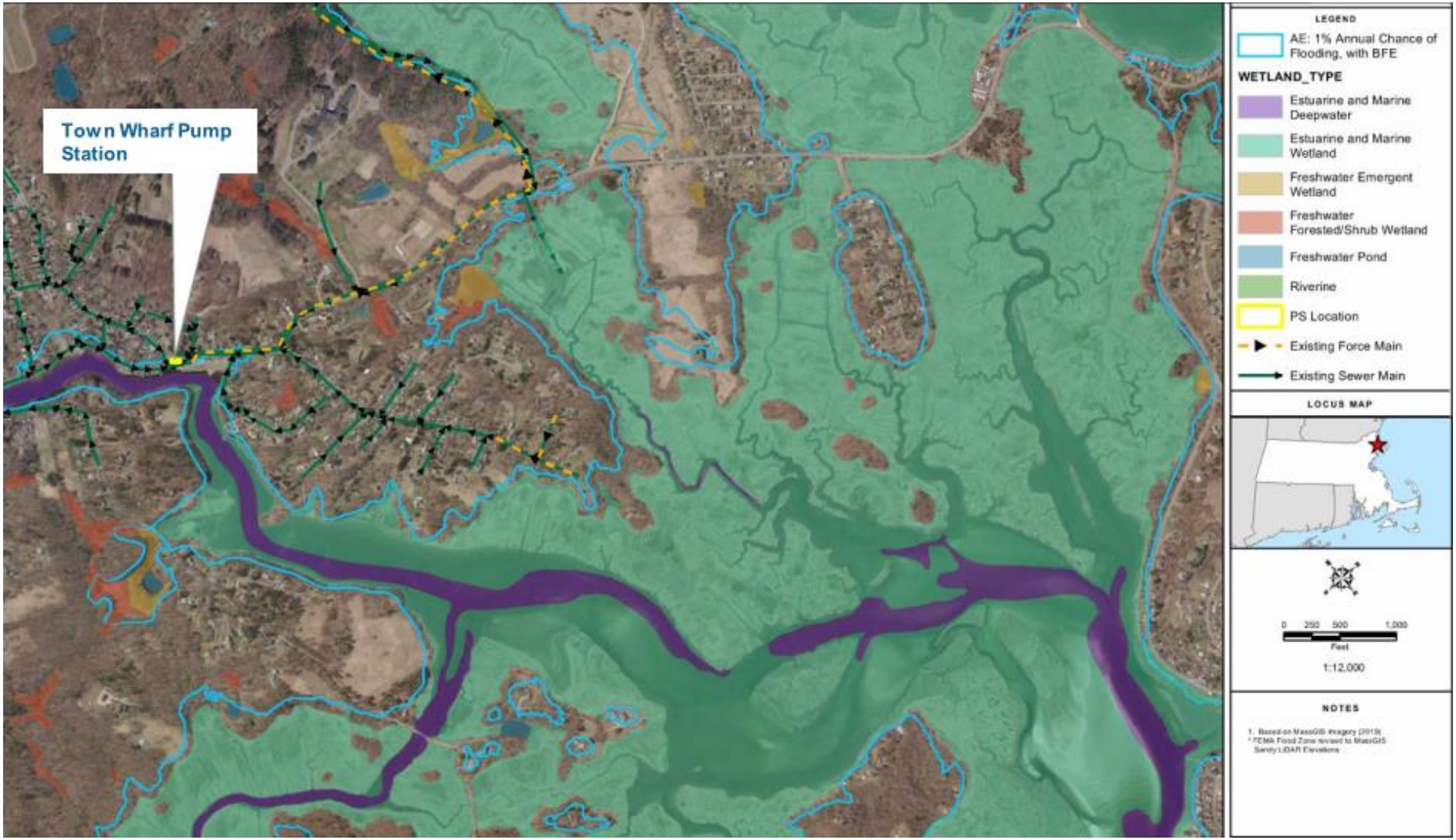
-Cable Trays with Kellum Grips

IPSWICH WASTEWATER VULNERABILITIES

Hazard Mitigation Plan High Priorities:

- Town Wharf Pump Station
- Sewer Siphon
- Sewer Interceptor

IPSWICH RIVER AND THE GREAT MARSH ACEC



RELOCATION VS. FLOOD PROOF PS

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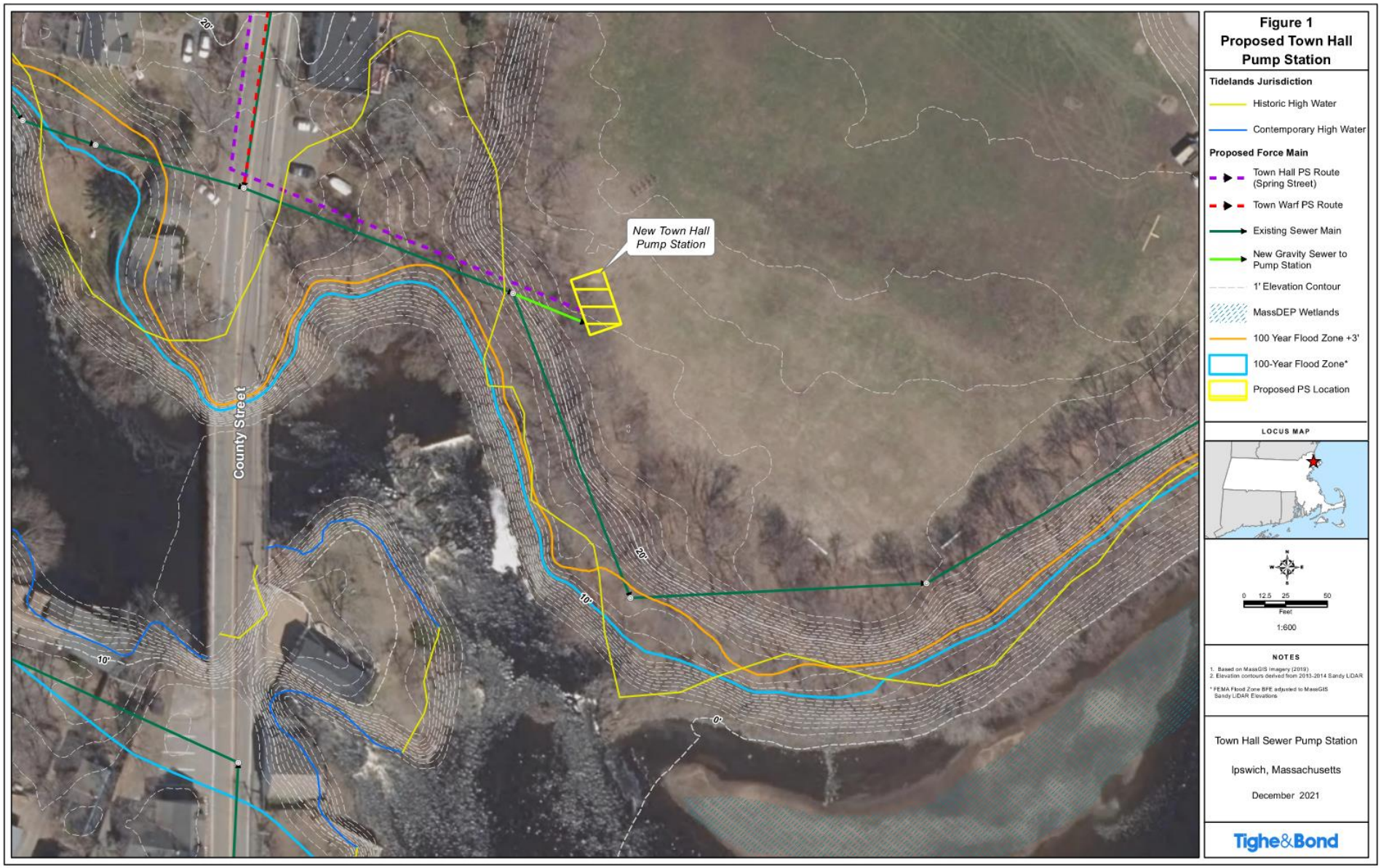
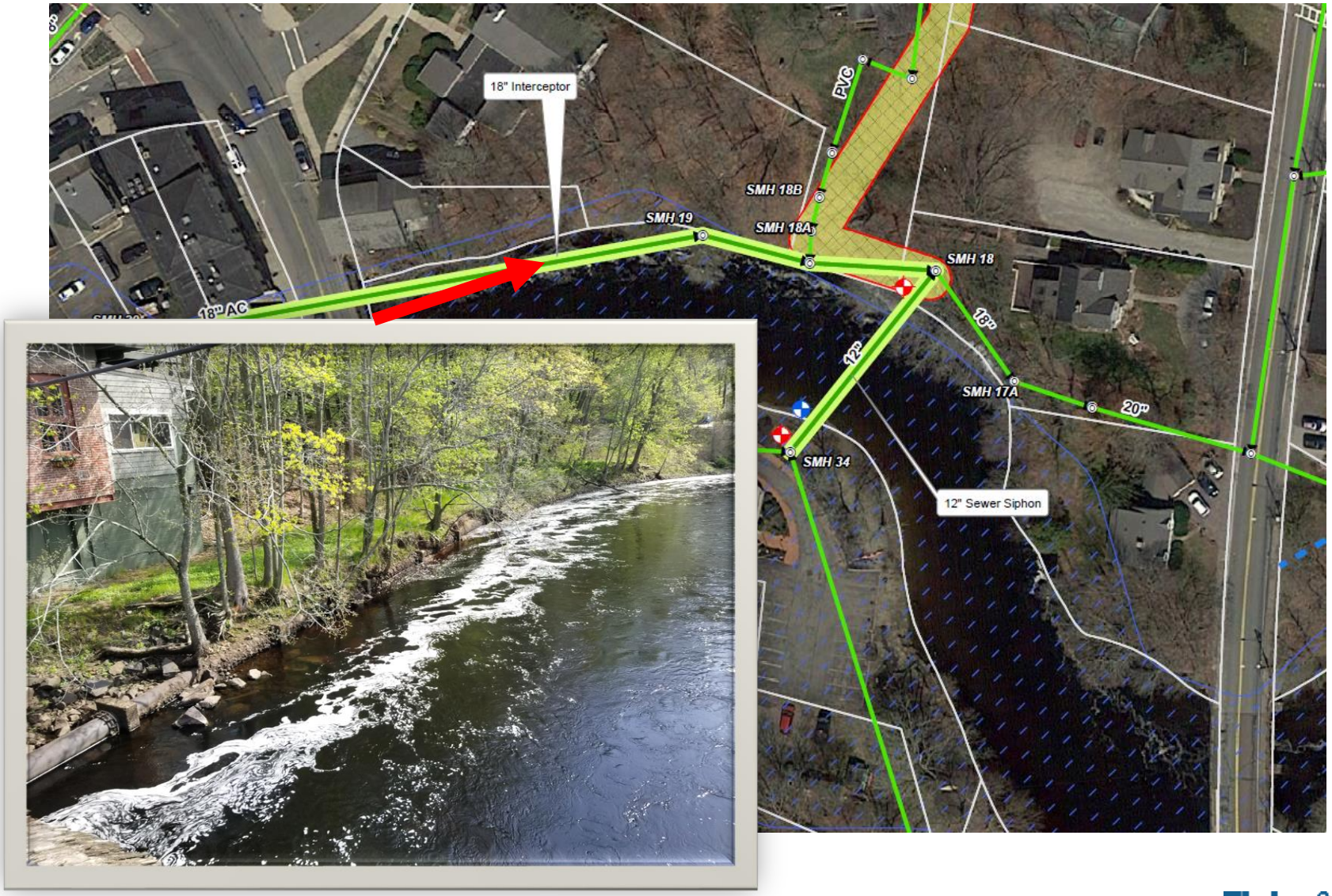
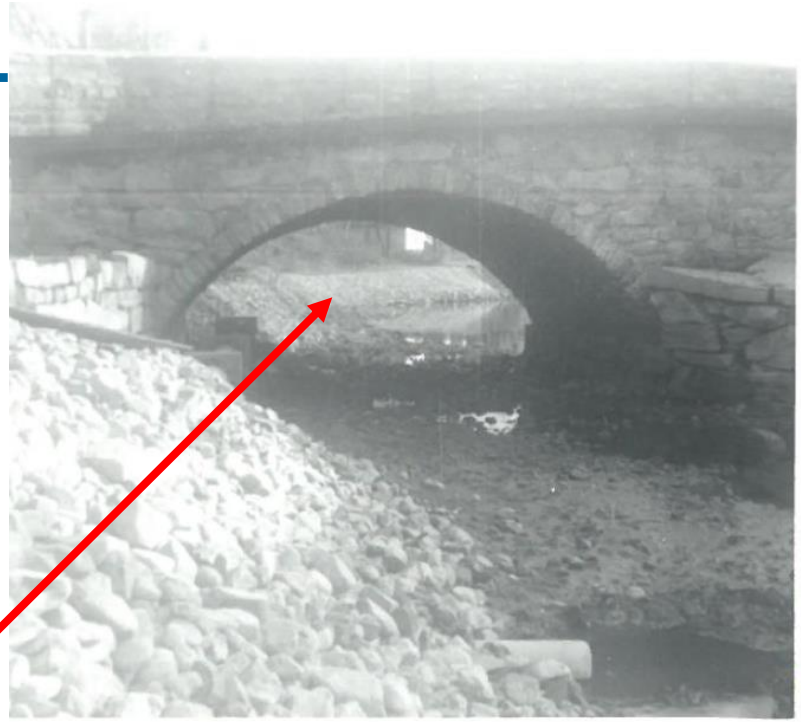


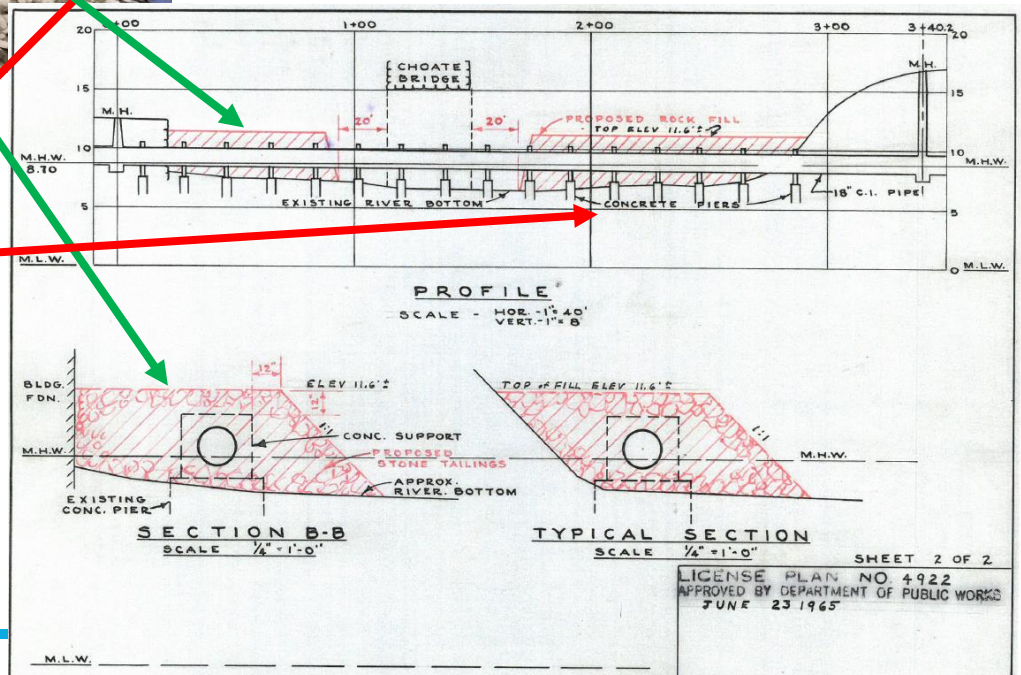
EXISTING INTERCEPTOR NORTH OF CHOATE BRIDGE

EXISTING INTERCEPTOR SOUTH OF CHOATE BRIDGE



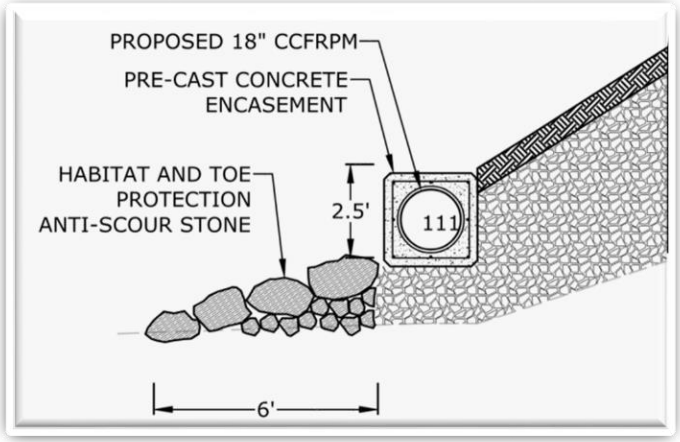
INTERCEPTOR IN 2018 VS 1965..

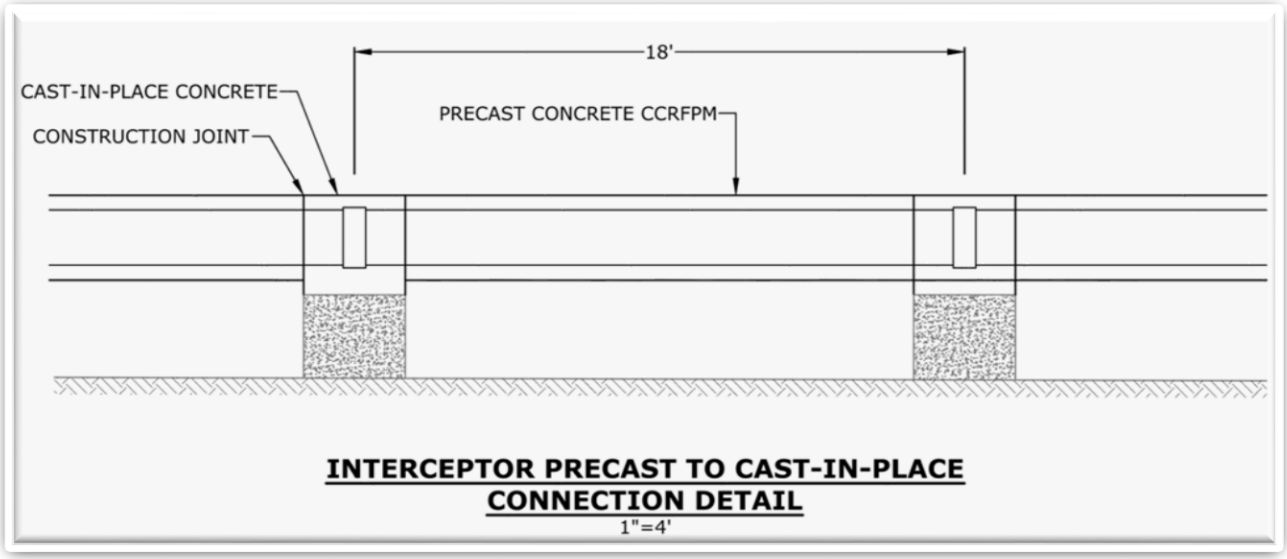




INTERCEPTOR RESILIENCY DESIGN ELEMENTS

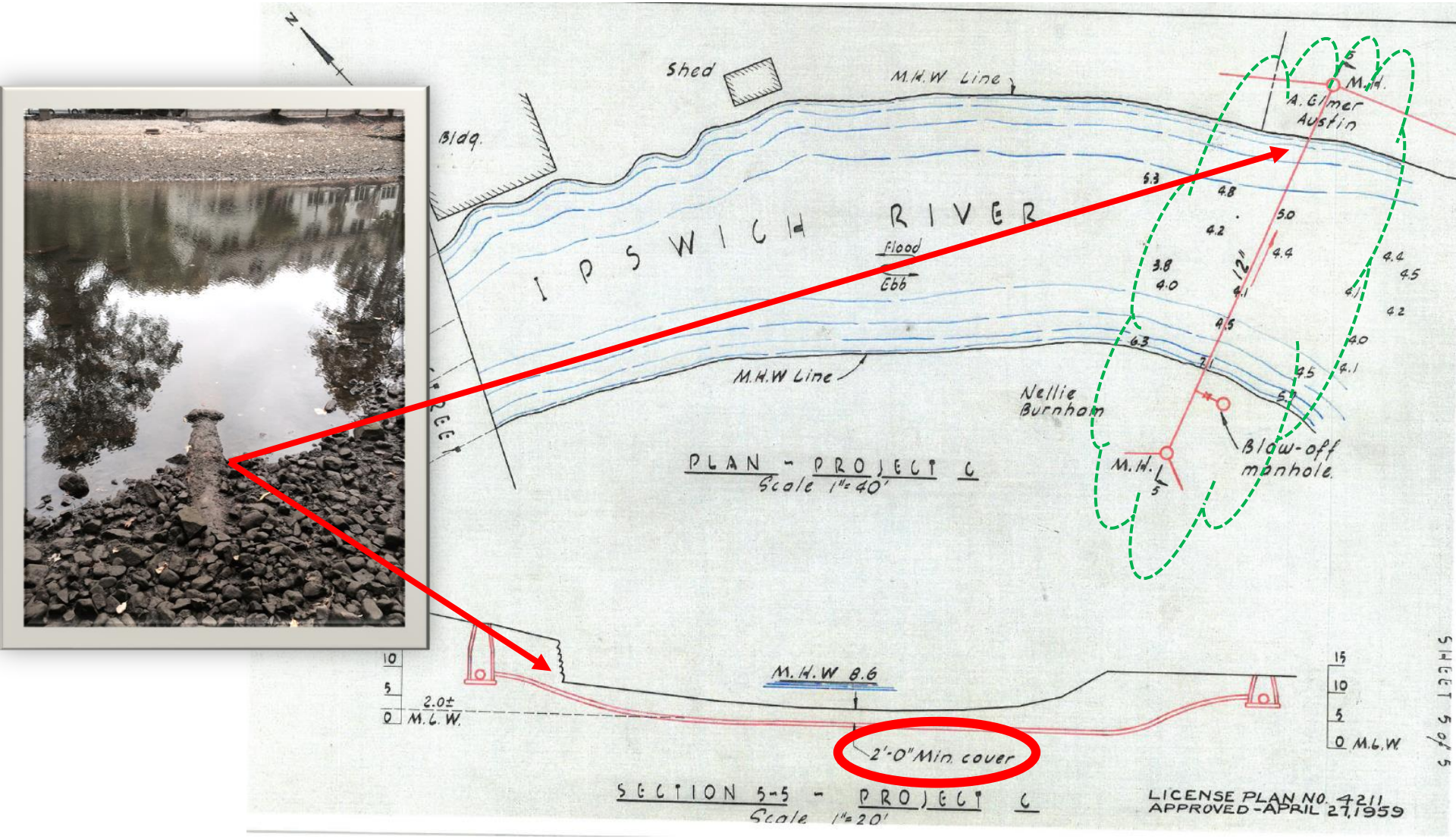
- **Precast Concrete Pipe Encasement (Exposed Pipe)**
  - CIP Construction Joints
- **CIPP Lining (Buried Pipe)**
- **Manhole Rehab & Watertight Covers**
- **Habitat & Anti-Scour Stone**
  - H&H Analysis with 500-Year Storm Velocities
  - D50 Max = 24-Inch





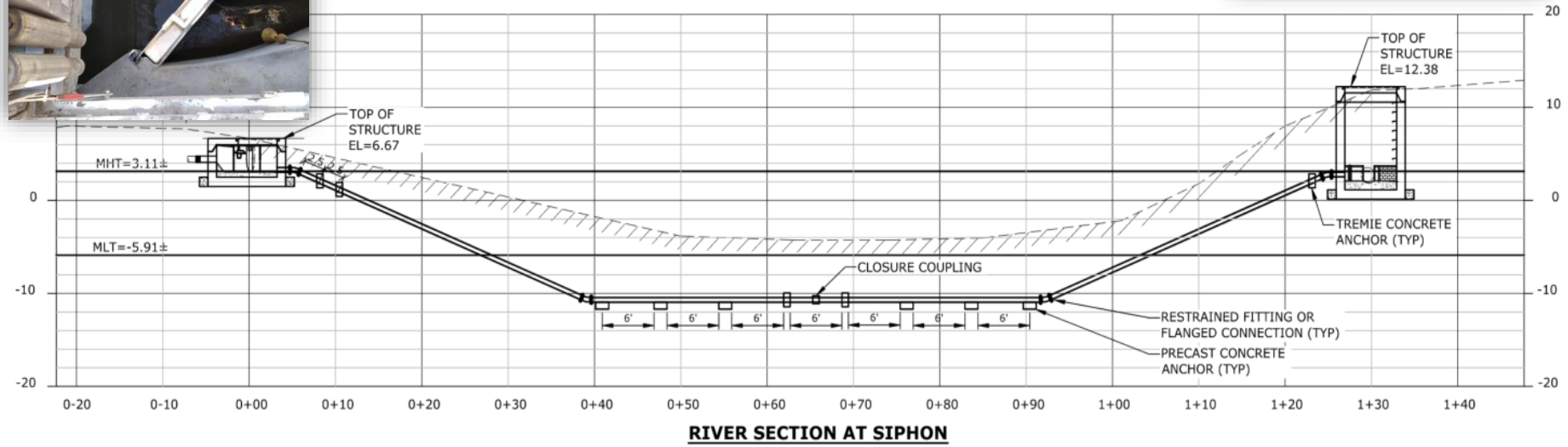
INTERCEPTOR CONSTRUCTION

SIPHON IN 2018 VS 1959 PLANS…



SIPHON RESILIENCY DESIGN ELEMENTS

- **Triple Barrel Siphon**
  - 2 x 6” Siphons for Normal Operation
  - 1 x 8” Siphon for Emergency/Redundancy
- **Watertight Hatches on Influent & Effluent Vaults**
- **Level sensor alarm for call out during backup conditions**
- **Appropriate substrate selection and coverage**



RIVER SECTION AT SIPHON

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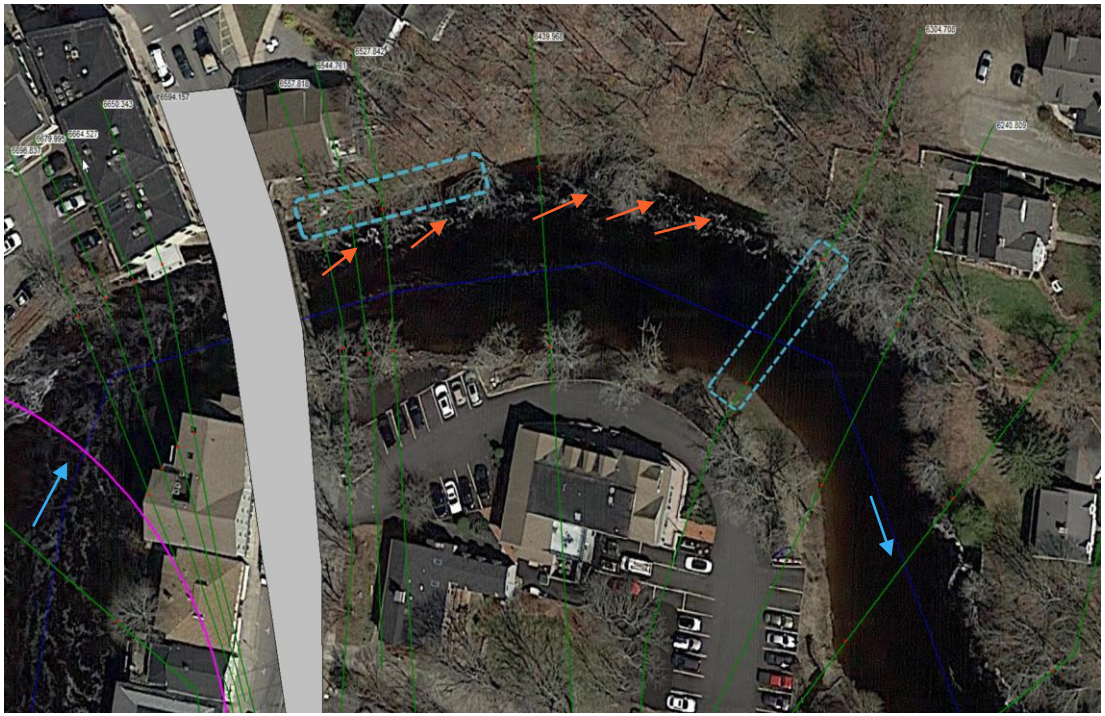
PROTECTING SEWER FROM INCREASED FLOOD RISK

- H&H Modeling
- Tidal and Terrestrial Flows
- Existing Stream Substrate
- Backfill Stream Substrate

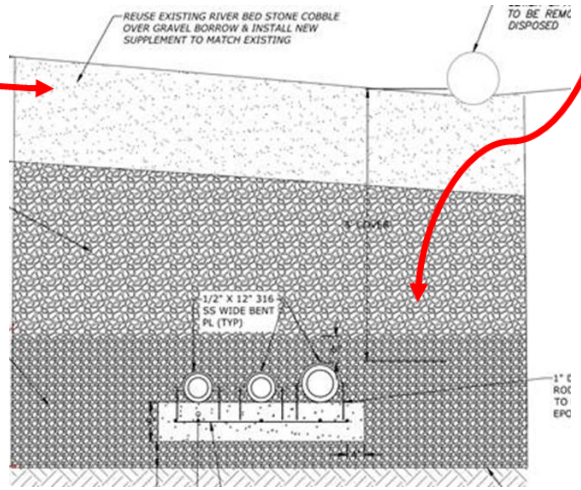


PROTECTING SEWER FROM INCREASED RIVER VELOCITY

Sieve	Percent Passing
4" ~~3"~~	100
1 ½"	70 – 100
¾"	50 – 85
No. 4	30 – 60
No. 200	0 - 10

Sieve	Percent Passing
1- ½ inch	50 – 85
3/4 inch	70-100
No. 4	40 – 75
No. 50	8 – 28
No. 200	0 - 10

Maximum size of stone in Gravel Borrow shall be 2 inches.



SEDIMENT COMPETENCE USING DIMENSIONLESS SHEAR STRESS

- D50 PARTICLE SIZE
- BANKFULL
- SLOPE

TABLE 3-4
Model Water Surface Elevation Results for Tailwater Scenario 2: Downstream Mean High Water - Water Surface Elevation in feet NAVD88

Survey Cross Section	Feet Downstream of Choate Bridge	HEC-RAS Cross Section	10-Year Water Surface Elevation (feet, NAVD88)			50-Year Water Surface Elevation (feet, NAVD88)			100-Year Water Surface Elevation (feet, NAVD88)			500-Year Water Surface Elevation (feet, NAVD88)		
			Existing	Proposed	Change	Existing	Proposed	Change	Existing	Proposed	Change	Existing	Proposed	Change
	-584	7177.681	5.8	5.8	0.0	7.2	7.2	0.0	7.5	7.6	0.0	9.1	9.1	0.0
	-426	7019.873	5.6	5.6	0.0	6.9	6.9	0.0	7.3	7.3	0.0	8.8	8.8	0.0
	-264	6858.394	5.6	5.7	0.0	7.0	7.0	0.0	7.4	7.4	0.0	8.9	8.9	0.0
	-191	6784.991	5.7	5.7	0.0	7.0	7.0	0.0	7.4	7.4	0.0	8.9	8.9	0.0
	-103	6696.837	5.6	5.6	0.0	7.0	7.0	0.0	7.3	7.3	0.0	8.8	8.9	0.0
102	-86	6679.995	5.6	5.6	0.0	6.9	6.9	0.0	7.3	7.3	0.0	8.8	8.8	0.0
103	-70	6664.527	5.6	5.6	0.0	6.9	6.9	0.0	7.2	7.2	0.0	8.7	8.8	0.0
104	-56	6650.343	5.6	5.6	0.0	6.9	6.9	0.0	7.2	7.2	0.0	8.7	8.7	0.0
CHOATE BRIDGE	0	6594.157												
109	36	6557.818	5.3	5.3	0.0	6.3	6.3	0.0	6.6	6.6	0.0	7.7	7.7	0.0
110	49	6544.761	5.3	5.3	0.0	6.3	6.3	0.0	6.5	6.6	0.0	7.6	7.7	0.1
	66	6527.842	5.3	5.3	0.0	6.3	6.3	0.0	6.6	6.6	0.0	7.7	7.7	0.0
	154	6439.968	5.3	5.3	0.0	6.4	6.4	0.0	6.6	6.6	0.0	7.7	7.8	0.0
SIPHON	289	6304.708	5.2	5.2	0.0	6.2	6.2	0.0	6.5	6.5	0.0	7.6	7.6	0.0

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SIPHON CONSTRUCTION

NATURE-BASED RESILIENCY: BIOSTABILIATION

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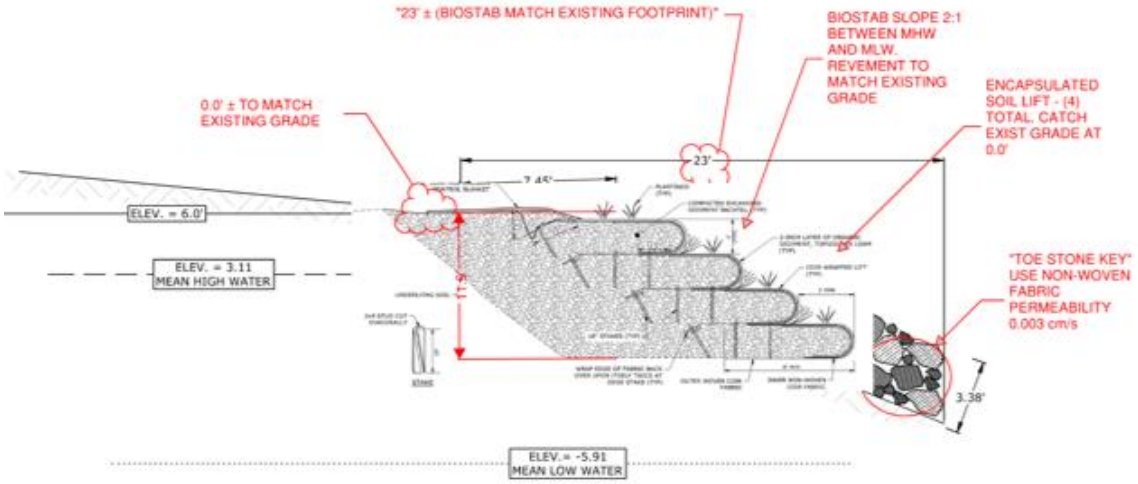

DOWNSTREAM REVETMENT

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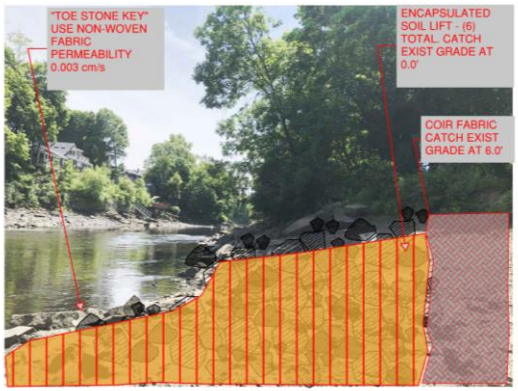
BANK SITE NO. 1
LOOKING UPSTREAM



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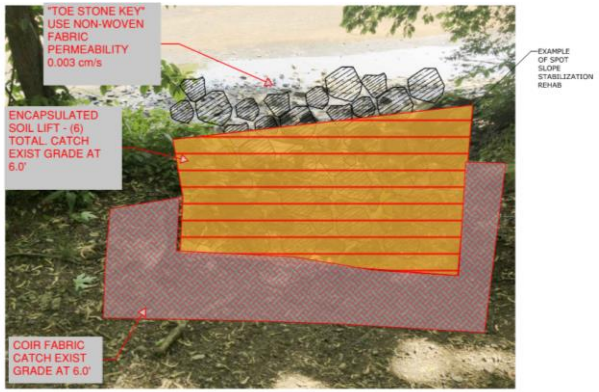
BANK SITE NO. 1
LOOKING UPSTREAM



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BANK SITE NO. 2 LOOKING
FROM PATHWAY

NATURE-BASED RESILIENCY: BIOSTABILIATION

FESL with Toe Rock
Upper Bank Failure Treatment

FABRIC ENCAPSULATED SOIL LIFTS

CHANNEL VELOCITIES > 6 fps &
BOUNDARY SHEAR STRESS > 2 psf

2006 IPSWICH RIVER FLOOD

THANK YOU

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