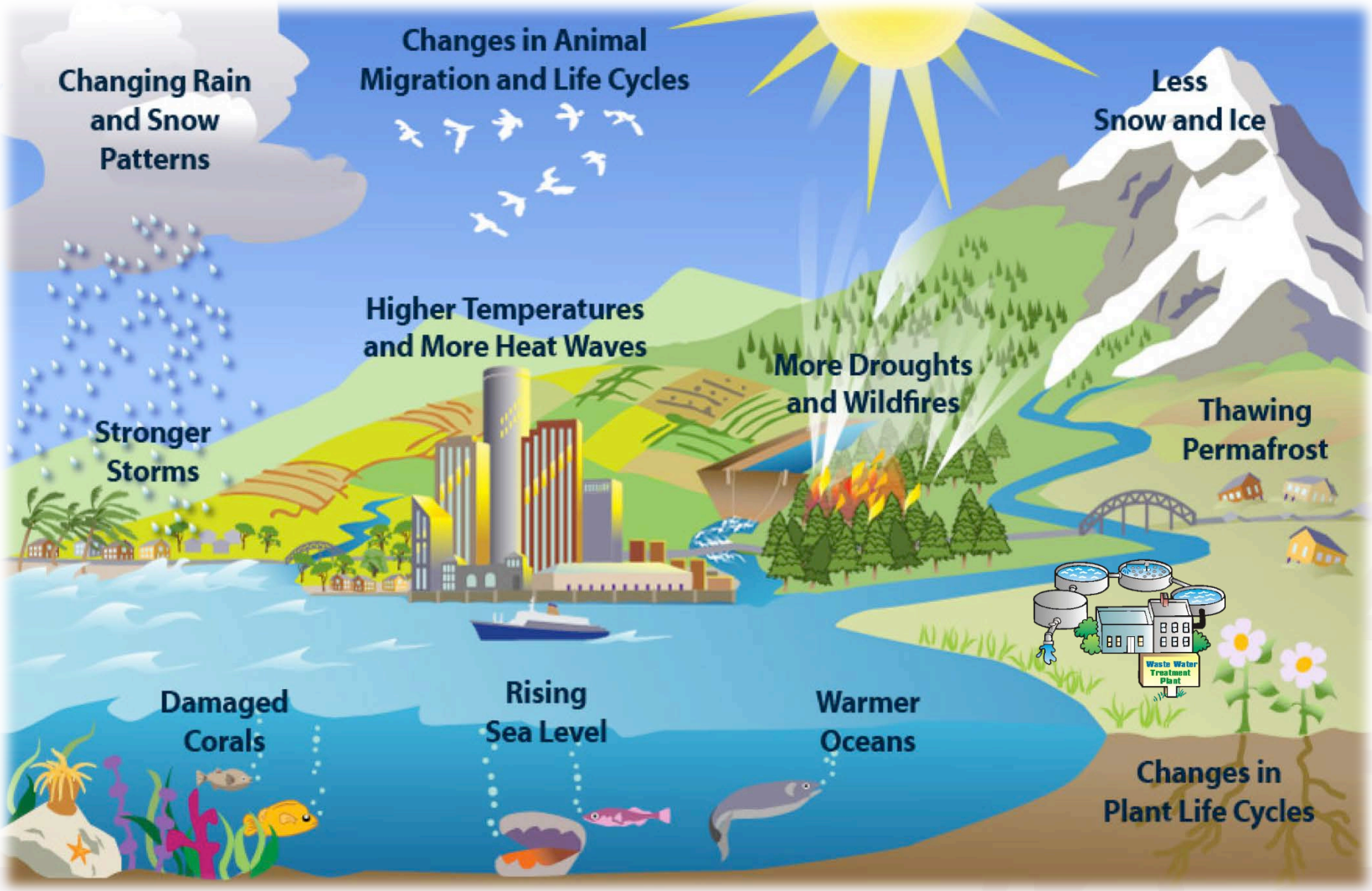
Building Resiliency in Narragansett Bay

Statewide Cooperation at Rhode Island's Wastewater Treatment Facilities

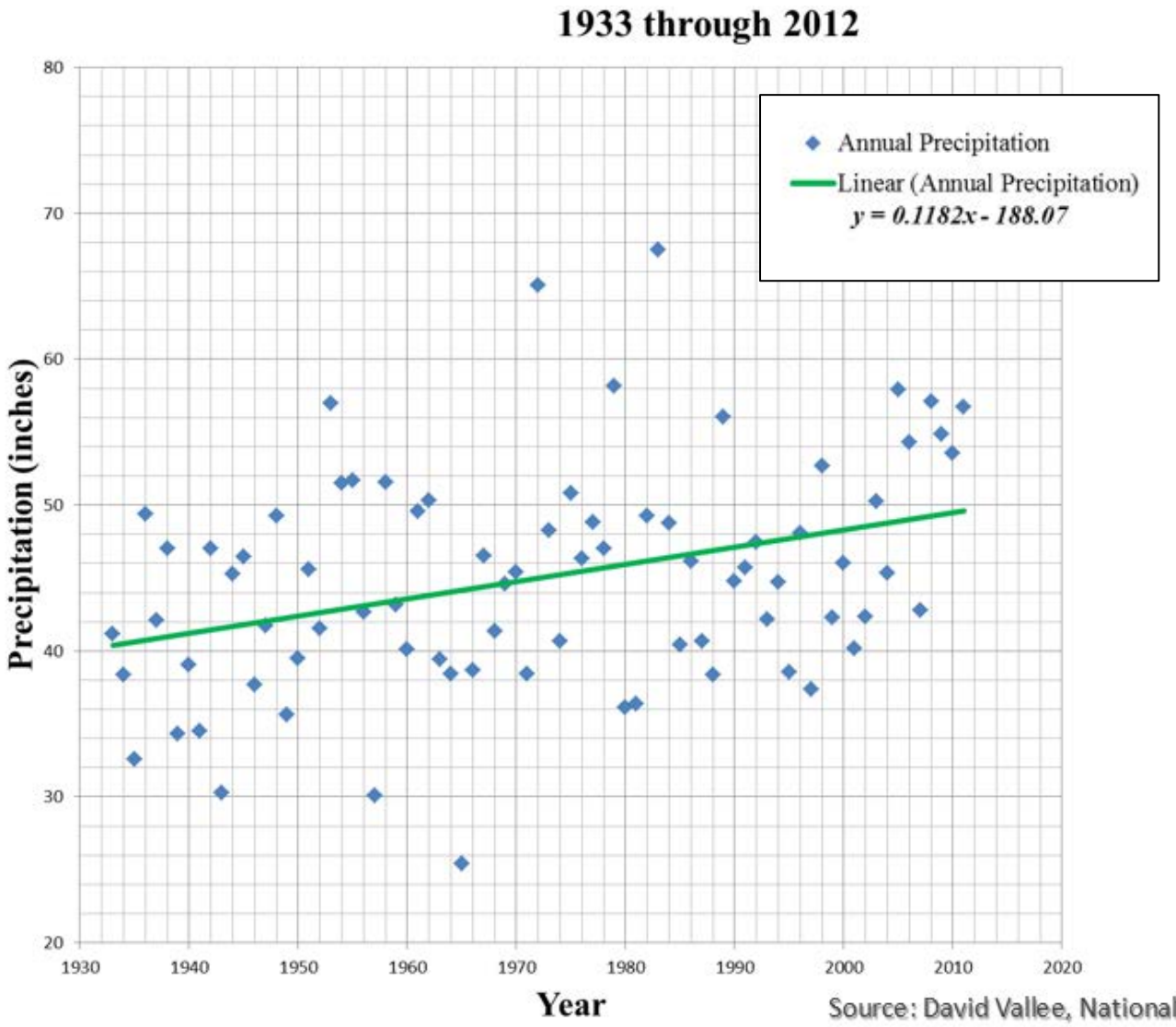
April 26, 2016


The climate is changing! Are you prepared?
State of Rhode Island

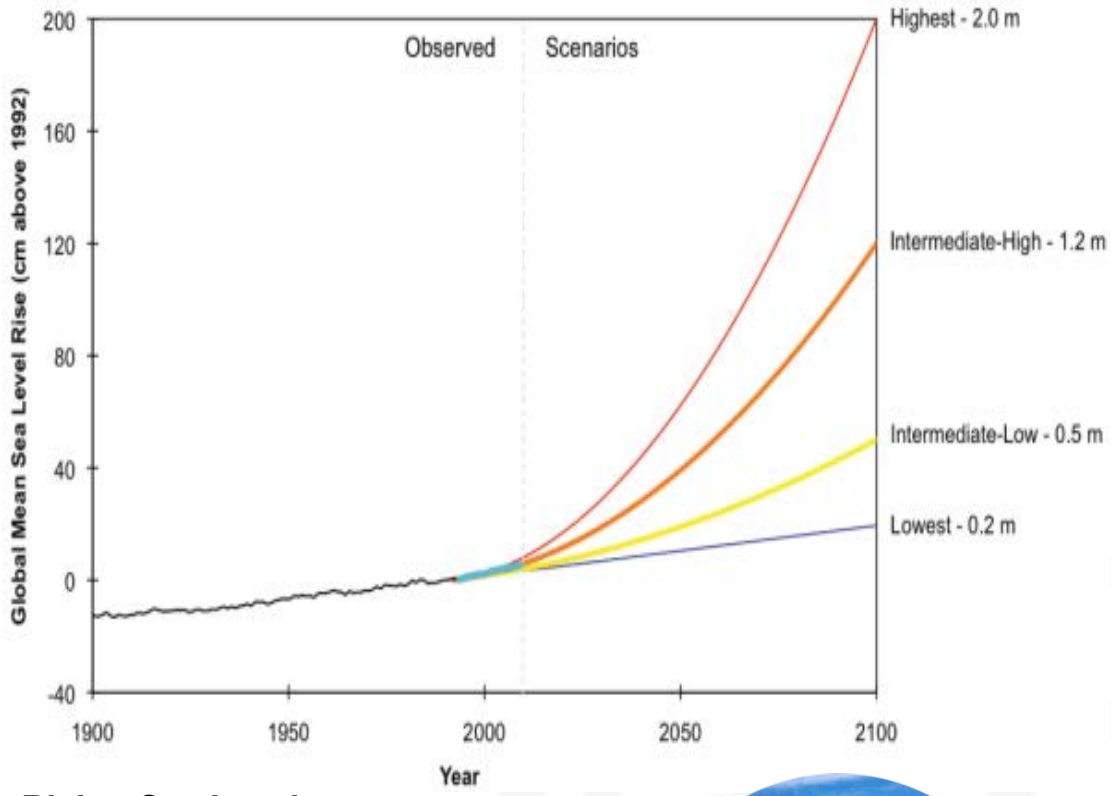
Climate Change Impacts



Sea Level Rise and Annual Precipitation (Providence)



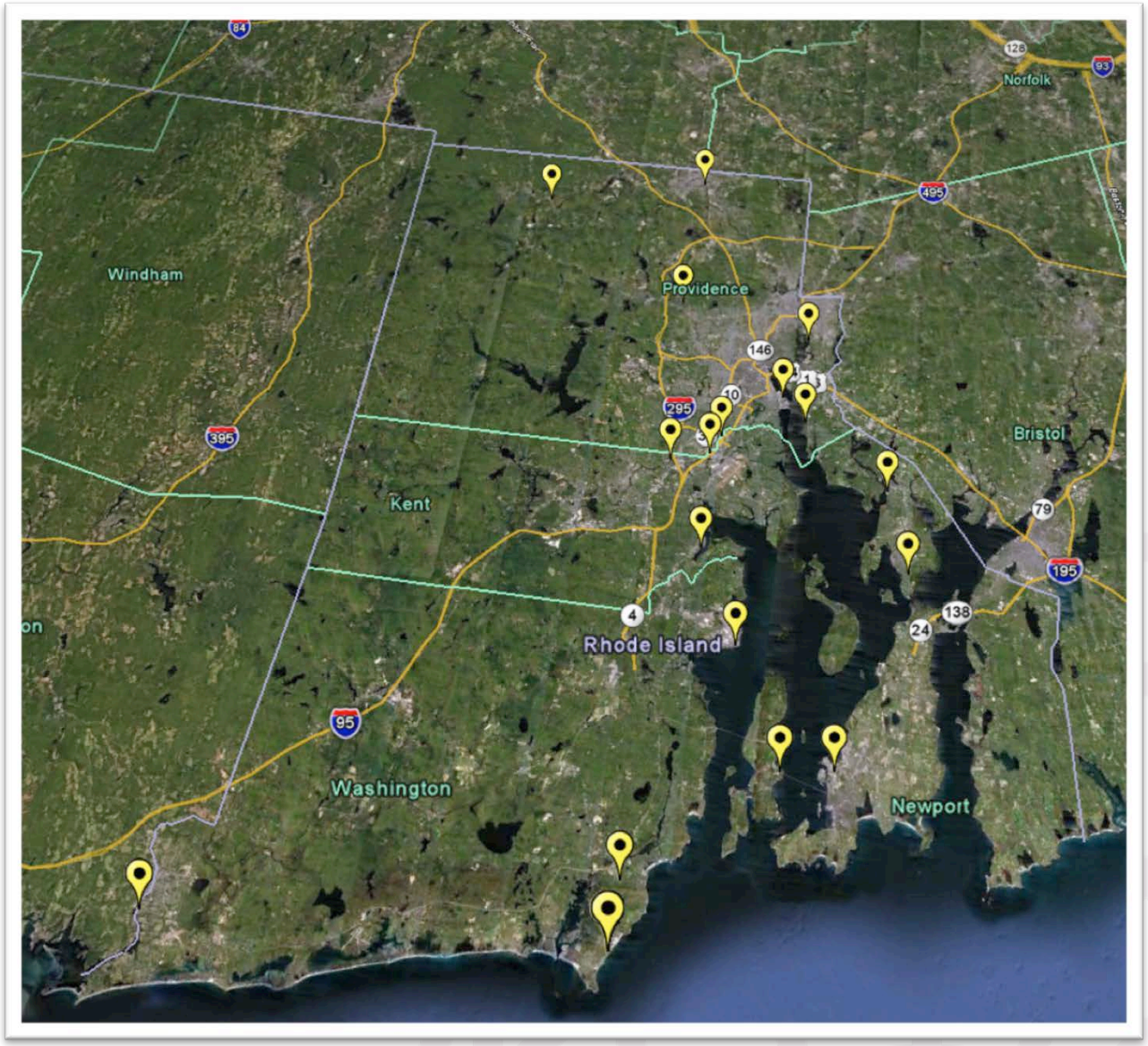
Source: David Vallee, National Weather Service



Rising Sea Levels

RI Wastewater Treatment Facility Vulnerability

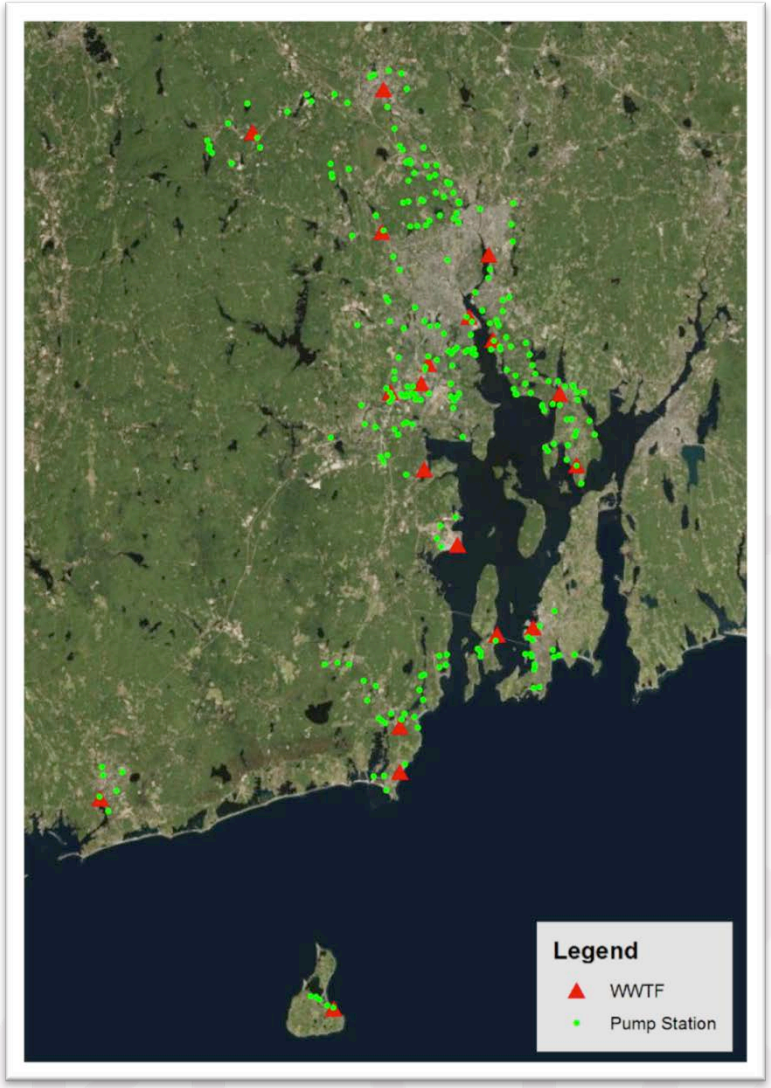
- WWTFs and pump stations in coastal and low lying areas
- Infrastructure to susceptible to coastal and riverine inundation
- Overflows discharge into adjacent surface waters



Warwick WWTF

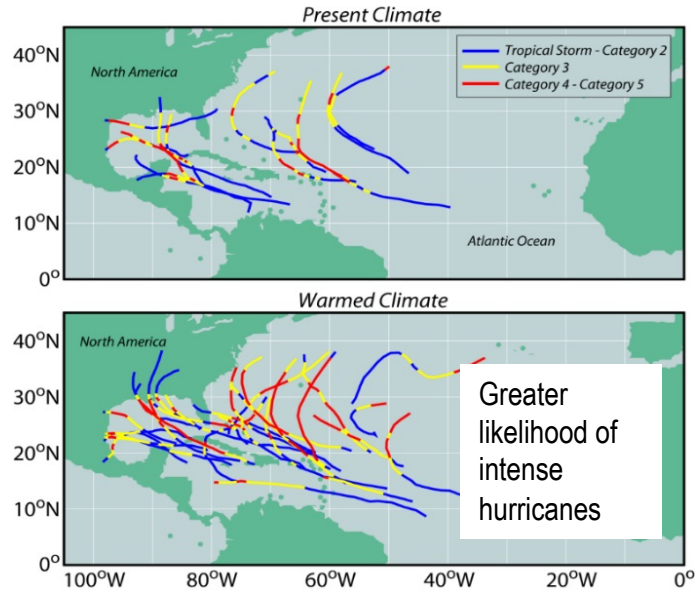
Long Term Planning

- RIDEM Statewide Approach for Long Term Planning for Major Modifications to WWTFs
- RIDEM formed a collaborative partnership with the Division of Planning and the RI Bays, Rivers, and Watershed Coordination Team, the CRMC, and local communities
- Developed a project to improve WWTF reliability under changing climate conditions:
  - Statewide assessment of 19 wastewater treatment facilities and major collection components
  - Identify vulnerabilities
  - Identify short-term and long-term adaptive strategies

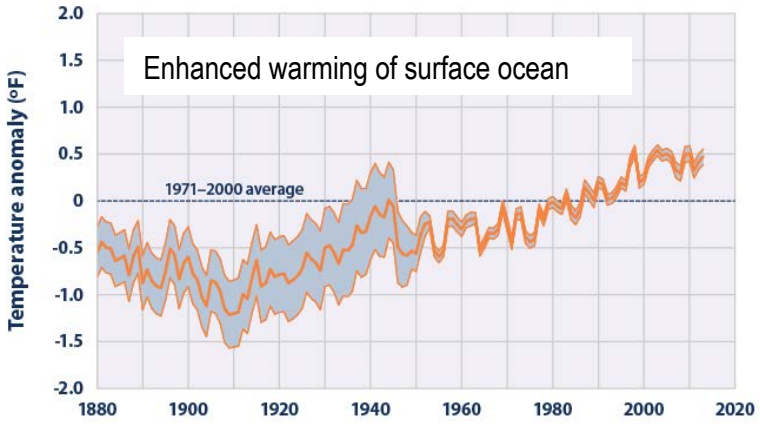


Five-Step Project Approach

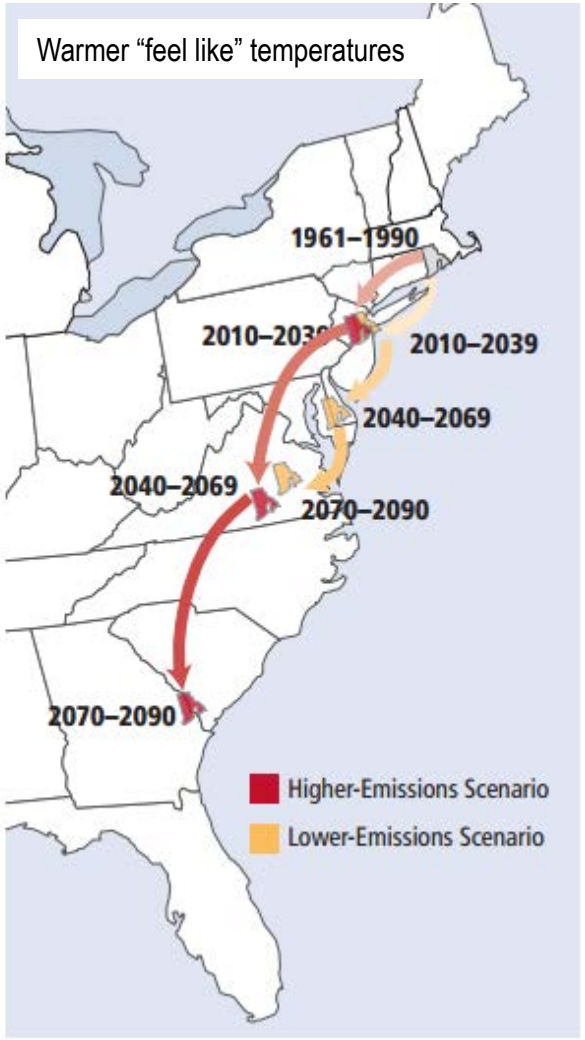
Step 1: Climate Change Science & Potential for Impacts in Rhode Island

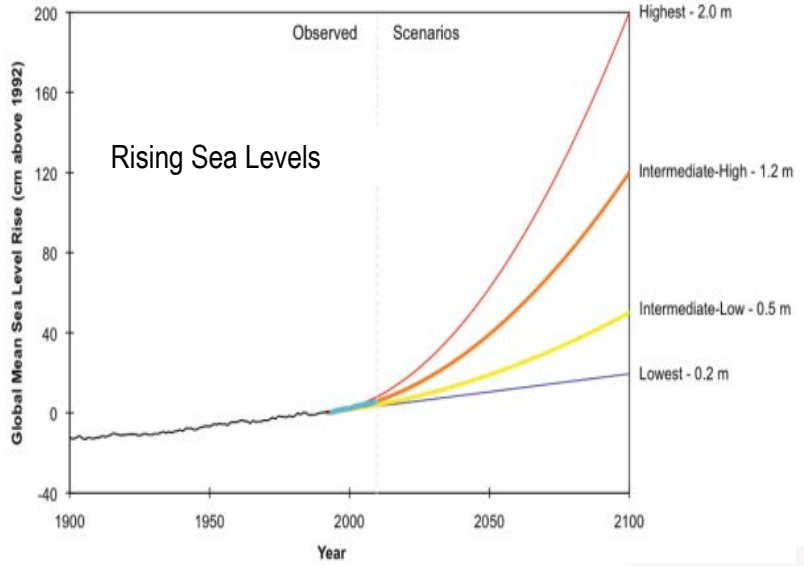


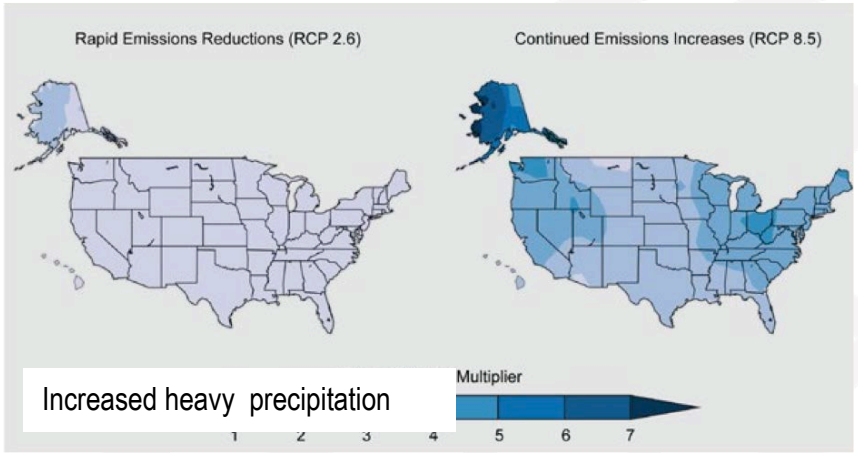
Greater likelihood of intense hurricanes



Enhanced warming of surface ocean







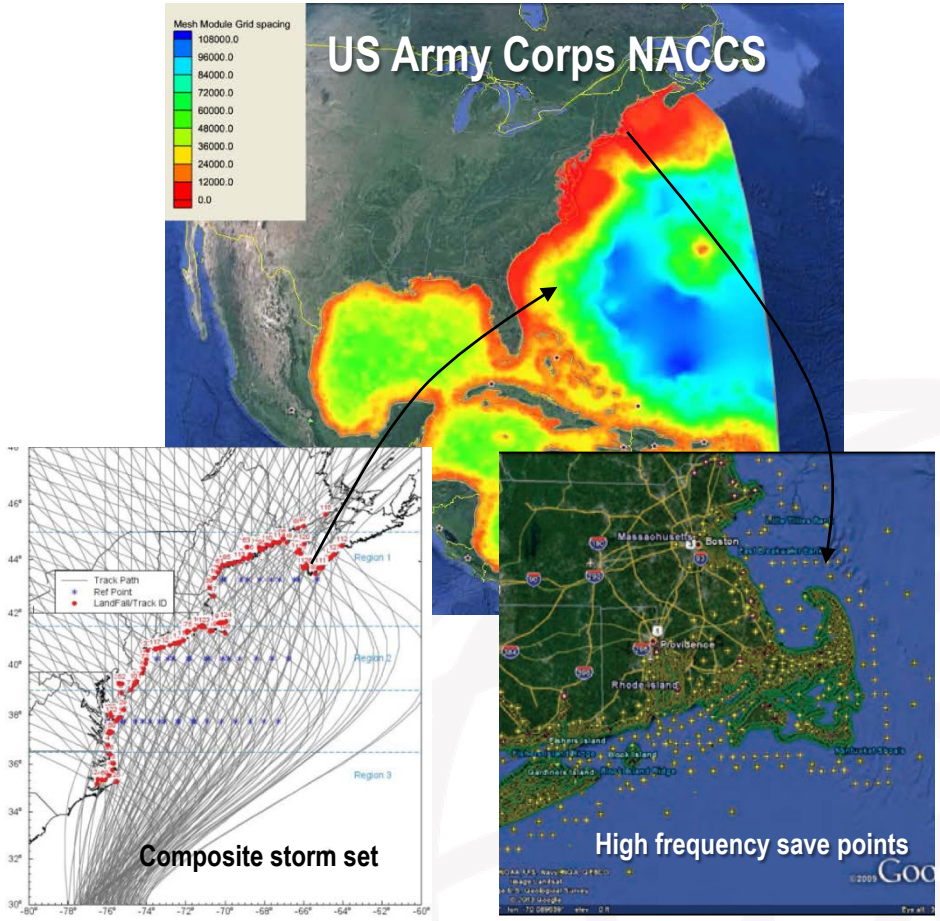
Increased heavy precipitation

Sources (clockwise): Bender et al., 2010; Frumhoff et al. 2007; Pariss et al., 2012, Melillo et al., 2014; EPA, 2014

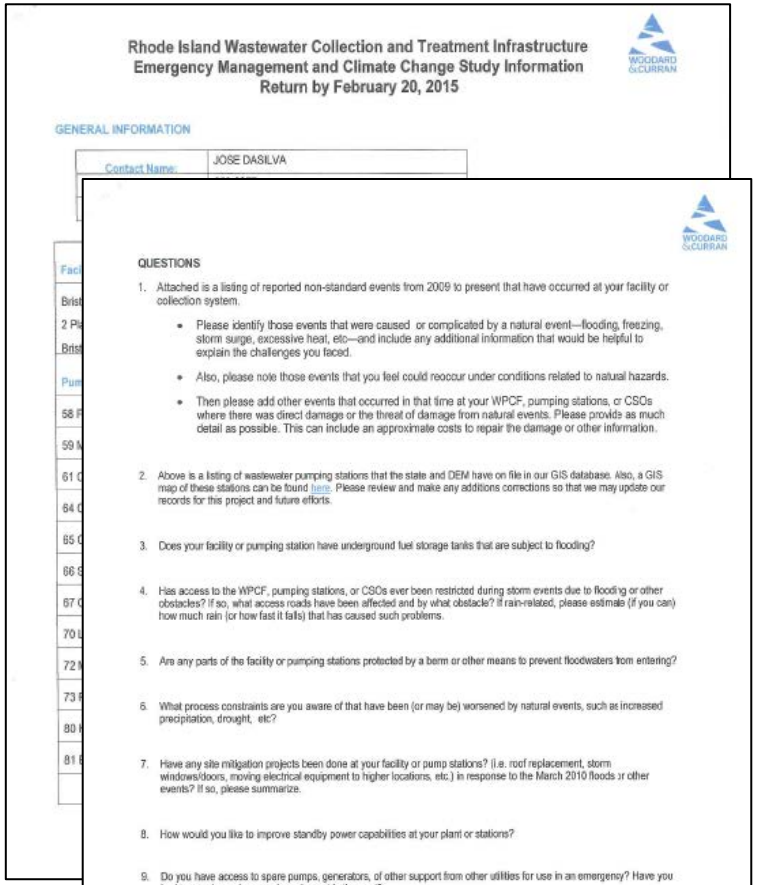
Step 2: Preliminary Assessment of Climate Change Impacts to Rhode Island WWTFs

1. Information from Facility Operators

2. Statewide Modeling Applications



Step 2: Preliminary Assessment



Rhode Island Wastewater Collection and Treatment Infrastructure
Emergency Management and Climate Change Study Information
Return by February 20, 2015

GENERAL INFORMATION

Contact Name: JOSE DASILVA

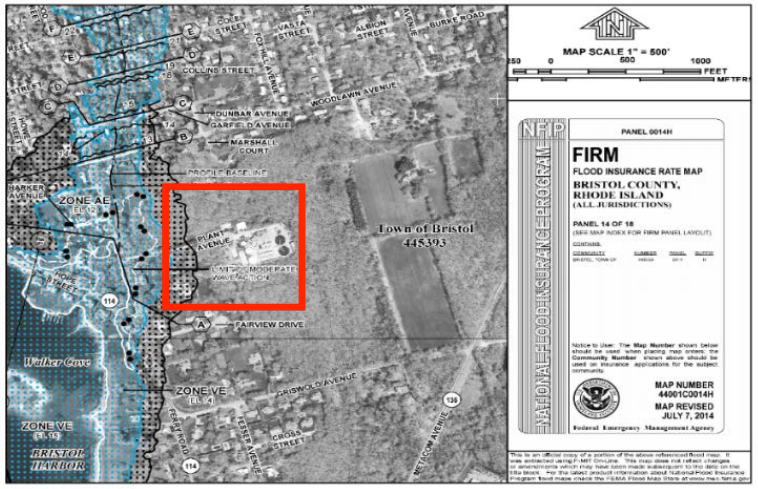
QUESTIONS

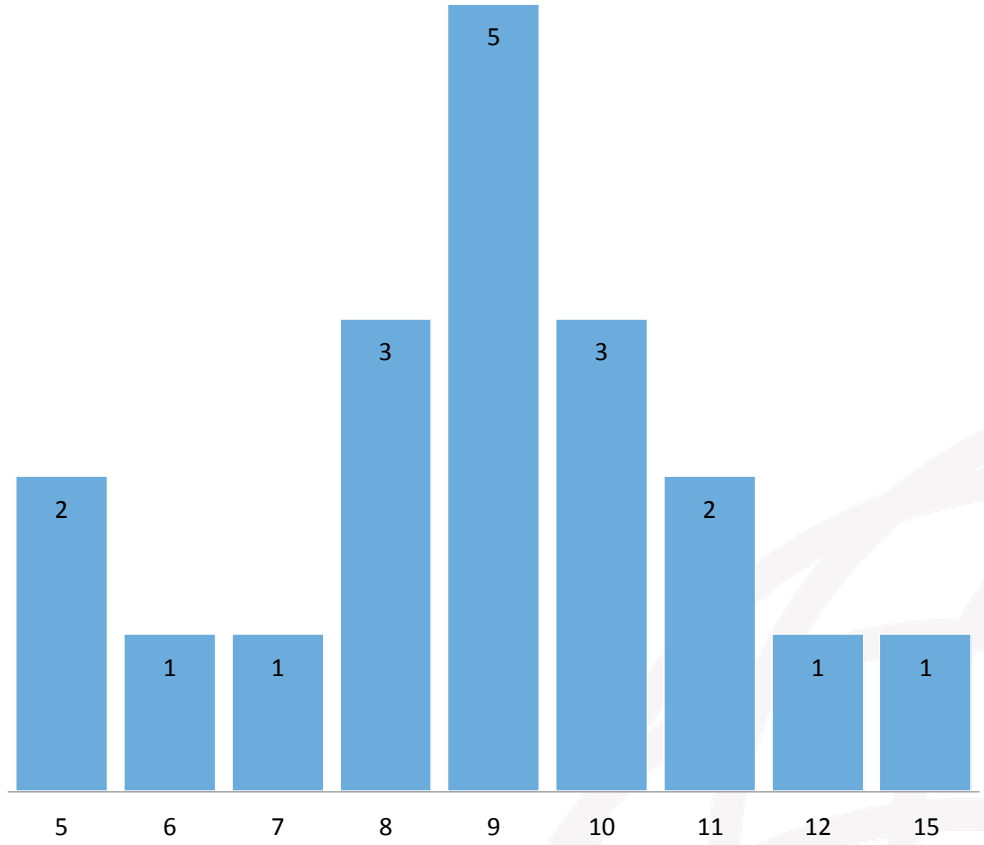
1. Attached is a listing of reported non-standard events from 2009 to present that have occurred at your facility or collection system.
   - Please identify those events that were caused or complicated by a natural event—flooding, freezing, storm surge, excessive heat, etc—and include any additional information that would be helpful to explain the challenges you faced.
   - Also, please note those events that you feel could reoccur under conditions related to natural hazards.
   - Then please add other events that occurred in that time at your WPCF, pumping stations, or CSOs where there was direct damage or the threat of damage from natural events. Please provide as much detail as possible. This can include an approximate costs to repair the damage or other information.
2. Above is a listing of wastewater pumping stations that the state and DEM have on file in our GIS database. Also, a GIS map of these stations can be found here. Please review and make any additions corrections so that we may update our records for this project and future efforts.
3. Does your facility or pumping station have underground fuel storage tanks that are subject to flooding?
4. Has access to the WPCF, pumping stations, or CSOs ever been restricted during storm events due to flooding or other obstacles? If so, what access roads have been affected and by what obstacle? If rain-related, please estimate (if you can) how much rain (or how fast it falls) that has caused such problems.
5. Are any parts of the facility or pumping stations protected by a berm or other means to prevent floodwaters from entering?
6. What process constraints are you aware of that have been (or may be) worsened by natural events, such as increased precipitation, drought, etc?
7. Have any site mitigation projects been done at your facility or pump stations? (i.e. roof replacement, storm windows/doors, moving electrical equipment to higher locations, etc.) in response to the March 2010 floods or other events? If so, please summarize.
8. How would you like to improve standby power capabilities at your plant or stations?
9. Do you have access to spare pumps, generators, of other support from other utilities for use in an emergency? Have you had to acquire and use such equipment in the past?
10. What are some other major issues that your facility is facing or has faced in the past? In other words, what worries you the most about maintaining the ongoing operations at your plant? List other information that you feel is important to share.

3

Facility	Location on FEMA FIRM	Value	Hazard History	Value	Documented losses and costs since 2009	Value	Value	Infrastructure Inundation	Value	Projection of Inundation	Value	TOTAL
East Providence WWTF	Within V Zone	3	More than 3 since 2009	3	Major Repairs	3	0	Greater than 50% system capacity loss under 5-ft scenario	3	Greater than 50% system capacity loss for 1-ft impacts	3	15
Warren United Water	Within V Zone	3	2-3 since 2009	2	None	1	0	Greater than 50% system capacity loss under 5-ft scenario	3	Greater than 50% system capacity loss for 1-ft impacts	3	12
Cranston WPCF	Within A Zone	2	2-3 since 2009	2	Major Repairs	3	0	Between 10% and 50% system capacity loss under 5-ft scenario	2	Between 10% and 50% system capacity loss for 1-ft impacts	2	11
Quonset Development Corporation	Within V Zone	3	1 or less since 2009	1	None	1	0	Greater than 50% system capacity loss under 5-ft scenario	3	Greater than 50% system capacity loss for 1-ft impacts	3	11
Bristol WWTF	Within X Zone	1	2-3 since 2009	2	Major Repairs	3	0	Between 10% and 50% system capacity loss under 5-ft scenario	2	Between 10% and 50% system capacity loss for 1-ft impacts	2	10
East Greenwich WWTF	Within A Zone	2	1 or less since 2009	1	None	1	0	Greater than 50% system capacity loss under 5-ft scenario	3	Greater than 50% system capacity loss for 1-ft impacts	3	10
West Warwick Regional WWTF	Within A Zone	2	1 or less since 2009	1	Major Repairs	3	0	Greater than 50% system capacity loss under 5-ft scenario	3	Less than 10% system capacity loss for 1-ft impacts	1	10
NBC Bucklin Point WWTF	Within X Zone	1	1 or less since 2009	1	None	1	0	Greater than 50% system capacity loss under 5-ft scenario	3	Greater than 50% system capacity loss for 1-ft impacts	3	9
NBC Fields Point WWTF	Within X Zone	1	1 or less since 2009	1	None	1	0	Greater than 50% system capacity loss under 5-ft scenario	3	Greater than 50% system capacity loss for 1-ft impacts	3	9
Newport WWTF	Within X Zone	1	More than 3 since 2009	3	None	1	0	Between 10% and 50% system capacity loss under 5-ft scenario	2	Between 10% and 50% system capacity loss for 1-ft impacts	2	9
Warwick Sewer Authority	Within X Zone	1	1 or less since 2009	1	Major Repairs	3	0	Between 10% and 50% system capacity loss under 5-ft scenario	2	Between 10% and 50% system capacity loss for 1-ft impacts	2	9
Westerly United Water	Within X Zone	1	2-3 since 2009	2	Major Repairs	3	0	Less than 10% system capacity loss under 5-ft scenario	1	Between 10% and 50% system capacity loss for 1-ft impacts	2	9
Jamestown Sewer Division	Within X Zone	1	2-3 since 2009	2	Miscellaneous Expenses	2	0	Less than 10% system capacity loss under 5-ft scenario	1	Between 10% and 50% system capacity loss for 1-ft impacts	2	8
Narragansett WWTF	Within V Zone	3	2-3 since 2009	2	None	1	0	Less than 10% system capacity loss under 5-ft scenario	1	Less than 10% system capacity loss for 1-ft impacts	1	8
South Kingstown Regional WWTF	Within X Zone	1	2-3 since 2009	2	None	1	0	Between 10% and 50% system capacity loss under 5-ft scenario	2	Between 10% and 50% system capacity loss for 1-ft impacts	2	8
Woonsocket WWTF	Within X Zone	1	1 or less since 2009	1	Major Repairs	3	0	Less than 10% system capacity loss under 5-ft scenario	1	Less than 10% system capacity loss for 1-ft impacts	1	7
Burrillville WWTF	Within A Zone	2	1 or less since 2009	1	None	1	0	Less than 10% system capacity loss under 5-ft scenario	1	Less than 10% system capacity loss for 1-ft impacts	1	6
New Shoreham Sewer Division	Within X Zone	1	1 or less since 2009	1	None	1	0	Less than 10% system capacity loss under 5-ft scenario	1	Less than 10% system capacity loss for 1-ft impacts	1	5
Smithfield Veolia Water	Within X Zone	1	1 or less since 2009	1	None	1	0	Less than 10% system capacity loss under 5-ft scenario	1	Less than 10% system capacity loss for 1-ft impacts	1	5

Step 2: Preliminary Assessment





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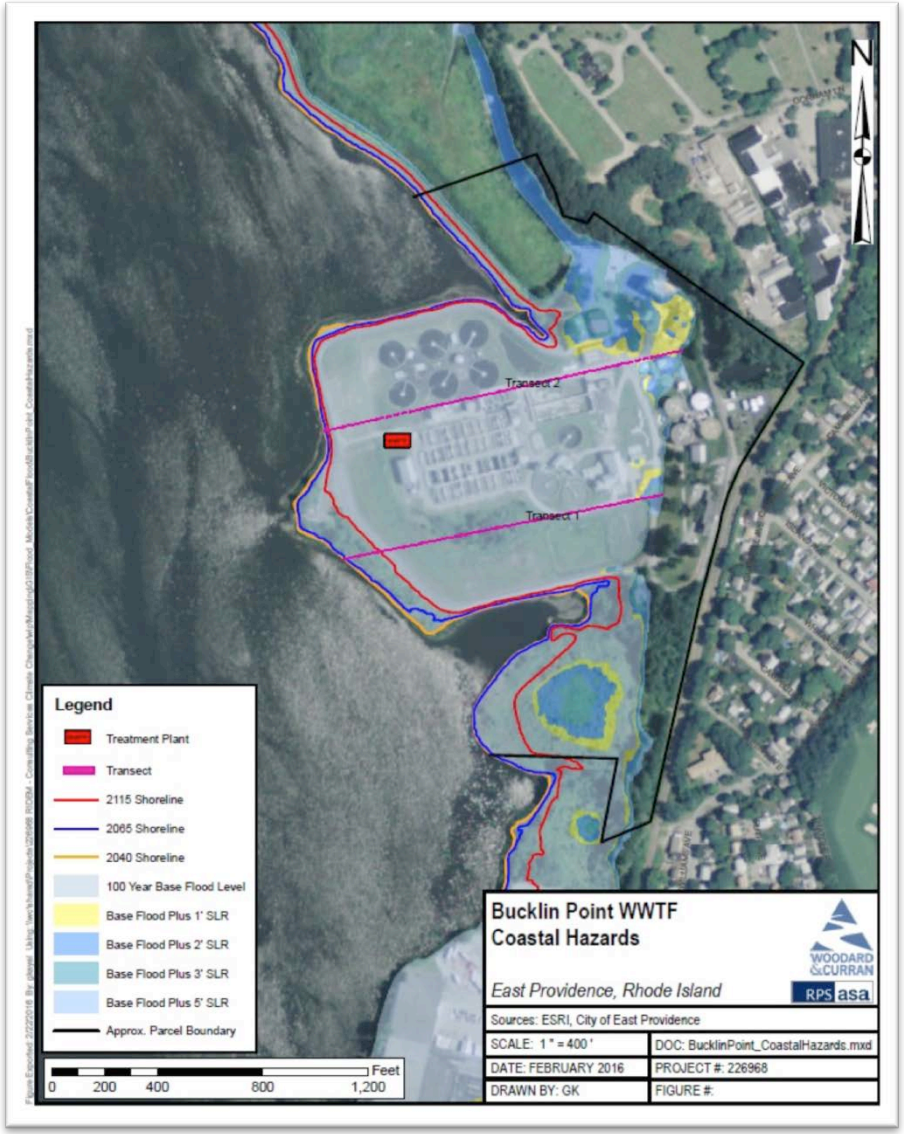
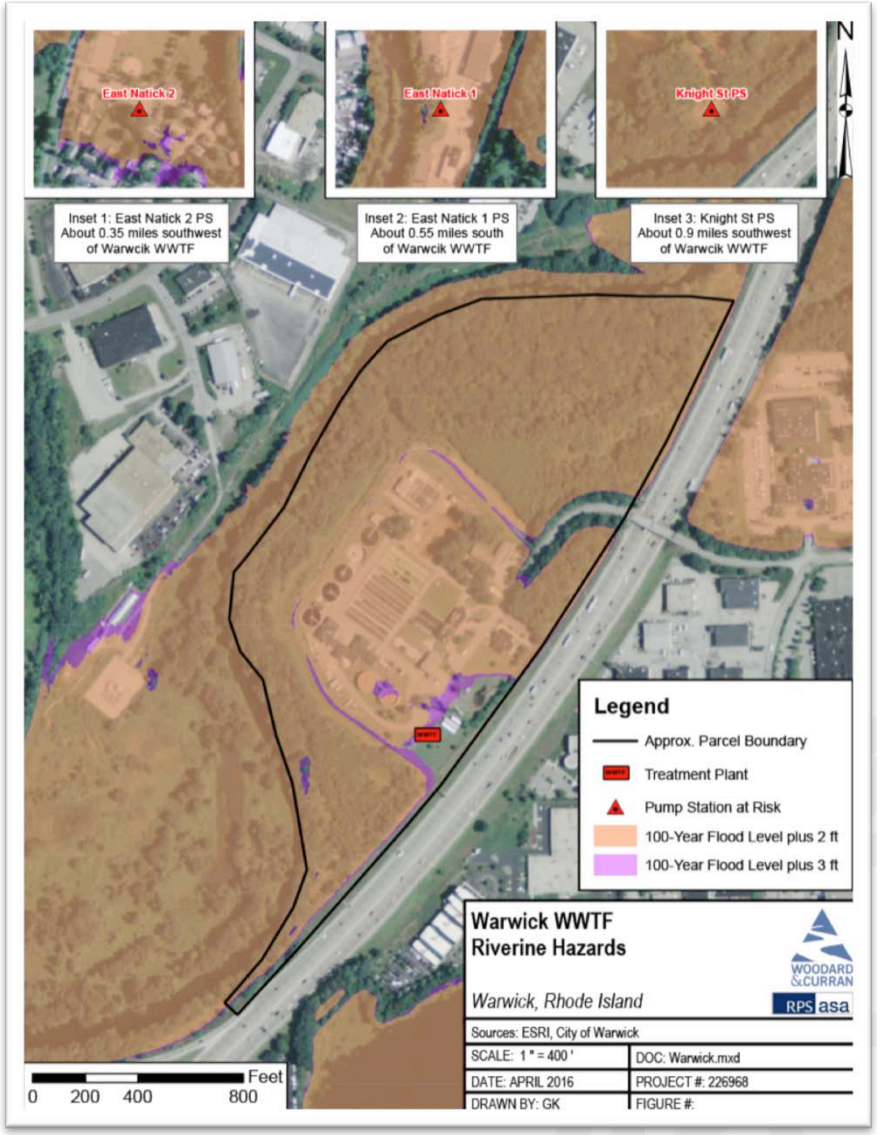
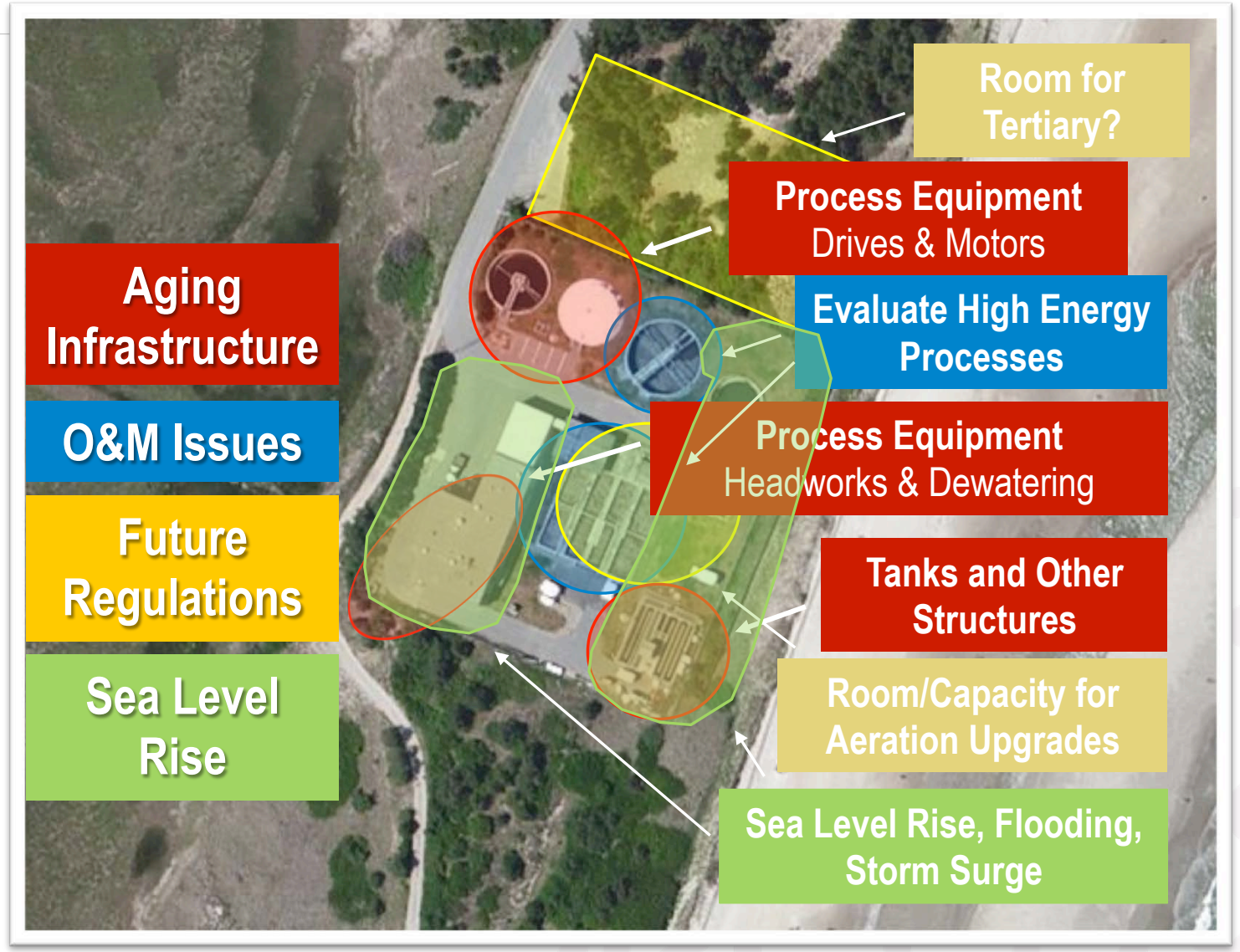




Step 3: Refined Risk Assessment

- Evaluate risk and impacts of failure to facility systems
- Prioritize systems, structures, and components requiring adaptive measures



Step 4: Recommendations for Adaptive Strategies

- Upgrades
- Relocation
- Protective barriers
- New access routes

Photos: Kennebunk Sewer District Berm, Warwick Protective Berm & Emergency Generator (Warren, RI)

Step 5: Outreach

State of Rhode Island

Cooperative Project Execution

Preliminary Results

Shoreline Change Assessment

Shoreline Change Inputs

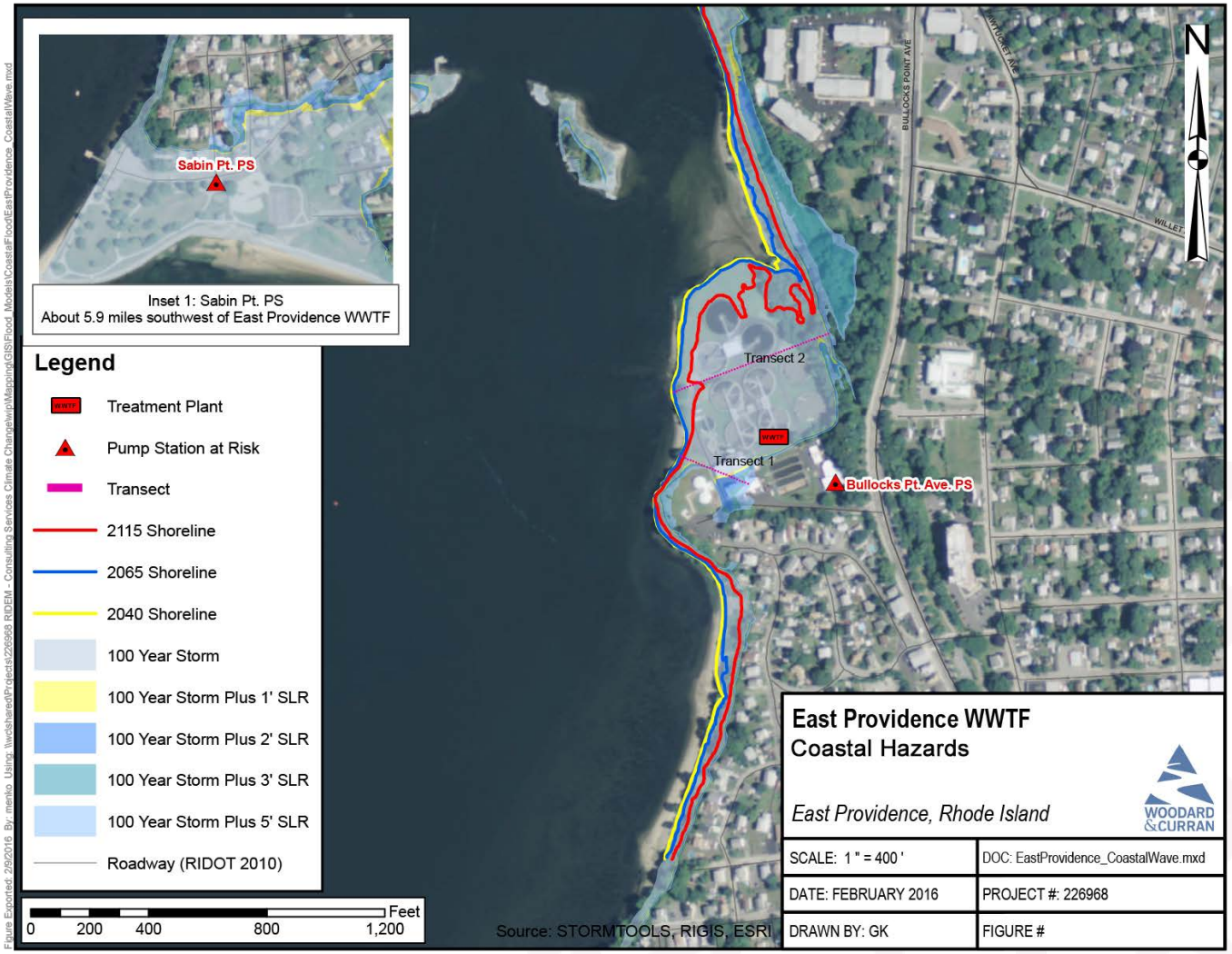
- Statewide LiDAR digital elevation model (URI)
- Projected sea level change on 25-, 50-, 100-yr time horizons
- Historic shoreline data mapped by USGS and CRMC
- Rates of erosion/accretion at shore normal transects

Shoreline Change Output

- GIS files of projected changes in shoreline orientation at various time horizons
- Results computed for select coastal reaches (plant locations)

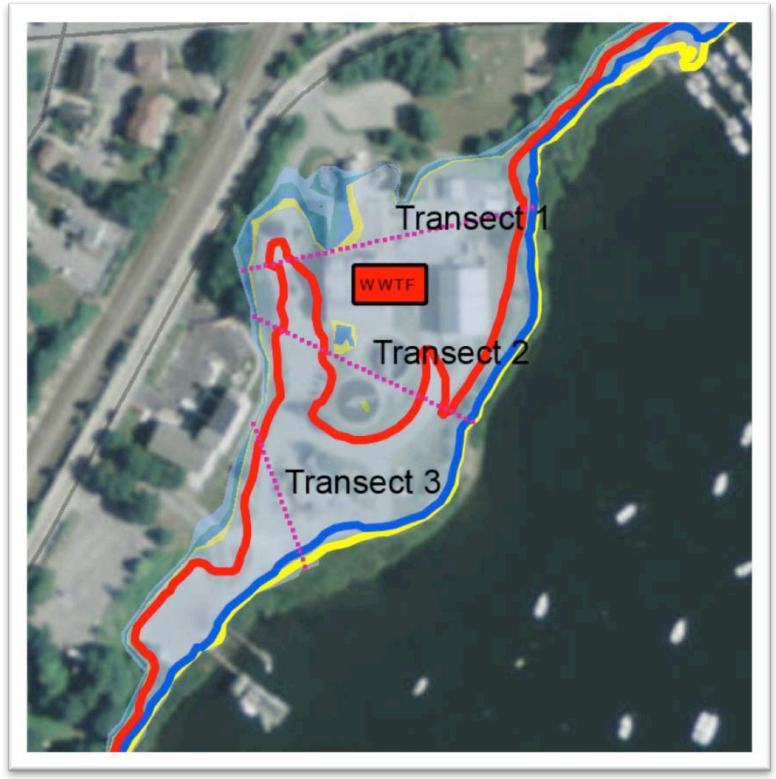
Coastal Hazard Assessment

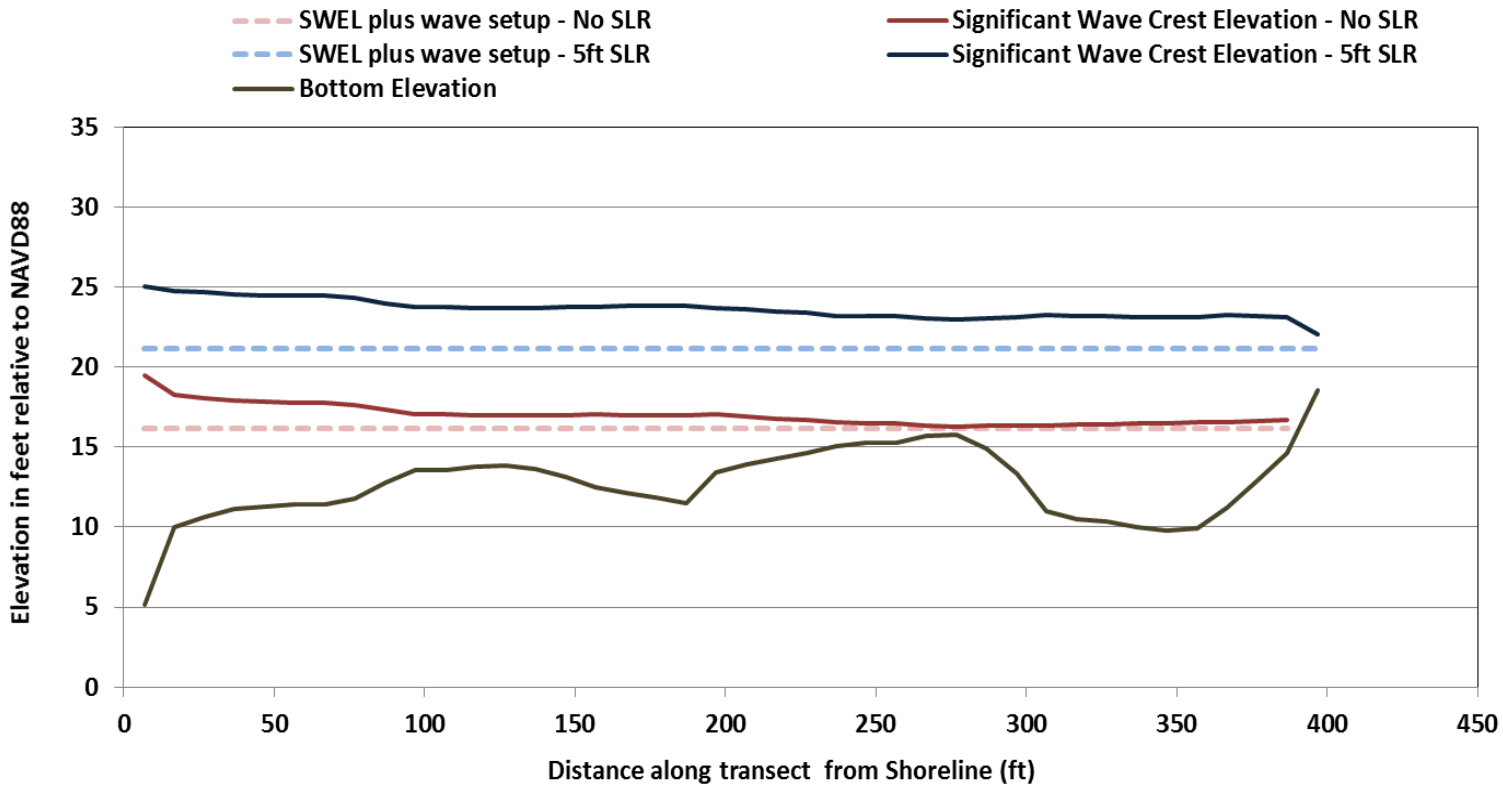
- Identified WWTF infrastructure at risk to inundation by storm surge and SLR
- Coastal climate change impacts to
  - 8 WWTFs
  - 24 Pump stations



Wave Hazard Assessment

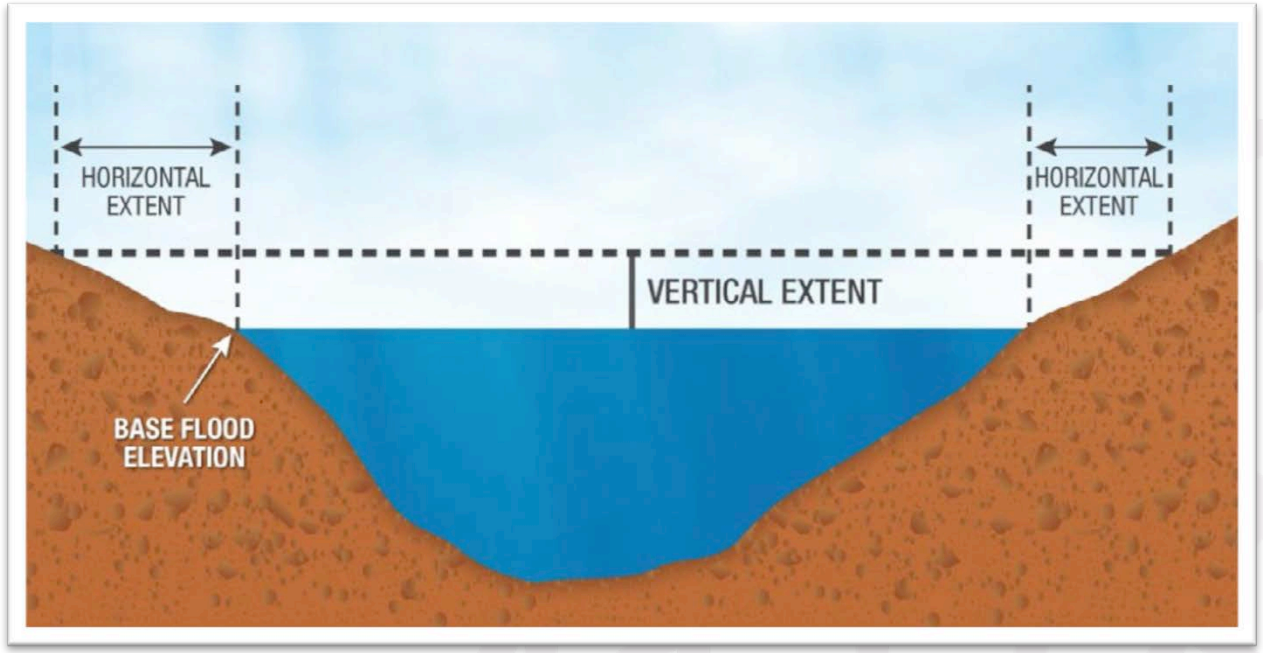
Wave Height Analysis for Flood Insurance Studies (WHAFIS) predictions for total water level at 8 WWTFs (19 transects)





Inland Flood Assessment

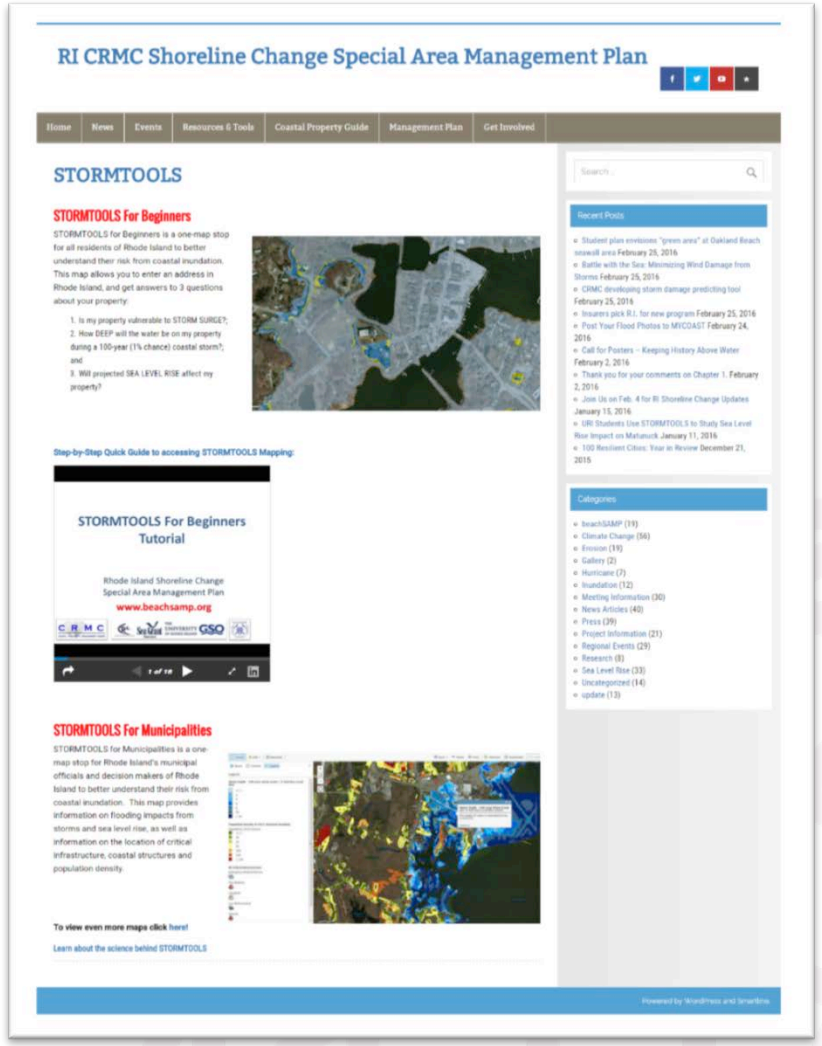
- Identified base flood elevations (BFEs) for inland waterways and mapped expanded floodplain boundaries for 2 feet and 3 feet increase per new Federal Flood Risk Management Standards (FFRMS)
- Identified 6 WWTFs at risk to inundation by inland flooding



Conclusions

Conclusions

- Expanded statewide coastal hazard assessment tools available online
- Significantly improved accuracy of statewide inland flooding potential
- Statewide collaboration and data sharing is helping:
  - RI WWTFs
  - Communities
  - Other State Agencies



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Thank You!

Project Approach

Step 1: Climate change science and potential for impacts in Rhode Island

Step 2: Preliminary assessment of climate change impacts to RI WWTFs

Step 3: Refined risk assessment of impacts on wastewater infrastructure

Step 4: Development of recommendations for adaptive strategies

Step 5: Final project report and outreach materials