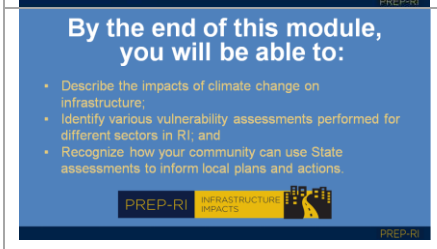
PREP-RI INFRASTRUCTURE IMPACTS

PRESENTATION NOTES

	1. Welcome to "Infrastructure at Risk: Protect Your Investments," this is part of the online series "Providing Resilience Education for Planning in Rhode Island", or PREP-RI. *** **Image Source:** WWTF Climate Vulnerability presentation, National Adaptation Forum, RI Department of Environmental Management, May 11, 2017 (pptx)
	2. I am Bill Patenaude, Principal Engineer at the Rhode Island Department of Environmental Management, and I'm joined by Michael DeLuca, Director of Community Development for Narragansett.
	3. Public infrastructure is expensive, built to last and difficult to relocate. Decisions about constructing new infrastructure, or adapting what is there now, must be strategic and often incremental. Designing with future conditions in mind will improve public safety and avoid costly repairs and hassles after hazard events.
	4. By the end of this module, you will be able to: ● Describe the impacts of climate change on infrastructure; ● Identify vulnerability assessments that have been performed for different sectors in Rhode Island; and ● Recognize how your community can use State assessments to inform local plans and actions.
	5. Natural hazards already threaten Rhode Island's infrastructure today, with increasing risks projected for the future. Affected infrastructure includes: ● Wastewater systems; ● Transportation, such as roads, bridges ports and harbors; ● Drinking water systems; and ● other critical infrastructure, including emergency services and energy networks; For many of these sectors, Statewide assessments have been conducted to evaluate the implications of climate change.

	*** **Image Sources (clockwise from top right):** 1. Wastewater Treatment Facility, Providence, Save the Bay's website 2. Critical infrastructure, M. Devine (N. Kingstown) 3. Flooded Street, Janet Freedman (Warwick) 4. Ferry, Pam Rubinoff
	6. Because water naturally flows downhill, wastewater treatment facilities and pump stations are often located at low elevations and within floodplains. Many of you likely remember the impacts to wastewater treatment plants during the 2010 floods.* A recent study of the vulnerability of Rhode Island's 19 major wastewater facilities to flooding and storm surge, among other findings,—determined that seven could be predominantly inundated in a catastrophic event**. The study includes individual facility assessments and suggests adaptive strategies such as flood-proofing, elevating, or relocating equipment. *** * The Flood Crews of 2010- A History of Rhode Island's 2010 Floods as Told by the State's Wastewater Collection and Treatment Operators, Nicolas Q. Holbrook, RIDEM Intern, 2017. ** Implications of Climate Change for RI Wastewater Collection & Treatment Infrastructure, Woodward & Curran, RPSASA, RIDEM, 2017. **Image Sources: (left to right)** 1. Cranson WWTF, The Flood Crews of 2010- A History of Rhode Island's 2010 Floods as Told by the State's Wastewater Collection and Treatment Operators, Nicolas Q. Holbrook, RIDEM Intern, 2017 2. Implications of Climate Change for RI Wastewater Collection & Treatment Infrastructure, Woodward & Curran, RPSASA, RIDEM, 2017.

7. Assessments of state and municipal transportation assets found that every coastal community in Rhode Island will likely be impacted by sea level rise.* More than four miles of roadway are expected to flood at high tide given one foot of sea level rise--and over 60 miles at three feet of sea level rise. A 1% annual chance storm would flood many additional miles of roadway. Many bridges, rail segments, bike trails, and RIPTA routes will be affected in the various scenarios as well. Associated fact sheets for each municipality list vulnerable assets.

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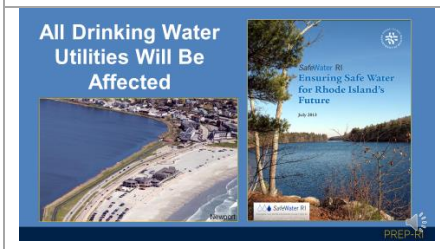
* Vulnerability of Transportation Assets to Sea Level Rise, RI Department of Administration, January 2015.

* Vulnerability of Municipal Transportation Assets to Sea Level Rise and Storm Surge, RI Department of Administration, September 2016.

Image Sources: (left to right)
1. Corn Neck Road after Superstorm Sandy, RIDOT
2, 3. Map and Infographic, RI Statewide Planning Division



8. An assessment of the impacts of climate change on Rhode Island drinking water utilities* found that all will be affected to some degree. Modeling estimates show that water utility losses from sea level rise, flooding, and hurricanes will total almost $90 million by the year 2084. The study presents strategies to prevent infrastructure losses from hazards and ensure adequate potable water supplies; and suggests integrated management and planning to enhance adaptation.

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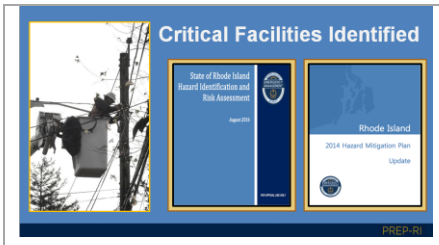
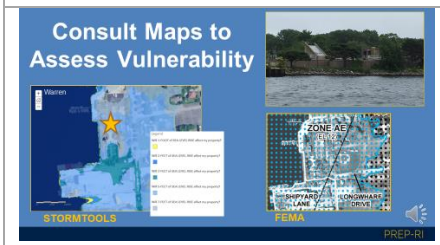
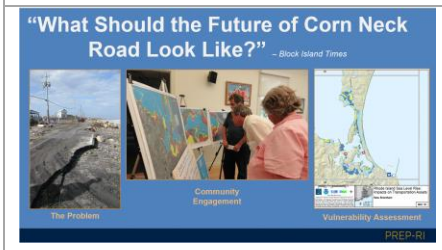
* SafeWater RI: Ensuring Safe Water for Rhode Island's Future, RI Department of Health, July 2013.

Image Source: (left to right)
1. Easton's Pond, First Beach, Newport, G. Brownell, CAP exercise with Red Cross. 2016.
2. SafeWater RI: Ensuring Safe Water for Rhode Island's Future, RI Department of Health, July 2013

	9. Rhode Island's emergency management planning efforts evaluate a broad array of critical facilities. These can be used as a starting point for municipal plans. *** * State of Rhode Island Hazard Identification and Risk Assessment, RI Emergency Management Agency, August 2016.) * RI 2014 State Hazard Mitigation Plan, RI Emergency Management Agency, April 2014 **Image Source:** Electrical Worker, P. Rubinoff
	10. It is important to "know your risk, make a plan, and take action," as outlined in PREP-RIs' Adaptation Module. Municipalities can use these State assessments to screen for impacts in their own community, tailor recommendations, and develop priorities. Many communities have already begun to examine infrastructure and take actions to adapt and protect their assets for future conditions.
	11. A preliminary assessment of infrastructure impacts must be included in your Comprehensive Plan*, along with implementation actions to address priority issues. The municipal hazard mitigation plan can then be used to further assess priorities and operationalize proactive and post-recovery actions**. This sets the stage to incorporate long-term adaptations to vulnerable infrastructure such as pump stations or municipal facilities in the Capital Improvement Plan. Regarding the Transportation Improvement Plan, municipalities should work with the state to include adaptation for projects selected. Including adaptation actions in local plans also improves the chance of securing funds for priority projects. *** * The RI Comprehensive Planning Standards Guidance Handbook #12: Planning for Natural Hazards & Climate Change **Integrating Hazard Mitigation Into Local Planning, Federal Emergency Management Agency

	12. I will turn it over to Mike now to share examples of how communities have begun to adapt their infrastructure to changing conditions.
	13. The Scarborough Wastewater Treatment Plant in Narragansett demonstrates three general types of action that can be used to rethink how infrastructure can be adapted to reduce risk to current and future conditions: First, the new berm is designed to **protect** critical elements of the facility and to reduce impacts from coastal flooding. The design includes consideration of future sea level rise in addition to storm surge that could affect the plant. Second, generators at the pump station were elevated to **accommodate** flooding that will likely occur during its life. Third, in decades to come, when the facility's functional life comes to an end, its replacement will likely be relocated to **avoid** impacts. The future site would be identified well in advance to allow time to acquire the land and secure sufficient funding. *** **Image Sources:** 1. "Protect," Scarborough WWTF, RT Group, Inc., Town of Narragansett 2. "Accommodate," Stanton Ave Pump Station, Town of Narragansett 3. "Avoid," Scarborough WWTF, STORMTOOLS, Coastal Resource Management Council
	14. In Warren officials consulted FEMA's flood maps and STORMTOOLS maps to determine the vulnerability of its wastewater facility. To rectify the differences between the two map sets, the town worked with CRMC and RIDEM to come up with a reasonable standard for construction which factored in the expected life of the upgraded facility.* A cost-benefit analysis revealed that certain expensive equipment should be relocated or flood proofed, while it would be more cost effective to let other lower value equipment flood during an event and then have it replaced. *** *Personal communication with Kate Michaud, Warren Town

	Planner. **Image Sources: (left to right)** 1. STORMTOOLS Online Mapper 2. Federal Emergency Management Agency Map Service Center 3. Warren, P. Rubinoff
	15. In Middletown, Third Beach Connector Road was elevated to improve resiliency and traffic safety.* At the same time, power lines were buried to prevent wind from causing power outages. While the elevation does not avoid the problem of storm surge or sea level rise indefinitely, it demonstrates a thoughtful compromise between projections of future hazards, site constraints, and the need to provide safe access. *** * Personal communication with Tom McLaughlin, Middletown, DPW. **Image Source:** Third Beach Connector Road, T. McLaughlin
	16. The Rhode Island vulnerability assessment identified Corn Neck Road on Block Island as one of the municipality's most vulnerable roads.* In fact, the road experienced flooding and wave damage in both 2010 and 2012. The town's comprehensive plan states the need to "conduct a planning study of Corn Neck Road to identify alternatives to mitigate future impacts from storms and climate change" and the town's Hazard Mitigation Plan identifies "Raising or relocating the road" as a high priority.** Funded by a Community Development Block Grant, studies have begun and stakeholders have engaged in developing alternatives for potential action. *** *Coastal Sea Level Rise and Storm Surge: Transportation Fact Sheet, New Shoreham – RI Statewide Planning ** Hazard Mitigation Plan, New Shoreham (pg. 82, 85) **Image Sources:** (left to right) 1. RI DOT Flickr October, 2012; 2. Block Island Public meeting, P. Rubinoff; 3. Map from Vulnerability Assessment: Vulnerability of Transportation Assets to Sea Level Rise, Technical Paper 164, January 2015

17. Sea level rise is being incorporated into new projects. The Providence River Pedestrian Bridge design incorporated elevation as a condition of the CRMC permit issued to the RI Department of Transportation.* In Barrington, the reconstruction of the White Church Bridge incorporated sea level rise as a result of discussions between the agencies.

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*Personal communication with Jim Boyd, Policy Analyst, CRMC.

Image Source: (left to right)
1. Pedestrian Bridge, I-195 District
2. Bridge, RI DOT Flickr, September 2015

18. Concerned about its drinking water infrastructure and the potential risk to over 1,800 properties, South Kingstown relocated its water main along Matunuck Beach Road to reduce exposure to erosion and flooding.

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Image Sources: (left to right)
1. Construction, P.Rubinoff
2. Water Main, Town of S. Kingstown

19. For some vulnerable areas, municipalities are coordinating with state agencies to improve long term outcomes. With the new 10-year Transportation Improvement Plan and its annual reviews, there will be more opportunities for discussions with state agencies about transportation priorities, projects, and adaptation actions. The CRMC and DEM can provide vital assistance during infrastructure planning to help assess risk and design accommodations for sea level rise and storm surge.

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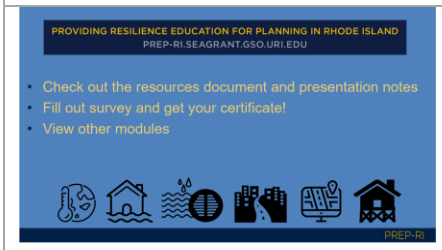
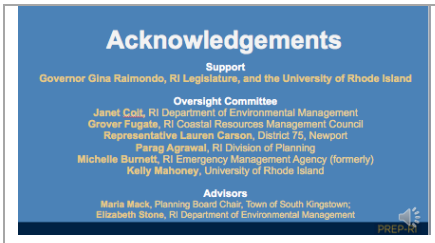
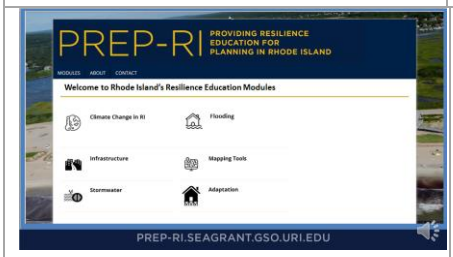
Image Source:
Meeting, P. Rubinoff

	20. Most successful funding comes in the form of a "package," or combination of local funds that leverage outside funds such as grants or loans. The town of Middletown is dedicating $2 million from their sewer enterprise fund for sewer infrastructure to secure an additional $4 million in financing from the Rhode Island Infrastructure Bank. Together, this funding will be used to reduce the impacts of aging infrastructure, protect the system from major storm events, and reduce the risk of the station going off-line during an emergency. Now I'll turn it back to Bill to finish up. *** *Personal communication with Tom McLaughlin, Middletown, DPW. **Image Source:** Wave Ave Pump Station, T. McLaughlin
	21. The State has invested in identifying vulnerable infrastructure so that municipal decision makers may begin to incorporate adaptation action into local plans and develop funding strategies. Small steps to adapt to climate change may be reasonable short-term strategies that protect existing infrastructure and help communities bounce back after a hazardous event. That said, preparing for the long term is key. *** **Image Sources:** See Previous Slides
	22. Thank you for viewing this module. Go to the PREP-RI website to see the resources document, to give us your feedback and get your certificate, and to view other modules.

	23. The PREP-RI team acknowledges the support of statewide leaders, experts and practitioners who helped to make this module a reality. **Support** Governor Gina Raimondo, RI Legislature, and the University of Rhode Island **Oversight Committee** Janet Coit, RI Department of Environmental Management Grover Fugate, RI Coastal Resources Management Council Representative Lauren Carson, District 75, Newport Parag Agrawal, RI Division of Planning Michelle Burnett, RI Emergency Management Agency (formerly) Kelly Mahoney, University of Rhode Island **Advisors** **Austin Becker,** Professor, URI; **Tom O'Loughlin,** Town of Middletown
	24. And thanks to the PREP-RI Team for pulling this module together! Pam Rubinoff, Jennifer West, Jennifer McCann, Teresa Crean, Dawn Kotowicz, Mary-Kate Kane, Kevin Proft, Sue Kennedy, Cathy Dwyer, Monica Allard Cox
	25. Providing Resilience Education for Planning in Rhode Island PREP-RI.Seagrant.gso.uri.edu