Climate Adaptation for Coastal Communities

Engaging RI Local Governments in Mitigation and Resilience

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RIEMA Preparedness Conference

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/ RI Sea Grant

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Drivers to Plan for Natural Hazards & Climate Change

- Public Health, Safety & Welfare
- Investment of Public Funds for Infrastructure
- State Mandate
- Impacts Felt at Local Level from Multiple Hazards

Photo credit: Melissa Devine, Rhode Island Sea Grant
State Policies

RI Sea Level Rise Policy
- RI CRMC Red Book Section 145
- 3-5’ by 2100

Comprehensive Plans
- Rhode Island 2012 Comprehensive Planning and Land Use Act update
- Requirement for plans to address Natural Hazards
New Federal Flood Risk Management Standard
Executive Order 11988 as amended by Executive Order 13690

- Requires federal projects be constructed to a higher vertical elevation to address current and future flood risk and ensure that projects funded with taxpayer dollars last as long as intended.

- Draft standard - out for public comment until May 2015

- Applies to federal projects, including projects using federal funding

- Projects will need to comply with one of the following:
  - Conducting a full vulnerability assessment (using best available science);
  - Adding 2 or 3 feet of elevation/freeboard, (depending on criticality), above the 100-year, or 1% annual chance, flood elevation; or
  - Designing to the 500-year, or 0.2% annual chance, flood elevation.
EMBODYING STATE GOALS AND POLICIES

To be consistent with the State’s many goals for planning for natural hazards and to receive State approval, comprehensive plans must include goals, policies and implementation actions that address:

- Avoiding or minimizing the effects that natural hazards pose to lives, infrastructure and property.
### Municipal Comp Plan vs. Haz Mit Plan

<table>
<thead>
<tr>
<th>Natural Hazards &amp; Climate Change Component of Local Comprehensive Plan</th>
<th>VS.</th>
<th>Local Hazard Mitigation Plan</th>
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| - Used to guide local development and infrastructure decisions  
  - Must take a more holistic view  
  - Should align land use, transportation, infrastructure and other goals and policies with natural hazards considerations  
  - Should consider different aspects of natural hazards and climate change than what is typically found in a local hazard mitigation plan | - Both “identify policies and actions to reduce risk and future losses.”  
  - Info contained within HAZ MITPLAN can serve as the basis for addressing natural hazards in the comprehensive plan  
  - Goals, policies, and implementation program of the comprehensive plan can reinforce the strategies detailed within the hazard mitigation plan | - FEMA focused  
  - More detailed in emergency response & post storm recovery |
Some words of wisdom:

(1) When you update each plan, consider integration of the plans from the beginning of the process.

- What are the target hazards?
- Which action items fall into both plans?
- What do you need in the Comp Plan to better enable action in your Haz Mit Plan?
- What will be the biggest obstacles to implementation?
- Goals/policies and actions can’t conflict.

(2) HELP is available! Ask for assistance from RI Statewide Planning (RISPP) and RI Emergency Management Agency (RIEMA)
Case Study: North Kingstown

- Adaptation to Natural Hazards and Climate Change in North Kingstown, RI
- Map Atlas
- SLAMM maps
- Data analysis
- Adaptation strategies
- Prioritization
- Comprehensive Plan, Goals & Objectives
What is North Kingstown doing?

- **FEMA Community Rating System**  
  NK’s Rating = 9
  - Currently **5% reduction** on flood insurance premiums town-wide
  - NK taking steps to get down to an “8” rating = **10% reduction**!

- **Hazard Mitigation Plan updated in 2014**, estimated adoption by end of year

- NK will incorporate natural hazards planning into **2015 rewrite of NK’s Comprehensive Community Plan**
What can residents & businesses do?

• Be informed.
  • Know your risk
  • Know who to call & how to access resources

• Make a plan.
  • Comp Plans & Hazard Mitigation Plans locally
  • Elevate, relocate, or floodproof

• Take action.
  • Evacuate areas at risk
  • Get involved in Comprehensive Community Plan & Beach SAMP

• Spread the word!
1) **STORMS:**
   When the next storm hits Rhode Island this year and in years ahead, how far will the storm surge reach inland roads and properties, and how will the coastline erode and change as the waters surge and recede?

2) **SEA LEVEL RISE:**
   Over the next 20, 50, and 100 years, how will incremental sea level rise change the coastline of town, and what roads and properties will be inundated by two high tides per day at levels higher than we are seeing today?
Sea-Level Change Curve Calculator

USACE Curves computed using criteria in USACE EC 1165-2-212
NOAA Curves computed using criteria in NOAA SLR Report
06-Dec-2012

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Ch. 3 Figure C. USACE Online Sea Level Change Curve Calculator (www.corpsclimate.us/ccaceslcurves.cfm)

www.corpsclimate.us
Historic Storm, 1938 Hurricane—Wickford
Mapping Sea Level Rise – Wickford – Infrastructure

http://seagrant.gso.uri.edu/climate/slr_tools.html
Local Applications

- Comprehensive Plan / Regulatory
- Hazard Mitigation
- Municipal Capital Improvement Plan
- State of RI Transportation Improvement Program (TIP)
- Building Code
- Open space acquisition
- Incorporate into town GIS and IMS
- Community Rating System (CRS)
The three maps on the right illustrate sea level rise scenarios for the Wickford Historic area of North Kingstown, RI using a digital elevation model and an aerial photograph with a "bathtub model" approach to show the projected boundaries of two high tides per day on the municipal landscape.

The accompanying illustrated maps (underneath each SLR scenario map) show the individual parcels and properties that intersect each sea level rise scenario, as well as specific segments of roads and bridges that are projected to be at risk from projected sea level rise scenarios in North Kingstown.

The green map below shows the FEMA flood zones for the Wickford Historic area.

These draft maps are intended for illustrative purposes only.
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Wickford Village, MHHW+5 ft

Sea Level Rise, MHHW+5 ft

Sea Level Affecting Marshes Model, MHHW+5 ft
Scope
Assess
Design
Adopt
Implement
Monitor & Evaluate

☑ Stakeholder engagement throughout

☑ Each step should be reviewed to see how it compares to initial scope & assessment
- Identify Goals
- Clarify Assessment Outcome
- Define Scale
- Data Needs and Sources

- Select a Planning Team
- Outline Public Process
- Capacity Building
- Prioritize Moving Forward
### Natural Hazards

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### Infrastructure, Assets, Resources and Populations

#### Building and Infrastructure
- Residential neighborhoods & homes
- Commercial & Industrial areas & businesses
- Historic and cultural sites or structures
- Public or Emergency facilities
- Healthcare facilities, nursing homes & assisted living facilities
- Municipal buildings
- Major roads and evacuation routes
- Public Transportation routes, stops or hubs
- Rail lines and stations; Airports
- Water supply infrastructure
- Wastewater infrastructure
- Stormwater drainage
- Natural Gas, Electricity or Energy Production infrastructure
- Marine Facilities; Dams
- Solid waste transfer stations
- Telecommunication infrastructure

#### Natural Resources
- Parks and recreation facilities
- Lakes, rivers and other water bodies
- Reservoirs
- Wetlands (coastal and freshwater)
- Coastal barriers (dunes, marshes, coastal ponds)
- Wildlife and endangered species
- Forests; Undeveloped and/or conservation lands

#### Special Populations
- Senior citizens
- Young children
- Low-income, unemployed or under-employed Renters
1% and 0.2% storm (also known as the 100 and 500 year storm event)  

Special Flood Hazard Areas using the most recent Federal Emergency Management Agency’s Flood Insurance Rate Maps  

Projected areas inundated due to sea-level rise:  
- 1 foot  
- 3 feet  
- 5 feet
ASSESS

- Compile Data and Maps
- Identify Exposed Assets
- Determine the Vulnerability of Exposed Assets
- Identify Priority Impacts
- Compare Results to Other Planning Efforts
- Stakeholder Review

COLLECT
SYNTHESIZE
ANALYZE
- Compile Data and Maps
- **Identify Exposed Assets**
- Determine the Vulnerability of Exposed Assets
- Compare Results to Other Planning Efforts
- Stakeholder Review
One potential process to identify vulnerable properties

- Creating a series of sea level rise maps for each study area
- “Lighting up” the parcels that are flooded under each scenario
STORMTOOLS:
Maps of Storms + Sea Level Rise

Visualizations
Maps flooding from a 25, 50, 100-year storm PLUS Sea Level Rise

**More accurate depiction of future flooding risk

Applications
Day-to-Day operations
Long term planning/financing

http://www.beachsamp.org/resources/understand-risk/
Vulnerability of Critical Facilities

STORMTOOLS
25-year Storm Event + SLR

Police / Fire / EMA
- First responders
- Recovery efforts

WARWICK – Is placement of existing fire stations sufficient for serving Warwick Neck during a storm event?

http://www.beachsamp.org/maps/stormtools
STORMTOOLS:
Maps of Storms + Sea Level Rise

Also provides flooding depth at specific points

http://www.beachsamp.org/resources/understand-risk/
- **Craft Adaptation Strategies**
  - Review Adaptation Options
  - Identify Opportunities to Mainstream Adaptation into Municipal Processes
  - Select Strategies and Actions

- **Prioritize Actions**

- **Integrate Adaptation into Planning Programs**

- **Stakeholder Review**
SAMPLE GOALS, POLICIES AND IMPLEMENTATION ACTIONS FOR NATURAL HAZARDS AND CLIMATE CHANGE

SAMPLE GOALS

- Our community will act in an integrated manner to implement a standard of resilience from natural hazards.
- Systems will be in place to minimize impacts from natural hazards in our vulnerable areas.

SAMPLE POLICIES

- Plan to accommodate a base rate of 3 to 5 foot rise in sea level by 2100 in the siting, design, and implementation of public and private coastal activities.
- Require municipal departments to incorporate climate change in all long-range planning and critical public infrastructure projects.
- Ensure that the local Hazard Mitigation Plan is up-to-date and utilizes the most recent available technical data for natural hazards and climate change.
- Ensure consistency between the Hazard Mitigation Plan, the Comprehensive Plan, SAMP plans, the city’s land use regulations, and the local Harbor Management Plan.
- Ensure that existing critical facilities are protected or otherwise improved to function in hazard and disaster situations.
- Ensure that new facilities are sited in areas that are not prone to flooding or other hazards.
- Improve the municipality’s stormwater management system to enhance infiltration and expand stormwater retention areas.
- Ensure that there is adequate funding and administrative support to implement the recommendations in the local Hazard Mitigation Plan.
- Educate the public to better understand the concept of community resilience and the meaning of probabilities and risk, especially for stream and coastal flooding.
- When making improvements to parks, playgrounds and other open spaces, include improvements so that these areas can function as stormwater retention areas.
- Encourage stormwater drainage improvements that reduce runoff and increase the permeability of the built environment.
- Expand the tree canopy in urbanized areas of the community to reduce heat impacts.
- Continue to improve community resilience in order to maintain the municipality’s Community Rating System score.
- Encourage reduction of carbon emissions in the municipality through improved transportation efficiency, reduction of traffic congestion, encouragement of alternative transportation options (rail, bike, pedestrian infrastructure), and implementation of an anti-idling ordinance for trucks, buses, and other vehicles.
- Ensure that public facility improvements necessary for increasing resiliency have priority placement on the municipal Capital Improvement Program.

SAMPLE IMPLEMENTATION ACTIONS

- Define areas of the municipality that fall within these categories Protection Zones that may be hardened to prevent or minimize floodwater intrusion; Accommodation Zones that are designed to be temporarily flooded with a high tide or storm event; Retreat Zones that have a master plan for managed retreat of structures and residents permanently out of the area; and Preservation Zones that have an established management plan for natural or cultural resource preservation.
- Provide incentives for achieving a higher level of flood protection when designing and constructing municipal infrastructure.
- Update the local Hazard Mitigation Plan on a minimum of every 3 years and as needed after natural hazard events.
- Complete vulnerability assessments of all municipal infrastructure to determine priorities for adaptation.
- Complete an assessment to identify the vulnerability of all critical public facilities such as police and fire stations, hospitals and schools, and other services.
- Develop a priority list of facilities that need to be hardened or otherwise improved and seek funding for improvements.
- Determine an appropriate funding source for acquisition of properties in the municipality’s most vulnerable areas.
- Revise local subdivision and land development regulations to require the incorporation of natural drainage systems, such as rain gardens and other small water management infrastructure, in private development.
- Design all new public buildings to include stormwater management best practices including the use of pervious materials, green roofs, and natural drainage systems.
- Undertake a study, working with the local land trust, to identify high priority water-adjacent land that could be designated as permanently protected open space.
- Review land uses in exposed areas to determine whether restrictions are necessary to prevent or lessen potential losses during large storm events.
- Develop design guidelines with examples of attractive design solutions for elevating existing buildings and for development of new elevated buildings.
- Develop and implement a street tree program in the municipality’s most urbanized areas.
- Identify tree species that will be most resilient to climate change and use these species in public landscaping projects.
- Develop and disseminate an educational campaign for the public on reducing risks to private property.
- Create an Emergency and Disaster Preparedness section on the municipal website with information on minimizing risk to private property and on general preparedness.
- Work with the state and FEMA to make brochures and other information available on the City website, in the library, and at other city destinations, such as community centers.
- Hire a Community Rating System (CRS) coordinator to assist in implementing measures to increase the community’s rating for the CRS program.
- Implement use restrictions within the Special Flood Hazard Area (SFHA) as well as in coastal areas projected to be inundated by future sea level rise scenarios.
- Create a Sea Level Rise Overlay Zone in a defined area along the coast that restricts or prohibits development of new structures and outlines plans for managing parcels and properties after storm events (i.e. debris management, removal requirements of damaged/abandoned structures, etc.).
- Establish a process to reexamine the science and sea level rise projections and estimated timeframes for rise to maximize protection of assets and public safety within impacted areas.
- Coordinate with RI CRM and RI DEM to establish clear and consistent setback requirements from boundaries of projected sea level rise scenarios or salt marsh migration areas for any structure proposed within the Special Flood Hazard Areas.
DESIGN

- Craft Adaptation Strategies
- Prioritize Actions
- Integrate Adaptation into Planning Programs
- Stakeholder Review
# Impact Prioritization Tool - Sample

Impact Statement: "Bayfront Park" will be impacted by coastal erosion.

<table>
<thead>
<tr>
<th>IMPACTS</th>
<th>IMPACT SEVERITY (high, medium, low)</th>
<th>ADAPTIVE CAPACITY (high, medium, low)</th>
<th>LEVEL OF NEED (high, medium, low)</th>
<th>ONSET</th>
<th>PRIORITY (high, medium, low)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loss of bayfront walkway</td>
<td>Medium</td>
<td>High</td>
<td>Low Need</td>
<td>Near-term</td>
<td>Low</td>
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<tr>
<td>Loss of fishing area</td>
<td>Low</td>
<td>Low</td>
<td>Medium Need</td>
<td>Near-term</td>
<td>High</td>
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<tr>
<td>Interrupted use of only park in neighborhood</td>
<td>Medium</td>
<td>Low</td>
<td>High Need</td>
<td>Near-term</td>
<td>High</td>
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</tbody>
</table>

![Impact Prioritization Diagram]

**Severity of the Impact**
- High
- Medium
- Low

**Adaptive Capacity**
- High
- Medium
- Low

**Level of Need**
- High Need
- Medium Need
- Low Need

**Onset**
- Near-term
- Mid-term
- Long-term
TOWN OF NORTH KINGSTOWN
Sea Level Rise Exposure Assessment
Study Area Map Key

**NORTH KINGSTOWN Sea Level Rise Scenarios - Study Area Prioritization Worksheet**

<table>
<thead>
<tr>
<th>STUDY AREA NUMBER</th>
<th>STUDY AREA NAME</th>
<th>Evacuation Route Impacted?</th>
<th>Barrier to Ingress/Egress?</th>
<th>Public Facilities Impacted?</th>
<th>State Route Impacted by 1' OR 3' SLR</th>
<th>State Route Impacted by 5' SLR</th>
<th>Local Road Impacted by 1' OR 3' SLR &lt; 1mi</th>
<th>Local Road Impacted by 5' SLR &lt; 1mi</th>
<th>Historic District Impacted?</th>
<th>TOTAL</th>
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</tbody>
</table>

**POINT VALUE**

- Evacuation Route Impacted: 2 points
- Barrier to Ingress/Egress: 2 points
- Public Facilities Impacted: 2 points
- State Route Impacted by 1' OR 3' SLR: 1 point
- State Route Impacted by 5' SLR: 1 point
- Local Road Impacted by 1' OR 3' SLR < 1mi: 1 point
- Local Road Impacted by 5' SLR < 1mi: 1 point
- Historic District Impacted: 1 point

**TOTAL**

- Number of study areas: 12
- Total points: 12

Note: The table values are indicative and may require specific criteria for assessment.
Wickford Village, MHHW+5 ft

Sea Level Rise, MHHW+5 ft

Sea Level Affecting Marshes Model, MHHW+5 ft
INTEGRATE ADAPTATION INTO PLANNING PROGRAMS

- Plan Implementation Timeline and Identify Responsible Party
- Day to day, and long term
- Share with Stakeholders
Local Adoption of Vulnerability Assessments & Adaptation Measures:

- Formal Adoption Options
- Guidance
- Incorporation into Standard Operating Procedures
Implementing Adaptation Measures:

- Adaptation Funding
- Governance
- Leadership
- Local Capacity Building
- Modify Municipal Operations, Departmental Duties & Processes
Mainstream Into Annual/Regular Updates
- Annual CIP or Biannual TIP, Hazard mitigation priorities
- 5 year Comprehensive Plan Implementation Report
- Hazard Mitigation Review
- NFIP Community Rating System (CRS) Audit
Capture Lessons Learned
Compare to State Policy
Create database of impacts & losses
Building Tools in Partnership
http://rhody.crc.uri.edu/accnk/

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401-874-6626