



TIDES TO STORMS: PREPARING FOR NEW HAMPSHIRE'S FUTURE COAST

Assessing Risk and Vulnerability of Coastal Communities
to Sea Level Rise and Storm Surge

Seabrook - Hampton Falls – Hampton - North Hampton – Rye - New Castle - Portsmouth

The Rockingham Planning Commission has completed a Vulnerability Assessment for Hampton Falls, which identifies areas of town at risk of flooding from rising sea levels and coastal storm surge. Please join staff from the Rockingham Planning Commission and members of the Hampton Falls Planning Board and Conservation Commission to learn more about threats posed by increased flooding.

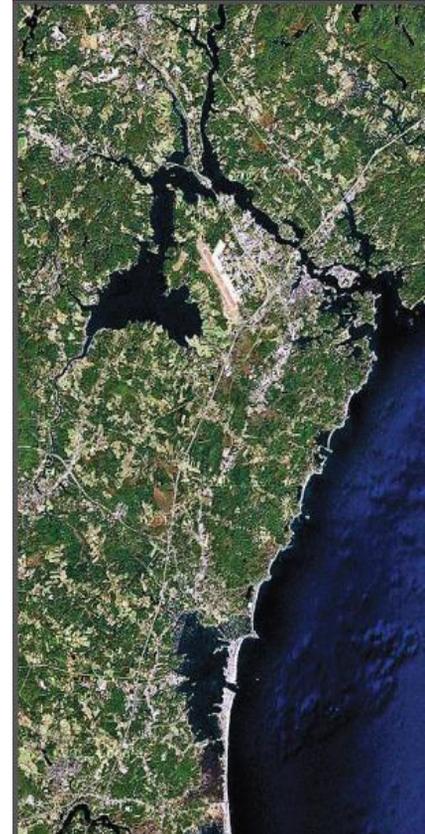
Wednesday, July 27, 2016

7:00pm

Hampton Falls Town Hall

1 Drinkwater Road

Hampton Falls, NH



How does the Vulnerability Assessment benefit my community?

The project is intended to assist coastal communities with taking action to prepare for increase flood risk, including:

- Enhance preparedness and raise community awareness of future flood risks.
- Identify cost-effective measures to protect and adapt to changing conditions.
- Improve resiliency of infrastructure, buildings and investments.
- Protect life, property and local economies
- Protect services that natural systems provide
- Preserve unique community character

For more information, please contact Theresa Walker of the Rockingham Planning Commission. twalker@rpc-nh.org. 603-778-0885



This project is funded by New Hampshire Homeland Security and Emergency Management (HSEM) through a Pre-Disaster Mitigation Grant from the Federal Emergency Management Agency (FEMA).



How can Hampton Falls be better prepared for coastal flooding and extreme weather events?

Presentation and Discussion

***Tides to Storms: Town of Hampton Falls, NH – Vulnerability Assessment of
Projected Sea-Level Rise and Coastal Storm Surge Flooding***

Wednesday, July 27th

7:00pm

Hampton Falls Town Hall

Join staff from the Rockingham Planning Commission and members of the Hampton Falls Planning Board and Conservation Commission to learn how vulnerable Hampton Falls may be to rising sea levels and coastal storms. We'll review a new report and maps that assess the risk and vulnerability to sea level rise and storm surge in coastal New Hampshire. We'll discuss potential impacts and changes based on different flood events on homes and roads. We'll also discuss impacts to salt marshes and wetlands and what the town and residents can do to help prevent or reduce property damage. For more information, please contact Theresa Walker of the Rockingham Planning Commission at 603-534-3913, twalker@rpc-nh.org.

Hampton Falls Master Plan Committee Meeting September 8, 2016

Summary of suggested ways in which the 2015 Tides to Storms Vulnerability Assessment may be incorporated into the Hampton Falls Master Plan update:

Existing and Future Land Use – Current precipitation events and higher tides already cause flooding along Route 1 at Dodge Ponds and Marsh Lane, and at the end of Depot Road at the town landing, and along Brimmer Lane.

The Vulnerability Assessment identifies increased areas of flooding caused by the three sea level rise scenarios and storm surge. Consideration is needed for new development or expansion of existing buildings in areas adjacent to tidal creeks and marshes

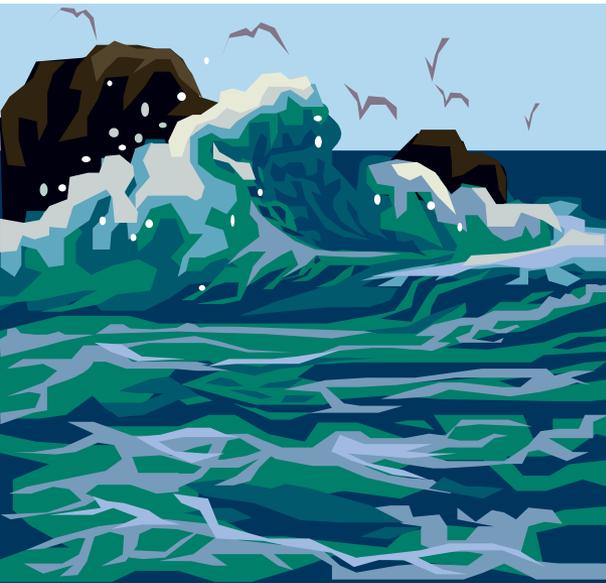
Adoption of a local flood hazard overlay district that includes higher development standards in areas of town identified as being at risk can help minimize impacts from flooding and storm surge. Options include requiring an additional 1-2 feet to the base flood elevation for non-critical structures and 2-3 feet for critical structures.

Wetland buffers and setback regulations also need to account for risk and vulnerability of buildings, infrastructure and natural resources posed by rising sea levels and storm surge. Marshes and wetlands in the coastal floodplain provide flood storage and storm wave energy reduction (as well as habitat and pollution prevention) and need to be protected and provided with undeveloped areas in which to migrate as water levels rise. Inland wetlands provide flood storage.

Recommendations may include:

- No variances granted in the floodplain.
- Adoption of a local flood hazard overlay district ordinance.
- Adoption of buffer and setback regulations that adequately separate development and infrastructure from tidal wetlands, freshwater wetlands, and surface waters to sustain flood storage capacity, and allow for inland migration of tidal marsh systems and conversion of freshwater systems to tidal systems to accommodate projected rise in sea-levels.

Housing – Creation of new housing stock or expansion of existing should be prevented in areas identified at risk by the Vulnerability Assessment.



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Assessing the Risk and Vulnerability of NH Coastal Communities to Sea Level Rise and Storm Surge

Town of Hampton Falls, NH

July 27, 2016

Theresa Walker
Consultant Planner

Julie LaBranche
Senior Planner



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King Tide 2011
Flooding on Route 1



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Route 1 southbound at
Dodge Ponds and Whittier Pond



Route 1 northbound, south of
Dodge Ponds and Whittier Pond



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Brimmer Lane



Depot Road



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Depot Road



Depot Road



Goal: Assess and plan for projected future impacts to NH's coastal resources and assets from sea level rise and storm surge

Vulnerability Assessment Results

- Critical Infrastructure
- State and Local Roads
- Utilities and Infrastructure
- Natural Resources - Environment

Regional Planning Recommendations

- Policy and Planning Recommendations
- Regulatory Strategies
- Non-Regulatory Approaches

*Local
Hazard Mitigation
Plans*

*State Agency
Plans*

*Regional
Master Plan*

*Natural Resource
Conservation*



Hampton Falls Vulnerability Assessment

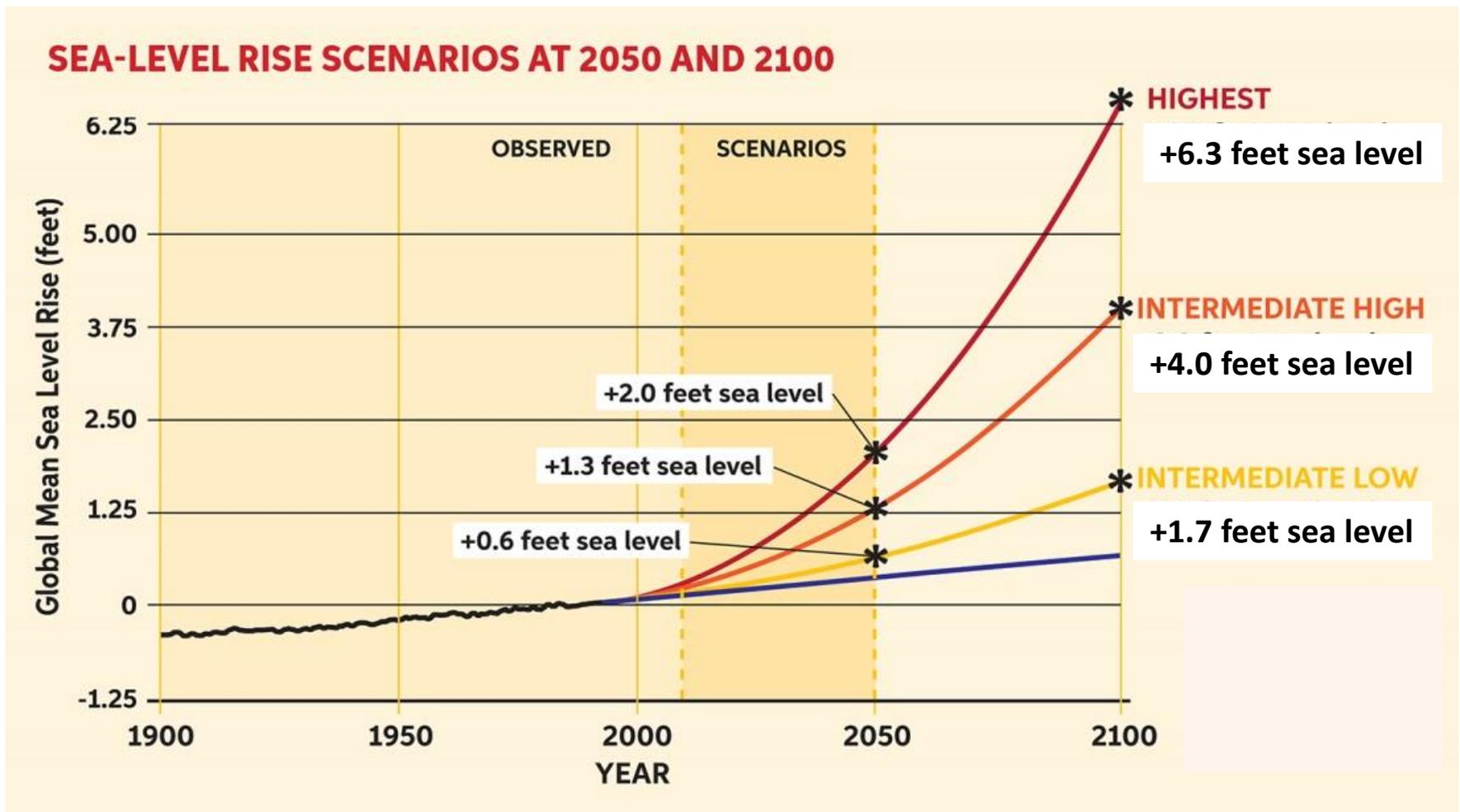
- Recommendations for Regulatory, Policy and Planning, Non-Regulatory/Outreach actions
- Short-term actions (1-5 years) that address current impacts (tidal flooding) and threats (severe storms)
- Low cost, high return actions
- 'No Regrets' actions that build resilience to future conditions
- Stepping stones to longer-term investment strategies, land use decisions and public awareness



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Sources: 1) Wake CP, E Burakowski, E Kelsey, K Hayhoe, A Stoner, C Watson, E Douglas (2011) *Climate Change in the Piscataqua/Great Bay Region: Past, Present, and Future*. 2) Wake CP, Kirshen P, Huber M, Knuuti K, and Stampone M (2014) *Sea-level Rise, Storm Surges, and Extreme Precipitation in Coastal New Hampshire: Analysis of Past and Projected Future Trends*.

Scenarios for Mapping and Analysis: Sea-Level Rise and Storm Surge





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Base Maps:

(map at left)

Sea-level Rise =

+ 1.7 feet

+ 4.0 feet

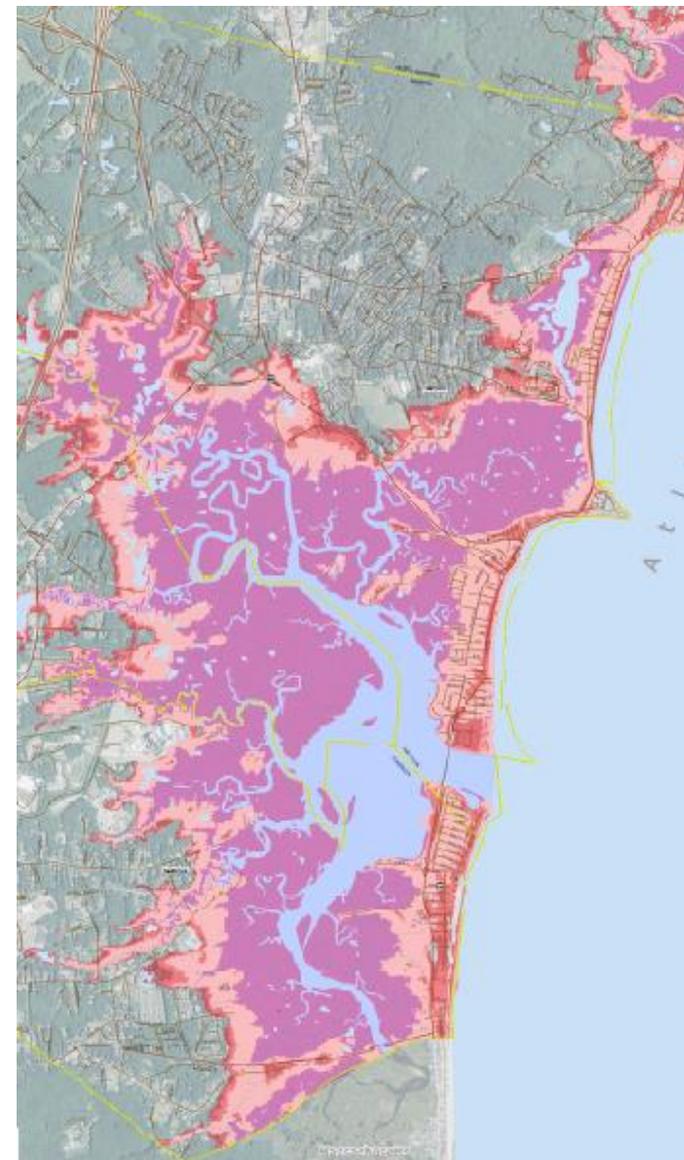
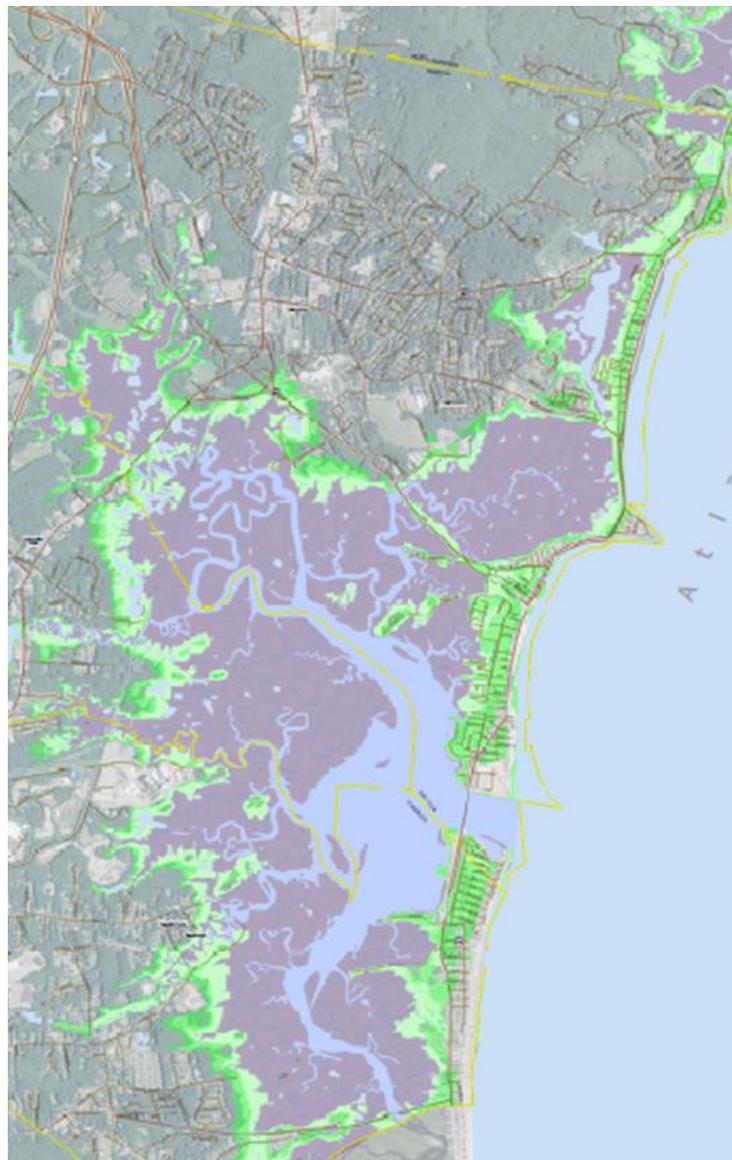
+ 6.3 feet

(map at right)

Storm Surge +

Sea-level rise =

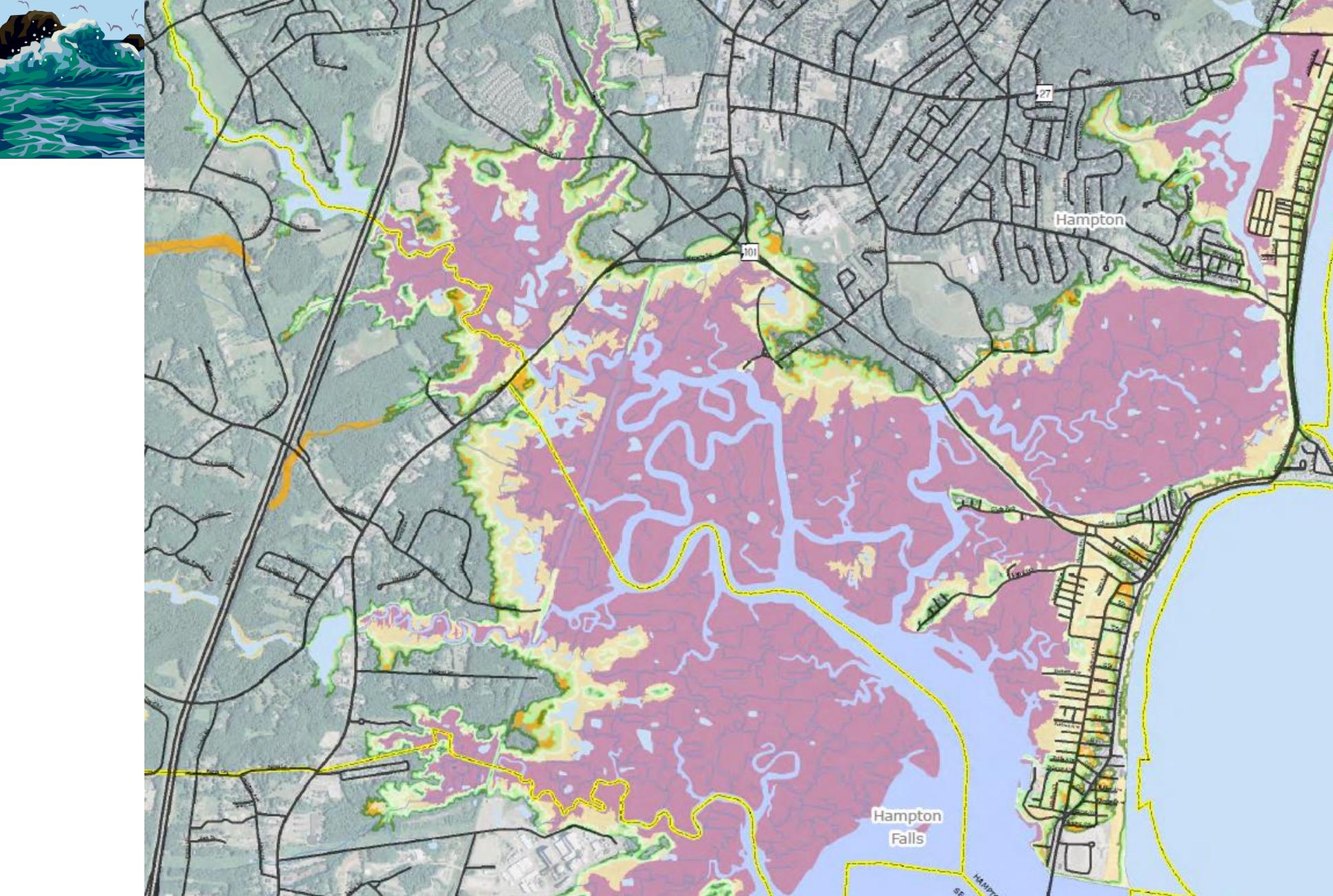
+ 100-year flood
and SLR



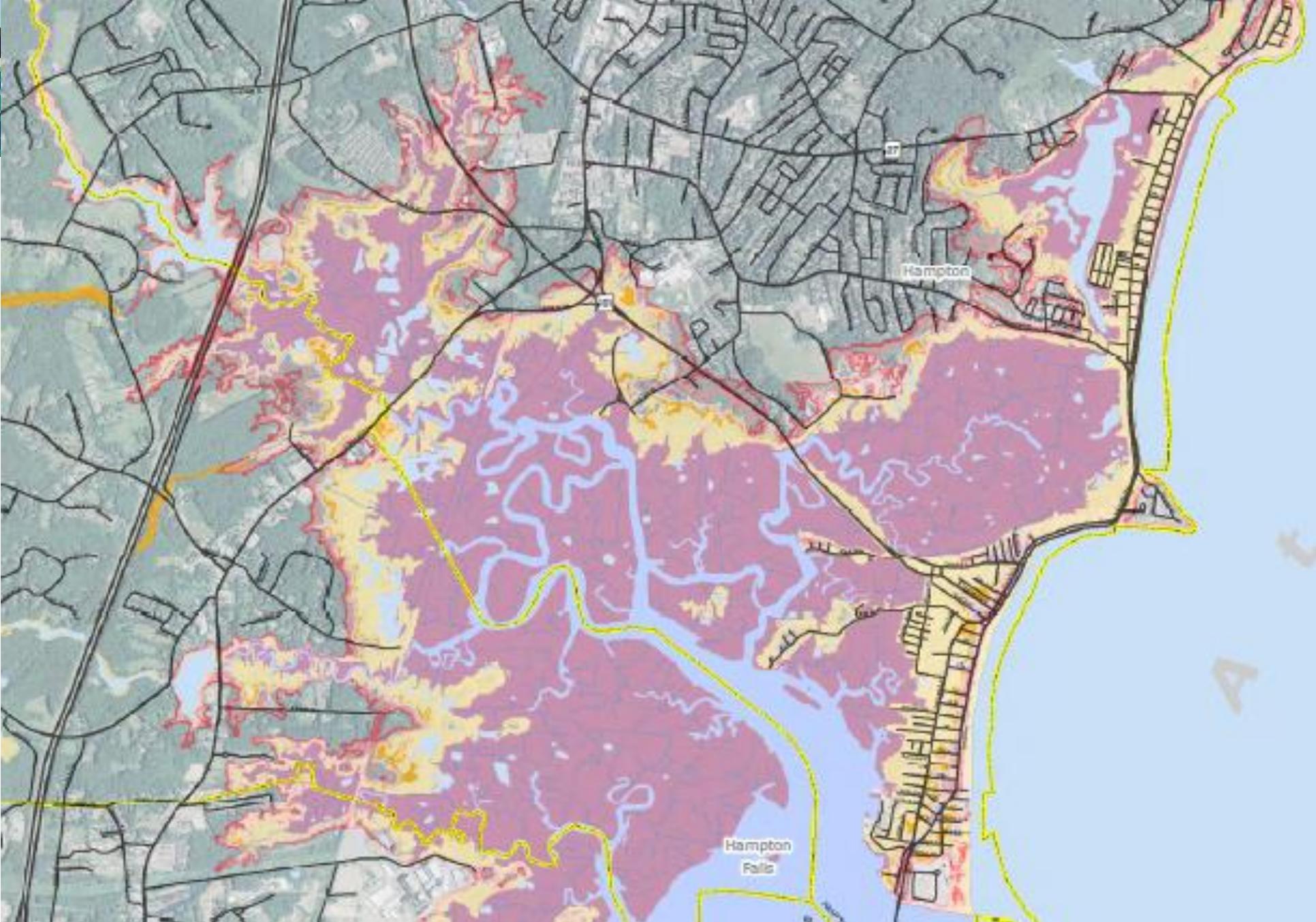


Overview of Assessment Findings

- 3 sea-level rise scenarios lie within/equal to extent of the current 100-year floodplain
- Designing for resiliency in the current 100-year floodplain will protect against long term sea-level rise
- Overall impacts increase dramatically at 4.0 feet of flooding
- Roadways and culverts are most heavily impacted parts of the municipal “built landscape”
- Land adjacent to freshwater and tidal wetlands will be critical flood storage and wetland/salt marsh migration areas
- Adaptation strategies customized to address vulnerability



100-year floodplain and +6.3 feet of sea-level rise



100-year floodplain and +6.3 feet sea-level rise + storm surge



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STATE AND LOCAL ROADWAYS

Impacted by Sea-Level Rise and Sea-Level Rise + Storm Surge
(reported in miles)

	Scenario 1	Scenario 2	Scenario 3	Scenario 1F	Scenario 2F	Scenario 3F
Town	MHHW + 1.7 feet SLR	MHHW + 4.0 feet SLR	MHHW + 6.3 feet SLR	100-year/1% + 1.7 feet SLR	100-year/1% + 4.0 feet SLR	100-year/1% + 6.3 feet SLR
Hampton	3.4	13.2	20.6	20.7	26.7	30.8
Hampton Falls	0.0	0.1	0.3	0.2	0.4	0.7
New Castle	0.1	0.5	1.4	1.3	1.8	2.5
North Hampton	0.0	0.7	1.3	1.3	2.6	3.3
Portsmouth	1.1	2.2	4.9	4.2	7.6	11.0
Rye	0.2	4.5	9.5	9.9	14.2	17.1
Seabrook	0.4	2.4	5.7	4.8	7.5	10.0
Total Miles	6.0	23.6	47.0	42.4	60.7	75.4



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INFRASTRUCTURE

impacted by sea-level rise and sea-level rise + storm surge
(number of sites)

	Scenario 1	Scenario 2	Scenario 3	Scenario 1F	Scenario 2F	Scenario 3F
Town	SLR 1.7 feet	SLR 4.0 feet	SLR 6.3 feet	SLR 1.7 feet + storm surge	SLR 4.0 feet + storm surge	SLR 6.3 feet + storm surge
Culverts	0	1	4	4	6	7
Dams	1	1	2	2	3	5
Public Water Supply, Pump Houses, Wells	0	0	0	0	3	9
Bridges	1	3	4	4	5	5
Public Transportation Facility	1	1	1	1	1	1
Total # of Sites	3	6	11	11	18	27



Regional Considerations – Critical Facilities and Infrastructure

- Water conveyance and drainage infrastructure impacted by flood scenarios
- Need for infrastructure management plans to determine future costs
- Adjustments to state highways affect connecting local roads, driveways, access points
- Flood impacts to Route 1 make east-west evacuation routes more critical



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UPLAND (land above mean higher high water)

impacted by sea-level rise and sea-level rise + storm surge
(reported in acres)

	Scenario 1	Scenario 2	Scenario 3	Scenario 1F	Scenario 2F	Scenario 3F
Town	MHHW + 1.7 feet SLR	MHHW + 4.0 feet SLR	MHHW + 6.3 feet SLR	100-year/1% + 1.7 feet SLR	100-year/1% + 4.0 feet SLR	100-year/1% + 6.3 feet SLR
Hampton	319.4	632.3	897.8	879.7	1,123.5	1,321.1
Hampton Falls	121.3	187.4	252.3	237.4	305.6	383.7
New Castle	33.6	64.5	96.4	94.7	126.0	159.7
North Hampton	67.8	135.3	215.9	193.5	283.9	358.6
Portsmouth	104.5	197.3	313.9	287.7	406.6	534.6
Rye	567.7	945.8	1,223.7	1,200.6	1,465.9	1,690.6
Seabrook	270.4	439.7	613.6	580.0	727.6	850.1
Total	1,484.6	2,602.2	3,613.5	3,473.5	4,439.0	5,298.4



NATURAL RESOURCES

impacted by sea-level rise and sea-level rise + storm surge
(reported in acres)

	Scenario 1	Scenario 2	Scenario 3	Scenario 1F	Scenario 2F	Scenario 3F
Town	SLR 1.7 feet	SLR 4.0 feet	SLR 6.3 feet	SLR 1.7 feet + storm surge	SLR 4.0 feet + storm surge	SLR 6.3 feet + storm surge
Surface Water	0.0	30.4	30.8	30.8	30.9	31.0
Aquifers	0.0	0.0	0.0	0.0	0.0	0.0
Freshwater Wetlands	3.3	12.1	18.4	17.0	23.4	29.2
Tidal Wetlands	119.7	122.5	122.7	122.7	122.8	122.9
Conserved & Public Lands	49.7	67.7	82.3	79.3	91.0	98.9
Wildlife Action Plan – focus areas	599.0	671.2	784.4	732.5	801.5	872.7
Coastal Conservation Plan – focus areas	134.4	214.9	269.5	257.6	308.0	356.6
Agricultural Soils	18.4	58.6	111.2	98.6	155.2	220.9



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Salt Marsh - Depot Road



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ZONING DISTRICTS (acres)

Sea-Level Rise (SLR) Scenarios	SLR 1.7 feet	SLR 4.0 feet	SLR 6.3 feet	SLR 1.7 feet + storm surge	SLR 4.0 feet + storm surge	SLR 6.3 feet + storm surge
Zoning / Land Use						
General/Single Zone	0.0	0.0	0.5	0.4	0.5	0.5
Residential – Medium Density	137.8	235.0	300.9	285.8	354.9	433.5

PARCELS AND ASSESSED VALUE

Sea-Level Rise (SLR) Scenarios	Number of Parcels Affected by scenario	Aggregate Value of Affected Parcels
1.7 feet SLR	237	\$18,004,600
4.0 feet SLR	276	\$37,463,800
6.3 feet SLR	289	\$42,794,300
1.7 feet SLR + storm surge	288	\$42,467,100
4.0 feet SLR + storm surge	293	\$44,493,700
6.3 feet SLR + storm surge	303	\$48,134,400



Regional Considerations – Natural Resources

- Tidal inundation of freshwater wetlands and surface waters may reduce flood storage over time
- Upland buffers will preserve flood storage
- Salt water intrusion may impact drinking water sources
- Conversion of freshwater systems to tidal/saltwater systems and habitats



Tides to Storms Reports and Maps

- Regional Assessment and Maps
- Municipal Assessment and Maps

Materials available on RPC's website at

<http://www.rpc-nh.org/regional-community-planning/climate-change/resources>

NH Coastal Viewer (online mapping tool)

<http://www.granit.unh.edu/nhcoastalviewer/>



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Transportation – Both the Vulnerability Assessment and the Town’s 2013 Natural Hazard Mitigation Plan identify impacts to roads and culverts caused by increased precipitation events and climate change. Impacts to Route 1 are critical to note as the road is a primary evacuation route for the region, as well as the Town’s primary commercial corridor.

The culvert under Route 1 at Dodges Pond needs to be addressed with DOT. Heavy rain and snow melt can result in flooding caused by upstream flow from Dodges Pond. Coastal storm surge and sea level rise will create flooding as flow is forced in the opposite direction. Existing flood control systems on the dam at Big Dodge Pond exacerbate flooding and impact flooding of Route 1 at this location.

Flooding across Depot Road, Brimmer Lane and Marsh Lane will become more common with sea level rise and storm surge.

Recommendations may include:

- Continue working with NH DES on long-term management of the dam at Big Dodge Pond.
- Continue working NH DOT on culvert upgrades and management along Route 1.
- Develop long-term plans for Depot Road, Brimmer Lane, and Marsh Lane.
- Integrate land use and environmental planning with floodplain management to prevent and minimize impacts from flood events.

Natural Resources – Ponds, rivers, streams, inland and coastal wetlands, marshes and beaches serve the town by absorbing and storing flood water. Coastal marshes and creeks also reduce storm wave energy, reducing erosion. In addition, undisturbed, vegetated buffers adjacent to surface waters prevent erosion and filter pollutants running off rooftops, roads, and lawns. In combination with adjacent undeveloped land, these natural areas become critical resources for the town.

Recommendations may include:

- Prioritize land conservation efforts to protect land that allows coastal habitats and populations to migrate and adapt to sea level rise.
- Adopt buffer and setback regulations that adequately separate development and infrastructure from tidal wetlands, freshwater wetlands, and surface waters to sustain flood storage capacity, and allow for inland migration of tidal marsh systems and conversion of freshwater systems to tidal systems to accommodate projected rise in sea-levels.
- Consider modeling marsh migration to identify where marshes will move to so those areas can be protected.
- Implement stormwater management to protect the health of wetlands and marshes so these resources can continue to function as flood storage.

Recreation/Community Facilities – Rising sea level and coastal storm surge will impact the boat ramp at the end of Depot Road, and the proposed recreational trail along the abandoned railroad tracks. The 2013 Natural Hazard Mitigation Plan lists installation of rip-rap at the end of Depot Road to prevent further erosion as a mitigation action.

Recommendations may include:

- Integrate protection of recreational resources and community facilities from impacts associated with climate change into the Town’s Natural Hazard Mitigation Plan, CIP and other municipal planning efforts.

Cultural and Historic Resources – Hampton Falls is a community rich with cultural and historic resources, some of which may be at risk due to rising sea-levels, storm surge, and increased precipitation events.

Recommendations may include:

- Map cultural and historical resources at risk of flooding.
- Integrate protection of cultural and historical resources from impacts associated with climate change into the Town’s Natural Hazard Mitigation Plan, CIP and other municipal planning efforts.

Economic Development – Commercial activity along both sides of Route 1 in town is threatened by rising sea levels, road closure due to flooding. Maintaining safe access along Route 1 will be a key component to future economic development.

Natural Hazards – The 2013 Natural Hazard Mitigation Plan will be due for FEMA required update in 2018.

Recommendations may include:

- The 2018 Natural Hazard Mitigation Plan Update should include information on risks identified in the Vulnerability Assessment and mitigation actions that encompass sea-level rise, storm surge, and flooding from increased precipitation events.

Utilities – Flooding and erosion from sea-level rise, storm surge, and increased precipitation will put underground and above ground utility infrastructure at risk of damage.

Recommendations may include:

- Identifying utility infrastructure located in areas identified by the Vulnerability Assessment.