Chapter 9. Coastal Hazards and Adaptation[1]

9.1 Introduction

Like other coastal municipalities in New Hampshire, Seabrook is confronted by a challenging set of land use and hazard management concerns that include exposure to extreme weather events, coastal erosion, and impacts to key coastal habitats. Seabrook has experienced significant impacts during extreme and moderate coastal storm events, extreme rainfall events, and localized flooding from more frequent seasonal highest tides both in immediate coastal areas and inland. These observed impacts may be exacerbated by changes in climate that may cause future increases in the frequency and intensity of storms and rates of sea-level rise. Flooding is compounded by increased stormwater runoff from development and impervious surfaces.

Projected changes in climate and coastal conditions will present challenges to many sectors of municipal governance, asset and infrastructure management, sustainability of recreation and tourism, and protection of natural resources and coastal ecosystems. Adapting to changing conditions will play an important part in the town's strategic planning and actions in the future. Effective preparedness and proactive land use management can help the town reduce its future exposure and improve resilience to increased flood risks and thus minimize economic, social, and environmental impacts.

The Coastal Hazards and Adaptation Chapter addresses the following topics:

Present and Future Coastal Hazards

Future Impacts to Coastal Assets and Resources

Other Climate Related Impacts

Future Growth Demands

Community Adaptation and Resilience

Recommendations for Long-Term Adaptation and Resilience Strategies and Actions

Municipal Action Plan for Facilities, Infrastructure and Services

Figure 1. 2013 King Tide flooding on Route 286.

[1] Preparation of this Chapter was funded by a grant from the Northeast Region Ocean Council through the U.S. Fish & Wildlife Service.

9.2 Vision

A. Vision Statement

Proactive strategies are identified and implemented that address the impacts of coastal hazards, and ensure the community is better prepared to protect the security, health and safety of its citizens, provide for a stable and viable economic future, and create a more sustainable and climate resilient community.

Seabrook identifies the following major goals relating to coastal hazards and climate adaptation:

- Critical facilities are protected against impacts from flooding and other coastal hazards.
- Coastal sand dunes are maintained to reduce flood and storm damage.
- Emergency access and evacuation routes are maintained or enhanced if necessary.
- Private property owners are allowed to take protective measures to reduce flood risks.
- Residents and businesses are aware of and better prepared to respond and adapt to coastal hazards.

B. Issues of Local and Regional Significance

Based on the Tides to Storms Vulnerability Assessment results and local knowledge of coastal hazards, the following issues of local and regional significance should be addressed in future policy, planning, regulatory and non-regulatory initiatives by the town and the community.

Maintain municipal and state roads, bridges, culverts, and stormwater systems.

As a tourist destination, keeping state and local roads and their infrastructure functioning and efficient is key to the growth and stability of the town and the Seacoast region. These systems are particularly critical during storm events when evacuation routes can be impacted by flood waters.

Sustain drinking water supplies, sources and infrastructure.

Growth and public health are supported by a high quality and plentiful drinking water supply. Seabrook has a finite land area from which to source drinking water, making long-term water management a priority for the town. In time of drought and high water consumption in summer months, it is not unusual for the town to post mandatory water conservation measures and bans.

Maintain function of wastewater services and infrastructure.

Nearly all homes and businesses in Seabrook are served by municipal wastewater services. For this reason, maintaining these systems is critical to the health and safety of the community. Over time, improvements to these systems may be necessary to adapt to rising seas, and storm-related flooding and power outages.

Dedicate funds for infrastructure improvements.

As infrastructure ages and environment conditions change due to sea-level rise and increase precipitation and stormwater runoff, the cost of maintaining critical infrastructure will grow with time. Identifying new methods for raising funds to do this will be necessary to lessen the burden on taxpayers.

Control flooding and protect natural resources with sound land use and development standards.

Implementing sound land development standards needs to consider a wide range of issues and how natural and development landscapes can complement one another, not at the detriment to either one. Additional challenges are present in that, although the Master Plan applies to the entire town, the Seabrook Beach Village District has a separate zoning ordinance and administration. This can create situations where land development and environmental protections are not consistent across the town.

Increase preparedness and raise awareness of coastal hazards in the community.

Residents need to be engaged and informed about how to protect themselves and their homes in the face of rising seas, coastal storms, and increased precipitation during extreme weather events. Being proactive

about planning to respond to these changing conditions is the best course of action but one that needs more attention.

9.3 Present and Future Coastal Hazards

A. Past and Present Coastal Hazards

Coastal Storms

A wide range of coastal storms have effected Seabrook in the past including extreme rainfall, Nor' Easters, hurricanes, tropical storms, and highest tides. Typical impacts from these types of events include flooding from high tides, storm surge, and rainfall, beach erosion, displacement of sand from the dune systems, road closures, disruption of businesses and schools, and increased demand for municipal emergency services.

The severity of flood events depends upon several factors and different types of storm events. A 100-year/1% chance precipitation event is based on the volume of rainfall (in inches) within a 24-hour period. A 100-year/1% chance coastal storm event is based on storm surge elevation which is influenced by tide stage, wind (direction, speed and duration), and seasonal astronomical cycles

Today, extreme precipitation and coastal storm surge (e.g. the 100-year or greater storm event) are the most immediate risk and threat resulting in flooding and property damage, while sea-level rise poses a more long-term risk of increased daily tidal flooding.

Figure 2. 2013 King Tide flooding at Cross Beach Road.

The New Hampshire seacoast has experienced many significant storm events in the last 50 years including extreme precipitation, Nor' Easters, and storm surge. In recent years the New Hampshire seacoast has narrowly escaped two major storm events – Hurricane Irene (2011) and Super Storm Sandy (2012). The likelihood of such storms reaching our area, with surges of 12 or more feet, has become an increasing concern as heavily developed coastal areas are at high risk of flood impacts (as documented in the Tides to Storms report, 2015).

Figure 3. History of significant storm and flood events that have impacted Seabrook.

Event	Type	Rainfall/ Snow	Inland Flooding	Tidal Flooding	High Winds	Surge Height	Tide Stage
February 1972	Nor' Easter			✓	✓		
Blizzard of 1978	Nor' Easter	33" snow					
August 1991	Hurricane Bob						
October 1991 "Perfect Storm"	Nor' Easter			✓	✓	+3.5'	
October 1996	Tropical Storm	14" rain	✓	✓		500-yr	High

December 9, 2003							
Mother's Day May 2006	100-year+	14" rain	✓				
Patriot's Day April 2007	Nor' Easter	6.5" rain	✓		✓		
Super Storm Sandy 2012	Tropical Storm	___" rain	✓	✓	✓		
King Tide 2014	extreme tide	None		✓			High
King Tide 2015	extreme tide			✓			High
King Tide 2016	extreme tide	None		✓			High

B. Projected Future Conditions

Studies published in the last five years, including the U.S. Global Change Research Project, 2014 National Climate Assessment, report updated trends and projections for several parameters influenced by changes in climate including sea levels, coastal storms, and precipitation. Information about New Hampshire trends and projections is summarized in sections 1-3 below.

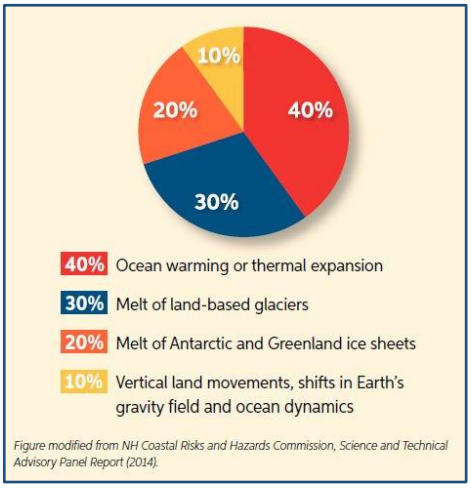

Figure 4. Primary factors contributing to sea-level rise worldwide.

1. Sea-Levels and Coastal Storm Surge[2]

Sea-Level Rise

Figure 4 shows the percent contribution of various factors that influence sea levels worldwide. Ocean warming and melting of land-based glaciers are the major drivers of sea-level rise.

Based on local tide gauge data, sea-level along the New Hampshire coastline has risen an average of 0.7 inches per decade since 1900. More recent reports show that the rate of sea-level rise has increased to approximately 1.3 inches per decade since 1983. The 2014 U.S. National Climate Assessment reports projected ranges of plausible sea-level rise scenarios from 0.6 feet to 2.0 feet by 2050, and from 1.6 feet to 6.6 feet by 2100.

Storm Surge

Based on the FEMA Flood Insurance Rate Maps (2014, preliminary), the storm surge elevation associated with the 100-year/1% chance storm event in Seabrook is elevation 8-10 feet in the AE zone (estuary shoreline areas) and elevation 14-18 feet in the VE zone (immediate coastal areas).

Among the scientific literature, there is insufficient basis to draw a specific conclusion whether storm surges will increase in the future however future storm surges will occur on top of higher sea levels. Considering changes in storm surge and high water levels due to sea-level rise alone, today's extreme surge events such as a 100-year storm will result in increased coastal flooding and expansion of the coastal floodplain over time.

[2] Paul Kirshen, Cameron Wake, Matt Huber, Kevin Knuuti, Mary Stampone, Sea-level Rise, Storm Surges, and Extreme Precipitation in Coastal New Hampshire: Analysis of Past and Projected Future Trends (2015), Prepared by Science and Technical Advisory Panel for the New Hampshire Coastal Risks and Hazards Commission.

2. Precipitation[3]

Recent studies show the mean annual precipitation in the Northeast has increased by approximately 5 inches or more than 10%, from 1895 and 2011, and has experienced a greater than 50 % increase in annual precipitation from storms classified as extreme events (100-year/1% annual chance or greater event). Climate models are uncertain about future increases in annual precipitation but project increases that could be as high as 20 percent in the period 2071-2099 compared to 1970-1999. Most of the increases may occur in winter and spring with less increase in the fall and perhaps none in the summer.

In 2014, the Northeast Regional Climate Center (NRCC) Extreme Precipitation Atlas was published, improving the accuracy of rainfall data for a range of storm events applied to engineering and science research. The NRCC atlas is the new standard used by the NH Department of Environmental Services, Alteration of Terrain Bureau for the design of stormwater management systems in permitting development projects. Prior to release of the NRCC atlas (2014), engineers and researched used National Weather Service Technical Paper No. 40 precipitation atlas (TP-40, 1960) based on data from the 1960's. Comparing rainfall data from the TP40 atlas and the NRCC Extreme Precipitation Atlas in Figure 5, rainfall from extreme events (50-year and 100-year storm events) has increased 25 percent and 35 percent respectively in Seabrook (data reported at location of the Seabrook Town Hall). For example, Figure 6 shows an increase of 2.3 inches of precipitation for the current 100-year storm event as reported from the new NRCC precipitation atlas.

Figure 6. Data for a range of 24-hour rainfall events (TP40, 1961 and NRCC, 2014).

	24-hour Rainfall Event						
Source	**1-year**	**2-year**	**10-year**	**25-year**	**50-year**	**100-year**	**500-year**
TP40*	2.6	3.1	4.4	5.2	5.8	6.5	not reported
NRCC	2.6	3.2	4.8	6.1	7.3	8.8	13.46

* The NH Department of Environmental Services, Alteration of Terrain Bureau has replaced the TP-40 atlas with the NRCC atlas (2014) as the rainfall standard for permitting the design of stormwater management systems.

Consistent with comparison of the precipitation data from the old TP-40 atlas and the new NRCC atlas, Figure 7 shows that the frequency of extreme precipitation events – those greater 4 inches in a 24-hour period - has increased significantly since 1990 compared with the period from 1950-1990.

Extreme precipitation is also projected to increase with the occurrence of extreme rainfall events during summer and fall influenced by changes in tropical storm activity as the rainfall amounts produced by tropical storms is projected to increase. In general, total annual precipitation is expected to increase as is extreme precipitation.

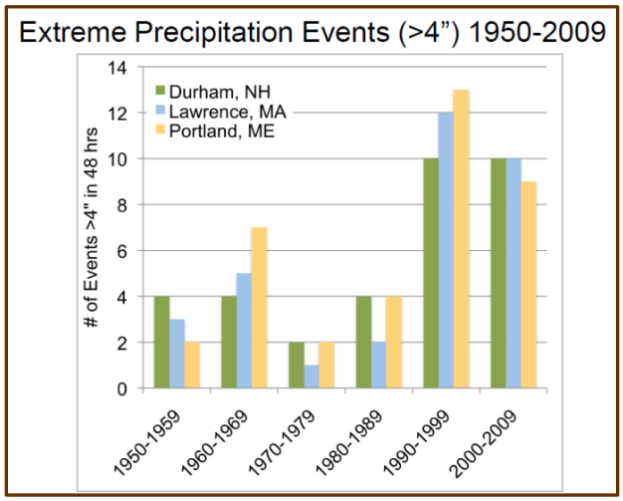

Figure 7. Total number of events with greater than four inches of precipitation in 48 hours per decade since 1950.[4]

[3] Paul Kirshen, Cameron Wake, Matt Huber, Kevin Knuuti, Mary Stampone, Sea-level Rise, Storm Surges, and Extreme Precipitation in Coastal New Hampshire: Analysis of Past and Projected Future Trends (2015), Prepared by Science and Technical Advisory Panel for the New Hampshire Coastal Risks and Hazards Commission.

3. Temperature[4]

In the last century, annual and seasonal temperatures have warmed by almost 2°F and lake ice-out dates are occurring earlier. Regional climate assessments report expected changes in seasonal temperatures:

- Warmer winters with 20-50 fewer days per year below 32°F. (Based on data from climate projection grids for southern NH, the number of days when MINIMUM temperature was below 32°F from 1980-2009 was 142. Source: http://www.climatesolutionsne.org/assessments#map)
- Hotter summers with 3-7 additional days per year above 90° F (compared to about 10 days per year above 90°F during the period 1970-1999).

9.4 Future Impacts to Coastal Areas

A. Tides to Storms Coastal Vulnerability Assessment[5]

In 2015, the Rockingham Planning Commission completed the Tides to Storms Coastal Vulnerability Assessment which evaluated the risk and sensitivity of roadways, infrastructure and natural resources to sea-level rise and storm related flooding. As shown in Figure 5, the Tides to Storms assessment applied a range of sea-level rise scenarios at 2100, similar those reported in the 2015 U.S. National Climate Assessment. The Tides to Storms assessment produced statistical data and mapping as part of a regional report and a customized assessment report for Seabrook. The Seabrook data is reported in this section.

Figure 5. Sea-Level Rise Scenarios used in the tides to Storms Vulnerability Assessment (Rockingham Planning Commission, 2015).

Time Period*	"Intermediate Low	"Intermediate High"	"Highest"
year 2050	0.6 ft.	1.3 ft.	2.0 ft.
year 2100	1.7 ft.	4.0 ft.	6.3 ft.

Sea-level rise and storm surge are measured from Mean Higher High Water which is the water elevation based on the average of the highest tides over a 19-year period. In Seacoast New Hampshire Mean Higher High Water is 4.4 feet. Storm surge is the area flooded by the current 100-year/1% chance storm event or greater. In Seabrook, the 100-year coastal storm event ranges from elevation 8-10 feet in the AE zone (estuary shoreline areas) and elevation 14-18 feet in the VE zone (immediate coastal areas).

Flooding from sea-level rise and storm surge are limited to the immediate coastal area, the shorelines of the Hampton-Seabrook Estuary where extensive saltmarsh are present, and coastal drainages systems including Cains Brook and the Taylor River. Because most of the immediate coastal area is densely developed, flood impacts to buildings, infrastructure and roads are widespread. A summary of impacts to road and transportation infrastructure, critical facilities, and natural resources from future sea-level rise and storm related flooding are presented in this section and Figure 8 below.

Roads and Transportation Infrastructure

State roadways in Seabrook are more highly susceptible to flooding than the local roadway network. State roadways affected include Route 1A, Route 286, Route 1 at Cains Brook, and I-95 at Taylor River. Local roadways affected by flooding are located primarily west of Route 1A in low-lying areas adjacent to the Hampton-Seabrook Estuary. The following local roads are impacted by the sea-level rise scenarios: Walton Road, Centennial Avenue, Cross Beach Road, River Street, and Seabrook Beach from Campton Street south to Dracut Street. The following additional local roads are impacted by the sea-level rise plus storm surge scenarios: Farm Lane, NextEra North Access Road, A and B Streets, and Beckman's Landing. State

[4] Wake, C., Burakowski, E., Kelsey, E., Hayhoe, K., Stoner, A., Watson, C., & Douglas, E. (2011). *Climate Change in the Piscataqua/Great Bay Region: Past, Present, and Future.* Carbon Solutions New England. Retrieved from www.carbonsolutionsne.org/resources/reports/pdf/greatbayreport_online.pdf

[5] Tides to Storms Coastal Vulnerability Assessment (2015) prepared by Rockingham Planning Commission.

roadways Route 1a and Route 286 are highly susceptible to flooding from all six sea-level rise and coastal storm surge scenarios.

Figure 8. Summary of Tides to Storms assessment data.

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
Infrastructure (# facilities)	8	12	21	20	22	27
Critical Facilities (# facilities)	1	5	6	6	6	9
Roadways (miles)	0.37	2.43	5.65	7.83	7.48	10.29
Upland (acres)	270.4	439.7	613.6	580.0	727.6	850.1
Freshwater Wetlands (acres)	7.8	26.8	41.0	38.5	46.1	50.7
Tidal Wetlands (acres)	235.3	257.3	264.2	266.5	268.4	268.6
Conserved and Public Lands (acres)	21.3	55.7	81.0	80.9	102.4	122.0
100-year floodplain (acres)	1,730.1	1,902.5	1,919.7	1,923.8	1,932.9	1,945.8
500-year floodplain (acres)	1,730.1	1,903.1	1,979.5	1,982.7	1,993.9	2,007.1

Note: Storm surge refers to the 100-year floodplain as depicted on the FEMA Flood Insurance Rate Maps (2015, preliminary). Upland refers to land above mean higher high water (highest tidal extent). Impacts to the 500-year floodplain were calculated using the full extent of the 500-year floodplain which includes areas within the 100-year floodplain.

Critical Facilities

Municipal critical facilities susceptible to projected sea-level rise and coastal storm surge flooding include several sewage pump stations, wastewater treatment plant and supporting sewage pump stations, and the Elementary-Middle School (recreation fields and grounds only). As reported in Figure 9, a number of critical facilities may be impacted by long-term increases in sea-level and vulnerable to flooding from coastal storm surge. In light of the immediate threat of coastal storms, it will be important in the near future to evaluate the flood impact potential of these critical facilities and ensure funds are allocated in the town's budget for the improvements necessary to maintain them.

Figure 9. Summary of Critical Facilities impacted by flooding (Tides to Storms, 2015).

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
Critical Facilities						
St Elizabeth's	0	0	0	0	0	1
Sewage Pump Station 3	0	0	0	0	0	1
Sewage Pump Station 4	0	0	0	0	0	1
Industrial Facility	0	0	1	1	1	1
Sewage Pump Station 1	0	1	1	1	1	1

Sewage Pump Facility	0	1	1	1	1	1
Next Era/Seabrook Station (access road and parking) *	1	1	1	1	1	1
Seabrook Elementary-Middle School (recreation fields)*	0	1	1	1	1	1
Wastewater Treatment Plant*	0	1	1	1	1	1
Total - Sites	**1**	**5**	**6**	**6**	**6**	**9**

*Note: Municipal Critical Facilities as identified in the town's Hazard Mitigation Plan with the addition of facilities noted with an *.*

Natural Resources

Salt marsh, sand dunes and sand beaches provide natural protection against floods and storm surge. The assessment indicates that tidal wetland systems and freshwater wetlands will be heavily impacted by flooding from sea-level rise. Changes in the daily tidal condition and seasonal high tides will affect the stability of these systems and their ability to sustain surface elevations that keep pace with rising water levels. Although a large number of acres are flooded by coastal storm surge these events are infrequent and of short duration so do not result in sustained conditions that might influence the health and function of tidal wetland systems. Impacts that might occur during storm events include erosion, excessive sedimentation and deposition of debris, and loss of saltmarsh vegetation.

Salt Marsh

In 2015, the N.H. Fish & Game used a modeling tool - Sea Level Affecting Marshes Model (SLAMM) **-** to project where saltmarsh may persist or migrate inland based on changes in sea level. Currently, 1,251 acres of salt marsh lie within Seabrook; however, at the 3.9 feet sea level rise by 2100 scenario there is potential for 204 acres of new marsh to form inland, and at the 6.6 feet scenario there is potential for 271 acres to form inland. Of the opportunities available, the areas circled at left are some of the priority areas for conservation as they are particularly large, currently mainly undeveloped, and are robust as they remain under the highest sea level rise scenario modeled.

Protecting land where salt marsh can potentially migrate as sea levels rise is a good strategy to enhance coastal resiliency.

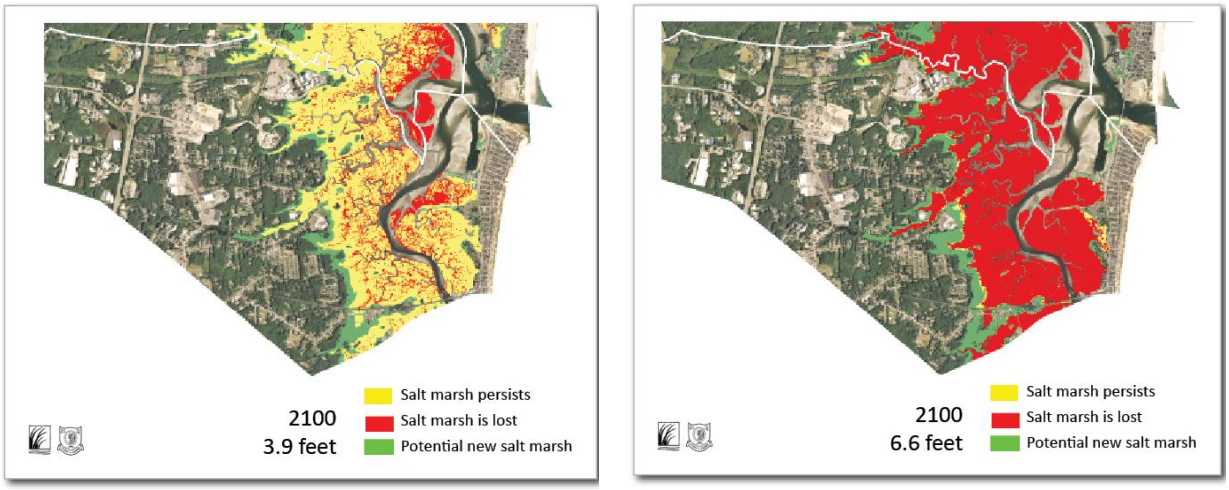

Figure 10. Maps of showing areas of saltmarsh loss and inland migration at 2100. [From: A Natural Choice: Conservation and Restoration Options to Enhance Coastal Resiliency in New Hampshire (NH Fish & Game, DRAFT September 2015)]

Freshwater wetlands and surface waters are impacted by both sea-level rise and coastal storm surge flooding including Cains Brook, Cains Pond and the Taylor River.

Significant acreage within the Coastal Conservation Plan Focus Areas and Wildlife Action Plan priority habitats may be affected by projected sea-level rise. Refer to the new Climate Change section of the Wildlife Action Plan for information about potential impacts to these resources (http://www.wildlife.state.nh.us/wildlife/wap.html).

The town may consider aligning its land protection strategies by incorporating criteria in its selection process that takes into account the value and benefits of protecting critical ecosystems and increasing land protection efforts in areas projected to have high flood risk in the future.

9.5 Other Climate-Related Impacts

A. Water Resources

The primary drinking water aquifer in Seabrook is located west of I-95. Seabrook's municipal drinking water wells and future well sites are located in this aquifer. In 2015, the town adopted more stringent zoning standards in the Aquifer Protection Overlay District to improve protection of the town's existing and future public drinking water supplies. Rising groundwater levels due to changes in sea level and saltwater intrusion may also impact water resources including local aquifers and drinking water sources (municipal, private and commercial supplies). Emerging research from the University of New Hampshire indicates that groundwater levels and salt water intrusion could cause effects further inland than the immediate coast. For this reason, coastal municipalities are encouraged to collaborate on planning for future regional and municipal drinking water needs.

Rising groundwater levels and increased precipitation could compromise the function of individual septic systems and both private and municipal stormwater management infrastructure. These system failures may result in increased transfer of pollutants to groundwater, surface waters, wetlands and estuarine systems. The vast majority of homes and businesses are serviced by town wastewater service so these impacts may be very localized.

B. Economy

The NH Coastal Risks and Hazards Commission report (2016) acknowledges New Hampshire's coastal region as an important economic driver for the state and consistently ranks above the national average for job growth. The report states the following statistics about New Hampshire's coastal economy:

- The Gross Regional Product of the coastal region totaled approximately $11 billion in 2014, with 16 percent derived from the finance and insurance industry and 13 percent coming from the manufacturing industry.
- Between 2002 and 2016 job growth for the coastal region was 12.8 percent, outpacing both the state and national job growth rates of 5.9 and 10.4 percent, respectively.
- As of Q3 2016, the coastal municipalities supported 109,070 jobs.
- In 2014, the coastal region exported $15.5 billion worth of goods and services, imported $14.1 billion worth of goods and services, and produced and consumed $5.9 billion worth of goods and services locally, making the region a net exporter of goods and services.

> ***OUR ECONOMY*** *is the systematic and productive exchange and flow of goods, services, and transactions that must be intact, functioning, and resilient to coastal risks and hazards in order to create and sustain a high quality of life in coastal New Hampshire. (CRHC Report, 2016)*

Impacts from sea-level rise and storm surge flooding can have an effect on the overall municipal tax rate by influencing land values, decisions made about infrastructure investments, need for and delivery of critical services, and maintenance of infrastructure and facilities. The economic vulnerability of a municipality can be evaluated by determining the exposure of its property tax base to coastal hazards. As shown in Figure

11, the Tides to Storms project (RPC, 2015) analyzed the number of tax parcels in Seabrook affected by each of the six sea-level rise and storm surge scenarios evaluated, and shows the aggregated assessed value of these parcels and percent of total assessed value of property town wide. For Seabrook, there is a 82 percent increase in the number of affected parcels and nearly a $100 million increase in assessed value from the 1.7 feet to the 4.0 feet sea-level rise scenarios. There is a 50 percent increase in the number of affected parcels and approximately a $142 million increase in assessed value from the 4.0 feet to the 6.3 feet sea-level rise scenarios

Figure 11. Parcels and assessed value by sea-level rise and storm surge scenario.

Sea-Level Rise (SLR) Scenarios	Number of Parcels Affected by scenario	Aggregate Value of Affected Parcels	% Total Assessed Value	% Total Assessed Value excluding utilities
1.7 feet SLR	323	$94,634,950	3.1	6.1
4.0 feet SLR	587	$193,727,050	6.4	12.6
6.3 feet SLR	882	$336,025,600	11.0	21.8
1.7 feet SLR + storm surge	824	$296,477,700	9.7	19.2
4.0 feet SLR + storm surge	1,051	$463,049,350	15.2	30.0
6.3 feet SLR + storm surge	1,187	$551,093,650	18.1	35.7

Note 1: The total assessed value of property is $3,049,423,750 (excludes the Next Era power plant). The total assessed value of property excluding utilities and the Next Era power plant is $1,543,263,550.
Note2: Affected parcels were identified if they were found to be partially or fully located within the extent of the scenarios evaluated; however, the extent to which a parcel and any structure or development on the parcel will be impacted by flooding was not analyzed.

A significant portion of the economy in New Hampshire's state, regional and local economies may be vulnerable to changes in climate and coastal conditions such as extreme storms and sea-level rise. New Hampshire's coastal region is an important economic driver for the state and consistently ranks above the national average for job growth. The natural resources that draw residents, visitors and businesses to coastal New Hampshire are a cornerstone of our quality of life. Residents, visitors and businesses depend on clean water for drinking, swimming, and boating; saltmarshes and eelgrass beds are critical habitat for commercial and recreational fisheries; beaches draw hundreds of thousands of visitors that boost the state economy and tax income; and forests and lands provide materials for heating, building and construction, and farm and food products.

C. Emissions and Energy Use

Climate change mitigation refers to the reduction of greenhouse gas (GHG) emissions through reduction in the burning of fossil fuels, energy efficiency and conservation, use of renewable and alternative energy sources, and carbon dioxide (CO_2) and carbon storage in living plants. Increased emissions also impact air quality which can pose serious health risks to certain populations in regions where air quality is impaired.

Many factors influence transportation emissions including land development patterns, land cover conversion, individual preferences and behavior, convenience, and fuel pricing. Nationwide, the transportation sector contributes roughly 28 percent of the total greenhouse gas emissions each year. As of 2012, the transportation sector alone accounts for 43 percent of greenhouse gas emissions in New Hampshire, making it the largest single contributor at rates significantly higher than the national average.[6]

D. Human Health

The town recognizes that climate change can impact human health, however municipalities rely primarily on federal and state agencies that regulate environmental conditions and provide public services to address human health impacts from climate change. This Chapter does not suggest recommended actions by the

[6] NH Department of Environmental Services

town but does acknowledge the general types of human health impacts that are already occurring and may continue or escalate as climate changes in the future.

Climate change affects human health and well-being in many ways, including impacts from increased extreme weather events, rising temperatures in both cold and warms months, wildfire, decreased air quality, threats to mental health, and illnesses transmitted by food, water, and disease-carriers such as mosquitoes and ticks. Increasing exposure to environmental pollutants and atmospheric emissions in recent decades has caused concern over its effect on public health, environmental ecosystems and climate worldwide.[7] Human health impacts are intensified with increasing levels of exposure which are likely to worsen with climate variability and change.[8]

Air pollution (ozone, pollen, mold, dust) and heat exposure have a range of mild to severe health effects and can aggravate chronic diseases, including cardiovascular and respiratory diseases, and respiratory conditions such as asthma.

According to the Centers for Disease Control and Prevention, New Hampshire and specifically Rockingham County have one of the highest occurrences of Lyme Disease in the country and among the New England states. Climate change may increase the presence of ticks and Lyme disease with warmers winters which allow ticks to persist year round and increases in the population of its host species (mice, deer). Other diseases carried by insects may increase with increasing insect populations and increased geographic ranges of certain insect species.

9.6 Future Growth and Development

Planning for future growth and development should consider the implications of existing and projected future coastal hazard such as areas subject to flooding and erosion. Land use decisions will largely dictate where new development and redevelopment occurs and where it will not. Sustaining the services provided by natural features such as saltmarsh, freshwater wetlands and natural shoreline processes will be an important aspect of managing coastal high risk areas into the future.

A. Growth and Development

1. Population

As reported by the U.S. Census, the population of Seabrook is reported as 6,503 in 1990, 6,934 in 2000, and 8,693 in 2010. The town has grown by 35 percent from 1990 to 2015. The current population as documented in the 2015 town report is 8,796.

2. Land Use Changes and Regulations

Impervious Surfaces

From 1990 to 2010, impervious surfaces have increased from 14.1 percent (802 acres) to 18.4 percent (1,046 acres) of the total land area in Seabrook. Referring back to Figure 5, the amount of precipitation associated with 50-year to 100-year or greater storms events has increased in the last 40 years resulting in more frequent flooding and failure of older infrastructure not designed to manage this increased runoff volume. Over the last several years, the Seabrook Planning Board has been increasing concerned about flooding related to increased impervious cover. The Board has discussed ways to reduce the risks and impacts of flooding as the town continues to grow particularly in the Seabrook Beach Village District and along the Route 1 and Route 207 corridors.

[7] *Center for Disease Control and Prevention: Climate and Health*. (n.d.). Retrieved from http://www.cdc.gov/climateandhealth/effects/allergens.htm.
[8] Melillo, J., Richmond, T., & Yohe, G. (2013). *Climate Change Impacts in the United States: Human Health Chapter.* U.S. Global Change Research Project.

Studies show that impervious surface cover exceeding 10 percent of a watershed area can negatively affect water quality and the health and diversity of aquatic species. Locally, pollutants discharged in stormwater runoff routinely result in closure of shell-fishing areas in the Hampton-Seabrook Estuary.

Non-Point Source Pollution

Coastal erosion and sediment transport during storm events can introduce pollutants to salt marshes and freshwater wetlands near the coast. The changes in precipitation documented in the Northeast Regional Climate Center - Extreme Precipitation Atlas increases the volume of stormwater runoff generated from impervious surfaces during moderate to severe storm events. Stormwater runoff often contains harmful pollutants that are discharged into waterways, wetlands and saltmarshes.

Shoreline Stabilization

Sand dunes offer protect buildings, roads and infrastructure from damaging wind and waves. Particular stretches of Seabrook's coastline are highly susceptible to damage during storm events, including the sand dunes that line most of Seabrook Beach and areas at the far north of the beach where the sand dunes have been developed or eroded over time. Maintaining the stability of the dunes requires keeping sea grass healthy and propagating to secure the sand in place. Human encroachments cause the structure of these dunes to weaken and the sand to be transported by wind.

3. Land and Zoning Districts Impacted by Sea-level Rise and Storm Related Flooding[9]

Upland impacted by flooding from 1.7 feet of sea-level rise is low while impacts increase markedly with 4.0 feet and 6.3 of sea-level rise. Flooding from coastal storm surge is fairly widespread especially along the beach and back beach areas. Seabrook has enough increase in land elevation in its western interior to protect most existing developed areas and resources from low to moderate flood levels. The most heavily impacted areas are located directly adjacent to the coast, Route 1A and Route 286, and upland fringe in the interior estuary.

Figure 12. Acres of upland impacted by sea-level rise and storm surge.

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
Acres	567.7	945.8	1,223.7	1,200.6	1,465.9	1,690.6
% Upland	7.0	11.7	15.2	14.9	18.2	20.9

Total Upland in Seabrook = 8,073.5 acres. Upland refers to land above mean higher high water (highest tidal extent) and excludes wetlands.

Seabrook's coastal area is predominantly developed as single-family dwellings, rental properties, and commercial development, all served by municipal water and wastewater systems. As reported in Figure 13, the zoning districts most heavily impacted by flooding from sea-level rise and storm surge are open space and conservations lands, and medium density residential. Conservation and open space lands can act as important flood storage areas and buffer development from damaging flood waters, wind and erosion, and by allowing salt marsh and freshwater wetlands systems to store flood waters and migrate inland as conditions change. Preserving these natural landscapes and ecosystems will be an important strategy for protecting developed areas from future impacts, as well as maintaining this vital component of the coastal economy.

[9] Tides to Storms Coastal Vulnerability Assessment, 2015 prepared by Rockingham Planning Commission

Figure 13. Zoning districts (acres) impacted by sea-level rise and storm surge.

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						
Commercial	8.9	21.9	32.8	31.0	39.9	47.1
Industrial	18.6	26.5	32.8	31.5	36.4	42.8
Mixed Urban	1.6	3.3	7.1	6.4	9.5	13.3
Open Space/Conservation	201.3	275.7	339.2	331.9	373.4	404.7
Residential - High Density	0.0	0.0	0.0	0.0	0.0	0.0
Residential - Med Density	45.8	120.5	212.5	190.9	282.8	359.6

4. 100-year Floodplain and Federal Flood Insurance

Approximately 480 principal buildings are located within the current 100-year coastal floodplain with an additional 60 units in a seasonal trailer park south of Route 286. As of March 2016 270 property owners hold policies with the National Flood Insurance Program (NFIP) with an insured value of $60,166,300.

Figure 14. Statistics of National Flood Insurance Program policies held in Seabrook.

Authority	# of Policies	Insured Value ($) In Force	Total # Paid Losses	Total $ Paid	Repetitive Loss Buildings	Repetitive Loss Payment $
Town of Seabrook	98	$17,428,500	36	$168,093	2	$36,427
Seabrook Beach Village District	172	$42,737,800	19	$170,892	4	$135,169
Total	270	$60,166,300	55	$338,985	6	$171,596

A total of six properties in the regulatory floodplain have experienced repetitive loss or damage (meaning properties that have had two or more claims of more than $1,000 paid by the NFIP within any 10-year period since 1978).

With expected increases in sea levels and extreme storm events, the 100-year and 500-year floodplains are likely to expand in size which will result in more parcels and buildings subject to flood impacts. Conducting outreach to currently and future affected property owners would be extremely helpful in informing them of potential risks and providing information they can use to make decisions about their property and investments.

Another option to reduce flood risks and save on insurance premiums is for the town to join the FEMA Community Rating System (CRS) Program. The CRS is a voluntary incentive based program that requires municipalities to implement specific actions, plans and regulations that reduce flood risk and damages in exchange for a reduction in premiums for National Flood Insurance Program (NFIP) policy holders. ***Currently, Seabrook NFIP policy holders pay $347,619 annually in insurance premiums ($90,180 Seabrook, $257,439 Seabrook Beach Village District). With a modest 5 percent CRS discount (the***

discount for a level 9 qualification in the program), policy holders would save a combined $17,381 each year.

Floodplain Standards for Development

The town has adopted the Floodplain Development and Building Ordinance (as updated in 2015) which contains the minimum floodplain management standards required by FEMA for eligibility in the National Flood Insurance Program (NFIP).

FEMA encourages municipalities to adopt more stringent standards than the minimum NFIP requirements such as requiring that buildings be elevated (1 foot or more) above the 100-year base flood elevation to reduce impacts from flooding and storm damage.

Existing regulatory standards in some instances are barriers to implementing adaptation to rising seas and damaging storms. For example:

- Approvals from the state to fill and encroach on critical freshwater wetlands and saltmarsh reduces flood storage capacity and alters drainage patterns.
- Municipal building height restrictions can prevent property owners from elevating existing structures and utilities above the base flood elevation.

B. Planning for Public Safety

1. Hazard Mitigation Plan

FEMA requires that municipalities maintain an updated and approved Hazard Mitigation Plan in order to qualify for federal disaster relief, grant funding, and participation in the National Flood Insurance Program. The Plan documents the town's exposure to past, current and future natural hazards, and recommends specific actions to reduce risk from these hazards. Seabrook's 2012 Hazard Mitigation Plan includes the following recommendations that address coastal hazards:

- **Review Existing Infrastructure**: Evaluate existing infrastructure (Roads, Bridges, Storm water Management Devices, Etc.) for repair replacement needs. Emphasis on infrastructure critical during hazard situation (e.g. evacuation route, culverts).
- **Repair/ Replace Infrastructure**: Implement schedule for repair or replacement of infrastructure in need. Incorporate into CIP or as warrant articles.

The town may incorporate information from the Tides to Storms Coastal Vulnerability Assessment as part of its next scheduled Hazard Mitigation Plan update including maps, statistics of future impacts, and recommended adaptation strategies to reduce risk and vulnerability of municipal assets and resources.

2. Emergency Response Plan

The Emergency Response Plan is maintained by Seabrook's Emergency Management Director. The Plan provides a comprehensive set of protocols that are activated in the event of an emergency, natural disaster or other situation that poses a threat to public safety and the town.

Incorporating new information about changes in weather, extreme events and long-term climate change can enhance emergency planning. The town could reduce its risk and exposure by incorporating coastal hazards and risks assessments in municipal emergency management and hazard mitigation plans, and improving connections and efficiencies between these plans. Collaborating with private sector representatives to evaluate and identify necessary improvements to emergency communications systems preparedness can ensure 911 and other critical communications services remain operational during emergencies and disasters. Local officials recognize the need to update a regional comprehensive emergency evacuation plan for coastal flood and storm events that includes early notification to highest risk areas and properties.

9.7 Community Adaptation and Resilience

A. Ways of Adapting and Being Resilient

Incorporating the latest flood trends and future projections into municipal planning and projects will minimize vulnerability and prove beneficial even if future hazards turn out to be less extreme than anticipated.

Adapting to changing conditions means designing buildings and facilities that account for flooding or modifying uses of land that are compatible under a wide range of conditions. The process of adapting creates buildings and systems that are more ***resilient*** and better able to perform under changing conditions with fewer impacts.

Adaptation – adjustments in ecological, social, or economic systems in response to actual or expected climatic change and their effects or impacts. It refers to changes in processes, practices, and structures to moderate potential damages or to benefit from opportunities associated with climate change. [http://unfccc.int/focus/adaptation/items/6999.php]

Resilience - a capability to anticipate, prepare for, respond to, and recover from significant multi-hazard threats with minimum damage to social well-being, the economy, and the environment. [http://epa.gov/climatechange/glossary.html]

1. Land Development and Natural Resource Protection

To the extent necessary based on expected impacts, the town should integrate comprehensive land use and environmental planning with floodplain management approaches that prevent and minimize impacts from coastal hazards. Establishing minimum regulations that consider vulnerability assessment information can support appropriate amendments to land development standards, building codes, floodplain management, erosion hazard zones, and stormwater management. Implementing strategies and tools (such as land use regulations, incentives, and building codes) can maintain or restore pervious surfaces, provide pollution reduction, protected vegetated buffers, and protect water quality.

Over time and as warranted, additional approaches may include adoption of flood hazard overlay districts that include higher development standards that minimize impacts from natural hazards and climate change. In the long-term, prohibiting development in areas destroyed by storms, experiencing repetitive loss of structures, and subject to chronic flooding and erosion can ultimately reduce risk and exposure along the coast. In the future, finding ways to acquire at-risk private properties and adapting them for new uses, such as recreational areas, will ensure continued enjoyment of coastal living. Another tool to implement adaptation for new development and redevelopment is to periodically modify the town's floodplain development ordinance to address impacts as conditions change and flood risk increases.

Land use and development regulations can be focused to reduce vulnerability while protecting ecosystem services. One of the most effective strategies is to conserve land that allows coastal habitats and populations to adapt to changing conditions while protecting natural functions that protect people, structures, and facilities. Watershed-based plans can include comprehensive water resource management principles focused on changes in hydrology resulting from climate change. Maintaining or restoring critical natural systems such as saltmarsh and sand dunes will ensure greater protection from storm surge and long-term impacts of sea-level rise. Best management practices for shoreline development can include alternatives to shoreline hardening, bank stabilization techniques, and vegetation restoration.

2. Infrastructure and Building Guidelines

Increased precipitation and sea-level rise will produce more inland runoff and localized flooding in addition to coastal flooding. Experts recommend that for floodplain and coastal locations, where there is little tolerance for risk (e.g. costly to repair or serves a critical function), that the following guidelines be used in the siting and construction of infrastructure and facilities.[10]

[10] Paul Kirshen, Cameron Wake, Matt Huber, Kevin Knuuti, Mary Stampone, *Sea-level Rise, Storm Surges, and Extreme Precipitation in Coastal New Hampshire: Analysis of Past and Projected Future Trends (2015)*, Prepared by Science and Technical Advisory Panel for the New Hampshire Coastal Risks and Hazards Commission.

- The range of sea-level rise scenarios from the Intermediate High to the Highest (Figure 4) be applied as follows:
  - **Determine** the time period over which the system is designed to serve (either in the range 2014 to 2050, or 2051 to 2100).
  - **Commit** to manage to the Intermediate High condition, but be **prepared** to manage and adapt to the Highest condition if necessary.
  - Be **aware** that the projected sea-level rise ranges may change and adjust if necessary.
- Development projects continue to use the present frequency distributions for storm surge heights and these be added to projected ranges for sea-level rise. The flood extent of the current 100-year storm surge will increase as sea level rises, and the 100-year floodplain will be flooded more frequently by smaller surges as sea level rises.
- At a minimum, infrastructure is designed using precipitation data from the current Northeast Regional Climate Center (Cornell) atlas and infrastructure be designed to manage a 15 % increase in extreme precipitation events after 2050. Infrastructure design should incorporate new precipitation data as it is published or updated.

3. Town Actions to Address Coastal Hazards

NH Coastal Program Pilot Project

In 2009, the town partnered with the Rockingham Planning Commission and the N.H. Coastal Program to evaluate projected changes in sea level and prepare maps showing where impacts associated with tidal flooding might occur in the future. The report *Adaptation Strategies to Protect Areas of Increased Risk from Coastal Flooding Due to Climate Change* included a series of maps and recommended actions the town may consider to address coastal hazards.

Tides to Storms Vulnerability Assessment

In 2015, town staff participated in the *Tides to Storms Vulnerability Assessment* project with the Rockingham Planning Commission. Through a series of meetings, maps and statistical information about impacts to roadways, critical infrastructure and natural resources was evaluated. Staff provided their perspectives on critical issues facing the town and drafted recommendations to address current and future flood hazards which were included in a final report and map set for the town. Information from these maps and report are being incorporated into the 2016 update of the town's Natural Hazards Mitigation Plan and in this chapter.

Not a lot of data or local information exists about what residents and businesses have done or are doing to accommodate and adapt to coastal hazards and climate change. However, many residents have installed generators to supply electricity in the event of power outages.

Seabrook-Hampton Estuaries Alliance

The Seabrook-Hamptons Estuaries Alliance (SHEA) is a voluntary collaborative advocacy group consisting of members from Hampton, Hampton Falls and Seabrook. The group's focus is to: 1) pursue activities that improve the resilience of natural systems, infrastructure and development to the impacts of climate change; and 2) facilitate communication and cooperation among the three towns, especially in regard to research, programs and other efforts designed to help preserve, protect, and strengthen the Estuary. SHEA can assist the town with outreach, planning and regulatory activities involving climate adaptation implementation.

9.8 Recommendations for Long-Term Adaptation and Resilience Strategies and Actions

The goal of becoming a resilient community is to sustain the local economy, implement sound land use and development, protect natural resources and their functions, and ensure public safety. To address the potential future impacts of climate change, the town can benefit by collaborating with state agencies, other municipalities, and technical service providers. The following recommendations can serve as guide to short-term and long-term actions that can be implemented incrementally over time as conditions warrant.

Municipal Policy and Planning

The Board of Selectman and Town Administrator would lead implementation of the following recommended strategies and actions with assistance from municipal Departments, and boards and commissions as necessary.

M1 Strengthen municipal capacity to utilize the best available science related to potential future impacts of climate change and its risks in order to improve decision-making and action planning.

M2 Identify funding to support preparation of an application to the FEMA Community Rating System Program, a voluntary program whereby the municipality takes specific actions to reduce flood risk and receives discounted flood insurance premiums for NFIP policy holders.

M2 Utilize the best available climate science and flood risk information for the siting and design of new, reconstructed, and rehabilitated municipal structures and facilities.

M3 Collaborate with private sector representatives to evaluate and identify necessary improvements to emergency communications systems preparedness to ensure 911 and other critical communications services remain operational during emergencies and disasters.

M4 Incorporate coastal hazards and risks assessments in municipal emergency management and hazard mitigation plans, and improve connections and efficiencies between these plans.

M5 Begin discussions with elected officials, planning board and zoning board of adjustment about long term land use development standards, building code, and zoning options in areas at high risk for flooding and erosion.

M6 Consider vulnerabilities of local tax base, state economic development plan, retention or replacement of economic resources, at risk populations and population migration.

M7 Adapt economic development planning approaches to respond to changing environmental conditions, leverage shifting opportunities, and promote resilience and sustainability planning as economic development strategies.

M8 Evaluate the costs and benefits of applying to the FEMA Community Rating System Program (e.g. cost of application and implementation versus insurance premiums savings for National Flood Insurance Program policy holders).

Land Use and Natural Resource Strategies

The Planning Board, Conservation Commission, Town Planner and Zoning Administrator would lead implementation of the following recommended strategies and actions with assistance from other municipal Departments as necessary.

L1 Adopt land development regulations aimed at minimizing impervious surfaces and stormwater flooding, and reducing or preventing non-point source pollution.

L2 Revise building codes to enable adaptive construction techniques and designs (e.g. elevating above base flood elevation, wet and dry flood-proofing).

L3 Over time and as warranted, consider adoption of flood hazard overlay districts that include higher development standards that minimize impacts from natural hazards and climate change.

L4 Require development project approvals to include drainage maintenance plans for stormwater infrastructure and streams or open drainage ways on site.

L5 Maintain or restore critical natural systems such as saltmarsh and sand dunes to ensure greater protection from storm surge and long-term impacts of sea-level rise. Employ best management practices for shoreline development such as bank stabilization techniques and vegetation restoration as alternatives to shoreline hardening.

L6 Utilize existing state and federal grant programs for natural resource restoration.

L7 Develop natural resource restoration plans that explicitly consider future coastal risk and hazards, and the ecological services that they provide.

L8 Encourage adoption of buffers and setbacks that restore and maintain ecosystem services (e.g. flood storage, storm surge protection, habitat, recreation).

L9 Provide recommendations and incentives for removal of structures and facilities, such as freshwater and tidal crossings, that create barriers to tidal flow and habitat migration, particularly those that will be impaired or severely impacted by sea-level rise, storm surge, or extreme precipitation.

L10 Engage in best practices for invasive species planning and removal and incorporate climate considerations in invasive species removal plans.

L11 Identify areas where erosion and shoreline instability exist, and prioritize areas for nature-based approaches (e.g. beach nourishment, dune restoration or marsh restoration).

L12 Protect future marsh migration areas identified by marsh migration modeling.

L11 Improve designs for dams, culverts and bridges to maintain existing function and reconnect fragmented surface waters (wetlands, lakes, ponds, rivers and streams) and protect high quality habitat for aquatic organisms.

L13 Incorporate in plans and implement strategies to prepare and adapt coastal recreational resources based on best available climate science.

L14 Assess existing and future recreational areas for their potential to provide storage for flood waters and stormwater runoff.

L15 Preserve open space and recreational areas that serve to minimize climate change impacts.

Local, Regional and State Coordination

The Board of Selectman and Town Manager would lead implementation of the following recommended strategies and actions with assistance from municipal Departments, and boards and commissions as necessary.

R1 Coordinate with municipalities and private water companies to evaluate water resources and drinking water needs for the seacoast region.

R2 Coordinate with the NH Department of Transportation on anticipated improvements to state and local roadways most vulnerable to flooding (state highways are Routes 1A, 101 and 286) and leverage funding necessary for such improvements.

R3 Coordinate evacuation route planning with Hampton, Hampton Falls and Salisbury, MA. Incorporate early communication and notification into regional evacuation route planning.

Community Preparedness and Awareness

The Town Manager and municipal Departments would lead implementation of the following recommended strategies and actions with assistance from Planning Board, Conservation Commission and civic organizations as necessary.

C1 Form a citizen lead committee to address flood impacts and act as an advocacy group for the community on flood related issues of concern.

C2 Provide informational materials about flood risk reduction at public and community events.

C3 Schedule events at the library or other public venues featuring topics relating to coastal hazards and preparedness, and climate adaptation.

C4 Provide information through outreach to residents and businesses about alternative approaches, reducing risk and lowering insurance premiums through adaptation.

C5 Provide information through outreach to residents and businesses about the benefits of living shorelines.

C6 Implement the FEMA High Water Mark Initiative to illustrate past flood elevations and future water levels associated with the 100-year storm surge and projected sea-level rise.

C7 Provide outreach and information to residents about how to clean up after a storm event (e.g. drainage ways, driveway culverts etc.)

C8 Continue participating in and supporting the Seabrook-Hamptons Estuaries Alliance.

C9 Continue participation in the NH Coastal Adaptation Workgroup to facilitate, coordinate, provide technical information, and convene public outreach events about climate adaptation.

C10 Partner with federal and state agencies as well as regional and local organizations to expand resources for education, outreach, and coordination.

C11 Encourage the incorporation of climate science and information about the risks and hazards associated with changing climatic conditions in public school curriculum.

C12 Improve information available to property owners and prospective buyers about coastal hazards and vulnerabilities.

C13 Improve consumer protection disclosure of properties vulnerable to coastal flooding.

C14 Distribute flood protection safety information to property owners in high-risk areas.

C15 Encourage homeowners to obtain flood insurance through the National Flood Insurance Program, and in moderate- to low-risk areas, to purchase a Preferred Risk Policy.

C16 Encourage landowners to preserve the beneficial functions of natural features like wetlands and to restore and protect coastal dune habitat.

9.9 Municipal Action Plan for Facilities, Infrastructure and Services

The recommendations in this action plan were identified through a series of meetings and interviews with municipal Department staff. This plan identifies short-term actions that all town departments and facilities should implement to safeguard municipal facilities and services from coastal flood impacts.

Action Items Identified by Departments		Responsible Party	Timeframe to Implement*	Funding Needs	Notes
A1	Incorporate vulnerability assessment information and adaptation strategies for structures and facilities planning and investment for long term capital projects in municipal Capital Improvement Programs (CIPs).	All Departments	Ongoing	Technical Assistance	
A2	Establish a capital reserve fund to support long-term adaptation actions into the future.	All Departments	Short-term	CIP	
A3	Evaluate future options to reduce flooding including construction of levees and/or tide gates on the estuary side of the beach, west of Route 1A or at mouth of the estuary.	Building Dept.	Medium-term	Technical Assistance	
A4	Support efforts to prepare a comprehensive shoreline management plan that includes dune restoration and maintenance.	Building Dept.	Ongoing	State program coordination	
A5	Consider adopting freeboard (+2-4 feet) and elevation of utilities above the BFE for all new construction and substantial improvements, residential and non-residential structures.	Building Dept.	Short-term	Staff time, Planning Board	
A6	Amend existing floodplain ordinances for the town and Seabrook Beach Village District (may require adjustment of maximum building height to allow elevation above the base flood).	Building Dept.	Short-term	Staff time, Planning Board	
A7	Conduct outreach to property owners, land use boards, staff and elected officials about what freeboard would look like on the beach landscape.	Building Dept.	Ongoing	Staff time, Planning Board	
A8	Conduct outreach to property owners, land use boards, staff and elected officials about the benefits of the National Flood Insurance Program.	Building Dept.	Ongoing	Staff time, Planning Board	

** Implementation Timeframes: short-term 1-5 years, medium-term 5-15 years, long-term 15+ years, or an ongoing action or activity.*

Action Items Identified by Departments		Responsible Party	Timeframe to Implement*	Funding Needs	Notes
A9	Waterproof the generator and electrical systems that are in low-lying elevations at the Waste Water Treatment Plant.	Wastewater Treatment Plant	Short-term	Dept. budget	
A10	Conduct a detailed analysis of the Waste Water Treatment Plant to determine elevations of land and structures and flood potential.	Wastewater Treatment Plant	Short-term	Technical Assistance	
A11	Evaluate flood reduction strategies at the Waste Water Treatment Plant (e.g. fill to increase land elevation or construct a berm around the facility).	Wastewater Treatment Plant	Short-term	Technical Assistance	
A12	Implement a new protocol for inspection program for manholes and incorporate the data points into GIS.	Wastewater Treatment Plant	Short-term	Staff time	
A13	Replace wastewater transmission lines along Route 286.	Wastewater Treatment Plant	Medium-term	CIP	
A14	Evaluate the function of wastewater and drinking water pump stations at different flood elevations.	Wastewater Treatment Plant and Water Dept.	Short-term	Technical Assistance	
A15	Replace drinking water transmission lines along Route 286.	Water Dept.	Medium-term	CIP	
A16	Flood-proof subsurface wastewater vaults and interconnections with systems in Salisbury, MA.	Dept. of Public Works	Short-term	Dept. budget	
A17	Support dune restoration and creation along the estuary shorelines to provide flood protection.	Dept. of Public Works	Ongoing	State program coordination	
A18	Coordinate with the NH Department of Transportation on anticipated improvements to state and local roadways most vulnerable to flooding (state highways are Routes 1A, 101 and 286) and leverage funding necessary for such improvements.	Dept. of Public Works	Medium to Long-term	State and regional coordination	

* *Implementation Timeframes: short-term 1-5 years, medium-term 5-15 years, long-term 15+ years, or an ongoing action or activity.*

Action Items Identified by Departments		Responsible Party	Timeframe to Implement*	Funding Needs	Notes
A19	Develop a comprehensive emergency evacuation plan for coastal flood and storm events (e.g. maps of vulnerable areas, methods to deliver warnings and announcements, when/where evacuation is most appropriate, outreach to affected property owners).	Emergency Management	Short to Medium-term	Technical Assistance	
A20	Apply for FEMA pre-disaster mitigation grant funds for infrastructure systems improvements, and other sources of funding to implement climate adaptation and planning strategies that reduce or eliminate flooding impacts.	Emergency Management	Ongoing	Grant writing	
A21	Improve coordination between the towns and MA Department of Transportation when Route 1A is closed in Salisbury frequently during storm events.	Emergency Management	Short-term	State and regional coordination	
A22	Improve coordination between the town and the Seabrook Beach Village District including zoning administration and Building Departments.	Emergency Management	Short-term/ Ongoing	Departments staff time	
A23	Consider establishing a budget line item for Emergency Management (staff, equipment, programs) including estimated “real cost” of services provided by other Departments to support emergency services.	Emergency Management	Short-term/ Ongoing	Departments staff time	
Additional Municipal Action Items		**Responsible Party**	**Timeframe to Implement***	**Funding Estimate**	**Notes**
A24	Evaluate deficiencies and barriers in municipal regulations, plans and policies, and their implications for local and regional vulnerability.	All Departments	Short-term	Technical Assistance	
A25	Encourage adoption of buffers and setbacks that better account for risk and vulnerability of municipal structures and facilities, and maintain ecosystem services (e.g. flood storage, storm surge protection).	Planning Board, Conservation Commission, facility managers	Short-term	Departments staff time, Planning Board, Conservation Commission	

** Implementation Timeframes: short-term 1-5 years, medium-term 5-15 years, long-term 15+ years, or an ongoing action or activity.*