

A Town in High Water:
Coastal Hazard Planning Practices for Kittery, Maine

FINAL REPORT
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1. Introduction

This report functions as a series of recommendations for addressing coastal hazard issues for the Town of Kittery, Maine and is a product of the 2020 University of New Hampshire Sustainability Fellows program. It functions best in combination with a series of vulnerability maps (Appendix A through I), draft zoning ordinances (Appendix J), and other explanatory products (FAQs, PowerPoint slide decks) that were also created as part of the fellowship program.

2. Coastal Hazard Planning

Climate and Hazards

Although we have always dealt with weather and seasons, the globe is getting significantly warmer. As a result of this warming, the world is beginning to experience unprecedented climatic repercussions. The American Meteorological Society reported that in 2018, the planet had an atmospheric carbon dioxide (CO₂) concentration of over 407 parts per million, which was the highest concentration the earth has seen in 3-5 million years.¹ This increasing carbon pollution has triggered widespread changes in the Earth's systems. This is referred to as climate change.

The evidence of anthropogenic (human-caused) climate change is extensive and largely irrefutable.² The impacts of climate change are intensifying, and threatening the physical, social, and economic well-being of our society. According to studies carried out by the National Oceanic and Atmospheric Administration (NOAA), every year since the beginning of this century has been hotter than the 1981-2010 average.³ If carbon emissions continue to rise in a business-as-usual scenario, the impacts of climate change are expected to cost the country up to 10% of its gross domestic product (GDP) by the end of the century.⁴ Although the consequences of climate change are relevant to every sector of society, there are also large-scale disasters that will become increasingly disruptive. For example, over the past five years (2015-2019) there were on average 14 weather and climate disasters per year with overall damages averaging \$107 billion per year and deaths averaging 772 per year.⁵

The many impacts of climate change include events associated with coastal areas, otherwise referred to as coastal hazards. Coastal hazards include flooding, shoreline erosion, groundwater rise, and destruction from storms. Flooding is one of the most pervasive hazards in the United States, with more than 70 percent of presidential disaster declarations for flooding events.⁶ The rate of global sea level rise has increased in recent years, which leaves coastal communities at greater risk to flooding.⁷ Rising seas result in more damage associated with coastal storms and storm surge. In addition, in some low lying areas, sea level rise results in an increase in the frequency and magnitude of high tide flooding.⁸ The two major causes of sea level rise are ocean water expanding from warming and the increased melting of ice on land (glaciers and ice sheets).⁹ Additionally, climate change can intensify storm events, such as hurricanes and tropical storms, that cause destruction along shorelines from intense waves, rainfall, and wind. During these more intense storms, areas of a municipality can be at even higher risk of flooding.¹⁰

At least 40 percent of the population in the United States live in coastal areas.¹¹ Over 452,000 Mainers live on the coast or on coastal islands (about 34% of the state's total population).¹² The University of Maine recently published a report titled 'Maine's Climate Future' which provides a detailed assessment of climate change in Maine.¹³ The report makes the point that acting in a significant way today to reduce greenhouse gas emissions and adapt to the changing climate holds tremendous opportunity to avoid worst-case scenarios for negative impacts from future climate change. In the southern coastal area of Maine, air temperature has increased 3.4 degrees Fahrenheit since 1895. There is less snow (-20%) and more frequent and intense rain (+15%) resulting in increasing flooding events. Runoff flows can impact drinking water and damage roads, bridges, and properties.

Data from the Portland tide-gauge indicates that the relative sea-level has risen about 7.5 inches since 1912. High-tide flooding used to occur about five times a year in Portland but now occurs 12 or more times a year. Coastal hazards threatened hundreds of miles of Maine roadways and thousands of homes, which has affected real estate values.¹⁴ Sea levels are projected to rise for centuries.⁹ Storms like Nor'easters continue to threaten Maine and coastal areas with increasing coastal flooding associated with these storms. A wide variety of evidence indicates that coastal New England will experience more intense and frequent rainstorms.⁹

The Town of Kittery is one of many coastal municipalities that is actively exploring what it can do to mitigate future risk related to coastal hazards. There are already federal, state, regional, and local efforts underway to address this crisis (many of these are listed in the 'Current Efforts' section of this document starting on page 10). By acting proactively, Kittery can better prepare for coastal hazards to protect its infrastructure, natural resources and the health and security of residents, while prioritizing and protecting vulnerable citizens. This Best Practices guide functions as a guide for Kittery residents and municipal staff to better address coastal hazards. By addressing coastal hazards, we can build a more resilient Kittery.

Climate Resilience

By addressing coastal hazards like flooding, erosion, and storm surge, we can develop resiliency in our communities. Climate resilience is generally defined as the capacity for a society to:

- 1) absorb stresses and maintain function in the face of external stresses imposed upon it by climate change and
- 2) adapt, reorganize, and evolve into more desirable configurations that improve the sustainability of the system, leaving it better prepared for future climate change impacts.

Building coastal resilience means planning for coastal hazards (flooding, storm surge, coastal erosion). There are "co-benefits" created by planning for these risks.¹⁵ These co-benefits touch major aspects of our society, including:

The Environment: Ecological co-benefits may include but are not limited to: protection of the natural and beneficial functions of coastal marshes and floodplains, creation of habitat for fish, fowl and wildlife, enhanced air and water quality, restoration of natural ecosystems, and a more sustainable environment."

The Economy: The local economy is at risk during coastal hazard events. Flooding, sea-level rise, and storm surge can ruin local businesses and reduce customer access to stores. Large employment sectors, such as the Portsmouth Naval Shipyard, are reliant upon stable and secure coastlines for their operations. Planning for future hazards can better preserve and enhance Kittery's economy. Planning for flood risk can create additional opportunities for recreation and interaction with nature. This can boost the local economy by attracting regional tourism.

Equity: The effects of coastal hazards do not affect everyone equally. Marginalized populations with less resources, including the elderly, poor, the unhealthy, and communities of color, are more likely to face the greatest repercussions of flooding, storm surge, and other hazard events with the least resources to recover from damage and loss. Understanding who and where these populations are is imperative to protect our communities in hazard events and build resilience for the future. Planning for coastal hazards can protect vulnerable populations that are at greatest risk. Equity is intrinsic to all aspects of coastal hazard planning, including more technical aspects such as insurance provisions. Vulnerable groups may include:

1. Elderly population
2. Households below the poverty level
3. Residents without vehicle access
4. Disabled individuals
5. Non-native English speakers
6. Service industry/tourism-based workers
7. Homeless population
8. Working waterfront workers
9. Other local vulnerable populations

Adaptation

There is great importance in reducing carbon pollution emissions to reduce the amount of anthropogenic climate change. This must also be paired with action to adjust to our warming world. Adaptation is adjustment in natural or human systems to a new or changing environment that expands beneficial opportunities or moderates negative effects. Adaptive Capacity is the combination of the strengths, attributes, and resources available to an individual, community, society, or organization that can be used to prepare for and undertake actions to reduce adverse impacts, moderate harm, or exploit beneficial opportunities.

Natural and Manufactured Adaptation Solutions

Natural capital, or the “living and nonliving components of ecosystems,” include basic components such as soil, air, and water. Healthy ecosystems can reduce the negative impacts of climate change. For example, coastal hazards can be diffused by habitats like mangroves and forests. On the other hand, manufactured capital is infrastructure built by humans and relied on by society (i.e. roads, bridges, buildings, water and sewer systems, electrical grid). When considering how to build coastal hazard resiliency, deciding between natural capital versus manufactured capital depends on the problem in need of addressing. The solutions may have differing costs and benefits.

This report focuses on ways of addressing coastal hazards in Kittery. By focusing on adaptation and building resilience, the Town can make strong steps towards reducing the impacts of flooding and other natural disasters.

Coastal Hazards in Kittery

As the oldest town in the State of Maine, Kittery has a long history of reliance on the ocean. Prior to European invasion, the area was known to the Algonquin indigenous peoples as Amiciskeag, meaning “the fishing point.” To this day, the area is still renowned for its coastal recreation and shipyard industry. Kittery also has a long history of storm impact, such as the recently destructive Nor’easters that upheaved Kittery’s coastal infrastructure. Among the hazards that threaten Kittery’s coast are storm surge, flooding, sea level rise, and coastal erosion. The Maine Geological Survey indicates that the coast of Maine can reasonably expect to experience one to two feet of sea level rise by 2050, and four to six feet of rise by 2100.¹⁶ This, however, is further exacerbated by storm surge events that raise the water even higher.



Figure 1: Fort Foster after storms in 2018 (photo taken by Judy Spiller)

The Town has begun addressing this issue through establishment of the Kittery Town Council Climate Adaptation Committee, joining with neighboring communities to form the Southern Maine Regional Sustainability and Resilience Program, collaborating with the Portsmouth Naval Shipyard and surrounding communities on the Portsmouth Naval Shipyard Joint Land Use Study, and has begun key planning processes like the Kittery Flood Resilience Checklist to identify vulnerabilities and plan to protect assets. The Flood Resilience Checklist identified areas vulnerable to flood hazards¹⁷:

- Residential neighborhoods

- Heavily traveled road segments and business areas
- Emergency evacuation routes
- The Portsmouth Naval Shipyard (PNSY)
- Fort Foster
- The Admiralty Village area
- Parts of Shepherds Cove senior housing
- Wood Island
- Sections of Seapoint, Chauncey Creek, and Payne Roads
- Whipple Road near the PNSY Gate 2
- The Spruce Creek area near the outlet shopping centers
- Kittery Water District land in the northwest
- Seapoint beach
- The southeastern side of Gerrish Island
- The Rachel Carson National Wildlife Refuge
- Pepperrell Road between Chauncey Creek and Deerings Pond
- Lewis Square

3. Vulnerability Mapping

A series of flood maps have been developed to exhibit the most vulnerable areas in the Town (Appendices A, B, C, D, E, F, G, H, I). We chose three different water level scenarios that portray flooding resulting from the combined impacts of sea-level rise and storm surge: 3.9 feet, 6.1 feet, and 10.9 feet above high astronomical tide (HAT). These scenarios are depicted in two formats: a coastal view of inundated areas in Kittery (Appendices A, B, C) and zoomed-in insert selections of inundated areas (Appendices D, E, F). The Portsmouth Naval Shipyard was also mapped with the sea level rise projections of 3.9 feet, 6.1 feet, and 10.9 feet. (Appendices G, H, I)

Kittery Sea Level Rise Scenarios

To best utilize the vulnerability maps, it is important to understand the projections of sea level rise and storm surge portrayed on the the maps. The following information is based on a 2019 study titled “New Hampshire Coastal Flood Risk Summary Part 1: Science.”¹⁸ The analysis of future sea level rise in coastal New Hampshire details impacts that are applicable to Kittery as well, given the Town’s proximity to coastal New Hampshire.

Sea Level Rise

The analysis indicates that our coast is likely to experience *sea level rise (SLR) of 0.5 to 1.3 feet between the years of 2000 and 2050*. There is a 1-in-100 chance that SLR will exceed 2.0 feet by 2050.

There is a much larger range in the estimates of sea-level rise after 2050 due to uncertainties in the rate at which the Antarctic ice sheet disintegrates. *By 2100, Kittery is likely to experience SLR of 1.0 to 3.8 feet*. There is a 1-in-100 chance that sea-level rise will exceed 5.3 to 6.5 feet.

The higher SLR estimates are associated with higher amounts of global greenhouse gas emissions.

Finally, sea levels will continue to rise for centuries. The rate of longer-term sea-level rise also depends on how rapidly the Antarctic ice sheets melt. The overall extent of this melting and ensuing sea level rise depends, most of all, on the action taken to reduce greenhouse gas emissions globally.¹⁹

Storm Surge

NOAA defines storm surge as the abnormal rise of water generated by a storm.²⁰ Recent scientific estimates of the height of storm surge associated with the 100-year storm range from about 4.0 to 5.3 feet.²¹ The 100-year storm really refers to a storm that has a 1% annual chance of occurring. Considering the complexities involved in storm surge predictions, it is not surprising that the range of return period estimates varies relative to one another and to historical water level analysis. The height of the storm surge will be greatest on the open coast and will be reduced as the surge moves up the river. Detailed modeling indicates that the height of the storm surge associated with a 100-year storm is reduced by 50% at the Little Bay Bridge.²²

Future Water Level Scenarios in Kittery Displayed on the Maps

The 3.9 foot Scenario: Currently, a 100-year storm could result in water levels that are 4.0 to 5.3 feet above current high astronomical tide (HAT). The maps of the 3.9 feet water level therefore provide a reasonable estimate of flooding associated with a 100-year storm today.

The 6.1 foot Scenario: By 2050, a combination of likely sea-level rise (0.5 – 1.3 feet) and 5 feet storm surge would result in water levels ranging from 5.5 to 6.3 feet. The 6.1 foot water level map therefore provides an estimate of likely flooding associated with a 100-year storm in 2050.

The 10.9 foot Projection: By 2100, a combination of likely sea-level rise (1.0 – 3.8 feet) and 5 feet storm surge would result in water levels ranging from 6.0 to 8.8 feet. The 10.9 feet water level map therefore provide a slightly higher estimate of flooding associated with a 100-year storm in 2100.

Kittery Vulnerability Maps

As mentioned, three different water level scenarios were used to portray flooding resulting from the combined impacts of sea-level rise and storm surge: 3.9 feet, 6.1 feet, and 10.9 feet (light blue) above high astronomical tide (HAT) (dark blue). The following maps showcase areas that are particularly at-risk of severe flood inundation. The following maps show the three scenarios in increasing water level scenarios for each location. Larger maps (with legends) are provided in the Appendix.

The Rachel Carson National Wildlife Refuge (Figure 2): As exhibited in Figure 2, the 3.9 ft scenario shows immediate flooding of Tower Road, Cutts Island Trail, Seapoint and Crescent Beaches, and properties near Route 103. This is exacerbated in the subsequent scenarios, with flooding extending over Route 103. However, the Rachel Carson wildlife preserves buffer further water spread.



Figure 2a: HAT plus 3.9 ft SLR & SS



Figure 2b: HAT plus 6.1 ft SLR & SS

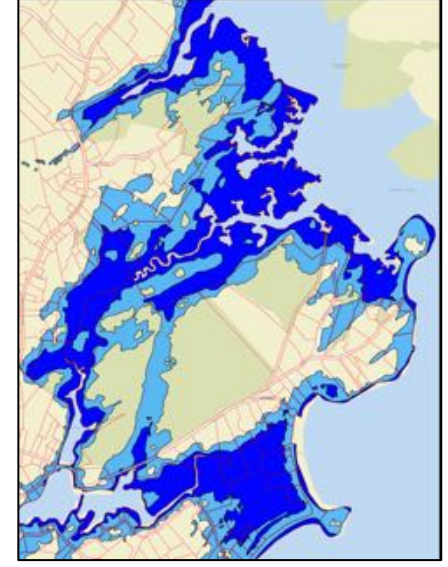


Figure 2c: HAT plus 10.9 ft SLR & SS

Badger's Island (Figure 3): Badgers Island and the adjacent shoreline will be severely affected by flooding. Warren's Lobster House will be affected by flooding immediately in the 3.9 ft scenario. These areas also host marinas and markets, like Seaview Lobster, that will be affected by flooding. Beyond the John Paul Jones Historic Site, however, there is expected to be little impact inland. The dark blue depicted for the Route 1 bridge represents an artifact of the analysis but is not likely to occur under these sea-level rise scenarios.



Figure 3a: HAT plus 3.9 ft SLR &



Figure 3b: HAT plus 6.1 ft SLR &



Figure 3c: HAT plus 10.9 ft SLR

Admiralty Village (Figure 4) : In this area, the difference between the 3.9 ft and 10.9 ft scenarios are stark. The neighborhoods in this area will experience drastically increasing flood events from now until 2100. While the 3.9 ft scenario affects homes primarily towards the north along Spruce Creek, in the 6.1 ft and 10.9 ft scenarios there is clear evidence of widespread flooding of dozens of properties and several roads. The area to the west of Boush St along Mason Ave is not expected to experience flooding.



Figure 4a: HAT plus 3.9 ft SLR & SS



Figure 4b: HAT plus 6.1 ft SLR & SS



Figure 4c: HAT plus 10.9 ft SLR & SS

Fort Foster (Figure 5): This area, though primarily green space, hosts properties that will be severely affected by flooding. Homes lining the coast are expected to be impacted as early as the 3.9 ft scenario. The Kittery Point Fire Station is in the path of flood waters as soon as the 3.9 ft scenario as well, with other key facilities like the Bethany Church and Citgo gas station also in the path of potential destruction. Route 103, Pocahontas Rd, and Goodwin Rd are the only potential evacuative roadways running through the area and are expected to flood.



Figure 5a: HAT plus 3.9 ft SLR & SS



Figure 5b: HAT plus 6.1 ft SLR & SS



Figure 5c: HAT plus 10.9 ft SLR & SS

Route 103 (Pepperrell Rd) over Spruce Creek (Figure 6): This roadway, a key transportation and evacuation route, is expected to experience flooding events. All three scenarios exhibit detriment to the roadway in the area over Spruce creek. In the 10.9 scenario, the western portion of mainland near Tilton and Newson Avenues are predicted to flood entirely, cutting off the mainland from passing through this exhibited area.



Figure 6a: HAT plus 3.9 ft SLR & SS



Figure 6b: HAT plus 6.1 ft SLR & SS



Figure 6c: HAT plus 10.9 ft SLR & SS

Route 1 and Route 1 Bypass (Figure 7): Although there will not be much inland flooding in the 3.9 ft and 6.1 ft scenarios in this area, the 10.9 ft scenario indicates that there will be a large area of flooding along the west side of Route 1, including Beach Pea Baking, Golden Harvest Produce Market, Carl's Meat Market, and the Kittery Water District properties. This flooding will continue south and may interfere with Government/Walker St. In the northwestern portion of this exhibit, there is expected flooding that will impact additional neighborhoods near Dennett Rd



Figure 7a: HAT plus 3.9 ft SLR & SS



Figure 7b: HAT plus 6.1 ft SLR & SS



Figure 7c: HAT plus 10.9 ft SLR & SS

Payne Road (Figure 8): This roadway near the intersection with Brave Boat Harbor (Route 103) is already flooded during large Nor'easters and will experience significant flooding in the 3.9 ft to 10.9 ft scenarios



Figure 8a: HAT plus 3.9 ft SLR & SS



Figure 8b: HAT plus 6.1 ft SLR & SS



Figure 8c: HAT plus 10.9 ft SLR & SS

4. Current Efforts

Several organizations, programs, and planning efforts play roles in developing resilience to coastal hazards. The references listed are important as they have considerable information and resources that can be used by the Town in coastal adaptation planning.

Federal

- National Flood Insurance Program (NFIP)²³: Part of the Federal Emergency Management Agency (FEMA). Aims to reduce the impact of flooding on private and public structures by providing affordable insurance to property owners, renters and businesses and by encouraging communities to adopt and enforce floodplain management regulations.
- Risk MAP and Flood Maps²⁴: FEMA and its NFIP program have created maps displaying at-risk areas across the country. Although these maps are changing and may require adjustment, they provide an idea of target areas for climate adaptation and mitigation.
- U.S. Climate Resilience Toolkit²⁵: A highly developed website designed to help communities find and use tools, information, and subject matter expertise to build climate resilience. The Toolkit offers information from all across the U.S. federal government in one easy-to-use location. Includes 'Steps to Resilience,' 'Case Studies,' 'Tools,' 'Regions,' and 'Expertise'. Operates under the auspices of the United States Global Change Research Program.
- CRS for Community Resilience²⁶: Aims to increase the number of communities making voluntary, effective measures to increase flood resilience through FEMA's Community Rating System (CRS). This project promotes CRS participation, provides guidance on actions that increase a community's rating, and works directly with communities to increase their resiliency through the CRS process.
- NOAA Climate Program Office²⁷: Advances understanding and prediction of climate and leverages the science to help Americans plan and respond.

- U.S. Global Change Research Program²⁸: A Federal program mandated by Congress to coordinate Federal research and investments in understanding the forces shaping the global environment, both human and natural, and their impacts on society.
- Georgetown Law Climate Center²⁹: The Georgetown Climate Center has pertinent resources for municipalities wanting to prepare for climate change. Of these resources the ‘Equitable Adaptation Legal & Policy Toolkit’ may be the most useful. In the toolkit, there are resources pertaining to ‘Community-Driven Engagement Processes,’ ‘Economic Resilience,’ and ‘Resilient Affordable Housing, Anti-Displacement & Gentrification,’ just to name a few.

State

- Maine Coastal Program³⁰: Part of the Maine Department of Marine Resources. Works with various partners toward the shared goal of a healthy coast and vibrant coastal communities.
- Municipal Planning Assistance Program³¹: Part of the Maine Department of Agriculture Conservation and Forestry. Put together the Municipal Climate Adaptation Guidance Series in collaboration with Maine’s Regional Planning Organizations. Provides land use planning expertise and promotes growth management principles by providing technical and financial assistance, coordinating with state agencies, and implementing Maine’s Growth Management Act.
- Municipal Climate Adaptation Guidance Series³²: These guidance documents explain how to identify threats to community resources and how to respond to those threats by integrating climate adaptation measures. The documents suggest doing so through local policies, practices, and ordinances. There are ten documents in the series, with each addressing a different area of municipality functions.
- Maine Floodplain Management Program³³: Part of the Maine Department of Agriculture Conservation and Forestry. Works with individuals, communities and professionals to reduce the risk of flooding.
- Maine Geological Survey³⁴: Part of the Maine Department of Agriculture Conservation and Forestry. Provides the people and businesses of Maine with essential geologic information about land. Experienced geologists collect and summarize information about groundwater, mineral resources, surface deposits and bedrock materials, stability of coastal properties, and natural hazards such as storms, floods, landslides, and earthquakes.
- Maine Natural Areas Program³⁵: Part of the Maine Department of Agriculture Conservation and Forestry. Serves Maine's citizens as the most comprehensive source on the State's important natural features. Inventories lands that support rare and endangered plants, rare natural communities and ecosystems, and outstanding examples of more common natural communities and ecosystems.
- Maine Climate Hub³⁶: Part of the Maine Department of Environmental Protection. A centralized climate directory providing decision makers and assistance providers with the resources needed to become more resilient in the face of a changing climate.
- Maine Climate Council³⁷: An assembly of scientists, industry leaders, bipartisan local and state officials, and engaged citizens to develop a four-year plan to put Maine on a trajectory to reduce emissions by 45% by 2030 and at least 80% by 2050.
- University of Maine’s Climate Change Institute³⁸: Integrates transformational field, laboratory and modeling activities to understand the physical, chemical, biological and socio-

cultural components of the climate system of the past and present, to better predict future changes in climate and their impacts in Maine and the globe. Released a highly informative report called “Maine’s Climate Future” that details the current and expected effects of climate change in Maine.

- Environmental Office³⁹: Part of the Maine Department of Transportation. Plays a lead role in proactively integrating transportation, environmental and innovation objectives with the department's plans, operations and maintenance activities.
- Maine Climate Table⁴⁰: Provides opportunities for learning, participation, and actions for solving climate change, with particular focus on what works for Maine and Mainers. They offer a wide array of communication materials, workshops, webinars, and research tools.

Regional

- The Southern Maine Planning and Development Commission (SMPDC)⁴¹: The Southern Maine Planning and Development Commission is a council of governments serving thirty-nine member municipalities. The Sustainability and Resilience of SMPDC coordinates and leads sustainability and coastal resiliency efforts with the aim of enhancing sustainability, climate preparedness, and coastal community resilience.
- Town of Kittery and Portsmouth Naval Shipyard Joint Land Use Study⁴²: Completed with Southern Maine Planning and Development Commission, regional jurisdictions, States of Maine and New Hampshire, and Portsmouth Naval Shipyard (PNSY). Issues covered include adequate local and regional transportation networks; adequate workforce housing, resiliency of coastal development; community development guidelines and infrastructure investments to guide compatible community development; and protection of military line of site corridors, port access, river channel/shipping lanes, and sea-based mobility corridors.
- New Hampshire Coastal Adaptation Workgroup⁴³: A collaboration of 24 organizations working to ensure coastal watershed communities are resourceful, ready and resilient to the impacts of extreme weather and long-term climate change.
- Maine Island Institute⁴⁴: The Island Institute works to sustain Maine’s island and coastal communities, and exchanges ideas and experiences to further the sustainability of communities.
- York County Hazard Mitigation Plan⁴⁵: York County has outlined various hazards, including flooding and storm events, with definitions, types, locations, extent, previous occurrences, and propagability of future occurrences. This document also includes assessments of vulnerabilities, and mitigation strategies relevant for Kittery.

Kittery

- Kittery Flood Resilience Checklist⁴⁶: a non- regulatory assessment tool developed by the Maine Coastal Program to assist coastal communities with examining local flood risk, evaluating vulnerability to flood hazards, and identifying specific actions for enhancing community-wide flood resilience. The process entailed two workshops during which Town staff, members of the Kittery Climate Adaptation Committee (CAC), and other relevant representatives from the community participated in a facilitated discussion about local flood hazards, community resilience, and adaptation planning.

- Kittery Climate Adaptation Committee⁴⁷: A committee of the Town Council dedicated to seeking options to make Kittery more resilient in the face of risks associated with warming temperatures and rising seas.
- Kittery Climate Adaptation Network: A grassroots civic organization comprised of Kittery residents who want to support the actions of the Kittery Climate Adaptation Committee. The goal of this is to support the Town’s adaptation to climate change hazards.
- Climate FAQs⁴⁸: A series of responses on the issue of climate change for Kittery residents, based on a climate survey conducted by the Kittery Climate Adaptation Committee.
- Comprehensive Planning⁴⁹: The Town of Kittery’s Comprehensive Plan identified preparing for climate-related coastal hazards as extremely important, lists developing a “Climate Adaptation Study” as one of the highest priorities, in other words, a “ripe apple” (as cited in the Inventory and Assessment of Existing Conditions section of the Comprehensive plan). Kittery also has Emergency Management municipal code that reflects emergency preparedness plans.⁵⁰

5. Overview of Coastal Resilience Strategies for Small Communities

The following information has been derived from prior research on strategies to address coastal vulnerabilities and resilience. These strategies will inform the Key Recommendations section as they apply within the context of the Town of Kittery.

Natural Capital Strategies

In a paper titled “Addressing Sea Level Rise through Natural Capital: Practice, Planning, and policy in Small East Coast Municipalities” University of New Hampshire students under the supervision of Prof. Cameron Wake identified ways of mitigating impacts of sea level rise through ecosystem services.⁵¹ Ecosystem services are described as “benefits that the natural world provides to humans.” These services function based on a community’s location and historical land use and there must be careful consideration in identifying the best natural capital for the job. Through research examining the policies, practices, and planning methods of small U.S. east coast municipalities under 50,000 residents, the following strategies were identified:

Planning

- Creation of a Master Plan
- Creation of a Hazard Mitigation Plan
- Creation of a Coastal Resilience Plan
- Creation of a Sea-Level Rise Plan
- Flood mapping
- Establishment of an Environmental Conservation Department
- Exploration of managed retreat options
- Mapping of vulnerable infrastructure
- Resilience and hazard planning workshops

Practices

- Dune restoration through revegetation and limitation of beach access pathways

- Salt marsh restoration
- Living shoreline installation
- Establishment of resources on Town website on resilience
- Removal of invasive species
- Acquisition of at-risk properties and land
- Preservation of open spaces
- Removal of structures that impair tidal flow and habitat migration
- Valuation of protected critical ecosystems and flood storage areas
- Launch education campaigns on resilience measures (i.e. coastal landscaping or structural elevation)
- Installation of ‘rip rap’ (loose stone) to prevent erosion
- Purchase of development rights to reduce density in flood prone areas

Policy

- Creation of a Wetlands Ordinance
- Creation of a Floodplain Ordinance
- Tax incentives for property easements
- Additional required setbacks
- Additional wetland buffers
- Limitations on development expansion

Manufactured Capital Strategies

In a paper titled “Investigation of Manufactured Capital in Response to Sea Level Rise for Small Coastal Communities” University of New Hampshire students under the supervision of Prof. Cameron Wake identified ways of mitigating impacts of sea level rise through manufactured capital adaptation.⁵² Manufactured capital refers to “infrastructure built by humans and relied on by society.” Manufactured capital like roads, bridges, buildings, and the electrical grid can both be vulnerable to sea level rise and can be used to leverage resilience in protection from sea level rise. The research found that towns had four main options in addressing coastal flood vulnerabilities: to protect, accommodate, retreat, or take no action. Through research examining innovative examples of small U.S. east coast municipalities under 50,000 residents, there were findings that suggested similar ‘planning,’ ‘practices,’ and ‘policy’ methods as the aforementioned Natural Capital paper. However, the following unique strategies were found:

Planning

- Establishment of state or regional programs for resources, funding, and technical support
- Continued research for small municipalities on steps to resilience
- Continued research into funding opportunities for small municipalities

Practices

- Elevation of homes
- Creation of storm water storage parks
- Encouraged development of permeable pavements
- Installation of vegetative sewer strips

- Required and responsive ditch and drainage cleaning
- Installation of deep-water ocean outfalls
- Utilization of stormwater ponds
- Installation of tide gates
- Installation of rain barrels and green roofs
- Installation of bioswales

Policy

- Requirements for low impact development
- Requirement of stormwater utility fee for funding

Other Flood Resilience Strategies Explored for Maine

The Maine Flood Resilience Checklist⁵³ is a non-regulatory self-assessment designed to assist Maine communities in evaluating how well positioned they are in preparation, response, and recovery to flood hazards. The Checklist defines five main sections for flood resilience:

- Risk and Vulnerability: Communities need to identify the potential geographic extent of flood hazards and effects in relation to their specific locality. A vulnerability assessment provides a baseline of your community's exposure to flood hazards, allowing for projects to be established and measured.
- Critical Infrastructure and Facilities: Critical infrastructure and facilities are those that have the potential to cause serious bodily harm, extensive property damage, or disruption of vital socioeconomic activities if damaged, destroyed, or functionally impaired. Information sharing between Town officials, owners, and operators regarding how flood hazards are incorporated into operation is important for safeguarding assets and fostering resilience.
- Community Planning: Planning decisions and policies can greatly influence how resilient a community is to coastal hazards. Additionally, Maine has a home rule governance structure, making plans essential to governance. By integrating hazard mitigation and emergency preparedness with existing community planning, communities can better prepare.
- Social and Economic Vulnerability: Understanding who is most vulnerable and why is crucial for developing strategies and actions to protect those populations from flood hazards and for building resilience.
- Natural Environment: Natural systems protect and buffer communities from the impacts of coastal storms and flooding, reduce vulnerability, and can prevent economic losses from existing and future coastal hazards. Development has impaired natural systems along the coast. Preserving coastal resources and supporting their adaptation to changing environmental conditions will help to ensure their functions, services, and benefits.

Kittery has undergone two workshops that utilize this Checklist to identify vulnerabilities and existing resources in the Town. This has culminated in a report and notes that are posted in the Resources section of the Climate Adaptation Committee page on the Town website.⁵⁴

6. Key Recommendations

Short Term

Determine Metrics of Success: Defining what coastal resilience looks like to Kittery

This is the first step towards developing coastal resilience in the Town of Kittery. In order for this recommendation to be successful, practitioners must remain focused and clear in their objectives. Bring individuals of varying expertise (planners, engineers, scientists, advocacy groups, town administration, etc.) to help form these metrics in respect to their fields. Use the strategies mentioned and the other recommendations to inform these metrics.

Considerations:

- Utilize this research to determine priorities in planning, practices, and policy measures.
- Establish clear objectives and goals in measurable qualitative and quantitative terms.
- Set dates for accomplishing tasks and appoint personnel to do so.
- The overall effect of this work is to establish a ‘Monitoring and Evaluation’ framework⁵⁵ to keep track of the implementation of adaptation plans and actions and assess their effectiveness and outcomes.
- Reference the Data, Metrics & Monitoring Tools that are included in the Georgetown Law Climate Center ‘Equitable Adaptation Legal & Policy Toolkit’.⁵⁶ This toolkit has productive steps towards evaluating actions.

Create Opportunities for Participatory Action: Involving community in working towards coastal resiliency

It is of the utmost important to bring the community into planning efforts for democratic and effectual governance. Because of the mental and physical strains brought on by the COVID-19 crisis, there will be a strong need for Kittery residents to find ways of supporting their community. This is an important moment for the Kittery Adaptation Committee to bring residents into their efforts. If citizenry is not properly engaged, there is serious risk of retaliation once a project is underway. Community participation must be considered within the short term, but continued throughout projects, for successful resilience planning in the Town of Kittery.

Considerations:

- Information sharing (from residents and to residents)
 - Create an easy-to-use platform for innovation and engagement. Residents should be able to use this platform to retrieve data, submit forms, and find information. This platform should also offer ways for residents to get further involved or share thoughts/considerations.
- Empowerment
 - Create opportunity for citizenry to hold authority and power in decision-making process through community partnerships.
 - Host neighborhood roundtables, forums, workshops, or open houses in addition to public hearings. Hearings can be intimidating to some, and a casual discussion may facilitate heightened engagement.

- For example, if pursuing the FEMA Community Rating System (CRS) regulations, make sure to educate Town citizens about the process and its importance.
- Continue offering an online option for Town meetings, with recordings of the meetings put online. This will allow working families and other folks to participate according to their lifestyle, health, and abilities.
- Identify civic organizations to join the effort. For example, the Kittery Climate Adaptation Network, neighborhood HOAs, or other neighborhood groups.
- Open discussion with community members on value judgements and decisions. For example, what is the risk tolerance for town residents? There will need to be prioritization of projects during the planning process, and the public may have unexpected perspectives to offer as to what needs to be addressed when. Laying out the risks and engaging citizens through workshopping opportunities may be an effective approach to achieving this.
- Developing a communications strategy
 - Reach out and broadcast to citizens via email, SMS, social media, advertisements, door to door, in-person events, or informational sessions/workshops.
 - Utilize resources provided by the Maine Climate Table⁵⁷ on how to communicate climate risk to Maine residents.
 - Utilize resources provided by NOAA⁵⁸ for communicating risks like storms, sea level rise, and other hazardous events.
 - Other ideas include a thorough FAQs webpage and maps for viewing in the Town Hall.
 - Working alongside civic organizations, such as the Kittery Climate Adaptation Network, to further communicate the issue through their connections.
- Arts and cultural campaigns
 - Interview residents on their feelings surrounding Climate Change and sea level rise and compile it into a website. These stories and first-hand experiences will not only better engage citizenry on the topic but will also show residents that their peers are considering this issue.
 - Employ professional artists to create public art works (murals, sculptures, music performances) to showcase the issue of coastal hazards.
 - Offer a competition for local students to submit their best climate change artworks (poems, songs, paintings, performances).
 - Include a prize and make sure to credit students for their efforts.
 - The best pieces can stay on display in Town Hall or another public space to continue to raise awareness.

Medium Term

Seek Trainings: Preparing municipal government for coastal hazards and disasters

Even with the greatest scientific information and data at our fingertips, there is still much we do not know about planning for climate change in small municipalities. It is crucial for Town staff to be versed in not only the impacts of climate change, but also how to communicate the issue to constituents, make long-term plans in addressing coastal hazards, and act swiftly in preparation and response to coastal hazard events. Engaging in training resources may open opportunities for

aligning current work with coastal resilience, thus limiting expenditure of additional financial or personnel resources. Proactive training will prevent the disaster of ill-equipped response later on.

Considerations:

- The Maine Climate Table⁵⁹ and NOAA⁶⁰ offers climate communication trainings and workshops online. The Maine Climate Table is especially helpful given its focused approach to Maine and its incredible research on what communication methods Mainers identify with.
- The international organization AdaptationCommunity.net is a great resource for seeing what the rest of the world's municipalities are doing to address climate change. They offer online trainings and additional literature or resources for engagement.
- National Center for Disaster Preparedness⁶¹ through the Earth Institute of Columbia University offers face-to-face, online, and personalized trainings, courses, and webinars.
- National Preparedness online course catalog⁶² through FEMA offers extensive information on preparing and recovering from disaster.
- Encourage Town personnel to join the American Society of Adaptation Professionals. The organization hosts online webinars based on the adaptation topic of interest, and the organization has an ever-expanding list of working professionals to connect with.
- The American Planning Association is another professional organization that offers resources for Town personnel to learn about enacting climate resilience planning in their municipality.

Implement Data Action: Showcasing important data for Town officials and citizens

Data collection will lend the quantitative lens for evaluating possible climate resilience projects. This may inform the determining of metrics of success. Data tools will not only inform Town decision making, as residents, businesses, and developers may all base their decision making off of these resources. Creating a database of mapping tools and other interactive data interfaces will lend well towards garnering support for projects. Additionally, these tools may help level the information shared between Town officials and residents, so that all those involved are on the same page as to the vulnerabilities and risks associated with coastal hazards.

Considerations:

- Creation of a GIS online mapping tool and database of coastal hazard vulnerability for the Town. There may be three main topics showcased: social, environmental, and infrastructural aspects of coastal hazards in Kittery.
- Offer additional GIS layers like land use, properties, taxes, historic sites and landmarks, critical facilities, socioeconomic data, demographics, impervious surfaces, flooding, high tides, storm surge, and shoreline dynamics.
- Continued development of GIS Story Telling Maps to explain data in relatable ways.
- Development of a "Risk Dashboard" conveying vulnerabilities associated with coastal hazards in Kittery. The COVID-19 Risk Dashboards seen across the country have been popular amongst community members seeking to understand the pandemic. A similar approach to coastal hazards could be very informative and engaging.
- Any other such online platforms that offer an interactive interface may be considered.
- Suggestions from the Kittery Flood Resilience Checklist:

- Update shoreland zoning layers and boundary lines on the Town GIS.
- Amend shoreline zoning map to account for areas that will likely be inundated by coastal hazards.
- Utilize work done by nonprofits and land trusts regarding marsh migration to identify areas of Kittery that may be conducive.
- Identify the number of properties that are impacted in each sea level rise scenario.
- Identify the values of properties that are impacted in each sea level rise scenario.

Long Term

Explore Funding Mechanisms: Leveraging external funding to support coastal resilience efforts

The most common concern for small municipalities in considering coastal hazards is expense. The best way for mitigating this concern is to seek out grant and funding sources. Additionally, collaboration with the Southern Maine Planning and Development Commission, Municipal Planning Assistance Program, local or regional consulting firms, and academic institutions can garner external resources to improve the chances of success in project implementation.

Considerations:

- Use available resources, such as the Southern Maine Planning and Development Commission, to find funding mechanisms.
- More information on funding and financing climate adaptation projects can be found through the Georgetown Climate Center’s ‘Equitable Adaptation Legal & Policy Toolkit’.⁶³
- List of suggested grants:
 - Executive Office of Energy and Environmental Affairs Coastal Community Resilience Grant Program
 - Community Development Block Grant Recovery Program
 - U.S. Army Corps of Engineers grants
 - National Science Foundation programs
 - Natural Resources Conservation Services
 - U.S. Department of Housing grants
 - National Fish and Wildlife Foundation grants
 - NOAA grants
 - FEMA grants
 - Northeast Regional Ocean Council grant
 - Island Institute grants
 - Economic Development Administration funding

Make No Small Plans: Urban planning and policy resources that work towards coastal resiliency

Urban planning is a tool that municipalities have that is already integral to their functioning. By reconsidering current zoning and land use practices, implementing new plans, and considering innovative approaches to planning, small towns like Kittery can strengthen their resilience to coastal hazards.

Considerations:

- Look into the creation of an Emergency Response Plan, Hazard Mitigation Plan, Coastal Resilience Plan, and/or a Sea-Level Rise Plan. These documents, when implemented in conjunction with changes to the Zoning and Land Use Plan, can lead the way for municipal resilience.
 - This will also provide opportunity for the Committee to define the Metrics of Success.
 - When creating plans, it is imperative to consider populations that are the most vulnerable. This may include the elderly and poor, and planners can consult community tax maps and census data to better understand where these impacted populations may be and how to support them.
- Use simple, decision-centered, scenario-based planning to improve coastal management. A study published in the Journal of the American Planning Association⁶⁴ found that this approach can facilitate enhanced hazard mitigation analysis and policy adoption in local master plans.
 - Scenario-based planning involved framing multiple potential circumstances along with their respective potential impacts, essentially accounting for uncertainty.
 - This requires a lot of data and mapping to understand what cannot be controlled (climate futures) and what can (shoreland area management).
- Zoning
 - Zoning is the most powerful tool that local governments have to preemptively mitigate coastal hazards. The Nature Conservancy and the Georgetown Climate Center suggest the following three overlay zone categories for mitigating coastal hazards:
 - Protection Zone: For areas with critical infrastructure and dense development with few options for adaptation
 - Rely on hardened flood protection structures for flood protection and erosion control
 - Other resiliency practices are encouraged, such as employing green infrastructure for stormwater control
 - Accommodation Zone: For moderately to intensely developed but non-critical areas promoting development that considers future SLR
 - Downzoning to lower impact uses to reduce risk exposure
 - Strengthening building codes with setback, elevation, freeboard, and construction requirements
 - Limits on structure height and footprint size
 - Shoreline armoring restricted to soft or natural solutions
 - Conservation Zone: For areas that either provide the greatest natural protection or have non-critical structures at the greatest risk of extensive damage
 - Goal to move development out of these areas to replace with natural protection, marsh advancement areas, open space, or public access
 - Can be achieved with downzoning to low density, water-dependent purposes
 - Shoreline armoring restricted to natural solutions
 - Setbacks aim to move new development landward
 - Rebuilding damaged structures also restricted

- Property acquisition and conservation programs focused on this area
 - Or, three main intensity divisions:
 - Intensely developed areas (IDA)
 - Limited development areas (LDA)
 - Resources conservation areas (RCA)
 - Examples of Maine municipalities addressing coastal hazards in their zoning:
 - Town of York: The Town has a Shoreland Zoning Ordinance with specification that include wetlands not contiguous to coastal wetlands that are 4+ acres, not just the state threshold of 10+ acres. Also has a Wetland Protection Overlay District that regulates wetlands regardless of size.⁶⁵
 - City of Portland: At the time of this report, the City of Portland is proposing a Coastal Resilience Overlay District (CRO) that would allow for alternate calculation of building heights when threshold climate resilience and mitigation strategies are met.⁶⁶
 - City of Saco: The City has a Floodplain Management ordinance that requires three feet of freeboard, which is a higher requirement than the state minimum of one foot. Structures within a special flood hazard area, based on a 100-year storm event, are to be elevated three feet above base flood elevation. These restrictions will also require revision to allow building height to increase, thus avoiding “shortening” effects from additional base elevation.⁶⁷
 - Suggestions from the Kittery Flood Resilience Checklist:
 - Update floodplain ordinance to reflect adoption of the new Flood Insurance Rate Map (FIRM).
 - Modify and strengthen floodplain ordinances through measures such as increasing freeboard requirements, extending floodplain beyond regulatory 100-year floodplain, establish development standards to reduce flood vulnerabilities.
 - Require low-impact development and green infrastructure in flood-predicted areas.
 - Adjust zoning to strengthen protections for marshes and vegetative buffers.
 - Reform septic tank and well requirements to ensure systems are safe in flood predicted areas.
 - Amend cluster development to require open space in flood predicted areas.
 - Require developers to use stronger stormwater management and design standards.
 - As part of this project through the University of New Hampshire Sustainability Fellowship, draft ordinances were created and presented as a “launching-point” for further zoning discussion. These ordinances are attached as Appendix J.
- Land Use
 - The Municipal Planning Assistance Program of the Maine Department of Agriculture Conservation and Forestry has issued a Municipal Climate Adaptation Guidance Series⁶⁸ that includes a section on Comprehensive Planning. Here are some of the included recommendations:

- Conditions and Trends: Include a description of past natural disasters and their effects on historic neighborhoods, structures, or culturally significant areas. An example of this in Kittery would be how Fort Foster has been affected by Nor'easter storms.
 - Natural Resources: Promote conservation of low-lying undeveloped uplands where coastal marshes, beaches, and other intertidal natural communities can migrate inland with sea level rise.
 - Existing Land Use: Establish regular schedule for updating flood maps and risk assessment, with provisions for extra mapping when new information becomes available that will substantially change high risk areas.
 - The Southern Maine Planning & Development Commission offers support and technical assistance for communities who wish to include Sea Level Rise chapters in their Comprehensive Plan updates.⁶⁹
 - Suggestions from the Kittery Flood Resilience Checklist:
 - Integrate language that encourages low impact development and green infrastructure.
 - Prohibit rebuilding or issuing further building permits for properties that are repeatedly damaged by flooding or are located in areas subject to future flooding, erosion, or marsh migration. This will require measurable metrics for determining impermissible repair.
 - Offer incentives for property owners to implement flood risk reduction practices on their property (i.e. elevation of structure, storm water retention, etc.).
- Maximize available National Flood Insurance Program Community Rating System (CRS) flooding reduction strategies. This program assists in reducing premium costs for flood insurance, while also incentivizing communities to build their resilience.
 - It is highly recommended to use consultants in this process to gain the maximum allowable CRS points.
 - It is also recommended to initiate extensive outreach to residents during the CRS process so that the community understands the benefits and importance of compliance with the program.
 - For example, Sanibel Island in Florida has reached Class 5 rating in CRS.⁷⁰ This has resulted in an annual \$2,860,000 reduction in the cost of flood insurance for resident policy holders.
- Consider the intersection of historic preservation and climate adaptation. Urban planners may investigate approaches to maintaining the structural and cultural integrity of historic buildings and sites.^{71,72}
- Identify 'managed retreat' resources such as those identified by Georgetown's Adaptation Clearinghouse.⁷³ It is crucial for communities to be prepared in the event that coastal residences be rendered uninhabitable. The process of applying for buy-outs is tedious and difficult. By preparing for this in advance, communities will be equipped to relocate residents from unsalvageable residences. They can make arrangements to ease the technical transition, so that more time and resources can be spent addressing the psychological effects of relocation, of which there can be more issues than in the physical movement itself.

7. Conclusion

In summary, we know that there are unprecedented hurdles in store for Kittery as sea levels rise and storms exacerbate flooding damage. However, there are many ways for the Town of Kittery to move towards developing climate and coastal resilience. Of the Key Recommendations listed above, there are a few that stand out as imperative next steps.

Next Steps

1. Identify:
 - a) How many properties are affected in each sea level rise + storm surge scenario
 - b) The total valuation of the properties affected in each sea level rise + storm surge scenario.
2. Create online mapping resources.
3. Engage wider range of Kittery residents in discussion of coastal hazards and what it means for our community.
4. Integrate suggested coastal resilience ordinance alterations into Kittery's zoning.
5. Begin the work of creating an Emergency Response Plan, Hazard Mitigation Plan, Coastal Resilience Plan, and/or a Sea-Level Rise Plan.
6. Begin planning for the National Flood Insurance Program Community Rating System (CRS).

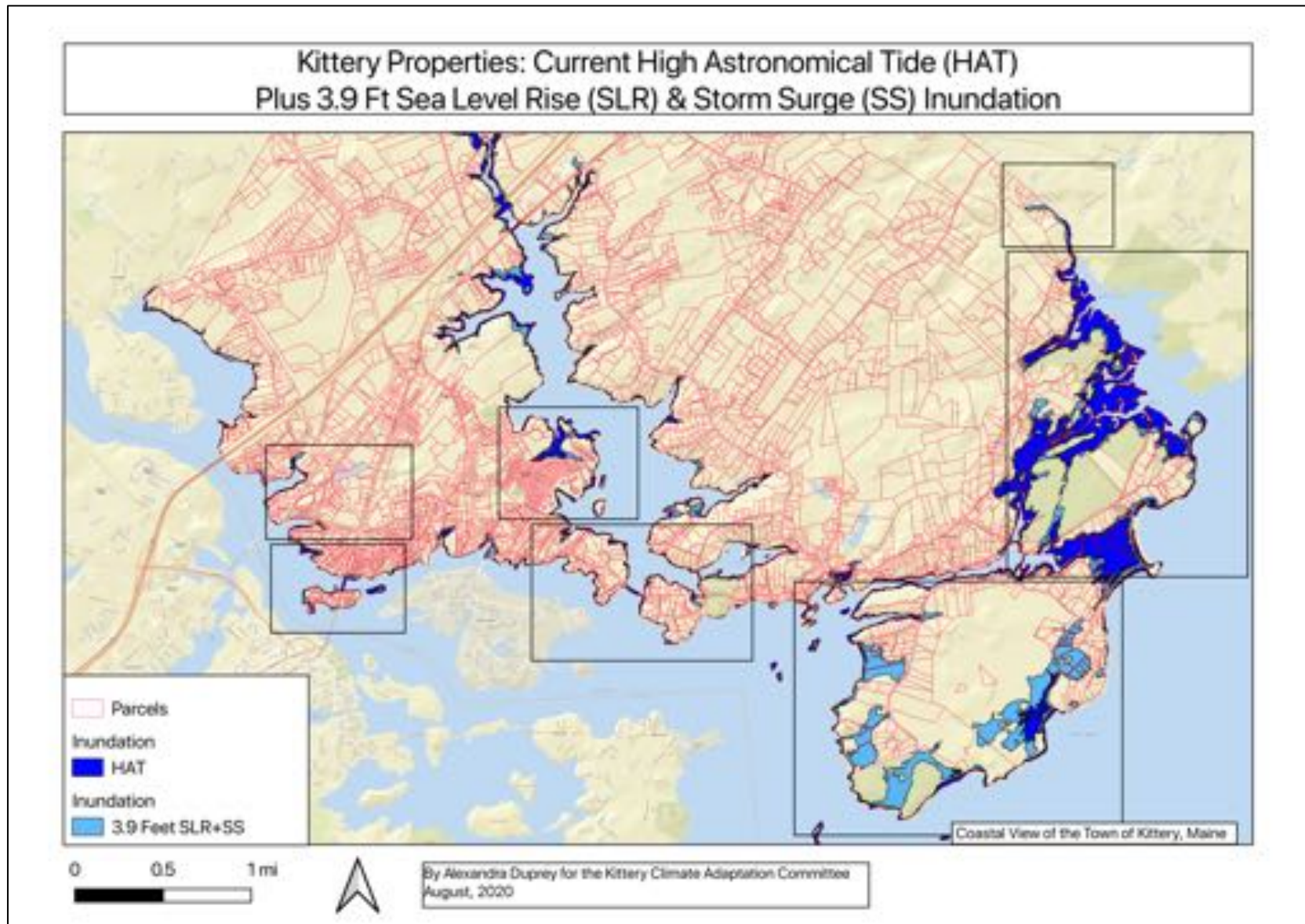
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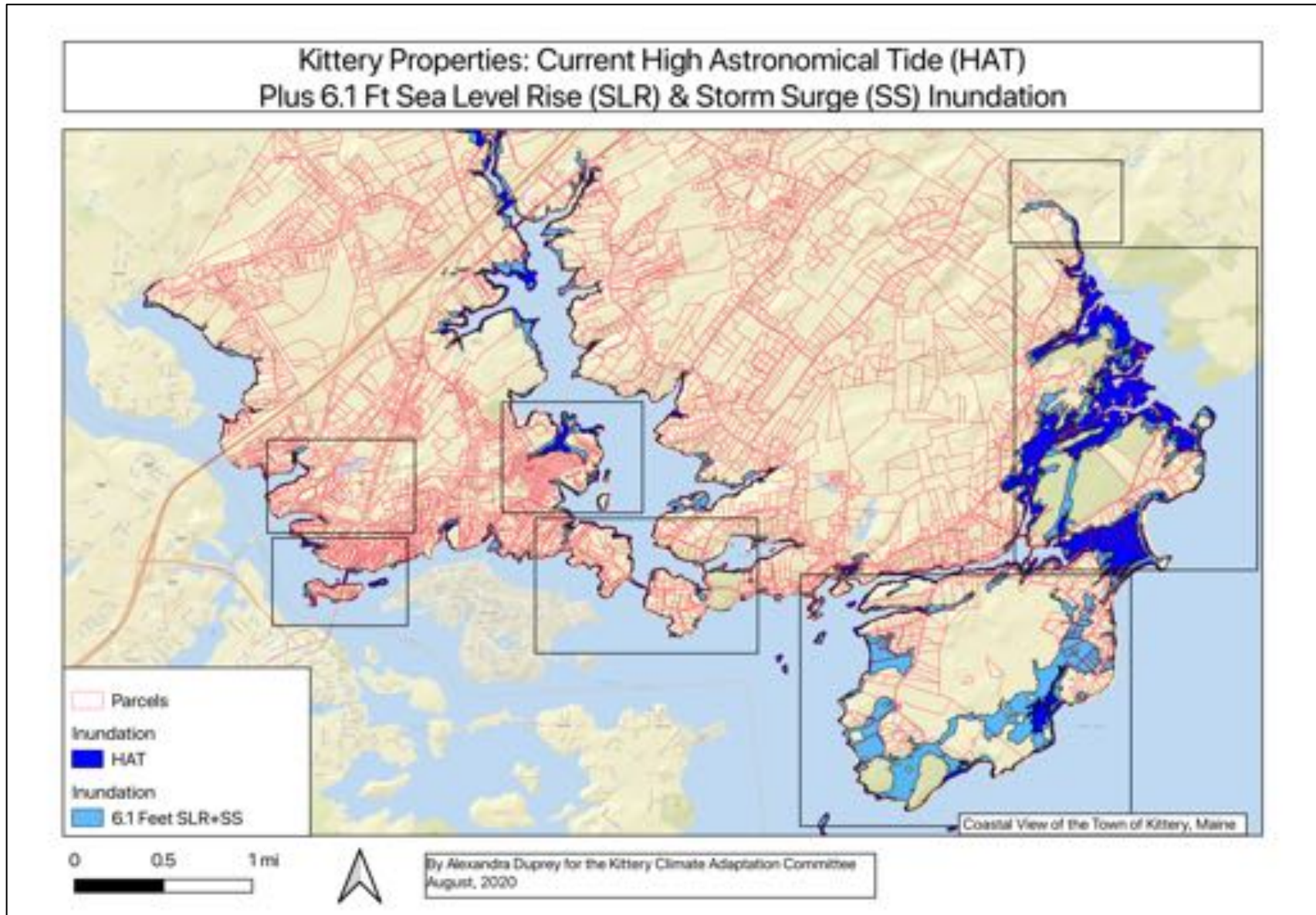
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- ⁶³ Georgetown Climate Center. Financing & Funding Tools: Paying for Equitable Adaptation. <https://www.georgetownclimate.org/adaptation/toolkits/equitable-adaptation-toolkit/financing-funding-tools-paying-for-equitable-adaptation.html>
- ⁶⁴ Norton, Richard K., Stephen Buckman, Guy A. Meadows, and Zachary Rable. “Using Simple, Decision-Centered, Scenario-Based Planning to Improve Local Coastal Management.” *Journal of the American Planning Association* 85, no. 4 (October 2, 2019): 405–23. <https://doi.org/10.1080/01944363.2019.1627237>.
- ⁶⁵ Town of York, Maine. (2020). Zoning Ordinances. <https://www.yorkmaine.org/DocumentCenter/View/902/Zoning-Ordinance-PDF>
- ⁶⁶ <http://www.portlandmaine.gov/DocumentCenter/View/1080/Chapter-14-Land-Use---Revised-12152019?bidId=>
- ⁶⁷ City of Saco, Maine. Zoning Code. <http://ecode360.com/32483142>
- ⁶⁸ Stephanie Carver. Greater Portland Council of Governments. Municipal Climate Adaptation Guidance Series: Comprehensive Planning. https://www.maine.gov/dacf/municipalplanning/docs/CAGS_06_Comprehensive_Planning.pdf
- ⁶⁹ Southern Maine Planning and Development Commission. Sea Level Rise. <https://smpdc.org/sealevel>
- ⁷⁰ CRS for Community Resilience. Sanibel Uses CRS Consultants to Advance and Outreach to Garner Support for Higher Erosion Control Standards. <https://www.floodsciencecenter.org/products/crs-community-resilience/success-stories/sanibel-florida/>
- ⁷¹ National Trust for Historic Preservation. Climate and Culture. <https://savingplaces.org/climate-and-culture>
- ⁷² Advisory Council on Historic Preservation. Climate Adaptation and Resilience. <https://www.achp.gov/initiatives/sustainability-climate-resilience/climate-adaptation-resilience>
- ⁷³ Adaptation Clearinghouse. Georgetown Climate Center. <https://www.adaptationclearinghouse.org/networks/state-government-professionals/managed-retreat.html>

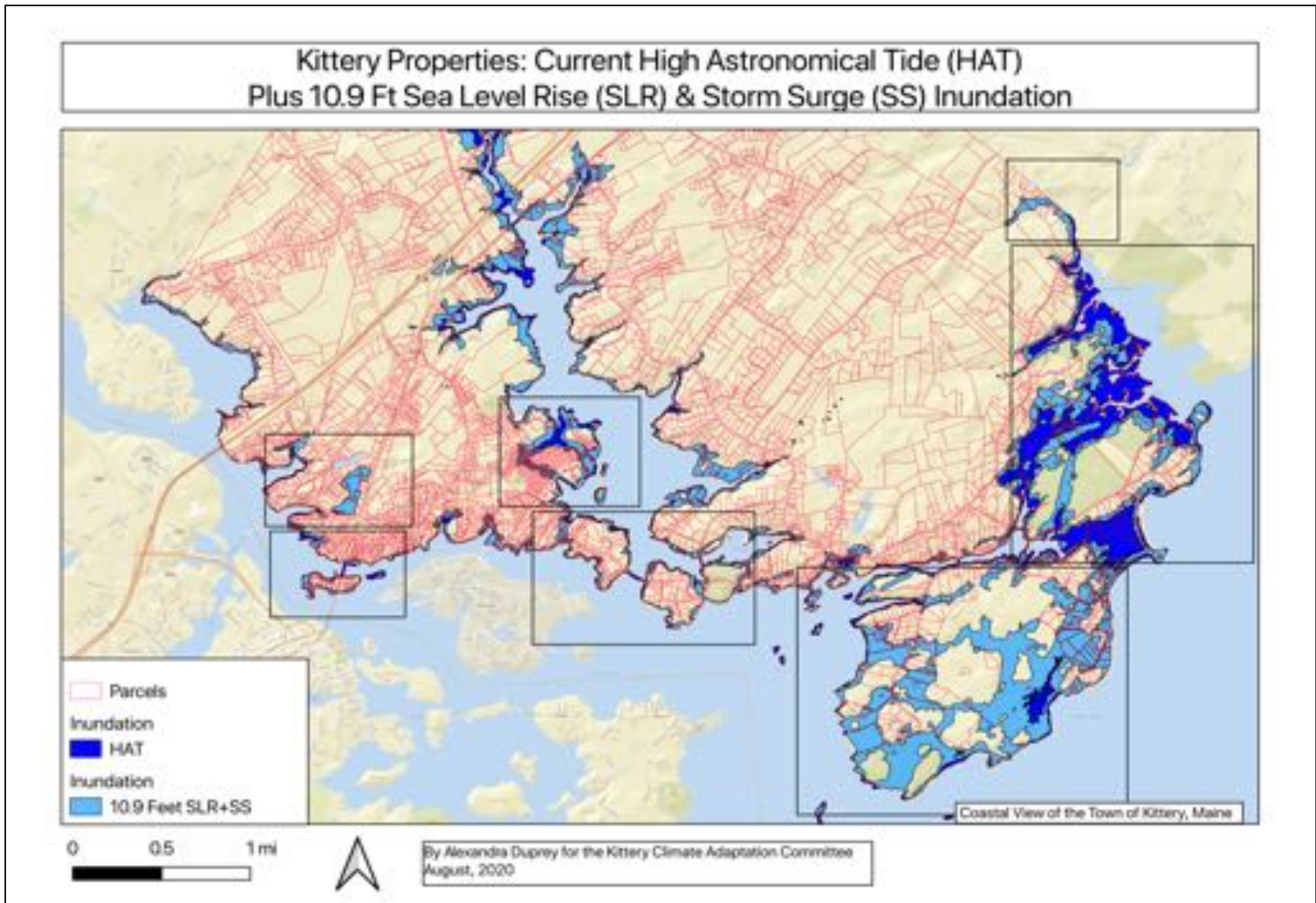
Appendix A: Coastal View 3.9 ft Sea Level Rise & Storm Surge Scenario



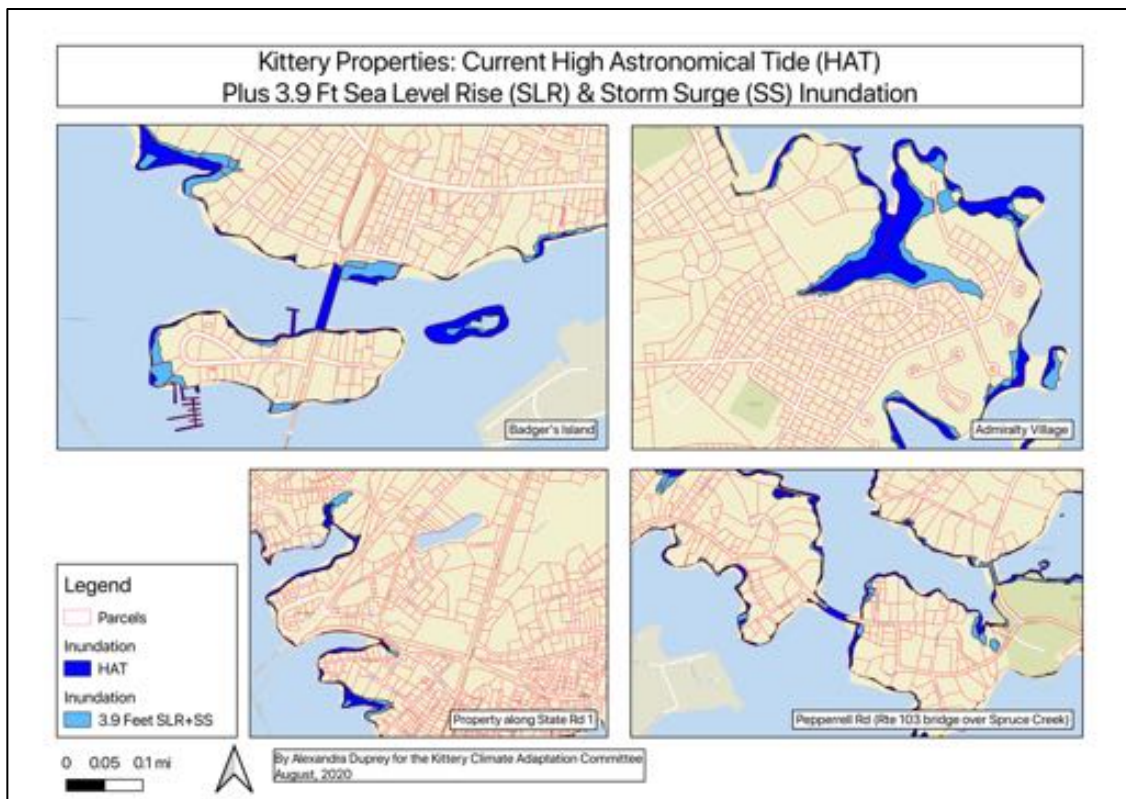
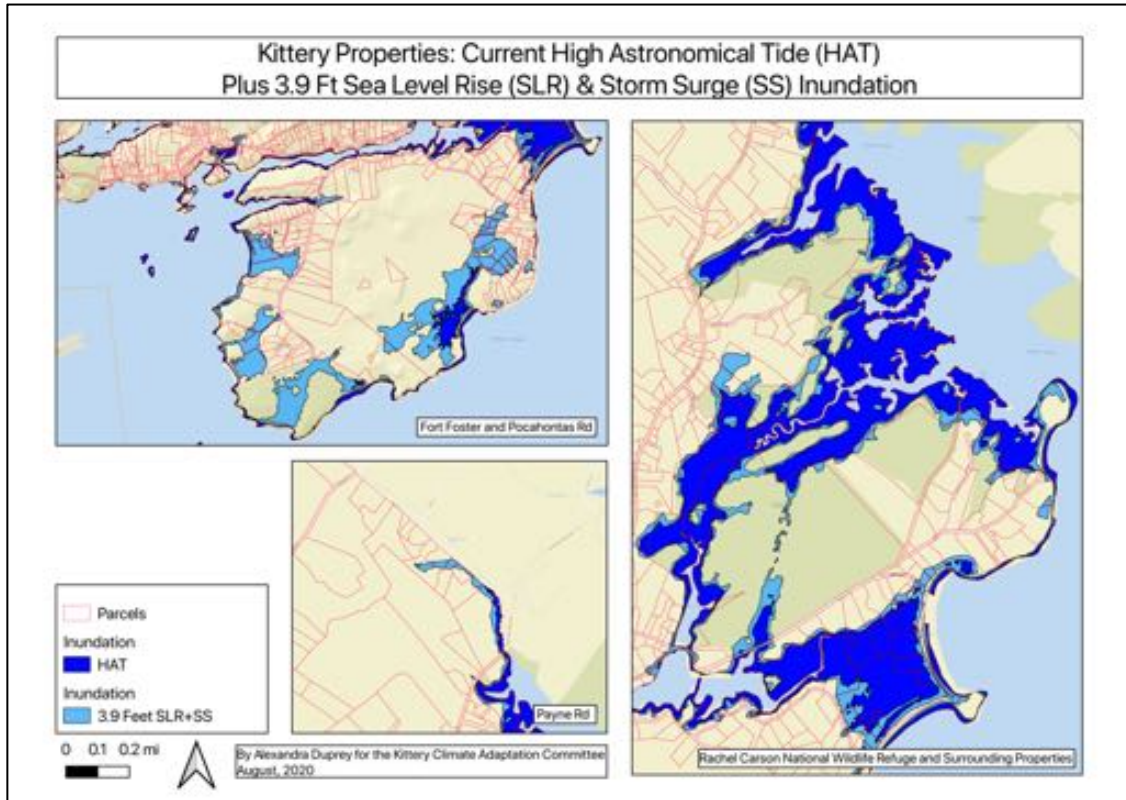
Appendix B: Coastal View 6.1 ft Sea Level Rise & Storm Surge Scenario



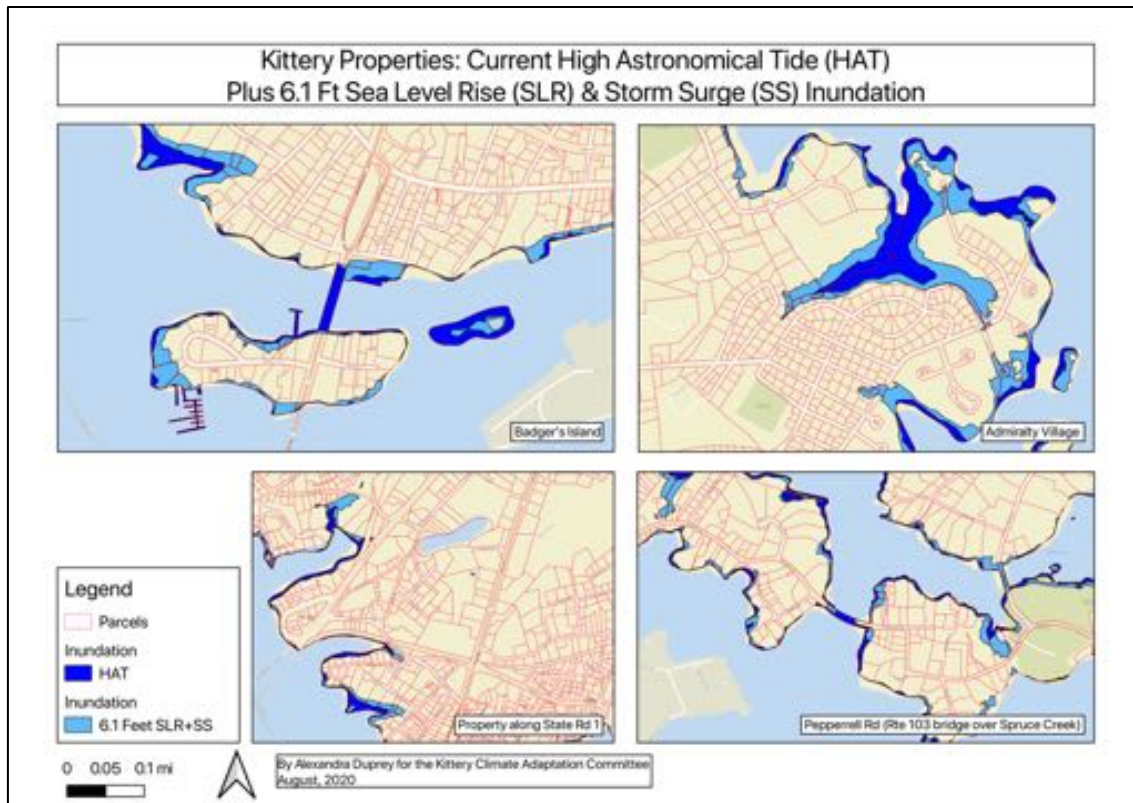
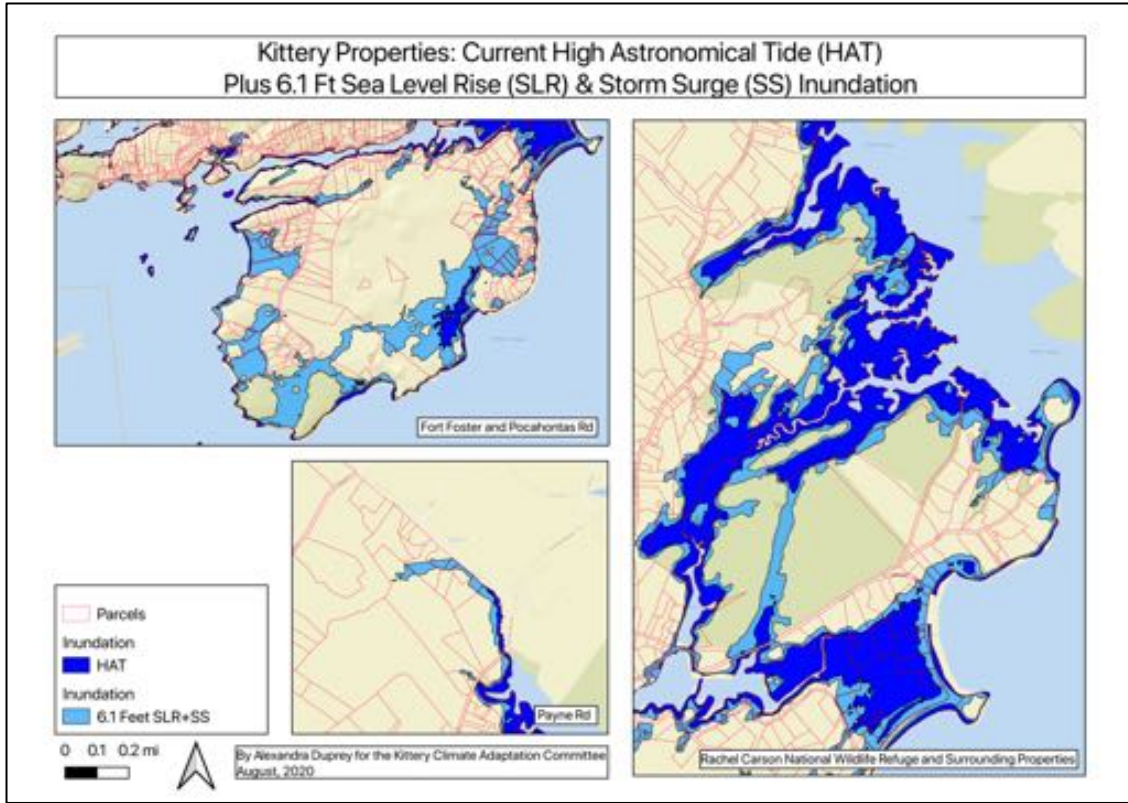
Appendix C: Coastal View 10.9 ft Sea Level Rise & Storm Surge Scenario



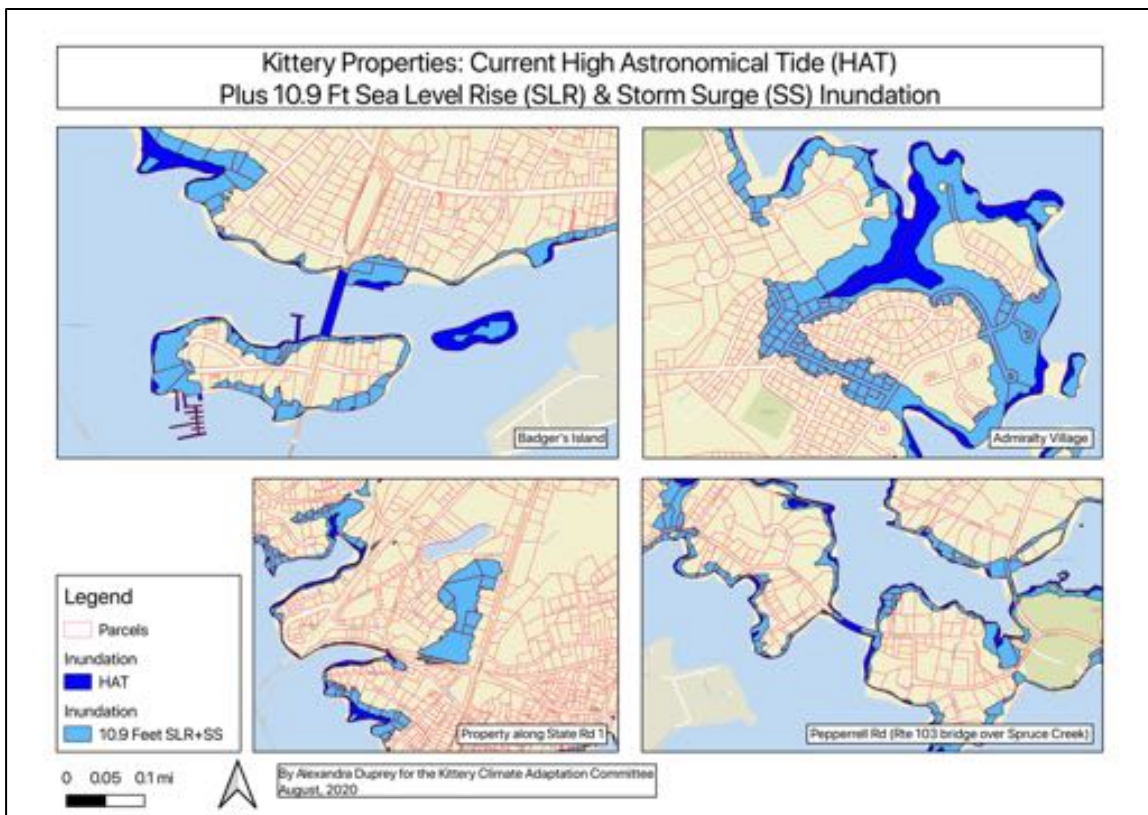
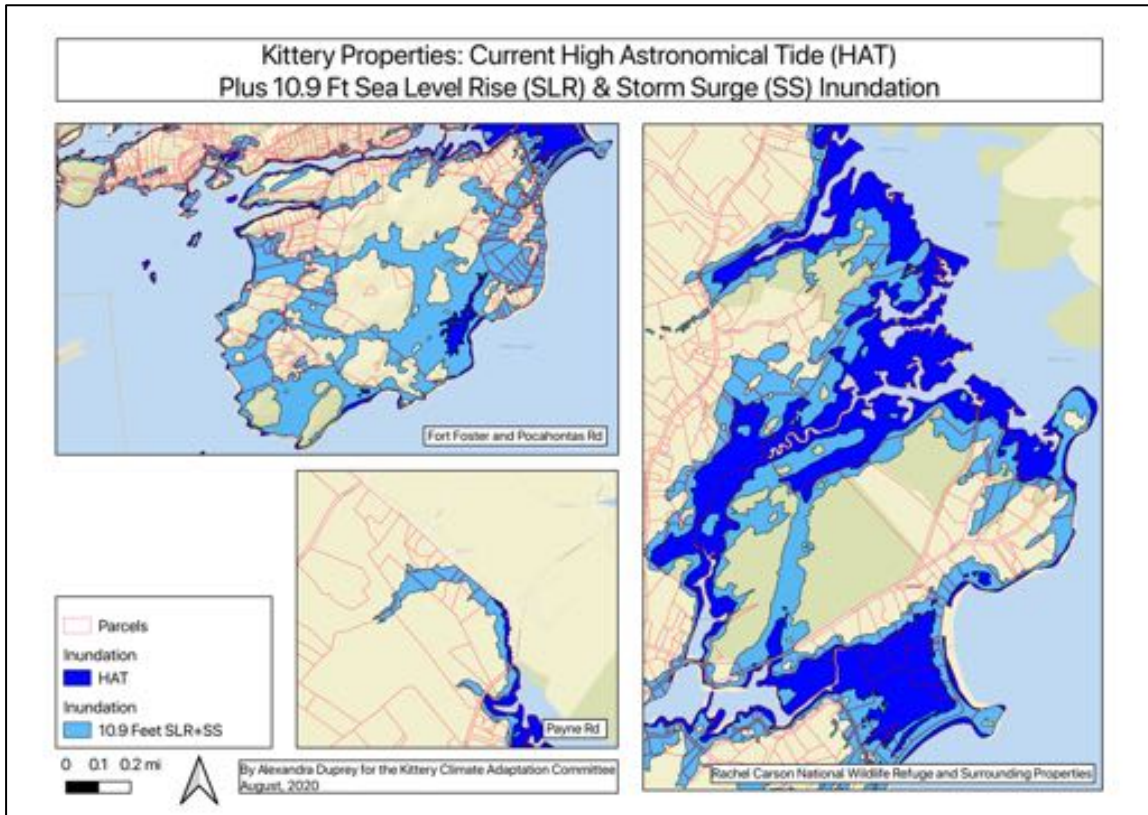
Appendix D: Insets 3.9 ft Sea Level Rise & Storm Surge Scenario



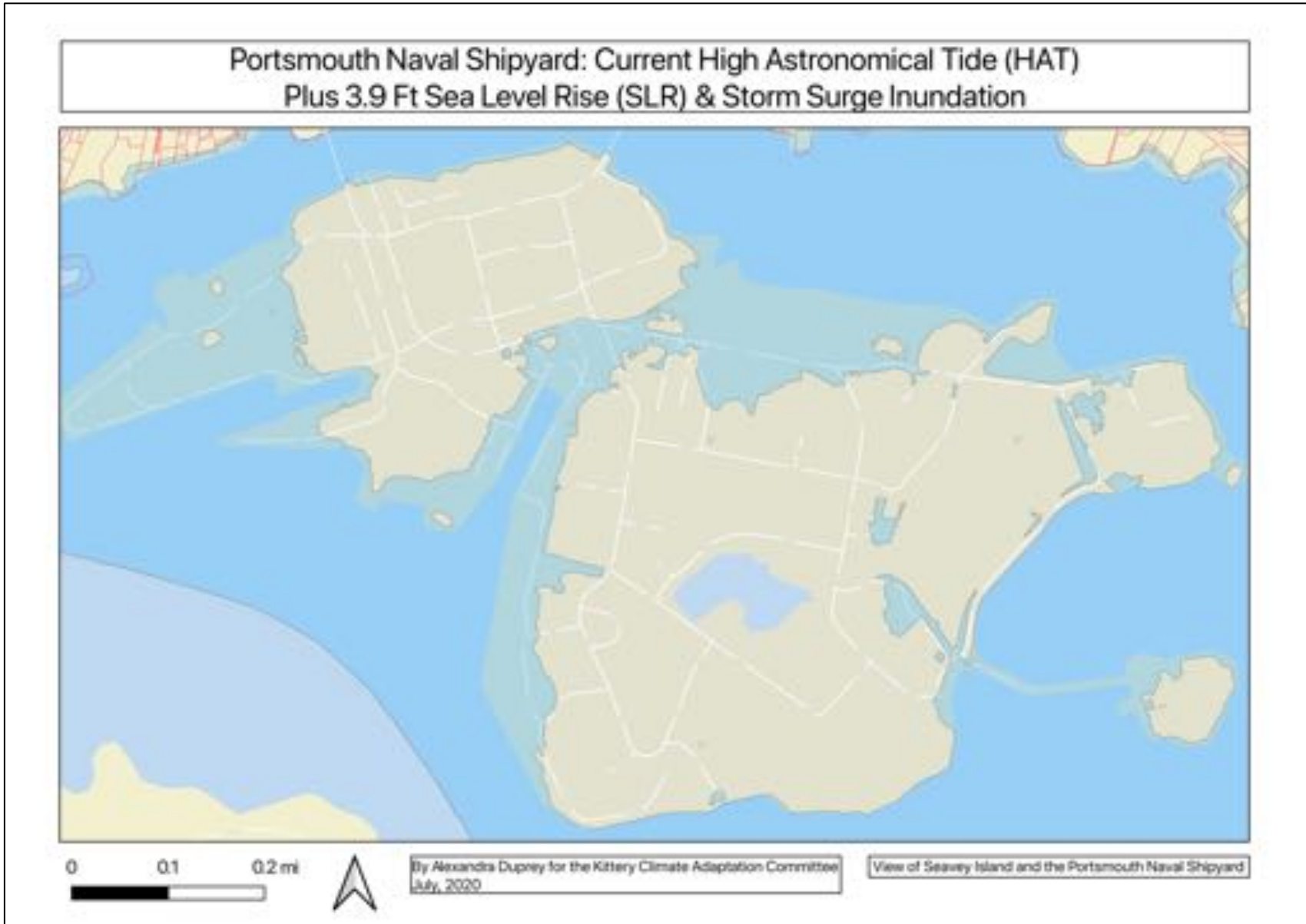
Appendix E: Insets 6.1 ft Sea Level Rise & Storm Surge Scenario



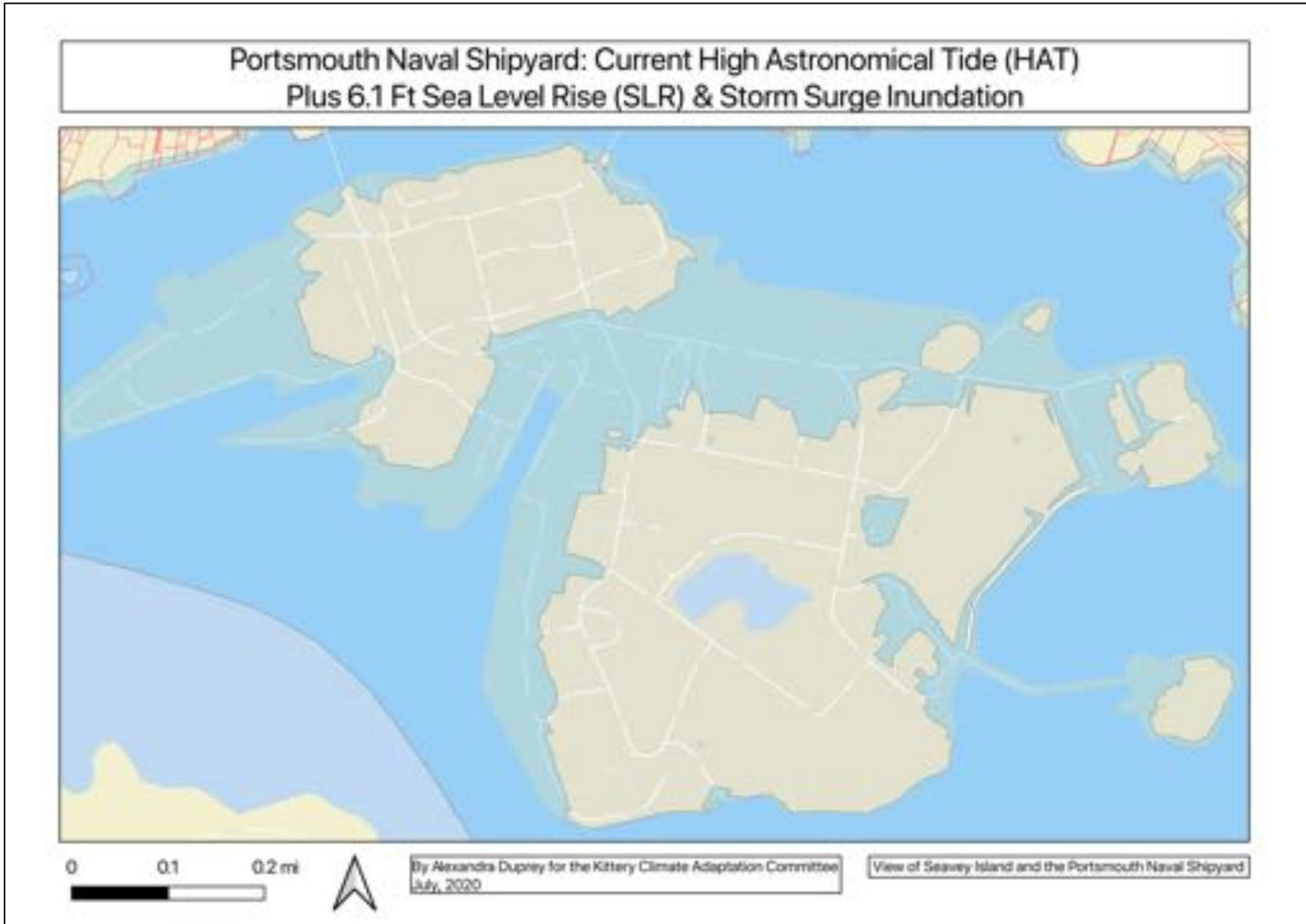
Appendix F: Insets 10.9 ft Sea Level Rise & Storm Surge Scenario



Appendix G: Portsmouth Naval Shipyard 3.9 ft Sea Level Rise & Storm Surge Scenario



Appendix H: Portsmouth Naval Shipyard 6.1 ft Sea Level Rise & Storm Surge Scenario



Appendix I: Portsmouth Naval Shipyard 10.9 ft Sea Level Rise & Storm Surge Scenario

Portsmouth Naval Shipyard: Current High Astronomical Tide (HAT)
Plus 10.9 Ft Sea Level Rise (SLR) & Storm Surge Inundation



0 0.1 0.2 mi



By Alexandra Duprey for the Kittery Climate Adaptation Committee
July, 2020

View of Seavey Island and the Portsmouth Naval Shipyard

Appendix J: Draft Ordinances

Kittery Coastal Hazard Resilience: Ordinance Recommendations and Examples

Zoning is the most powerful tool that local governments have to preemptively mitigate coastal hazards. The Nature Conservancy and the Georgetown Climate Center suggest the following three overlay zone categories for mitigating coastal hazards:

- **Protection Zone:** *For areas with critical infrastructure and dense development with few options for adaptation*
 - *Rely on hardened flood protection structures for flood protection and erosion control*
 - *Other resiliency practices are encouraged, such as employing green infrastructure for stormwater control*
 - ***Suggested Overlay Zones for this found on page 2 onward***

- **Accommodation Zone:** *For moderately to intensely developed but non-critical areas promoting development that considers future SLR*
 - *Downzoning to lower impact uses to reduce risk exposure*
 - *Strengthening building codes with setback, elevation, freeboard, and construction requirements*
 - *Limits on structure height and footprint size*
 - *Shoreline armoring restricted to soft or natural solutions*
 - ***Kittery's Shoreland Overlay Zone could fit under this category with editing***

- **Conservation Zone:** *For areas that either provide the greatest natural protection or have non-critical structures at the greatest risk of extensive damage*
 - *Goal to move development out of these areas to replace with natural protection, marsh advancement areas, open space, or public access*
 - *Can be achieved with downzoning to low density, water-dependent purposes*
 - *Shoreline armoring restricted to natural solutions*
 - *Setbacks aim to move new development landward*
 - *Rebuilding damaged structures also restricted*
 - *Property acquisition and conservation programs focused on this area*
 - ***Kittery's Resource Protection Overlay Zone could fit under this category with editing***

Or, three main intensity divisions:

- **Intensely developed areas (IDA)**
- **Limited development areas (LDA)**
- **Resources conservation areas (RCA)**

Coastal Overlay Zone (Example Code: Greenwich, CT)

(a) Purposes

A. The purposes of the zone shall include the following:

- (1) To ensure that the development, preservation or use of the land and water resources of the coastal area proceeds in a manner consistent with the capability of the land and water resources to support such development, preservation or use without significantly disrupting the natural environment;
- (2) To preserve and enhance coastal resources;
- (3) To give high priority and preferences to uses and facilities which are dependent upon proximity to the water or the shorelands immediately adjacent to marine and tidal waters;
- (4) To limit the immediate shorefront properties to the following principal uses:
Residential and water dependent uses;
- (5) To limit the potential impact of coastal flooding and erosion patterns on coastal development so as to minimize damage to and destruction of life and property and to reduce the necessity of public expenditure to protect future development from such hazards;
- (6) To encourage public access to the water in both a physical and visual manner;
- (7) To encourage the development of recreational facilities in the coastal area;
- (8) To encourage fishing and recreational boating harbor space, and the related uses and facilities which support those activities.

(b) **Zone Boundary** The area subject to these regulations shall include all portions of Kittery within the Coastal Overlay Zone as delineated on map on file.

(c) Coastal Site Plan Review, Approval, and Exemptions.

A. Coastal Site Plan review and approval by the Planning Board and, as applicable, by the Planning Board shall be required for all projects and activities as defined fully or partially within the Coastal Overlay Zone. These activities shall include but not limited to all applications for building permits, subdivisions, rezoning, special permits, special exceptions, variances, and municipal improvements. Gardening, grazing and harvesting of crops and interior modifications to buildings shall be exempt from all coastal site plan review requirements. The following activities may be exempt from coastal site plan review.

- (1) Minor additions to or minor modifications of existing buildings or detached accessory buildings
- (2) Construction of new or modification of walks, decks, patios, driveways, swimming pools, tennis courts, docks and detached accessory buildings or other structures incidental to the enjoyment and maintenance of residential property.
- (3) Construction of new or modification of existing on premise structures including fences, walls, pedestrian walks and other impervious surfaces, underground utility connections, essential electric, gas, telephone, water and sewer service lines, signs and

such other minor structures as will not substantially alter the natural character of coastal resources or restrict access along the public beach.

(4) Construction of an individual single family residential structure, except when such structure is located on an island not connected to the mainland by an existing road bridge or causeway or except when such structure is in or within one hundred feet of the following coastal resource areas: tidal wetlands, coastal bluffs and escarpments, beaches and dunes.

(5) Activities conducted for the specific purpose of conserving or preserving soil, vegetation, water, fish, shellfish, wildlife, and other coastal land and water resources.

B. Administrative Review

(1) All activities as indicated in 1 through 5 above shall be subject to a review by the Town Planner or their designee prior to the issuance of a building permit in order to determine their consistency with standards. An activity determined to be potentially inconsistent with any of these standards shall have a formal review by the Commission. An activity determined to be consistent with all of the aforementioned standards shall be exempt from coastal site plan review requirements.

(2) An affidavit certifying that all abutting property owners have been notified about the application shall be submitted with any application for review.

C. Procedure

A coastal site plan shall include the following information:

(1) A plan showing the location and spatial relationship of coastal resources on and contiguous to the site.

(2) A description of the entire project with appropriate plans, indicating project location, design, timing and methods of construction.

(3) An assessment of the capability of the resources to accommodate the proposed use.

(4) An assessment of the suitability of the project for the proposed site.

(5) An evaluation of the potential beneficial and adverse impacts of the project and a description of proposed methods to mitigate adverse effects on coastal resources.

(6) A demonstration that the adverse impacts of the proposed activity upon coastal resources and future water dependent development activities are acceptable.

(7) A demonstration that the proposed activity is consistent with the goals and policies of the Town of Kittery

D. Standards

The Planning Board, in reviewing coastal site plans, may take into consideration the recommendations of any Town agencies or outside specialists with which it consults in determining whether the proposed activity:

(1) Is in accordance with the Comprehensive Plan.

(2) Preserves important open space and other features of the natural environment.

- (3) Does not materially obstruct significant waterfront views.
- (4) Does not unreasonably adversely affect storm drainage, sewerage disposal or other municipal services.
- (5) Is consistent with all the above purposes as authorized by the Coastal Management Act.
- (6) Potential adverse impacts as enumerated in the Coastal Management Act on both coastal resources and future water dependent development activities may be acceptable upon a Commission finding that the benefits of the proposed activity to the public are greater than the adverse impacts. In determining the acceptability of the above, the Commission shall consider:

- (a) The characteristics of the site, including the location and condition of any of the coastal resources.

- (b) The potential effects, both beneficial and adverse, of the proposed activity on coastal resources and future water dependent opportunities.

Flood Hazard Overlay Zone (Example Code: Greenwich, CT)

Application for review and certification of projects in regard to the FHO zone standards shall be initiated through the office of Planning and Development. Permits are required for all proposed development in any area of special flood hazard.

(a) Purpose

The FHO zone is intended to add additional safeguards to those areas of Kittery subject to riverine and coastal flooding as shown on the Flood Insurance Rate Maps as indicated by FEMA and the Town of Kittery, and as amended from time to time. The zone is not intended to remove existing permitted uses as stated in these Regulations. It is the purpose of this section to:

- (1) Promote the public health, safety and general welfare and to minimize public and private losses due to flood conditions in specific areas.
- (2) Restrict or prohibit uses which are dangerous to health, safety and property due to water or erosion hazards, or which result in damaging increases in erosion or in flood heights or velocities.
- (3) Require that uses and structures vulnerable to floods, including facilities which serve such uses, be protected against flood damage at the time of initial construction.
- (4) Control the alteration of natural flood plains, stream channels, and natural protective barriers which are involved in the accommodation of flood waters.
- (5) Control filling, grading, dredging and other development which may increase erosion or flood damage.
- (6) Prevent or regulate the construction of flood barriers which will unnaturally divert flood waters or which may increase flood hazards to other lands.

(b) Objectives

The objectives of this section are to:

- (1) Protect human life and health.
- (2) Minimize the expenditures of public money for costly flood control projects.
- (3) Minimize the need for rescue and relief efforts associated with flooding which are generally undertaken at the expense of the general public.
- (4) Minimize prolonged business interruptions.
- (5) Minimize damage to public facilities and utilities such as water and gas mains, electric, telephone and sewer lines, streets and bridges located in flood plains.
- (6) Help maintain a stable tax base by providing for the sound use and development of flood prone areas in such a manner as to minimize flood blight areas.
- (7) Insure that potential home buyers are notified that property is in a flood hazard area.

(c) Definitions

The following definitions are for use in this section only:

- (1) Addition to an Existing Building - means any walled and roofed expansion to the perimeter of a building in which the addition is connected by a common load - bearing wall other than a fire wall. Any walled and roofed addition which is connected by a fire wall or is separated by independent perimeter load-bearing walls is considered new construction.
- (2) Administrator - means the Federal Insurance Administrator, to whom the Federal Emergency Management Agency (FEMA) has delegated the administration of the National Flood Insurance Program, (NFIP).
- (3) Appeal - means a request for a review of the Code Enforcement Officer's interpretation of any provision of this section or a request for a variance.
- (4) Area of Special Flood Hazard - is the land in the flood plain within a community subject to a one percent or greater chance of flooding in any given year. On the Flood Insurance Rate Map (FIRM), the flood zones are delineated as zones A, AE and VE. The determination of flood hazard areas shall be based on the flood elevation shown on the FIRM map. Special Flood Hazard Zones shall also include areas where the land surface elevation is lower than the base flood elevations as shown in the Flood Insurance Study, and the area is not protected from flooding by a natural or man-made feature. In no case shall the regulated area be closer to the source of flooding than that shown on the FEMA maps without revising or amending the maps in accordance with FEMA procedures.
- (5) Base Flood (100-year flood event) - The "100-year flood" is confusing because it leads people to believe that it only happens once every 100 years. The term "100-year flood" is sometimes used to simplify the definition of a flood that statistically has a 1% chance (or 1-in-100 chance) of occurring in any given year. The technical term used by hydrologists for this extreme hydrologic event is the 1% annual chance flood¹ and is based on the probability that the given event will be equaled or exceeded in any given year. The 1% annual chance flood is calculated for a single year. However, one might be interested to know the probability of the 1% annual chance flood over a longer time period – say the 30-year lifetime of a standard mortgage on an individual property. The probability of 1% annual chance flood occurring over a 30-year period is 26%!²
- (6) Base Flood Elevation (BFE) – means the elevation reached by the base flood, also known as the 100-year flood event, referred to the vertical datum of the community's Flood Insurance Rate Map.
- (7) Basement – means that portion of a building having its floor subgrade (below ground level) on all sides.
- (8) Breakaway Wall - means a wall that is not part of the structural support of the building and is intended through its design and construction to collapse under specific lateral loading forces without causing damage to the elevated portion of the building or the supporting foundation system.

¹ i) USGS, Floods: Recurrence Intervals and 100-year floods. <https://water.usgs.gov/edu/100yearflood.html>;

ii) USGS, Questions and answers about floods. <https://water.usgs.gov/edu/qa/floods.html>

² Statistical analysis to calculate these values is provided at Geology Labs-On-line Project: www.sciencecourseware.com/VirtualRiver/FloodingDemo/Files/page13.html

- (9) Building - means any structure build for support, shelter or enclosure for any occupancy or storage.
- (10) Coastal High Hazard Area - means the area of special flood hazard subject to high velocity waters caused by, but not limited to, storms and hurricane wave wash. The area is designated on a FIRM as Zone VE.
- (11) Development - means any man-made change to improved or unimproved real estate, including, but not limited to the construction of buildings or structures; the construction of additions, alterations or substantial improvements to buildings or structures; the placement of buildings or structures; mining, dredging, filling, grading, paving, excavation or drilling operations or storage of equipment; the storage, deposition, or extraction of materials; and the installation, repair or removal of public or private sewage disposal systems or water supply facilities.
- (12) Elevated Building - means a building without a basement built to have the lowest floor elevated the above ground level by means of fill, solid foundation perimeter walls, pilings, columns (posts and piers), shearwalls, or breakaway walls, as allowed under applicable standards.
- (13) Existing Manufactured Home Park or Subdivision - means a manufactured home park or subdivision for which the construction of facilities for servicing the lots on which the manufactured home are to be affixed (including, as a minimum, the installation of utilities, the construction of streets, and either final site grading or the pouring of concrete pads).
- (14) Expansion to an Existing Manufactured Home Park or Subdivision - means the preparation of additional sites by the construction of facilities for servicing the lots on which the manufacturing homes are to be affixed (including the installation of utilities, the construction of streets, and either final site grading or the pouring of concrete pads).
- (15) Federal Emergency Management Agency (FEMA) - is the federal agency that administers the National Flood Insurance Program (NFIP).
- (16) Flood or Flooding - means a general and temporary condition of partial or complete inundation of normally dry land areas due to the overflow of inland or tidal water and/or the unusual and rapid accumulation or runoff of surface waters from any source.
- (17) Flood Insurance Rate Map - means an official map of a community on which the Federal Emergency Management Agency has delineated both the areas of special flood hazard and the applicable risk premium zones.
- (18) Flood Insurance Study (FIS) - is the official report by the Federal Emergency Management Agency. The report contains flood profiles as well as the Flood Insurance Rate Map (FIRM) and the water surface elevation of the base flood.
- (19) Floodway - means the channel of a river or other watercourse and the adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than one foot.
- (20) Floor - means the top surface of an enclosed area in a building (including basement) i.e. top of slab in concrete slab construction or top of wood flooring in wood frame construction. The term does not include the floor of a garage used solely for parking of vehicles.
- (21) Functionally Dependent Facility - means a facility which cannot be used for its intended purpose unless it is located in close proximity to water. The term includes only docking facilities, port facilities that are necessary for the loading and unloading of cargo

or passengers, and ship building and ship repair facilities. The term does not include seafood processing facilities, long-term storage, manufacturing, sales or service facilities.

(22) Free Board – the distance from the water surface to the top of the facility. It provides a factor of safety usually expressed in feet above a flood level for purposes of flood plain management. Freeboard tends to compensate for the many unknown factors that could contribute to flood heights greater than the height calculated for a selected size flood and floodway conditions, such as wave action, bridge openings and the hydrological effect of urbanization of the watershed.

(22.1) Grade Plane, Flood Zone – A reference plane from which to measure the number of stories, height, and floor area of dwelling units in residential zones within the Flood Hazard Overlay Zone. The flood zone grade plane shall be measured from two feet (2') below the Base Flood Elevation.

(23) Historic Structure - means any structure that is:

(a) Listed individually in the National Register of Historic Places; listing maintained by the Department of the Interior) or preliminarily determined by the Secretary of the Interior as meeting the requirements for individual listing on the National Register;

(b) Is part of a Local Historic District;

(c) Certified or preliminarily determined by the Secretary of the Interior as contributing to the historic significance of a registered historic district or a district preliminarily determined by the Secretary to qualify as a registered historic district; Individually listed on a state inventory of historic places in states with historic preservation programs which have been approved by the Secretary of the Interior; or

(d) Individually listed on a local inventory of historic places in communities with historic preservation programs that have been certified either:

(1) By an approved state program as determined by the Secretary of the Interior or

(2) Directly by the Secretary of the Interior in states without approved programs.

(24) Lowest Floor - means the lowest floor of the lowest enclosed area (including basement). An unfinished or flood resistant enclosure, usable, solely for parking of vehicles, building access or storage, in an area other than a basement area is not considered a building's lowest floor.

(25) Manufactured Home - means a structure, transportable in one or more sections, which is built on a permanent chassis and designed to be used with or without a permanent foundation when connected to the required utilities. The term also includes recreational vehicles, park trailers, travel and recreational trailers, and similar transportable structures placed on a site for 180 consecutive days or longer and intended to be improved property.

(26) Manufactured Home Park or Subdivision - means a parcel, or contiguous parcels of land divided into two or more manufactured home lots for rent or sale.

(27) Market Value - means the market value of the structure shall be determined by the appraised value of the structure using the cost approach to value method prior to the start of the initial repair or improvement, or in the case of damage, the value of the structure prior to the damage occurring.

(28) Mean Sea Level - means, for purposes of the National Flood Insurance Program, the North American Vertical Datum (NAVD) of 1988 or other datum, to which base flood elevations shown on the community's Flood Insurance Rate Map are referenced.

(29) National Geodetic Vertical Datum (NGVD) - National Geodetic Vertical Datum of 1929 (NGVD 29) – an obsolete vertical datum, superseded by the North American Vertical Datum of 1988 (NAVD 88), shall only be used when base flood elevations shown on the community's Flood Insurance Rate Map are referenced thereto.

(30) New Construction - means structure for which the "start of construction" commenced on or after the effective date of this section.

(31) New Manufactured Home Park or Subdivision - means a manufactured home park or subdivision for which the construction of facilities for servicing the lots on which the manufactured homes are to be affixed (including at a minimum, the installation of utilities, the construction of streets, and either final site grading or the pouring of concrete pads).

(32) Recreational Vehicle - means a vehicle which is:

- a) built on a single chassis,
- b) 400 square feet or less when measured at the largest horizontal projection,
- c) designed to be self-propelled or permanently towable by a light duty truck; and,
- d) designed primarily not for use as a permanent dwelling, but as temporary living quarters for recreational, camping travel, or seasonal use.

(33) Regulatory Floodway - means the channel of a river or other watercourse and the adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than one (1) foot.

(34) Riverine - means relating to, formed by, or resembling a river (including tributaries), stream, brook, etc.

(35) Sand Dunes - means naturally occurring accumulations of sand ridges or mounds landward of the beach.

(36) Special Flood Hazard Areas - the determination of flood hazard areas shall be based on the flood elevation shown on the FIRM map in conjunction with an up-to-date and accurate topographical survey of the site a Licensed Professional Land Surveyor. Special Flood Hazard areas shall also include areas where the land surface elevation is lower than the base flood elevations as shown in the Flood Insurance Study, and the area is not protected from flooding by a natural or man-made feature. In no case shall the regulated area be closer to the source of flooding than that shown on the FEMA maps without revising or amending the maps in accordance with FEMA procedures.

(37) Start of Construction - for other than new construction or substantial improvements under the Coastal Barrier Resources Act (P.L. 97-348), includes substantial improvement, and means the date the building permit was issued, provided the actual start of construction, repair, reconstruction, or improvement was within 180 days of the permit date. The actual start means the first placement or permanent construction of a structure (including a manufactured home) on a site such as the pouring of slabs or footings, installation of piles, construction of columns, or any work beyond the stage of excavation or placement of a manufactured home on a foundation. Permanent construction does not include land preparations, such as clearing, grading and filling; nor does it include the installation of streets and/or walkways; nor does it include excavation for a basement, footings, piers or foundations or the erection of temporary forms; nor does it include the

installation of streets and/or walkways; nor does it include excavation for a basement, footings, piers or foundation or the erection of temporary forms; nor does it include the installation on the property or accessory buildings, such as garages or sheds not occupied as dwelling units or not part of the main structure. For a substantial improvement, the actual start of construction means the first alteration of any wall, ceiling, floor, or other structural part of a building, whether or not that alteration affects the external dimensions of the structure.

(38) Structure - means a walled and roofed building that is principally above ground, a manufactured home, a gas or liquid storage tank, or other man-made facilities or infrastructures.

(39) Substantial Damage - means damage of any origin sustained by a structure whereby the cost of restoring the structure to its before damaged condition would equal or exceed 50% of the market value of the structure before the damage occurred.

(40) Substantial Improvement - means any combination of repairs, reconstruction, alteration, or improvements to a structure taking place during the life of a structure, in which the cumulative costs equals or exceeds fifty percent of the market value of the structure. The market value of the structure should be:

(1) the appraised value of the structure (using the cost approach to value) prior to the start of construction of the initial repair or improvement, or

(2) in the case of damage, the value of the structure prior to the damage occurring.

This term includes structures that have incurred "substantial damage," regardless of the actual repair work performed. The start date for cumulative costs is the effective date of the Flood Insurance Rate Map (FIRM) that rendered the structure non-compliant. For purposes of this definition, "Substantial Improvement" is considered to occur when the first alteration, after being rendered non-compliant, of any wall, ceiling, floor, or other structural part of the building commences, whether or not that alteration affects the extended dimensions of the structure. The term, Substantial Improvement, does not however, include any improvement project required to comply with existing health, sanitary, or safety code specifications which have been previously identified by the local code enforcement official, and which are the minimum necessary to assure safe living conditions. Separate conditions govern any alteration of a historic structure listed on the National Register of Historical Places of the State Inventory of Historic Places.

(41) Variance - is a grant of relief from the requirements of this ordinance which permits construction in a manner otherwise prohibited by this ordinance where specific enforcement would result in unnecessary hardship.

(42) Violation – means a failure of a structure or other development to be fully compliant with the community's floodplain management regulations. A structure or other development without required permits, lowest floor elevation documentation, floodproofing certificates or required floodway encroachment calculations is presumed to be in violation until such time as that documentation is provided.

(43) Water Surface Elevation - means the height of various magnitudes and frequencies in the flood plains of coastal or riverine areas, with respect to the vertical datum to which the community's Flood Insurance Rate Map is referenced.

(d) General Provisions

- (1) This section shall apply to all areas of special flood hazard within the jurisdiction or the Town of Kittery.
- (2) The areas of special flood hazard identified by the Federal Emergency Management Agency (FEMA) in its Flood Insurance Rate Maps (FIRM) and other supporting data applicable to the Town of Kittery, and any subsequent revisions thereto, are adopted by reference and declared to be a part of this regulation. The area of special flood hazard includes any area shown on the FIRM as Zones A, AE, and VE, including areas designated as a floodway on a FIRM. Zone VE is also identified as a Coastal High Hazard Area. In no case shall the regulated area be closer to the source of flooding than that shown on the FEMA maps without revising or amending the maps in accordance with FEMA procedures.
- (3) Establishment of a floodplain development permit. A development permit shall be required by the Planning Board in conformance with the provisions of this section prior to the commencement of any development activities.
- (4) No structure or land shall hereafter be located, extended, converted, or structurally altered without full compliance with the terms of this regulation and other applicable regulations.
- (5) This regulation is not intended to repeal, abrogate, or impair any existing easements, covenants, or deed restrictions. However, where this regulation and another conflict or overlap, which imposes the more stringent restrictions shall prevail.
- (6) In the interpretation and application of this regulation all provisions shall be:
 - a) Considered as minimum requirements,
 - b) Liberally construed in favor of the governing body, and
 - c) Deemed neither to limit nor repeal any powers granted to the Town.
- (7) The degree of flood protection required by this ordinance is considered reasonable for regulatory purposes and is based on scientific and engineering consideration. Longer floods can and will occur on rare occasions. Flood heights may be increased by manmade or natural causes. This regulation does not imply that land outside the areas of special flood hazard or uses permitted within such areas will be free from flooding or flood damages. This ordinance shall not create liability on the part of the Town or any officer or employee thereof for any flood damages that result from reliance on this ordinance or any administrative decision lawfully made thereunder.
- (8) Portion of Structure in Flood Zone - If any portion of a structure lies within the Special Flood Hazard Area (SFHA), the entire structure is considered to be in the SFHA. The entire structure must meet the construction requirements of the flood zone. The structure includes any attached additions, garages, sunrooms, or any other structure attached to the main structure.
- (9) Structures in Two Flood Zones - If a structure lies within two or more flood zones, the construction standards of the most restrictive zone apply to the entire structure. The structure includes any attached additions, garages, sunrooms, or any other structure attached to the main structure.
- (10) Severability - If any section, subsection, paragraph, sentence, clause, or phrase of this regulation should be declared invalid for any reason whatsoever, such decision shall not affect the remaining portions of this regulation, which shall remain in full force and

effect; and to this end the provisions of this regulation are hereby declared to be severable.

(e) Administration

(1) The Code Enforcement Officer is hereby appointed to administer and implement the provisions of this regulation.

(2) Where required under this regulation, a registered professional engineer or architect shall certify that design and methods of construction are in accordance with accepted standards of practice for meeting the provisions of this regulation. Such certification must be provided to the Code Enforcement Officer.

(3) Prior to any development activities, application for any development shall be made to Planning & Development. Such application shall be accompanied by four sets of plans, done by a Licensed Professional Engineer in accordance with State Statutes, drawn to scale showing, at a minimum, the property lines and location of the parcel; existing and proposed contours; existing or proposed structures, fill, storage of materials or equipment, drainage facilities and the location of the foregoing. This following information shall also be submitted

- a) Application Stage: Elevation in relation to mean sea level of the proposed lowest floor (including basement) of all structures.
- b) Elevation in relation to mean sea level to which any non-residential structure will be flood proofed.
- c) Description of the extent to which any watercourse will be altered or relocated as a result of proposed development.
- d) A statement as to whether or not the proposed alterations to an existing structure meet the criteria of the substantial improvement definition.
- e) A statement as to whether there will be dry access to the structure during the 100- year storm event.
- f) Certification as to flood proofing.
- g) Certification as to the provisions governing fully enclosed areas below base flood elevation, if the minimum design criteria is not used.
- h) Certification as to floodway heights.
- i) Certification as to breakaway walls. If the design criteria is not utilized then the design and construction methods must be certified as explained.
- j) Certification as to the structural anchoring provisions.
- k) Construction Stage: Upon completion of the applicable portion of construction, the applicant shall provide the Code Enforcement Officer with verification by a Licensed Land Surveyor of the as-built lowest floor elevation, defined as follows:
 - i) In the A zone: The top of the lowest floor (including basement);
 - ii) In the V zone: The lowest point of the lowest supporting horizontal member (excluding pilings or columns); and
 - iii) Floodproofed structures: The elevation to which the flood proofing is effective.
 - iv) Compliance: Deficiencies in the lowest floor elevations shall be corrected by the permit holder immediately and prior to further progressive work being permitted to proceed. Failure to submit an

acceptable survey or failure to make corrections required hereby shall be caused for issuance of a stopwork order. Final as-built plans of the finished project will be certified by a Licensed Engineer or Architect of Record as appropriate in addition to the confirmation of lowest floor elevation by a Licensed Land Surveyor.

l) The Code Enforcement Officer, in the administration of this regulation shall perform the following duties, among others:

i) Review all permit applications to determine whether proposed building sites will be reasonably safe from flooding.

ii) Review all development permits to assure that the requirements of this regulation have been satisfied.

iii) Advise permittee that additional Federal or State permits may be required, and if specific Federal or State permit requirements are known, require that copies of such permits be provided and maintained on file with the building permit. Such additional permit requirements may include, but not be limited to: Stream Channel Encroachment Line Permit, Coastal Area Management Permit, Water Diversion Permit, Dam Safety Permit, Corps of Engineers 404 Permit.

iv) Notify the regional planning agency and the affected municipality at least 35 days prior to the public hearing if any change of regulation or use of a flood zone will affect an area within 500 feet of another municipality.

v) Notify adjacent communities and the Department of Environmental Protection, Inland Water Resources Management Division prior to any alteration or relocation of a watercourse and submit evidence of such notification to the Federal Emergency Management Agency.

vi) Assure that maintenance is provided within the altered or relocated portion of said watercourse so that the flood carrying capacity is not diminished.

vii) Record the elevation (in relation to mean sea level) of the lowest floor (including basement) of all new or substantially improved structures.

viii) Record the elevation (in relation to mean sea level) to which the new or substantially improved structures have been flood proofed.

ix) Obtain and maintain all certificates required under this regulation and assure that they meet standards.

x) Make the necessary interpretation, where needed, as to the exact location of boundaries of the areas of special flood hazard (for example, where there appears to be a conflict between a mapped boundary and actual field conditions). The person contesting the location of the boundary shall be given a reasonable opportunity to appeal the interpretation as provided in this article.

xi) Obtain review and reasonably utilize any base flood elevation and floodway data available from a Federal, State or other source in order to administer provisions when base flood elevation data or floodway data have not been provided. Maintain all records pertaining to the provisions of this section.

xiii) Review plans for adequacy of breakaway walls in Coastal High Hazard Areas.

(f) Provisions for Flood Hazard Reduction

General Standards: In all areas of special flood hazard the following provisions shall apply:

- (1) New construction and substantial improvements shall be anchored to prevent floatation, collapse or lateral movement of the structure resulting from hydrodynamic and hydrostatic loads, including the effects of buoyancy;
- (2) New construction and substantial improvements shall be constructed with materials resistant to flood damage.
- (3) New construction or substantial improvements shall be constructed using methods and practices that minimize flood damage.
- (4) Electrical, heating, ventilation, plumbing, air conditioning equipment, and other service facilities shall be designed and/or located so as to prevent water from entering or accumulating within the components during conditions of flooding.
- (5) New and replacement water supply systems shall be designed to minimize or eliminate infiltration of flood waters into the systems and discharges from the system into flood waters;
- (6) New and replacement sanitary sewage system shall be designed to minimize or eliminate infiltration of flood waters into the systems and discharges from the system into flood waters;
- (7) On-site waste disposal systems shall be located and constructed to avoid impairment to them or contamination from them during flooding of a frequency determined by the State and Local Department of Health.
- (8) In any portion of a watercourse which is altered or relocated the flood carrying capacity shall be maintained;
- (9) Manufactured Homes: All manufactured homes including those located outside of a manufactured home park or subdivision, in a new manufactured home park or subdivision, in an existing manufactured home park or subdivision, in an expansion to an existing manufactured home park or subdivision, or in an existing manufactured home park or subdivision on which a manufactured home has incurred substantial damage as a result of a flood, (including recreational vehicles placed on a site for 180 consecutive days or longer) to be placed or substantially improved shall be:
 - a) Elevated so that the lowest floor is one foot above the base flood elevation, in accordance with this regulation.
 - b) Placed on a permanent foundation which itself is securely anchored and to which the structure is securely anchored so that it will resist floatation, lateral movement, and hydrostatic and hydrodynamic pressures. Anchoring may include, but is not limited to, the use of over-the-top or frame ties to ground anchors.
 - c) Installed using methods and practices which minimize flood damage. Elevation construction standards include piling foundations placed no more than 10 feet apart, and the provision of reinforcement for piers more than six feet above ground level. Work within a Special Flood Hazard Area, but outside the Floodway must not result in an increase in the Base Flood Elevation of more than 0.1 foot.
 - d) Adequate access and drainage should be provided.
 - e) Meet all the construction standards for Zones A and AE.

f) Recreational vehicles shall either be on the site for fewer than 180 consecutive days and be fully licensed and ready for highway use. A recreational vehicle is ready for highway use if it is on its wheels or jacking system, is attached to the site only by quick disconnect type utilities and security devices and has no permanently attached additions.

(10) Standards for Streams without Established Base Flood Elevations and/or Flooding: The Code Enforcement Officer shall obtain, review and reasonably utilize any base flood elevation and floodway data available from a Federal, State or other source, including data developed pursuant to this regulation, as criteria for requiring that new construction, substantial improvements, or other development in Zone A on Kittery's FIRM meet the standards.

a) In A Zones where base flood elevations have been determined, but before a floodway is designated, no new construction, substantial improvement, or other development (including fill) shall be permitted which will increase base flood elevations more than one (1) foot at any point along the watercourse when all anticipated development is considered cumulatively with the proposed development.

b) Should data be requested and/or provided, the Town shall adopt a regulatory floodway based on the principle that the floodway must be able to convey the waters of the base flood without increasing the water surface elevation more than one (1) foot at any point along the watercourse.

(11) Specific Standards: In all areas of special flood hazard A and AE where base flood elevation data has been provided the following provision shall apply:

a) Residential Construction. New construction or substantial improvement of any residential structure shall have the lowest floor, including basement, elevated at least to one (1) foot above the base flood elevation.

b) Non-Residential Construction. New construction or substantial improvement of any commercial, industrial, or non-residential structure located in A and AE Zones shall have the lowest floor including basement, elevated at least to one (1) foot above the level of the base flood elevation.

c) Non-Residential Structures located in all A and AE Zones may be flood-proofed in lieu of being elevated provided that together with all attendant utilities and sanitary facilities the areas of the structure below the required elevation are water tight with walls substantially impermeable to the passage of water, and use structural components having the capability of resisting hydrostatic and hydrodynamic loads and the effects of buoyancy. A registered professional engineer or architect shall review and/or development structural design specifications and plans for the construction and shall certify that the design and methods of construction are in accordance with acceptable standards of practice for meeting the provisions of this sub-section. Such certification shall be provided to the Code Enforcement Officer.

d) Fully Enclosed Areas Below Base Flood Elevation. New construction or substantial improvements of Non-Residential buildings not flood proofed and all Residential Buildings that include fully enclosed areas formed by foundation and other exterior walls below the base flood elevation shall be designed to preclude finished living space and designed to allow for the automatic entry and exit of flood waters to equalize hydrostatic flood forces on exterior walls. Designs for

complying with this requirement must either be certified by a professional engineer or architect and meet the following minimum criteria:

(i) Provide a minimum of two openings having a total net area of not less than one square inch for every square foot of enclosed area subject to flooding. Openings shall be on at least two sides of the enclosed area; alternatively, an International Code Council Evaluation Service, (ICC-ES) certification must be submitted to document that the design of the openings will allow for the automatic equalization of hydrostatic flood forces on exterior walls, providing the equivalency of 1 square inch per 1 square foot of enclosed area. The specific provisions that are addressed in the certification must include:

- a. A statement certifying that the openings are designed to automatically equalize hydrostatic flood loads on exterior walls by allowing the automatic entry and exit of floodwaters in accordance with the Engineered openings, design requirements below;
- b. Description of the range of flood characteristics tested or computed for which the certification is valid, such as rates of rise and fall of floodwaters; and
- c. Description of the installation requirements or limitations that, if not followed, will void the certification.

(ii) The bottom of all openings shall be located at, or no higher than one foot above, the exterior or interior grade immediately below the opening, whichever is higher.

(iii) Openings may be equipped with screens, louvers, valves or other coverings or devices provided they permit the automatic flow of floodwaters in both directions. Non-supporting breakaway wall, lattice work on mesh screening may be allowed below the base flood elevation provided it is not part of the structural support of the building and is designed so as to breakaway, under abnormally high tides or wave action, without damage to the structural integrity of the building on which it is to be used and provided the following design specifications are met: Design safe loading resistance of each wall shall not be less than 10 nor more than 20 pounds per square foot; or if more than 20 pounds per square foot, a registered professional engineer or architect shall certify that the design wall collapse would result from water load less than that which would occur during the base flood event, and the elevated portion of the building and supporting foundation system shall not be subject to collapse, displacement, or other structural damage due to the effects of wind and water loads acting simultaneously on all building components during the base flood event. Maximum wind and water loading values to be used in this determination shall each have one percent (1%) chance of being equaled or exceeded in any given year (100-year mean recurrence interval).

(iv) Mechanical equipment including but not limited to electrical and plumbing equipment, HVAC ducts, generators, and air conditioning units must be located one foot above the base flood elevation and all utility

connections below the BFE such as into sewer lines or underground electrical conduits must be floodproofed both indoors and outdoors. Duct systems and other service equipment is permitted below the elevation provided that they are designed and installed to prevent water from entering or accumulating within the components and to resist hydrostatic and hydrodynamic loads and stresses, including the effects of buoyancy, during the occurrence of flooding to the design flood elevation.

(v) Access to the enclosed area shall be the minimum necessary to allow for the parking of vehicles (garage door) or limited storage of maintenance equipment used in connection with the premises (standard exterior door) or entry to the living area (stairway or elevator).

e) Floodways: Located within areas of special flood hazard are areas designated as floodways. Since the floodway is an extremely hazardous area due to the velocity of flood waters which carry debris and potential projectiles and have erosion potential, no encroachments including fill, new construction, substantial improvements and other developments shall be permitted unless certification (with supporting technical data), by a registered professional engineer is provided demonstrating, through hydrologic and hydraulic analyses performed in accordance with standard engineering practice, that encroachments shall not result in any (0.00 feet) increase in flood levels during occurrence of the base flood discharge.

f) Work within a Special Flood Hazard Area, but outside the floodway must not result in an increase in the Base Flood Elevation of more than 0.1 foot.

(12) Coastal High Hazard Areas (VE Zone). Located within the areas of special flood hazard are areas designated as Coastal High Hazard Areas (Zone VE). Since these areas have special flood hazards associated with high velocity waters, including hurricane wave wash, the following provisions shall apply:

a) All new construction or substantial improvement shall be located landward of the reach of the mean high tide;

b) All new construction or substantial improvement shall be elevated so that the bottom of the lowest supporting horizontal member (excluding pilings or columns) is located no lower than one (1) foot above the base flood elevation level, with all space below the lowest supporting member so as not to impede the flow of water; Mechanical equipment including but not limited to electrical and plumbing equipment, HVAC ducts, generators, and air conditioning units must be located one foot above the base flood elevation and all utility connections below the BFE such as into sewer lines or underground electrical conduits must be floodproofed both indoors and outdoors; Duct systems and other service equipment is permitted below the elevation provided that they are designed and installed to prevent water from entering or accumulating within the components and to resist hydrostatic and hydrodynamic loads and stresses, including the effects of buoyancy, during the occurrence of flooding to the design flood elevation.

c) All new construction or substantial improvement shall be securely anchored on pilings or columns.

- d) All pilings and columns and the attached structures shall be anchored to resist floatation collapse and lateral movement due to the effect of wind and water loads acting simultaneously on all building components. The anchoring and support system shall be designed with wind and water loading values which equal or exceed the 100 year mean recurrence interval (one percent annual chance floods and winds);
- e) A registered professional engineer or architect shall review and/or develop structural design specifications and plans for construction and shall certify that the design specifications and methods of construction are in accordance with acceptable standards of practice for meeting the provisions
- f) There shall be no fill used as structural support. Non-compacted fill may be used around the perimeter of a building for landscaping/aesthetic purposes provided the fill will wash out from storm surge, (thereby rendering the building free of obstruction) prior to generating excessive loading forces, ramping effects, or wave deflection. The Planning Board shall approve design plans for landscaping/aesthetic fill only after the applicant has provided an analysis by an engineer, architect, and/or soil scientist, which demonstrates that the following factors have been fully considered.
- (i) Particle composition of fill material does not have a tendency for excessive natural compaction;
 - (ii) Volume and distribution of fill will not cause wave deflection to adjacent properties; and
 - (iii) Slope of fill will not cause wave run-up or ramping.
- g) There shall be no alteration of sand dunes which would increase potential flood damage;
- h) Non-supporting breakaway wall, lattice work or mesh screening may be allowed below the base flood elevation provided it is not part of the structural support of the building and is designed so as to breakaway, under abnormally high tides or wave action, without damage to the structural integrity of the building on which it is to be used and provided the following design specifications are met.
- (i) Design safe loading resistance of each wall shall not be less than 10 nor more than 20 pounds per square foot; or
 - (ii) If more than 20 pounds per square foot, a registered professional engineer or architect shall certify that the design wall collapse would result from a water load less than that which would occur during the base flood event, and the elevated portion of the building and supporting foundation system shall not be subject to collapse, displacement, or other structural damage due to the effects of wind and water loads acting simultaneously on all building components during the base flood event. Maximum wind and water loading values to be used in this determination shall each have a one percent (1%) chance of being equaled or exceeded in any given year (100-year recurrence interval).
- j) Prior to construction, plans for any structures that will have breakaway walls, lattice work or screening must be submitted to the Code Enforcement Officer for approval.

- k) Any alteration, repair, reconstruction or improvement to a structure shall not enclose the space below the lowest floor except with breakaway walls, lattice work or screening.
- l) The placement of manufactured homes or recreational vehicles is prohibited.

(g) Standards for Subdivision Proposals

In all special flood hazard areas the following requirements shall apply:

- (1) All subdivision proposals shall be consistent with the need to minimize flood damage;
- (2) All subdivision proposals shall have public utilities and facilities such as sewer, gas, electrical and water systems located and constructed to minimize flood damage.
- (3) All subdivision proposals shall provide adequate drainage to reduce exposure to flood hazards; and
- (4) Base flood elevation data shall be provided for all subdivision proposals and other proposed development which are five acres or fifty lots, whichever occurs first, and are located in Zone A.

(h) Variance Procedures:

- (1) The Board of Appeals as established by these regulations shall hear and decide appeals and requests for variances from the requirements of this section of the regulations.
- (2) The Board of Appeals shall hear and decide appeals when it is alleged this is an error in any requirement, decision or determination made by the Code Enforcement Officer in the enforcement or administration of this regulation.
- (3) Any person aggrieved by the decision of the Board of Appeals or any person owning land which abuts or is within a radius of (100) one hundred feet of the land in question may appeal.
- (4) Specific Situation Variances:
 - a) Buildings on Historic Register. Variances may be issued for the reconstruction, rehabilitation or restoration of structures listed on the National Register of Historic Places on the State Inventory of Historic Places without regard to the procedures set forth in the remainder of this section and provided the proposed reconstruction, rehabilitation or restoration will not result in the structure losing its historical character.
 - b) Pre-existing, Small Lot Location. Variances may be issued for new construction and substantial improvements to be erected on a lot of one-half acre or less in size which is contiguous to and surrounded by lots with existing structures constructed below the base flood level.
 - c) Functionally Dependent Uses. Variances may be issued for new construction and substantial improvements and other development necessary for the conduct of a functionally dependent use provided the structure or other development is protected by methods that minimize flood damage, creates no additional threat to public safety.
 - d) Floodway Prohibition. Variances shall not be issued within any designated floodway if any increase in flood levels during discharge would result.

(5) Consideration for Variances. In passing upon such applications the Planning Board shall consider all technical evaluations, all relevant factors, all standards specified in other sections of this regulation; and

- a) The danger that materials may be swept into other lands to the injury of others;
- b) The danger to life and property due to flooding or erosion damage;
- c) The susceptibility of the proposed facility and its contents to flood damage and the effect of such damage on the individual owner;
- d) The importance of the services provided by the proposed facility to the community;
- e) The necessity of the facility to waterfront location, in the case of a functionally dependent facility;
- f) The availability of alternative locations which are not subject to flooding or erosion damage for the proposed use;
- g) The compatibility of the proposed use with existing and anticipated development;
- h) The relationship of the proposed use to the comprehensive plan and flood plain management program for that area;
- i) The safety of access to the property in times of flood for ordinary and emergency vehicles;
- j) The expected heights, velocity, direction, rate of rise and sediment transport of the flood waters and the effects of wave action, if applicable, expected at the site; and
- k) The cost of providing governmental services during and after flood conditions including maintenance and repair of public utilities and facilities such as sewer, gas, electrical and water systems, and streets and bridges.
- l) Upon consideration of the factors listed above and the purpose of this ordinance, the Planning Board may attach such conditions to the granting of variances as it deems necessary to further the purpose of this regulation.

(6) Conditions for Variances

- a) Variances shall only be issued upon a determination that the variance is the minimum necessary, considering the flood hazard, to afford relief; and in the instance of a historical building, a determination that the variance is the minimum necessary as not to destroy the historic character and design of the building.
- b) Variances shall only be issued upon:
 - (i) A showing of good and sufficient cause.
 - (ii) A determination that failure to grant the variance would result in exceptional hardship; and
 - (iii) A determination that the granting of a variance will not result in increased flood heights, additional threats to public safety, extra-ordinary public expense, creation of a nuisance, cause fraud on or victimization of the public or conflict with existing local laws or regulations.
- c) Any applicant to whom a variance is granted shall be given written notice specifying the difference between base flood elevation and the elevation to which the structure is to be built and stating that the cost of the flood insurance will commensurate with the increased risk resulting from the reduced lowest floor elevation up to amounts as high as \$25.00 for \$100.00 of insurance coverage.

d) The Code Enforcement Officer shall maintain the records of all appeal actions and report any variances to the Federal Emergency Management Agency upon request.

(i) Penalties for Violation. Violation of the provisions of this regulation or failure to comply with any of its requirements, including violation of conditions and safeguards established in connection with grants of variance or special exceptions, shall constitute a misdemeanor. Any person who violates this ordinance or fails to comply with any of its requirements shall, upon conviction thereof, be fined not more than \$250.00 per day if proven done willfully and \$100.00 per day if not, or imprisoned for not more than 10 days for each day of violation, or both, and in addition, shall pay all costs and reasonable legal fees involved in the case. Nothing herein contained shall prevent the Town of Kittery from taking such other lawful action as is necessary to prevent or remedy any violation.