



Borough of Atlantic Highlands

Municipal Coastal Vulnerability Assessment

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for the Borough of Atlantic Highlands
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Atlantic Highlands Municipal Coastal Vulnerability Assessment Report

I. Introduction

Municipal Coastal Vulnerability Assessment

The Municipal Coastal Vulnerability Assessment (CVA) is both a process and tool to help communities make incisive and sound decisions on near and long-term coastal management, reconstruction, and resiliency measures. The CVA categorizes the degree to which a community's assets (e.g. built, natural, social, etc.) will be impacted by projected sea level rise and storm events, and analyzes the consequences those vulnerabilities pose to the community. By accounting for vulnerability and consequence factors associated with future flood events, local officials will be better informed to make critical decisions regarding land use planning, mitigation, adaption measures, and public investments.

The CVA was developed by the New Jersey Resilient Coastal Communities Initiative (RCCI), a post-Sandy project funded by the National Oceanic and Atmospheric Administration (NOAA), and managed by the NJ Department of Environmental Protection's Office of Coastal and Land Use Planning. The tool was created in response to the need for municipalities to be better prepared for the increasing rate of sea level rise and extreme storm events.

II. Municipal Background

Location and Demographics

Atlantic Highlands Borough is located in northern New Jersey in the northeast corner of Monmouth County. The borough overlooks where the Atlantic Ocean and Raritan Bay meet at Sandy Hook, and its hills (Mt. Mitchell 268 ft. above sea level) mark the highest point on the eastern seaboard south of Maine. Sandy Hook, NJ and the skyline of New York City can be seen from the hills of the borough. The borough encompasses over 4 square miles and borders the municipalities of Middletown Township and the Borough of Highlands. Atlantic Highlands has a total population of 4,385 according to the 2010 census.

Future Flooding

Atlantic Highlands is faced with a new set of challenges as sea level continues to rise and the intensity and frequency of storms and precipitation persist. Figure 1 shows past and future trends in monthly mean sea level rise using data from The Battery tide gauge station in New York City. Additional data and maps regarding future flood projections, precipitation and climate change are available at Climate Central (<http://www.climatecentral.org>); NJAdapt (<http://www.njadapt.org>); and the NJ Climate Adaptation Alliance (<http://njadapt.rutgers.edu>).

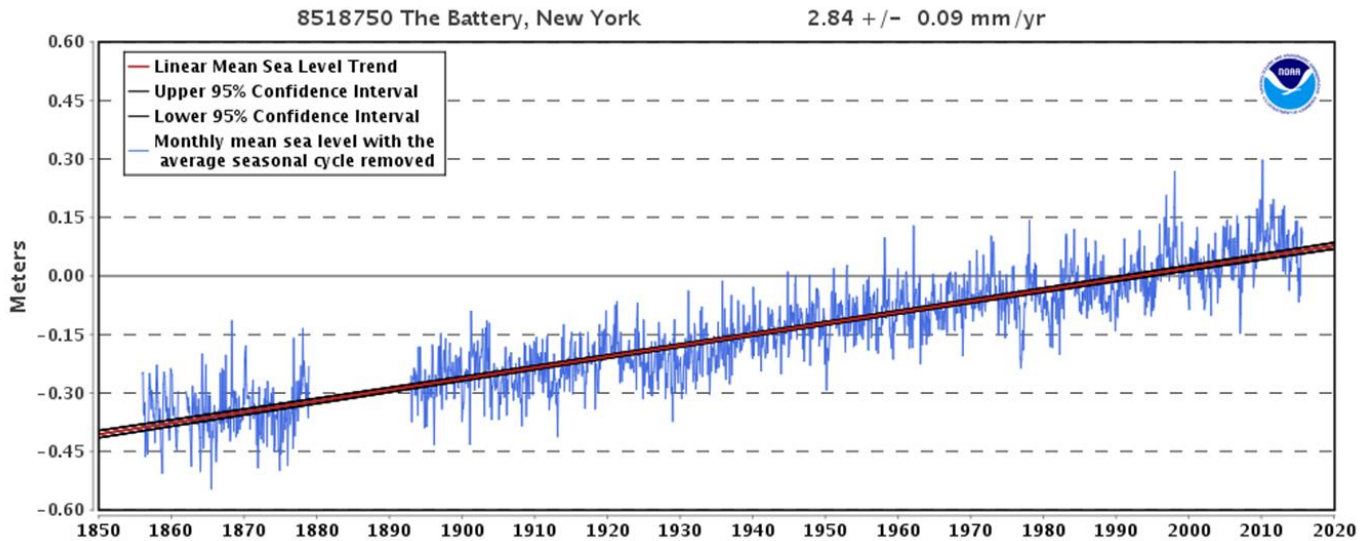


Figure 1. Mean Sea Level Trend at The Battery, NY (NOAA, 2015).

III. Municipal Coastal Vulnerability Assessment – Methodology

The CVA process is a methodical, step-by-step approach for conducting a comprehensive vulnerability assessment of coastal flooding hazards. It identifies the vulnerability of community assets (identified by the municipality) to a series of future flood hazard scenarios, and the associated consequences to the community. The CVA goes beyond a simple analysis of flooding extent and duration by also examining how flooding will affect the functional capacity of buildings, services, infrastructure, businesses, ecological systems, and residents. The three key steps of the CVA are described below:

- ✓ *Identify and map community assets and selected coastal flood hazard scenario(s)*

Geographical Information Systems (GIS) maps are the most effective way of locating and analyzing community assets and flood hazards. Community assets are identified among four categories - Critical Facilities & Infrastructure Systems, Community Resources & Amenities, Natural Resources & Ecosystems, and Districts, Neighborhoods, & Population Clusters – and plotted using GIS. Flood hazard scenarios are selected and are also mapped. Communities are encouraged to use both future sea level rise and storm surge levels for at least 2050, and, preferably, 2030 and 2100, if available.

- ✓ *Evaluate the vulnerability of community assets.*

Vulnerability is the predisposition of a community asset to be adversely affected by a hazard—in this case, coastal flooding. Vulnerability is measured by the anticipated degree of *exposure* and *sensitivity*.

Exposure is the extent to which community assets may be flooded, measured by magnitude and depth. The magnitude of exposure incorporates the frequency of occurrence (e.g. for high tide, the occurrence would be daily), and the depth of floodwater during the occurrence.

Sensitivity is measured by the extent in which the flooding will impact the following features of the asset¹:

- Durability of the structure or asset (materials, elevated structure, flood mitigation measures, etc.)
- The ability of an asset to continue to provide its key benefits and operations in the aftermath of a storm event
- The ability to move quickly from harm's way.

Each asset is assigned a single vulnerability rating based on the adverse impacts due to exposure and sensitivity to each hazard. A Vulnerability Rating Key provides guidance in the assignment of these ratings. (See Appendix C).

✓ *Evaluate the overall consequences to the community*

Consequence is the degree of impact on the entire community if an asset will be lost or damaged, or if the assets function is impaired. The degree of impact is measured over eight topic areas that can potentially impact the community. The topic areas include: property damage, population displacement, delivery of services, typical operations / daily life, environment, emergency response, hazardous materials, and municipal budget. The Consequences Rating Key in Appendix D provides guidelines for identifying and rating consequences.

IV. Findings: Vulnerability of Assets and Consequences to the Community

Atlantic Highlands initially identified approximately 45 assets to be included in the vulnerability and consequences assessment, but only those assets shown to be impacted by sea level rise and/or a Category 1 Hurricane in 2050 (31 assets in total) were included in the assessment. The assets were identified under four broad categories of potential community assets: Critical Facilities & Infrastructure Systems, Community Resources & Amenities, Natural Resources & Ecosystems, and Districts, Neighborhoods, & Population Clusters. While the majority of assets were assessed individually, some of them were assessed as part of "systems" to ensure the functionality and consequence if one component or asset failed. For example, Atlantic Highlands Municipal Harbor is comprised of many separate businesses, structures, and park facilities; however, the harbor is made up of all these components and if one component is destroyed or fails it will have consequences for the whole harbor complex.

The flood hazards scenarios used for this assessment were projected sea level rise and hurricane category 1 storm surge for 2050, both provided by the NJ Department of Environmental Protection. The sea level rise projections are based upon a 2013 study by New Jersey climate scientists,² and use the 2050 mid-range projections in that study, or 1.3 feet of sea level rise. The sea level rise maps show the additive layers of the projections and the mean higher high water (MHHW) mark, determined by NOAA calculations. The storm surge maps were developed using NOAA's SLOSH (Sea, Lake, and Overland Surge from Hurricanes) model, combined with the sea level rise projections. The approximate depth of water is based on LiDAR data.³

The community assets were assessed for their vulnerability (exposure and sensitivity) to the above two hazard scenarios, and then for the consequences to the community if the asset was damaged or destroyed. The complete set of data on vulnerability and consequences are included in the CVA Matrix (Appendix A), and summarized in

¹ Sensitivity also includes the natural coping capacity of individuals to move out of harm's way. However, contrary to some definitions, it does not include adaptive capacity since by its inherent definition adaptive capacity is a likely future condition that requires action, e.g. elevating structures. The CVA evaluates sensitivity based on the assets' current conditions.

² Miller et al. December 2013. "A geological perspective on sea-level rise and its impacts along the U.S. mid-Atlantic coast." http://onlinelibrary.wiley.com/doi/10.1002/2013EF00_0135/pdf

³ Note that the projected flood events used in this assessment were generated by several models prepared by state and national agencies and professionals, and are suitable for planning purposes. However, due to the uncertainty of projections and accuracy of certain types of data, the maps should not be the sole resource for conducting site specific analyses.

Table 1 below. Since sea level rise is more likely to occur than a Category 1 hurricane, the borough should particularly focus its attention on the assets with high consequences in the sea level rise column. There are also other considerations for interpreting the data in the Matrix and Table 1. The flood hazard maps are based upon the latest technology and best available data, both of which will continue to be updated as new data is generated and technology advances. Additionally, there may be existing topographical features or mitigation measures in place that the assessment did not pick up, which could lower the vulnerability rating of an asset. For these reasons, the Matrix should be used for general planning purposes and not for specific site planning or design, unless site conditions are field verified. More considerations on the use of the data and “next steps” are offered in Section V.

| Table 1. Atlantic Highlands Coastal Vulnerability Assessment Matrix Summary | | | | | | |
|---|---|--|----------------------|----------------|---------------------|----------------|
| Asset Name | Asset Category | Asset Function | Vulnerability Rating | | Consequences Rating | |
| | | | Sea Level Rise | CAT1 Hurricane | Sea Level Rise | CAT1 Hurricane |
| Atlantic Highlands Municipal Harbor | Critical Facilities & Infrastructure Systems | The municipal harbor is the largest harbor in the state of New Jersey. | Low | High | Low | High |
| Avenue A Beach | Natural Resources & Ecosystems | Small local beach used for fishing and passive recreation. | Low | Low | Low | Low |
| Bayshore Plaza | Community Assets & Amenities | Retail shopping center. | NA | Insignificant | NA | Insignificant |
| Bayside Neighborhood | Districts, Neighborhoods, & Population Clusters | A residential neighborhood located along Bayside Drive and along the Henry Hudson Trail. | NA | Low | NA | High |
| Bayview Neighborhood | Districts, Neighborhoods, & Population Clusters | A residential neighborhood located along Bayview Avenue on the hills above the Henry Hudson Trail. | NA | Low | NA | High |
| Blackfoot Mobile Marine Services | Community Assets & Amenities | A small marine repair and storage business. | NA | Low | NA | Insignificant |
| Bowne Avenue Neighborhood | Districts, Neighborhoods, & Population Clusters | A residential neighborhood located along Bowne Avenue and next to Wagner Creek. | NA | Low | NA | Moderate |
| Center Avenue Park | Natural Resources & Ecosystems | An active recreation park located along Center Avenue, which contains a soccer field. | NA | Low | NA | Low |
| Central Business District | Districts, Neighborhoods, & Population Clusters | The Central Business District is the downtown area of Atlantic Highlands and includes several blocks along 1st Avenue from Bayview Avenue to State Highway 36. | NA | Low | NA | Low |

Table 1. Atlantic Highlands Coastal Vulnerability Assessment Matrix Summary Continued

| Asset Name | Asset Category | Asset Function | Vulnerability Rating | | Consequences Rating | |
|---|---|--|----------------------|----------------|---------------------|----------------|
| | | | Sea Level Rise | CAT1 Hurricane | Sea Level Rise | CAT1 Hurricane |
| Commercial & Industrial District | Districts, Neighborhoods, & Population Clusters | The Commercial & Industrial District is located along several blocks of West Avenue / Hennessey Boulevard from Bayview Avenue to State Highway 36. | NA | High | NA | High |
| Detention Pond | Critical Facilities & Infrastructure Systems | A stormwater retention facility for the west side of the borough. The facility is currently not functional as it is filled in with silt. | Low | Moderate | Insignificant | Low |
| Dredge Pit | Critical Facilities & Infrastructure Systems | The Municipal Harbor is dredged on a 5-8 year cycle. The dredge pit contains the dredge spoils from the harbor. | Low | Moderate | Moderate | High |
| Drinking Water Treatment Facility & Recycling Center | Critical Facilities & Infrastructure Systems | A municipally owned drinking water treatment facility for the borough. | NA | Moderate | NA | High |
| Firemans Field Building | Community Assets & Amenities | A community rental hall. Used as polling for Districts 2 and 3 during elections. | NA | Insignificant | NA | Insignificant |
| Firemans Memorial Field | Natural Resources & Ecosystems | Firemans Memorial Field is an active recreation park used for community-wide organized sports. | NA | Low | NA | Low |
| Harbor View Neighborhood | Districts, Neighborhoods, & Population Clusters | A residential neighborhood located along Harbor View Drive and Sandy Hook Bay. | Insignificant | Low | Insignificant | Low |
| Henry Hudson Trail | Natural Resources & Ecosystems | The Henry Hudson Trail is a 10 foot wide former rail track converted to recreation trails that runs 24 miles in length with a mixture of paved and primitive areas. Through Atlantic Highlands 1.2 miles of trail run along Sandy Hook Bay and the Municipal Harbor. | Low | High | Low | High |

Table 1. Atlantic Highlands Coastal Vulnerability Assessment Matrix Summary Continued

| Asset Name | Asset Category | Asset Function | Vulnerability Rating | | Consequences Rating | |
|---|---|---|----------------------|----------------|---------------------|----------------|
| | | | Sea Level Rise | CAT1 Hurricane | Sea Level Rise | CAT1 Hurricane |
| Jaspan Brothers Hardware | Community Assets & Amenities | Family-owned and operated hardware store. | NA | Low | NA | Insignificant |
| Leonard Avenue Neighborhood | Districts, Neighborhoods, & Population Clusters | A residential neighborhood located along the Southeast end of Leonard Avenue. | NA | Low | NA | Low |
| Many Mind Creek | Natural Resources & Ecosystems | Many Mind Creek is a natural waterway which receives rain water that drains from a large land area of Atlantic Highlands and parts of neighboring Middletown. | Low | High | Low | High |
| Many Mind Creek Culvert | Critical Facilities & Infrastructure Systems | A culvert located under State Highway 36 where Many Mind Creek runs under the state highway. | NA | Moderate | NA | Moderate |
| NJ Natural Gas (NJNG) Treatment Facility & Offices | Critical Facilities & Infrastructure Systems | The offices and facility are used as part of a coal tar remediation project. The facility is treating contaminated soils from Many Mind Creek. | NA | Insignificant | NA | Insignificant |
| Ocean Boulevard Neighborhood | Districts, Neighborhoods, & Population Clusters | A residential neighborhood located along Ocean Boulevard on the hills above the Henry Hudson Trail. | NA | Low | NA | High |
| Popamora Point Park | Natural Resources & Ecosystems | Popamora Point Park is a Monmouth County Park which contains open park area, wetlands, and beaches. | Low | Low | Insignificant | Low |
| Public Works Yard | Critical Facilities & Infrastructure Systems | The public works yard includes offices, equipment, a drinking water well (No. 7), salt storage shed, and street sweeping shed. | NA | Low | NA | Moderate |
| Sandy Hook Bay Catamaran Club | Community Assets & Amenities | Gazebo, clubhouse, lined with catamarans in summer. | Low | Moderate | Low | Moderate |
| Seastreak Ferry Terminal | Critical Facilities & Infrastructure Systems | Seastreak Ferry is a high speed passenger service that runs a daily commuter service between Atlantic Highlands and NYC. | Low | High | Low | High |

| Table 1. Atlantic Highlands Coastal Vulnerability Assessment Matrix Summary Continued | | | | | | |
|---|--|---|----------------------|----------------|---------------------|----------------|
| Asset Name | Asset Category | Asset Function | Vulnerability Rating | | Consequences Rating | |
| | | | Sea Level Rise | CAT1 Hurricane | Sea Level Rise | CAT1 Hurricane |
| Sewer Main (Along Henry Hudson Trail) | Critical Facilities & Infrastructure Systems | The Monmouth County Bayshore Outfall Authority (MCBOA) serves the Bayshore area of the county and provides collective means of effluent disposal for 13 municipalities carried over 14 miles of pipeline. | Moderate | Moderate | High | High |
| Sewer Transfer Station | Critical Facilities & Infrastructure Systems | A municipally-owned and operated sewer transfer station. | NA | Low | NA | Insignificant |
| South Avenue Park | Natural Resources & Ecosystems | A small passive recreation park with a small playground area. | NA | Low | NA | Low |
| St. Paul Baptist Church | Community Assets & Amenities | A Catholic Church. | NA | Insignificant | NA | Insignificant |
| U.S. Post Office | Community Assets & Amenities | Atlantic Highlands branch of the U.S. Post Office. | NA | Low | NA | Low |
| Wagner Creek | Natural Resources & Ecosystems | Wagner Creek is a natural waterway which receives stormwater that drains from a small land area on the western boundaries of Atlantic Highlands and from a large area of Middletown. | Low | High | Low | High |

V. Recommendations

This section offers key steps that the borough should consider following the vulnerability assessment, and discusses the long-term planning process that is integral to risk reduction and adaptation planning and implementation.

Short-term Considerations

1. Coordinate community outreach and education on flood vulnerabilities

In order for Atlantic Highlands to better prepare for the future impacts of sea level rise and hurricane events, it is important to have an engaged and informed community. The results of this report should be shared with the community either at a public meeting or workshop, but at a minimum by posting it on the municipal website. The borough should also consider special outreach to residents, business owners, and property owners in the most vulnerable areas of Atlantic Highlands, including the Bayside Avenue, Bayview Avenue, Ocean Boulevard, and Bowne Avenue Neighborhoods, Commercial & Industrial District, and the Central Business District. Educating these stakeholders about future flood vulnerabilities and working together to find solutions will protect Atlantic Highlands at large and keep the fabric of the neighborhoods intact and the businesses operating.

2. Share the results of the Coastal Vulnerability Assessment with owners and managers of vulnerable and at-risk non-residential properties and work together to develop mitigation and adaptation strategies. Many of Atlantic Highlands's at-risk assets are owned and managed by private businesses and industries, and public and quasi-public entities. These property owners may be aware of additional risks and vulnerabilities that were not identified in this CVA, or perhaps have already launched efforts to prepare for future risk reduction. Atlantic Highlands is encouraged to reach out to these property owners to discuss the results of this report and future steps that may be taken individually and collectively to protect the properties from future flood hazards.

Suggestions

- Consider convening a workshop or meeting with at-risk non-residential property owners and operators to discuss opportunities to collaborate on adaptation strategies to minimize risks and potential damage to future flood hazards.
- When working with flood-risk private industries in development proposals, redevelopment or other activities, promote the importance of emergency management planning site remediation and the safe storage of toxic materials.

3. Incorporate the results of the Coastal Vulnerability Assessment into the municipal master plan with short-term and long-term strategies for protecting and adapting the community assets and vulnerable areas. As the primary planning policy document for the community, the master plan should identify areas in the community that will likely be impacted by future flood hazards, and offer measures for mitigation and adaptation strategies to protect the community's assets and properties.

Suggestions

- Include maps of projected sea level rise and future storm events in the land use plan and conservation plan elements of the municipal master plan.
- Identify natural resources that serve as protective flood mitigation measures (e.g. wetlands), and provide recommendations for maintenance and management in the conservation plan element.
- Identify planning policies for mitigation and adaptation strategies to protect properties from future flooding, including sea level rise and extreme storm events, in the land use plan element.

4. Cross-reference the Coastal Vulnerability Assessment in relevant sections of the municipal master plan, floodplain management plan, emergency operations plan and all hazards mitigation plan. Community flood risks are influenced largely by land use and development patterns that are grounded in local master plan policies. Hazard mitigation plans also provide strategies to reduce these risks, but as stand-alone documents often do not relate to the master plan policies. The same is true for flood mitigation plans and emergency plans. This disconnect can result in conflicting policies and undermine the progress in mitigation and adaptation. Integrating flood risks and hazard mitigation into all local policy documents, especially master plans and hazard mitigation plans, ensures a coordinated, complementary approach to mitigation, and avoids potential conflicts from competing goals and interests.

Resources

- *Integrating Hazard Mitigation Into Local Planning, Case Studies and Tools for Community Officials*, FEMA, 2013

5. Consider the use of living shorelines to protect community assets against shoreline erosion

Living shorelines are a shoreline stabilization practice that address erosion and attenuate wave energy using a hybrid approach of strategically placed plants, stone, sand fill and other structural or organic materials. Living shorelines typically have other co-benefits such as the protection of flora and fauna habitats, flood mitigation, improved water quality and attractive, natural appearances. These practices are an alternative to the traditional hard or “gray” infrastructure (e.g. bulkheads, revetment walls, etc.), which are especially vulnerable to sea level rise and extreme flood events. The Henry Hudson Trail may be a good opportunity to install a living shoreline to minimize trail erosion and the impacts of flooding and erosion at the toe of the slope of the hills and neighboring properties.

Resource

- The Nature Conservancy. [Coastal Restoration Explorer Mapping tool](#).

Adaptation: A Long-Term Planning Process⁴

Planning for the predicted increase in the frequency and severity of flood hazards is a complex and challenging task. Adaptation to these flood hazards requires a longer planning timeframe for which most municipalities are not accustomed. Incremental steps are key to ensuring progress and minimizing public investments on projects that may be compromised by flooding in the near to distant future. This vulnerability assessment is an important first step in planning for these future hazards. The above recommendations provide key steps immediately following the vulnerability assessment to further identify and confirm vulnerabilities and consequences, and to begin thinking about adaptation. This section frames a strategic approach to identifying, assessing, and implementing long-term solutions to reducing flood risks. The process will need to be repeated periodically to respond to new data, changes in the physical environment and the long-term planning horizon.

Identify plans, studies and activities that are needed prior to identifying adaptation strategies

The borough should re-convene the CVA committee or any other local flood management committee that includes a similar representation of multiple disciplines, e.g. municipal engineer, floodplain manager, planner, public works official, governing body representative, planning board representative, conservation planner, floodplain manager and emergency management official. This group should determine if there are data gaps or ambiguities in the CVA that need to be addressed to get a complete picture of vulnerability. For example, the community may want to field-verify certain sites or assets to determine if topography or adaptation measures may exacerbate or attenuate the projected flood impacts. If studies or plans are deemed necessary, the committee should identify who might take the lead. Also, the vulnerability and consequence ratings in this assessment should be compared with other current mitigation and planning documents to determine if there are any conflicts that should be addressed. Finally, the committee should determine which of the CVA recommendations will be implemented and who should take the lead.

Identify adaptation strategies

Given that the CVA’s purpose is to identify vulnerabilities, not pose solutions, the critical next step is to identify and evaluate potential solutions. Using the vulnerability assessment of community assets and

⁴ The term “adaptation” in this document refers to all measures to minimize flood risks, including “mitigation” projects and strategies, a term which is traditionally used by emergency managers and engineers.

other pertinent data and reports (e.g. the hazard mitigation plan, beach nourishment program, flood management reports) identify the broadest range of possible solutions to reduce flood risks. Depending upon the magnitude of the vulnerabilities and consequences, the community may need to consult with coastal engineers outside of the community to fully realize the range of adaptation measures. DEP and other agencies and organizations may be available to provide workshops or host consultation meetings. This process of identifying adaptation strategies could take several months or more to fully understand the options available to the community.

The borough should also determine whether a regional approach to an adaptation project is appropriate, and, if so, arrange for multi-jurisdictional meetings. The county or NJDEP Office of Coastal and Land Use Planning may be able to assist in scheduling or facilitating these meetings.

Once the broad list of adaptation options is created, the committee should select the most desirable projects and strategies to pursue, along with associated timeframes, funding options and project/task leads. The community may also want to conduct a cost-benefit analysis to prioritize adaptation strategies. Most adaptation projects will need to be reviewed the NJ Department of Environmental Protection to ensure they meet permitting requirements. Projects that cannot be approved or funded at this time should be noted and discussed in future iterations of this process.

Engage the Community

Host community meetings to discuss and solicit feedback on the recommended adaptation strategies while also educating the participants about flood risk.

Seek funding opportunities for adaptation planning and mitigation projects. Below is a short list of potential grant programs:

- [NJ Department of Community Affairs \(DCA\) planning assistance grants](#)
- [NJDEP Office of Coastal and Land Use Planning](#)
- [NJDEP Office of Flood Hazard Risk Reduction Measures](#)
- [FEMA Hazard Mitigation grants](#)
- [FEMA Pre-Disaster Mitigation grants](#)
- [FEMA Flood Mitigation Assistance grants](#)
- [US Army Corps of Engineers](#)
- Other Federal grant programs – see the Appendix of the [NOAA Adaptation Guide](#)

Develop an implementation strategy

Adaptation strategies should be integrated into the local hazards mitigation plan, capital improvement plan, master plan and ordinances to coordinate all related land use and adaptation policies and projects in the community. Key individuals and municipal departments should be assigned to lead and/or implement each of the adaptation strategies, along with proposed timeframes and funding options.

Schedule annual meetings

Unfortunately, there may not currently be sufficient resources and assistance available to address all of the community's identified vulnerabilities. Federal and State programs for coastal resiliency are still evolving, and grants, technical assistance, best practices and models, will inevitable become available. The committee should flag the issues for which solutions cannot be found and revisit them in the next

adaptation planning process. Key staff should be charged with signing up for state and federal email lists that share grant and program information. The committee should continue to meet at least once a year, even after all current options for making progress have been exhausted, to consider if new programs or solutions have become available.

APPENDIX A: Atlantic Highlands Coastal Vulnerability Matrix

| Asset Name | Asset Category | Asset Description | Asset Function | 2050 Depth Projections (feet) | | Exposure | Sensitivity | 2050 Vulnerability Rating | | Consequences | 2050 Consequences Rating | |
|---|---|----------------------------------|--|-------------------------------|----------------|--|---|---------------------------|----------------|---|--------------------------|----------------|
| | | | | Sea Level Rise | CAT1 Hurricane | | | Sea Level Rise | CAT1 Hurricane | | Sea Level Rise | CAT1 Hurricane |
| Atlantic Highlands Elementary School | Community Assets & Amenities | Public School | | NA | NA | No impacts from sea level rise. No impacts from CAT1 event. | | | | | | |
| Atlantic Highlands United Methodist Church | Community Assets & Amenities | Church | The church contains a local food pantry. | NA | NA | No impacts from sea level rise. No impacts from CAT1 event. | | | | | | |
| Atlantic Highlands Municipal Harbor | Critical Facilities & Infrastructure Systems | Harbor | The municipal harbor is the largest harbor in the state of New Jersey. The harbor is a large complex which includes the Seastreak Ferry Terminal, Shore Casino, two restaurants, a catering business, active recreation park, senior center, and fishing pier. The harbor includes 482 boat slips, 172 moorings, land storage for 140 boats on trailers, and six-vehicle wide boat launch. The area is completely open to the public including docks, piers, and access to the Henry Hudson Trail. | 0-4 | 2-10 | May see several feet of inundation in the harbor waters and the edges of parking lots/boat ramp during high tide due to sea level rise. May see major inundation during a CAT1 event. | During high tide, due to sea level rise, inundation may occur at the edges of the harbor and may impact some fixed dock and piers, which may limit access to parts of complex. One fixed dock includes gasoline and diesel pumps and storage which may be inundated if not elevated. A major storm event has the potential to cause mass destruction and damage to the entire harbor complex. Several of the docks are floating and rated for a CAT3 Hurricane and would likely not be impacted in this scenario. Several other docks are fixed and storm surge has the potential to destroy the docks and cause debris problems to the surrounding area. Boats located in the water and stored on land may be destroyed or damaged, and will also become debris to other vessels and surrounding properties. Structures located throughout the complex consist of wood frame and block construction, and are not elevated, which would cause substantial damage to all the businesses and facilities found within the complex. | Low | High | Damage and/or destruction of the Municipal Harbor Complex will have far reaching consequences for Atlantic Highlands and the region. The harbor brings in over a million dollars in revenue annually to the municipality between slip rentals, commuters passing through, local residents, and visitors. Damage to the harbor will result in a loss of revenue and would need to be made up through increases in property taxes. Businesses located with the complex may be unable to recover and could potentially close down permanently. Damage to the harbor could limit the ability of evacuation into and out of the region, and the ability of regional commuters to go to and from work. The harbor is also a part of the character and social center of Atlantic Highlands. Loss of the harbor will result in loss in the sense of self to character of Atlantic Highlands and within local residents. The complex contains the only public recreation and senior social facilities in the municipality. | Low | High |
| Avenue A Beach | Natural Resources & Ecosystems | Beach | Small local beach used for fishing and passive recreation. | 0-4 | 3-9 | May see several feet of inundation during high tide due to sea level rise. May see major inundation during a CAT1 event. | The beach may experience erosion and land loss due to increasing high tide levels. A major storm event may cause beach erosion as well. | Low | Low | The loss beach will reduce available recreation opportunities for the beach. | Low | Low |
| Avenue D Bulkhead | Critical Facilities & Infrastructure Systems | Bulkhead | Municipal bulkhead located at the North end of Avenue D. | NA | NA | No impacts from sea level rise. No impacts from CAT1 event. | | | | | | |
| Bayshore Family Success Center is located in Leonardo | Community Assets & Amenities | Community Center | Community center used during Sandy as an evacuation center and FEMA headquarters. | NA | NA | No impacts from sea level rise. No impacts from CAT1 event. | | | | | | |
| Bayshore Plaza | Community Assets & Amenities | Shopping Center | Retail shopping center which includes Bayshore Pharmacy, Super Foodtown, Pomodoro Rosso Italian Grill, and a liquor store. | NA | 0-2 | No impacts from sea level rise. May see a couple feet of inundation during a CAT1 event. | The Bayshore Plaza is an elevated structure and would likely only experience some flooding around the building and in the park lot with little to no damage. | NA | Insignificant | Bayshore Plaza may experience temporary closure of parts of the parking lot, creating a nuisance issue for customers. | NA | Insignificant |
| Bayside Neighborhood | Districts, Neighborhoods, & Population Clusters | Residential Neighborhood | A residential neighborhood located along Bayside Drive and along the Henry Hudson Trail. The neighborhood consists of approximately 20 single-family homes. | NA | 4-8 | No impact from sea level rise. May see major inundation at toe of slope below residential homes during a CAT1 event. | The homes along Bayside Drive sit above the Henry Hudson Trail on a hillside with a steep slope. A major storm event can cause erosion at the toe of slope, and contribute to shallow landslides along the coast, which can undermine the stability of the slope, foundations of the homes, infrastructure, and roadways. | NA | Low | If sections of the roadway were lost and undermined, home owners and emergency services would no longer have access or egress to and from homes in the neighborhood. Homes that fall during a shallow landslide can become a debris hazard for Henry Hudson Trail. Substantial damage and/or loss of homes will have a great impact on property values, and would result in major tax losses to borough. | NA | High |
| Bayview Neighborhood | Districts, Neighborhoods, & Population Clusters | Residential Neighborhood | A residential neighborhood located along Bayview Avenue on the hills above the Henry Hudson Trail. The neighborhood consists of approximately 30 single-family homes. | NA | 4-8 | No impact from sea level rise. May see major inundation at toe of slope below residential homes during a CAT1 event. | The homes along Bayview Avenue sit above the Henry Hudson Trail on a hillside with a steep slope. A major storm event can cause erosion at the toe of slope, and contribute to shallow landslides along the coast, which can undermine the stability of the slope, foundations of the homes, infrastructure, and roadways. | NA | Low | If sections of the roadway were lost and undermined, home owners and emergency services would no longer have access or egress to and from homes in the neighborhood. Homes that fall during a shallow landslide can become a debris hazard for Henry Hudson Trail. Substantial damage and/or loss of homes will have a great impact on property values, and would result in major tax losses to borough. | NA | High |
| Blackfoot Mobile Marine Services | Community Assets & Amenities | Marine Services | A small marine repair and storage business. | NA | 0-2 | Not impacted by sea level rise. May see minimal inundation on the edges of the property during a CAT1 event. | The marina may experience minor inundation on the edges of the property during a storm event. It may impact a small number of boats stored on the property. If boats are properly stored and or moved prior to the storm event, little to no impact will occur. | NA | Low | Minor damage to private boats possible. | NA | Insignificant |
| Borough Hall, Police, Library, & Courts | Critical Facilities & Infrastructure Systems | Civic | The building is the location for the borough hall, police department, municipal courts, and a branch of the Monmouth County Library. | NA | NA | No impacts from sea level rise. No impacts from CAT1 event. | | | | | | |
| Bowne Avenue Neighborhood | Districts, Neighborhoods, & Population Clusters | Residential Neighborhood | A residential neighborhood located along Bowne Avenue and next to Wagner Creek. Bowne Avenue is the western most street in the town with approximately 16 single-family homes. | NA | 0-6 | No impact from sea level rise. May see several feet of inundation during a CAT1 event. | A major storm event would impact those homes closest to Wagner Creek and the Atlantic Ocean. One home in the impacted area is elevated. Other homes are not elevated and may experience some water and structural damage. | NA | Low | Impacted home owners may experience substantial damage and would be required to raise and elevate their homes. Increasing costs and recovery periods can result in home owners selling and/or walking away from properties. Substantial damage can decrease property values, impacting municipal tax revenues. | NA | Moderate |
| Center Avenue Park | Natural Resources & Ecosystems | Active Recreation | An active recreation park located along Center Avenue, which contains a soccer field. Park has a high water table, as such the field is treated for saltwater intrusion. | NA | 0-1 | No impacts from sea level rise. May see minimal inundation on the west side edge of the park during a CAT1 event. | The soccer field turf may be damaged from salt water intrusion during a storm event. The field is currently treated for potential salt water intrusion from high water tables, thus the field damage during a storm event would be limited. | NA | Low | Field may need reseeding and further treatment after a storm event. | NA | Low |
| Central Baptist Church | Community Assets & Amenities | Church | | NA | NA | No impacts from sea level rise. No impacts from CAT1 event. | | | | | | |
| Central Business District | Districts, Neighborhoods, & Population Clusters | Business District | The Central Business District is the downtown area of Atlantic Highlands and includes several blocks along 1st Avenue from Bayview Avenue to State Highway 36. The area includes municipal buildings, emergency services, retail, restaurants, offices, churches, and hotel. | NA | 0-4 | No impact from sea level rise. May see several feet of inundation in areas nearest Many Mines Creek during a CAT1 event. | A major storm event would impact the Northwest section of the Central Business District. The business in this area include the Memphis Pig Out, Blue Bay Inn, and Hess office building. These buildings may experience some inundation on the first floor. Inundation on the first floor may cause damage to any equipment, furniture, and some internal damage. A municipal parking lot would also be inundated and damage could result to any vehicles left in the parking lot during a storm event. | NA | Low | Damage to any of the businesses in the district will result in temporary closures for debris removal and cleanup and possible permanent closure. The Blue Bay Inn has been used for emergency service personnel during recovery operations, damage to the building may limit communities capacity to house service personnel during recovery. | NA | Low |
| Commercial & Industrial District | Districts, Neighborhoods, & Population Clusters | Commercial & Industrial District | The Commercial & Industrial District is located along several blocks of West Avenue / Hennessey Boulevard from Bayview Avenue to State Highway 36. The area consists of several commercial and industrial businesses, condominiums, apartment complex, retail and restaurants. | NA | 0-7 | No impact from sea level rise. May see several feet of inundation during a CAT1 event. | Almost every single structure within the district would be impacted by a major storm event. The apartment and condominiums located in the North end of the district are not elevated and would see several feet of inundation, causing substantial damage on the first floor. The businesses found through out the district are also not elevated. Several feet of inundation would cause millions of dollars in equipment, stock, and merchandise damage and loss. | NA | High | Substantial damage to apartments, condominiums, and businesses will result in individuals, facilities and business owners leaving the district permanently. Substantial damage will also require long term recovery for businesses, which will impact the regional economy and reduce municipal assessment values. | NA | High |
| Detention Pond | Critical Facilities & Infrastructure Systems | Stormwater Detention | A stormwater retention facility for the west side of the borough. The facility is currently not functional as it is filled in with silt. The facility is being remediated by New Jersey National Gas. | 0-0.5 | 0-6 | May see minimal impact during high tide moving up Many Mines Creek due to sea level rise. May see several feet of inundation from a CAT1 event. | The facility is currently not functioning, however remediated is planned. If properly remediated and returned to working order, the facility should help reduce flooding issues in the west part of the borough and nearby residents. Currently the facility has no backflow prevention and is silted in, thus it creates flooding issues for nearby residents. | Low | Moderate | Impact from detention pond should be limited if it is properly remediated | Insignificant | Low |
| Dredge Pit | Critical Facilities & Infrastructure Systems | Public Works | The Municipal Harbor is dredged on a 5-8 year cycle. The dredge pit contains the dredge spoils from the harbor. The Henry Hudson Trail also runs along the north edge of the dredge pit. | 0-1 | 0-3 | No impact from sea level rise. May see a couple feet of inundation in the front entrance of the dredge pit during a CAT1 event. Dredge Pit itself is not impacted. | Increasing high tides will cause erosion along the Henry Hudson Trail and the edges of the dredge pit. A major storm event will also contribute to erosion and possible release of dredge spoils into the harbor. | Low | Moderate | Erosion to the dredge pit due to high tide and major storm events will cause dredge spoils to release onto the Henry Hudson Trail, which can cause closures and trail maintenance. Dredge spoils can also release back into the harbor, filling the harbor back in creating problems to navigation channels and possibly containments into the coastal ecosystem. | Moderate | High |
| Drinking Water Treatment Facility & Recycling Center | Critical Facilities & Infrastructure Systems | Public Works | A municipally owned drinking water treatment facility for the borough. The facility draws and treats water from four wells, two on site, pulling water from the Englishtown Aquifer. Location includes a recycling drop off area. | NA | 0-3 | No impact from sea level rise. May see a couple feet of inundation during a CAT1 event. | The control systems and sludge tanks for the facility are elevated above base flood elevation. The water filters might be flooded and would need to be cleaned. A major storm event around the facility may limit access and facility operators may have trouble reaching the facility to ensure facility remains operational and water filters cleaned. | NA | Moderate | If facility operators cannot access the facility, the water filters would remain unclean and clogged, which would cut off the borough's access to clean drinking water for extended period of time. | NA | High |
| Fire House & OEM | Critical Facilities & Infrastructure Systems | Emergency Services | The building is located immediately behind the borough hall and contains the main fire station, a first aid squad, and the emergency operations center. | NA | NA | No impacts from sea level rise. No impacts from CAT1 event. | | | | | | |
| Firemans Field Building | Community Assets & Amenities | Community Use Building | A community rental hall. Used as polling for Districts 2 and 3 during elections. | NA | 0-0.5 | No impacts from sea level rise. May see minimal inundation on edges of parking lot during a CAT1 event. | The building contains some tractors and small equipment at the east end of the building, however, the building is unlikely to experience any inundation. Only small portions of the parking lot show as being potentially inundated. | NA | Insignificant | Little to no damage. | NA | Insignificant |
| Firemans Memorial Field | Natural Resources & Ecosystems | Active Recreation | Firemans Memorial Field is an active recreation park used for community-wide organized sports. | NA | 1.5-4 | No impact from sea level rise. May see several feet of inundation during a CAT1 event. | The field may be damaged from salt water intrusion during a storm event. Some of the structures on the field might be damaged or destroyed. | NA | Low | The field may need reseeding, and structures may require repair and/or replacement. | NA | Low |
| First Presbyterian Church | Community Assets & Amenities | Church | | NA | NA | No impacts from sea level rise. No impacts from CAT1 event. | | | | | | |
| Harbor View Neighborhood | Districts, Neighborhoods, & Population Clusters | Residential Neighborhood | A residential neighborhood located along Harbor View Drive and Sandy Hook Bay. The neighborhood consists of approximately 13 single-family homes and each property is bulk-headed along the bay. | 0-3 | 0-5 | May see minimal inundation during high tide in front of residential bulkheads due to sea level rise. May see several feet of inundation in front of residential bulkheads during a CAT1 event. | Privately and publicly-owned bulkheads protect the residential neighborhood. Bulkheads were recently damaged in Sandy and have since been rebuilt to a higher standard. The bulkheads may experience damage during a major storm event, however damage would be limited to homes in the neighborhoods. | Insignificant | Low | Major storm event impacts may require repairs to bulkheads, which may cost home owners several thousand dollars. | Insignificant | Low |
| Henry Hudson Spring | Natural Resources & Ecosystems | Historic Landmark | A natural spring located along the Henry Hudson Trail, believed to be the location of where Henry Hudson first gathered freshwater on the Atlantic Coast. | NA | NA | No impacts from sea level rise. No impacts from CAT1 event. | | | | | | |

| Asset Name | Asset Category | Asset Description | Asset Function | 2050 Depth Projections (feet) | | Exposure | Sensitivity | 2050 Vulnerability Rating | | Consequences | 2050 Consequences Rating | |
|--|---|--------------------------|---|-------------------------------|----------------|--|---|---------------------------|----------------|---|--------------------------|----------------|
| | | | | Sea Level Rise | CAT1 Hurricane | | | Sea Level Rise | CAT1 Hurricane | | Sea Level Rise | CAT1 Hurricane |
| Henry Hudson Trail | Natural Resources & Ecosystems | Active Recreation | The Henry Hudson Trail is a 10 foot wide former rail track converted to recreation trails that runs 24 miles in length with a mixture of paved and primitive areas. Through Atlantic Highlands 1.2 miles of trail run along Sandy Hook Bay and the Municipal Harbor. The trail is an important social, historic, and recreational asset in the community. The trail is used daily by residents and was one of the first assets cleared and repaired only days after Sandy, after an outcry for its reopening by residents. | 0-0.5 | 4-8 | May see inundation during high tide in small locations along the trail due to sea level rise. May see major inundation along the entire length of the trail. | The Henry Hudson Trail sits below major hills with steep slopes, during major storm events the slopes are susceptible to shallow landslides and slump blocking. Landslides can cover large sections of the trail with dirt, vegetation, and debris. Inundation from a storm event can erode the primitive trail in several locations, destabilize the soils underneath the trail and destroy wood bridge structures. | Low | High | Damage and debris on the trail will close the trail for extended period of time, after Sandy it took 10 months to clear. Clean up and restoration of the trail can cost the county and borough over a million dollars. The trail is used for daily work commutes and active and passive recreation which would cease for a period. Even after a majority of debris is removed the trail may remain unsafe for a time, and users of the trail may experience frequent injuries with its use. Closure of the trail will result in tremendous political pressure for the county and borough, as the trail is considered one of the most important community assets in the entire town. Political pressure is so great, after Sandy more resources were focused on trail and reopening and away from other necessary recovery operations. | Low | High |
| Jaspan Brothers Hardware | Community Assets & Amenities | Business | Family-owned and operated hardware store. Storage of Propone area. | NA | NA | No impacts from sea level rise. No impacts from CAT1 event. | Old storage underground tanks, could see loss of tanks and storage. | | | It's a major financial business owner. Only local propane filling station. | | |
| Leonard Avenue Neighborhood | Districts, Neighborhoods, & Population Clusters | Residential Neighborhood | A residential neighborhood located along the Southeast end of Leonard Avenue. The neighborhood consists of approximately a dozen homes. A municipal water well, one of four, is located in the neighborhood. The area is known for flooding and a few properties have been bought out by the borough and county. | NA | 0-2.5 | No impact from sea level rise. May see a couple feet of inundation during a CAT1 event. | A few homes may see up to 1 foot of inundation, which would have minimal impacts on the homes. Inundation would likely not go into homes limiting damage to the outside of homes themselves and garages. | NA | Low | Inundation would require minor clean-up and repairs by home owners, substantial damage would not be expected. | NA | Low |
| Many Mind Creek | Natural Resources & Ecosystems | Creek & Wetlands | Many Mind Creek is a natural waterway which receives rain water that drains from a large land area of Atlantic Highlands and parts of neighboring Middletown. The creek drains into Sandy Hook Bay at the sandy beach between Avenue A and First Avenue. It is part of the Bayshore Watershed Area, which includes approximately 15 creeks between Highlands and South Amboy. (More info on the Army Corps project needed) | 0-3 | 0-10 | May see a couple feet of inundation during high tide due to sea level rise. May see major inundation during a CAT1 event. | Through the years Many Mind Creek has been allowed to silt in, especially the mouth of the creek at the bay, which has created problems for stormwater drainage and flooding along the creek. During major storm events waters push up through the creek and because of the siltation are not able to drain back to the bay quickly. The inability to drain pushes flood waters further up the creek and creates flooding through the community. | Low | High | The siltation in the creek causes and exacerbates flooding throughout the borough, which otherwise would not occur. The inundation coming from the creek can cause millions of dollars in damages and losses to local residents, businesses, and municipal infrastructure. Loss and damage will create major economic losses and decreasing assessment values for the community. | Low | High |
| Many Mind Creek Culvert | Critical Facilities & Infrastructure Systems | Bridge Culvert | A culvert located under State Highway 36 where Many Mind Creek runs under the state highway. | NA | NA | No impacts from sea level rise. No impacts from CAT1 event. | Although the mapped scenarios do not show inundation, Many Mind Creek is silted in and when the creek becomes inundated the creek is unable to drain quickly and water pushes up the creek. In addition to the silted in creek the culvert creates a bottleneck which causes additional flooding to nearby residential areas. | NA | Moderate | The siltation in the creek and bottleneaking at the culvert causes and exacerbates flooding throughout nearby residential neighborhoods, which otherwise would not occur. The inundation coming from the creek can cause thousands of dollars in damages and losses to local residential neighborhoods. Loss and damage will create economic losses and decreasing assessment values for the community. | NA | Moderate |
| Mount Mitchell | Natural Resources & Ecosystems | Passive Recreation | Mount Mitchell is a tourist attraction and Monmouth County Park with the highest point on Eastern Seaboard. The park also contains a 9/11 Memorial. | NA | NA | No impacts from sea level rise. No impacts from CAT1 event. | | | | | | |
| NJ Natural Gas (NUNG) Treatment Facility & Offices | Critical Facilities & Infrastructure Systems | Utility | The offices and facility are used as part of a coal tar remediation project. The facility is treating contaminated soils from Many Mines Creek. | NA | 0-0.5 | No impact from sea level rise. May see minimal inundation in the parking lot during a CAT1 event. | The parking lot of the facility may be inundated with little to no impacts expected. | NA | Insignificant | None | NA | Insignificant |
| Ocean Boulevard Neighborhood | Districts, Neighborhoods, & Population Clusters | Residential Neighborhood | A residential neighborhood located along Ocean Boulevard on the hills above the Henry Hudson Trail. The neighborhood consists of approximately 20 single-family homes and is considered some of the most valuable residential property in the borough. | NA | 4-8 | No impact from sea level rise. May see major inundation at toe of slope below residential homes during a CAT1 event. | The homes along Ocean Boulevard sit above the Henry Hudson Trail on a hillside with a steep slope. A major storm event can cause erosion at the toe of slope, and contribute to shallow landslides along the coast, which can undermine the stability of the slope, foundations of the homes, infrastructure, and roadways. | NA | Low | If sections of the roadway were lost and undermined, home owners and emergency services would no longer have access or egress to and from homes in the neighborhood. Homes that fall during a shallow landslide can become a debris hazard for Henry Hudson Trail. Substantial damage and/or loss of homes will have a great impact on property values, and would result in major tax losses to borough. | NA | High |
| Popamora Point Park | Natural Resources & Ecosystems | Active Recreation | Popamora Point Park is a Monmouth County Park which contains open park area, wetlands, and beaches. The park is popular with local residents for passive recreation (sunbathing and fishing), active recreation (swimming and kayaking) and dog walking. The park includes picnic areas, restroom facilities, and parking amenities. The park contains a small section of the Henry Hudson Trail before entering Highlands to Southeast. | 0-2 | 0-7 | May see a couple feet of inundation along the beachfront during high tide due to sea level rise. May see major inundation during a CAT1 event. | A major storm event may cause little to no damage to vegetation and structures found within the park, and create minimal debris. The beach at the park experiences accretion. Increasing high tides and major storm events may actually build up the beaches at the park. | Low | Low | Minor clean up of debris and repair of structures may be required. | Insignificant | Low |
| Portland Pointe | Apartment Complex | Senior Residence | | NA | NA | No impacts from sea level rise. No impacts from CAT1 event. | | | | | | |
| Public Works Yard | Critical Facilities & Infrastructure Systems | Public Works | The public works yard includes offices, mechanical repair, equipment, a drinking water well (No. 7), salt storage shed, and street sweeping shed. | NA | 0-3 | No impact from sea level rise. May see a couple feet of inundation during a CAT1 event. | The drinking water well is built above base flood inundation. The main building includes storage of public works equipment and hand tools, worth approximately \$250,000. The storage sheds, salt shed, and street sweeper shed, are elevated; however, salt and sand would be washed out of the storage sheds. | NA | Low | A major storm event in winter would wash out the salt and sand supply for the borough. The loss of the salt and sand would limit the public works department ability to provide basic winter road services for an extended period of time. The loss of major equipment and tools would hinder the departments ability to maintain equipment and provide basic services. | NA | Moderate |
| Sandy Hook Bay Catamaran Club | Community Assets & Amenities | Active Recreation | Gazebo, clubhouse, lined with catamarans in summer. | 0-4 | 3-9 | May see several feet of inundation during high tide due to sea level rise. May see major inundation during a CAT1 event. | The beach located along the property may experience erosion with increasing high tides and major storm events. The catamarans are tied down when not in use, but could break loss during a storm event being damaged and/or becoming dangerous debris. The structures on the property could be experience substantial damage. Beach loss, leased for \$38,000, beach loss could equal loss in ratable, and loss of revenue. Gazebo and building may see damage. | Low | Moderate | The property is leased from the borough and loss of beach through erosion will impact assessed value of the property and the value of leasing the property. Catamarans could cause damage to surrounding properties and other watercraft in the area. Damaged structures would need to be repaired and/or rebuilt. | Low | Moderate |
| Seastreak Ferry Terminal | Critical Facilities & Infrastructure Systems | Transportation Services | Seastreak Ferry is a high speed passenger service that runs a daily commuter service between Atlantic Highlands and New York City. The ferry service is an important evacuation service for evacuating New York City during emergency events. | 0-4 | 2-10 | May see several feet of inundation during high tide due to sea level rise. May see major inundation during a CAT1 event. | Due to sea level rise during high tide may limit access to and from the fixed pier, if infrastructure leading to terminal is not upgraded and elevated. The pier serving the ferry is fixed and thus may be susceptible to damage or even complete destruction during a major storm event. | Low | High | Damage and/or destruction of the pier will result in the inability of the ferry to dock at Atlantic Highlands. An inability to dock will limit and/or stop service between New Jersey and New York. On a daily basis this will have severe consequences for people to be able commute to and from work. During a storm event and immediately after destruction and damage to the pier will limit the ability of New York City to effectively evacuate. | Low | High |
| Sewer Main (Along Henry Hudson Trail) | Critical Facilities & Infrastructure Systems | Sewer Infrastructure | The Monmouth County Bayshore Outfall Authority (MCBOA) serves the Bayshore area of the county and provides collective means of effluent disposal for 13 municipalities carried over 14 miles of pipeline. The effluent is runs to Sandy Hook where it is dispersed into the Atlantic Ocean. The sewer main runs through Atlantic Highlands and along the entire length of the section of the Henry Hudson Trail that runs through the borough. Although the sewer main runs through Atlantic Highlands, the main does not service Atlantic Highlands. | 0-0.5 | 4-8 | May see inundation during high tide in small locations along the trail due to sea level rise. May see major inundation along the entire length of the trail. | The Henry Hudson Trail will experience erosion during high tide and major storm events in the future. Erosion along the trail causes shifting and instable soils, which in turn causes the sewer main to shift creating breaks and leaks in places. The manhole covers found along the trail for access to the sewer main are sealed. | Moderate | Moderate | In the increasing instability of soils and shifting of the sewer main will require increasing maintenance costs and scheduled inspections. Prolonged breaks will cause disruption of services to a large region of the Bayshore which could have major public health and safety issues. | High | High |
| Sewer Transfer Station | Critical Facilities & Infrastructure Systems | Sewer Infrastructure | A municipally-owned and operated sewer transfer station. | NA | 0-2 | No impact from sea level rise. May see a couple feet of inundation during a CAT1 event. | The underground storage tanks are sealed prior to a major storm event. The main control panels and back up generator are raised above base flood elevation. The facility recently received 406 mitigation funding from FEMA for the installation of a door dam, which will help prevent flooding into the facility. Little to no damage is expected in a major storm event. | NA | Low | None | NA | Insignificant |
| South Avenue Park | Natural Resources & Ecosystems | Passive Recreation | A small passive recreation park with a small playground area. | NA | 5-7 | No impact from sea level rise. May see major inundation during a CAT1 event. | A major storm event may cause debris build up in the park from nearby vegetation. The playground equipment may be damaged and/or destroyed. | NA | Low | Minor clean up of debris and repair of structures may be required. | NA | Low |
| St. Paul Baptist Church | Community Assets & Amenities | Church | A Catholic Church. | NA | 0-1 | No impacts from sea level rise. May see minimal inundation in parking lot during a CAT1 event. | May see minimal inundation in the parking lot, which will recede after a storm event. | NA | Insignificant | None | NA | Insignificant |
| U.S. Post Office | Community Assets & Amenities | Civic | Atlantic Highlands branch of the U.S. Post Office. | NA | 0-2.5 | No impacts from sea level rise. May see a couple feet of inundation during a CAT1 event. | Inundation may occur in the back of the building, which is elevated slightly, during a storm event. There may be some damage to mail and parcels located at the back of the building. | NA | Low | Limited damage to mail and parcels, with no damage to the building. No service disruptions expected. | NA | Low |
| Veterans Memorial Park | Natural Resources & Ecosystems | Passive Recreation | A small municipal park located across from the borough hall used for passive recreation. | NA | NA | No impacts from sea level rise. No impacts from CAT1 event. | | | | | | |
| Wagner Creek | Natural Resources & Ecosystems | Creek & Wetlands | Wagner Creek is a natural waterway which receives stormwater that drains from a small land area on the western boundaries of Atlantic Highlands and from a large area of Middletown. The creek drains into Sandy Hook Bay at a sandy beach at the Sandy Hook Bay Catamaran Club. It is part of the Bayshore Watershed Area, which includes approximately 15 creeks between Highlands and South Amboy. | 0-1.5 | 0-9 | May see minimal inundation during high tide due to sea level rise. May see major inundation during a CAT1 event. | Through the years Wagner Creek has been allowed to silt in, especially the mouth of the creek at the bay, which has created problems for stormwater drainage and flooding along the creek. During major storm events waters push up through the creek and because of the siltation are not able to drain back to the bay quickly. The inability to drain pushes flood waters further up the creek and creates flooding through residential neighborhoods located along the creek. | Low | High | The siltation in the creek causes and exacerbates flooding throughout the residential neighborhoods, which otherwise would not occur. The inundation coming from the creek can cause thousands of dollars in damages and losses to residents. Loss and damage will create major economic losses and decreasing assessment values for the community. | Low | High |

Appendix B – Vulnerability Rating Key

| Vulnerability Rating Key | |
|---------------------------------|---|
| Level | Vulnerability Rating Given Hazard Exposure and Sensitivity |
| Insignificant | <p><i>Exposure to Flooding:</i> This community asset is located out of harm’s way.</p> <p><i>Physical/Structural Damage:</i> No physical/structural damages expected.</p> <p><i>Disruption/Impairment:</i> No disruption in function, accessibility, or development and delivery of basic services and supplies. No apparent impacts to services provided by, typical operations, routine or daily life.</p> <p><i>Accessibility:</i> Key staff able to access facilities or locations without interruption.</p> |
| Low | <p><i>Exposure to Flooding:</i> The majority of this community asset is located out of harm’s way.</p> <p><i>Physical/Structural Damage:</i> Minor physical/structural damages expected.</p> <p><i>Disruption/Impairment:</i> Limited disruption in function, accessibility, or development and delivery of basic services and supplies. Limited impacts to typical operations, routine or daily life, if any.</p> <p><i>Accessibility:</i> Key staff able to access facilities or locations with minimal interruption.</p> |
| Moderate | <p><i>Exposure to Flooding:</i> A significant portion of this community asset is located in harm’s way.</p> <p><i>Physical/Structural Damage:</i> Moderate physical/structural damages sustained.</p> <p><i>Disruption/Impairment:</i> Moderate level of disruption to accessibility or mobility of asset, amenity or population. Moderate level of interruptions to development and delivery of basic services and supplies. Typical operations, routine or daily life moderately affected by flood hazard scenario.</p> <p><i>Accessibility:</i> Secondary evacuation and access routes available for use if/when primary systems fail.</p> |
| High | <p><i>Exposure to Flooding:</i> The majority of this community asset is located in harm’s way.</p> <p><i>Physical/Structural Damage:</i> Severe level of harm (destruction on property or degradation of function and/or injury) is expected, resulting in a high degree of loss. Asset, amenity or population is unable to withstand flood impacts.</p> <p><i>Disruption/Impairment:</i> Severe, potentially irreparable challenges faced requiring significant changes to asset functioning, community’s daily life or "new normal." Production, provision of services or daily routine expected to sustain high degree of disruption. Significantly reduced operational capacity of community assets and amenities; long term or permanent relocation of asset, amenity or population.</p> <p><i>Accessibility:</i> Severe disruptions to accessibility of asset, amenity or population or the disruption of this assets causes accessibility issues to other community assets. Key individuals, material supplies, core operating systems and functioning interrupted or unavailable.</p> |

Appendix C – Consequences Rating Key

| Consequences Rating Key | |
|-------------------------|--|
| Level | Given Vulnerability of Assets, Rate the Magnitude or Severity of Consequences |
| 1 | Insignificant |
| | <p><i>Property Damages:</i> Only minor property damage.</p> <p><i>Typical Operations/Daily Life:</i> No impacts or disruptions to typical operations, routine or daily life.</p> <p><i>Environment:</i> No lasting environmental degradation.</p> <p><i>Emergency Response:</i> No adverse effects to emergency response.</p> <p><i>Hazardous Materials:</i> No increase or change in community/ecosystem exposure to toxics or hazardous materials.</p> <p><i>Municipal Budget:</i> Negligible operational costs.</p> |
| 2 | Minor |
| | <p><i>Property Damages:</i> Limited property in narrow affected area damaged or destroyed.</p> <p><i>Typical Operations/Daily Life:</i> Limited disruption to typical operations, routine or daily life.</p> <p><i>Environment:</i> Minor damage or loss to habitat and species or functioning of the systems as a component of “coastal green infrastructure” of the community. Small loss of natural resource base. Increased, but tolerable stress on ecosystem.</p> <p><i>Emergency Response:</i> Slight decrease in emergency response times and effectiveness</p> <p><i>Hazardous Materials:</i> Limited hazardous materials spill, manageable clean-up and remediation.</p> <p><i>Municipal Budget:</i> Additional but tolerable operational costs.</p> |
| 3 | Moderate |
| | <p><i>Property Damages:</i> Substantial property in affected area damaged or destroyed.</p> <p><i>Population Displacement:</i> Long-term population displacement over a broader segment of the population.</p> <p><i>Typical Operations/Daily Life:</i> Daily life is affected such that only redundant systems can be used for an extended duration.</p> <p><i>Environment:</i> Major damage or loss of habitat or functioning of the systems as a component of “coastal green infrastructure” of the community that may be permanent with adverse impacts.</p> <p><i>Emergency Response:</i> Emergency response is strained resulting in significant degradation of response effectiveness and times.</p> <p><i>Hazardous Materials:</i> Large hazardous material spill with significant risk to humans and ecosystems.</p> <p><i>Municipal Budget:</i> High operational costs straining local budgets</p> |
| 4 | High |
| | <p><i>Property Damages:</i> Majority of property in affected area damaged or destroyed</p> <p><i>Population Displacement:</i> Permanent and widespread population displacement.</p> <p><i>Delivery of Services:</i> Long-term interruption of supply and services.</p> <p><i>Typical Operations/Daily Life:</i> Majority of community operations, daily life patterns intensely impacted for an extended period.</p> <p><i>Environment:</i> Permanent degradation of habitat or functioning of the systems as a component of “coastal green infrastructure” of the community.</p> <p><i>Emergency Response:</i> Need for emergency services exceeds full capacity and/or services are degraded and not functioning.</p> <p><i>Hazardous Materials:</i> Hazardous material spill that requires multi-year clean-up and poses significant health or ecosystem risk.</p> |

Appendix D – Municipal CVA Committee

Municipal CVA Committee

Atlantic Highlands convened a diverse group of municipal representatives and community leaders to participate in the CVA process facilitated by Sustainable Jersey. The meetings were held on March 23rd and April 22nd, 2016 at the Atlantic Highlands Borough Hall. The meeting attendees are shown below.

| Appendix E. Atlantic Highlands CVA Participants. | | |
|--|----------------------------------|---|
| Participant | Title | Affiliation |
| Rhonda Le Grice | Mayor | Borough of Atlantic Highlands |
| Adam Hubeny | Business Administrator | Borough of Atlantic Highlands |
| John Amici | Manager | Atlantic Highlands Municipal Harbor |
| James Krauss | Chair | Atlantic Highlands Environmental Commission |
| Michael Curry | Commission Member | Atlantic Highlands Environmental Commission |
| Ken Thoman, PWS | Parks Resource Manager | Monmouth County Park System |
| Jack Heide, AICP | Resiliency Manager | Sustainable Jersey |
| Emma Melvin | Green Infrastructure Coordinator | Sustainable Jersey |

Appendix E – Atlantic Highlands Coastal Vulnerability Assessment Maps

Table of Maps

Map 1. Borough of Atlantic Highlands Community Assets

Map 2. Borough of Atlantic Highlands (West) Community Assets

Map 3. Borough of Atlantic Highlands (East) Community Assets

Map 4. Borough of Atlantic Highlands 2050 Sea Level Rise

Map 5. Borough of Atlantic Highlands (West) 2050 Sea Level Rise

Map 6. Borough of Atlantic Highlands (East) 2050 Sea Level Rise

Map 7. Borough of Atlantic Highlands 2050 CAT1 Hurricane

Map 8. Borough of Atlantic Highlands (West) 2050 CAT1 Hurricane

Map 9. Borough of Atlantic Highlands (East) 2050 CAT1 Hurricane

Atlantic Highlands Coastal Vulnerability Assessment

Community Assets

Asset Categories

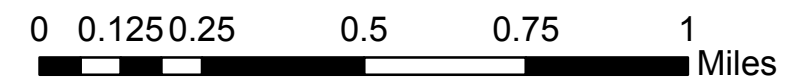
- Community Resources & Amenities
- Critical Facilities & Infrastructure Systems
- Natural Resources & Ecosystems

Community Assets

- 1, Atlantic Highlands Elementary School
- 2, Atlantic Highlands Municipal Harbor
- 3, Atlantic Highlands United Methodist Church
- 4, Avenue A Beach
- 5, Avenue D Bulkhead
- 6, Bayshore Family Success Center
- 7, Bayshore Plaza
- 8, Blackfoot Mobile Marine Services
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- 12, Detention Pond
- 13, Dredge Pit
- 14, Fire House & OEM
- 15, Firemans Field Building
- 16, Firemans Memorial Field
- 17, First Presbyterian Church
- 18, Fishing Pier
- 19, Harbor Park
- 20, Henry Hudson Springs
- 21, Jaspan Brothers Hardware
- 22, Many Mines Culvert
- 23, Mount Mitchell
- 24, NJ Natural Gas Offices
- 25, On the Deck & Sissy's at the Harbor
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- 31, Senior Center
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- 33, Shore Casino
- 34, St. Paul Baptist Church
- 35, U.S. Post Office
- 36, Veterans Memorial Park

District Assets

- 38, Bayside Neighborhood
- 39, Bayview Neighborhood
- 40, Bowne Avenue Neighborhood
- 41, Central Business District
- 42, Commercial & Industrial District
- 43, Harbor View Neighborhood
- 44, Henry Hudson Trail
- 45, Leonard Avenue Neighborhood
- 46, Ocean Blvd Neighborhood



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 August 2016



Atlantic Highlands (West) Coastal Vulnerability Assessment Community Assets

Asset Categories

- Community Resources & Amenities
- Critical Facilities & Infrastructure Systems
- Natural Resources & Ecosystems

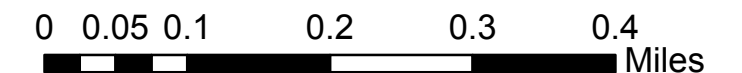
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Atlantic Highlands (East) Coastal Vulnerability Assessment Community Assets

Asset Categories

■ Natural Resources & Ecosystems

Community Assets

■ 20, Henry Hudson Springs

■ 23, Mount Mitchell

■ 26, Popamora Point Park

District Assets

— 38, Bayside Neighborhood

— 44, Henry Hudson Trail

— 46, Ocean Blvd Neighborhood



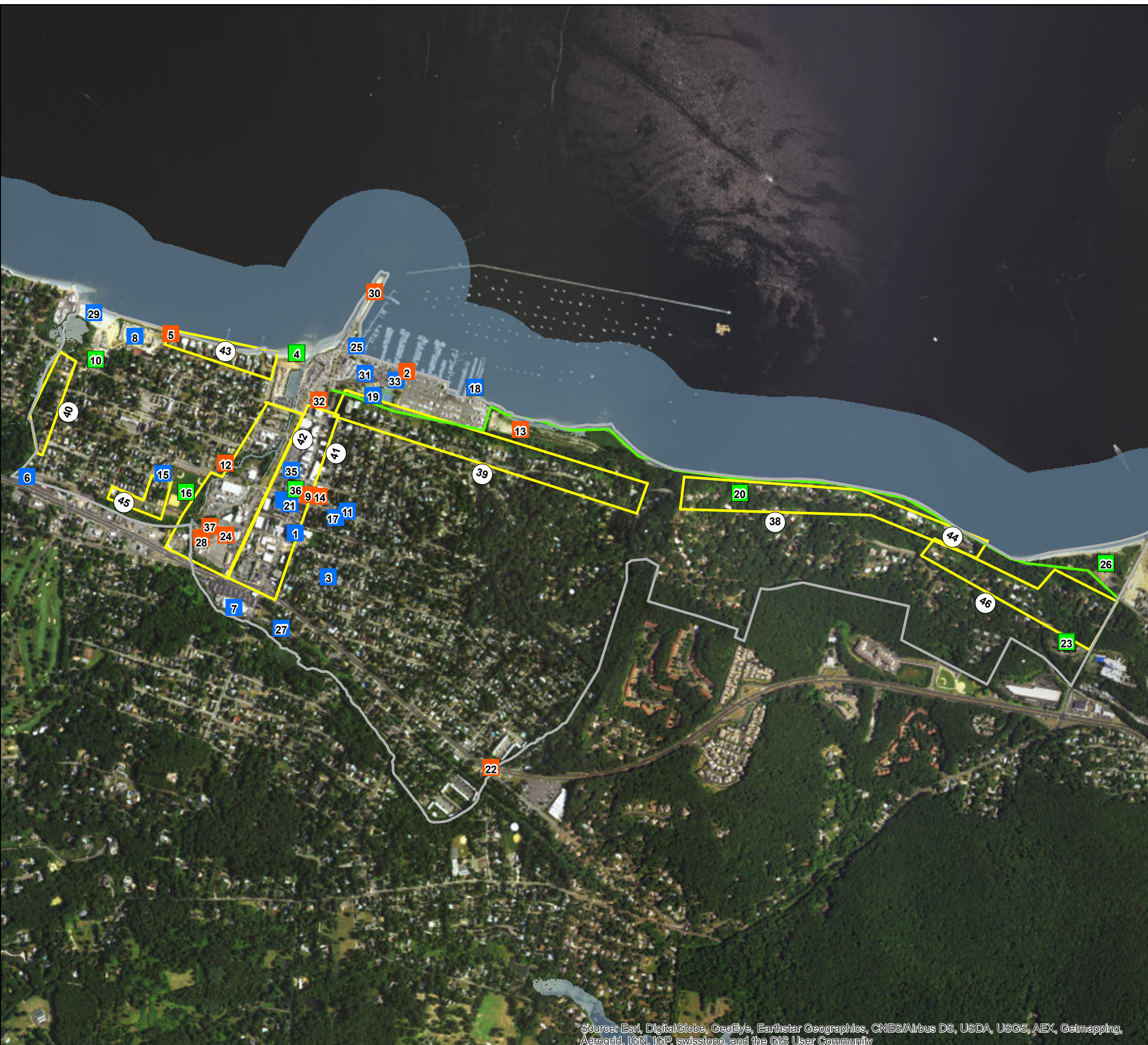
0 0.05 0.1 0.2 0.3 0.4 Miles

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Atlantic Highlands Coastal Vulnerability Assessment

2050 Sea Level Rise



Asset Categories

- Community Resources & Amenities
- Critical Facilities & Infrastructure Systems
- Natural Resources & Ecosystems

Community Assets

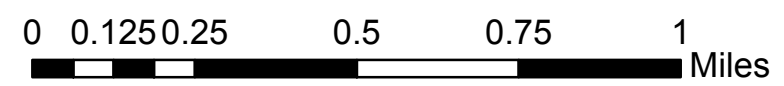
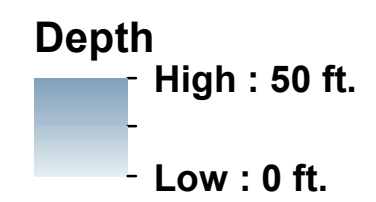
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2050 Sea Level Rise



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Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Atlantic Highlands (West) Coastal Vulnerability Assessment 2050 Sea Level Rise

Asset Categories

- Community Resources & Amenities
- Critical Facilities & Infrastructure Systems
- Natural Resources & Ecosystems

Community Assets

- 1, Atlantic Highlands Elementary School
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- 19, Harbor Park

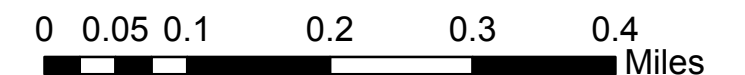
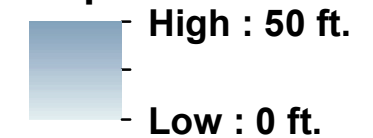
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2050 Sea Level Rise

Depth



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Atlantic Highlands (East) Coastal Vulnerability Assessment 2050 Sea Level Rise

Asset Categories

■ Natural Resources & Ecosystems

Community Assets

■ 20, Henry Hudson Springs

■ 23, Mount Mitchell

■ 26, Popamora Point Park

District Assets

— 38, Bayside Neighborhood

— 44, Henry Hudson Trail

— 46, Ocean Blvd Neighborhood

2050 Sea Level Rise

Depth

■ High : 50 ft.

■ Low : 0 ft.



0 0.05 0.1 0.2 0.3 0.4 Miles

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Atlantic Highlands Coastal Vulnerability Assessment

2050 CAT1 Hurricane

Asset Categories

- Community Resources & Amenities
- Critical Facilities & Infrastructure Systems
- Natural Resources & Ecosystems

Community Assets

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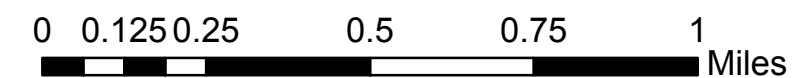
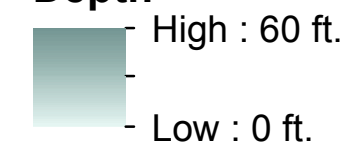
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2050 CAT1 Hurricane

Depth



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Atlantic Highlands (West) Coastal Vulnerability Assessment 2050 CAT1 Hurricane

Asset Categories

- Community Resources & Amenities
- Critical Facilities & Infrastructure Systems
- Natural Resources & Ecosystems

Community Assets

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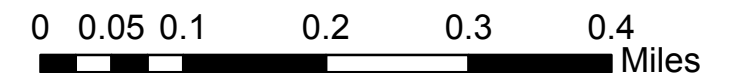
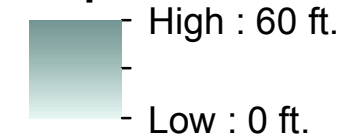
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2050 CAT1 Hurricane

Depth



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Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Atlantic Highlands (East) Coastal Vulnerability Assessment 2050 CAT1 Hurricane

Asset Categories

■ Natural Resources & Ecosystems

Community Assets

■ 20, Henry Hudson Springs

■ 23, Mount Mitchell

■ 26, Popamora Point Park

District Assets

— 38, Bayside Neighborhood

— 44, Henry Hudson Trail

— 46, Ocean Blvd Neighborhood

2050 CAT1 Hurricane

Depth

■ High : 60 ft.

■ Low : 0 ft.



0 0.05 0.1 0.2 0.3 0.4 Miles

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