BUILDING ECOLOGICAL SOLUTIONS TO COASTAL COMMUNITY HAZARDS (BESCCH)

Township of Middle

Municipal Coastal Vulnerability Assessment

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for the Township of Middle
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Township of Middle 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 long-term decisions about 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

Middle Township is the 8th largest community (land coverage) in New Jersey located on the Cape May Peninsula in Cape May County. The township encompasses more than 80 square miles of land and is also the county seat for Cape May County. Middle is composed of many smaller historic, unincorporated communities including: Whitesboro, Burleigh, Del Haven, Dias Creek, Goshen, Goshen Landing, Green Creek, Holly Beach, Mayville, Norburys Landing, Nummytown, Pierces, Pierces Point, Reeds Beach, Shellbed Landing, Swain Point, Swainton, Wildwood Gardens and Wildwood Junction. Middle has a year-round population of 18,911 residents according to the 2010 census, with a considerably higher seasonal population that surpasses 60,000 during the summer months. The township has close to 10,000 housing units and over 4,000 campground sites.

Future Flooding

Middle 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 Cape May tide gauge station in Cape May, NJ. 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)/

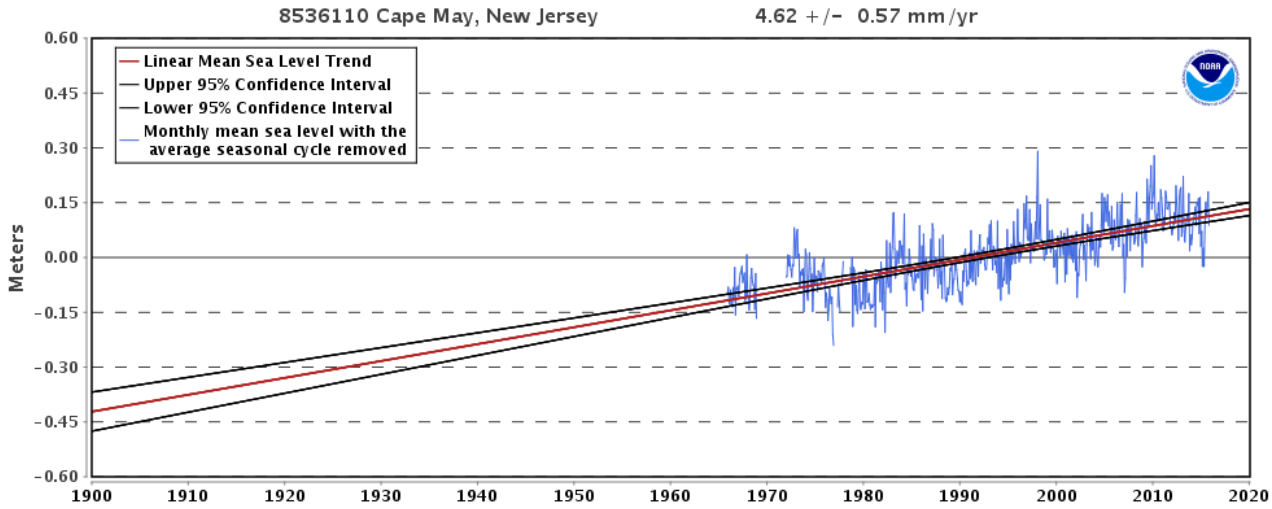


Figure 1. Mean Sea Level Trend at Cape May, NJ (NOAA, 2015)

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 asset[1]:

- Durability of the structure or asset (materials, elevated structure, flood mitigation measures, etc.)

[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.

- 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 and Consequences of Community Assets

Middle originally identified 92 assets to be included in the coastal vulnerability assessment, but only those assets shown to be impacted by sea level rise and/or a Category 1 Hurricane in 2050 (a total of 41 assets) were ultimately included. The assets were identified under four broad categories of potential community assets: Critical Facilities & Infrastructure Systems, Community Resources & Amenities, Natural Assets & 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, several of Middle's neighborhoods (Avalon Manor, Stone Harbor Manor, Grassy Sound, Del Haven, Pierces Point, and Reeds Beach) were assessed as single assets. The homes throughout the neighborhoods are impacted by many of the same issues including ingress and egress, life safety, and nuisance flooding.

The flood hazards scenarios used for this assessment were projected sea level rise and hurricane category 1 storm surge for 2050. The sea level rise projections are based upon a 2013 study by New Jersey climate scientists,[2] and used the 2050 mid-range projections in that study, or 1.3 feet of sea level rise. The sea level rise projections were then layered on top of the mean higher high water (MHHW). The storm surge maps were developed using the NOAA 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] Both the 2050 sea level rise and 2050 storm surge maps were obtained from the NJ Department of Environmental Protection (NJDEP).

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 Table 1 below. Since sea level rise is more likely to occur than a Category 1 hurricane, the township 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 most readily available data, both of which will continue to be updated as new data is

[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.

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 recommendations are offered in Section V.

Table 1. Middle Township Coastal Vulnerability Assessment Matrix

Asset Name	Asset Category	Asset Function	2050 Vulnerability Rating		2050 Consequences Rating	
			Sea Level Rise	CAT1 Hurricane	Sea Level Rise	CAT1 Hurricane
Avalon Boulevard (County 601)	Critical Facilities & Infrastructure Systems	The route is a state designated evacuation route. The boulevard also serves as the only access way for Avalon Manor.	NA	Moderate	NA	High
Avalon Golf Club	Natural Resources & Ecosystems	A private eighteen hole golf club.	Low	Moderate	NA	Low
Avalon Manor	Districts, Neighborhoods, & Population Clusters	A residential neighborhood consists of single family homes and the Avalon Marine Center.	Low	Moderate	Low	High
Back Bay Wetlands Complex	Natural Resources & Ecosystems	The salt marshes serve as wildlife habitat, storm protection and aesthetic backdrop for the seaside community.	High	High	High	Low
Bay Shore Road (County 603)	Critical Facilities & Infrastructure Systems	State designated evacuation route and serves as a major access corridor for the Del Haven Neighborhood of Middle and Lower Township.	NA	Moderate	NA	High
Big Timber Lake Resort	Districts, Neighborhoods, & Population Clusters	A large recreational campground open from mid-May to mid-September.	NA	Low	NA	Insignificant
Briarwood Trailer Park	Districts, Neighborhoods, & Population Clusters	A low to moderate income trailer park with approximately 75 single-wide trailers. The trailer park is mostly an elderly population.	NA	Insignificant	NA	Insignificant
Cape May County Cemetery	Community Resources & Amenities	A Cape May County veterans cemetery.	NA	NA	NA	NA
Cape May County Park & Zoo	Natural Resources & Ecosystems	A 200 acre park and zoo with many passive and active recreational facilities.	NA	Low	NA	Insignificant

Asset Name	Asset Category	Asset Function	2050 Vulnerability Rating		2050 Consequences Rating	
			Sea Level Rise	CAT1 Hurricane	Sea Level Rise	CAT1 Hurricane
Cape May County Park South/Fishing Creek Wildlife Preserve	Natural Resources & Ecosystems	Largest of the county's three parks, consisting of more than 1,700 acres. Includes active and passive recreation.	Insignificant	Low	Insignificant	Low
Cape May County Police Academy	Community Resources & Amenities	A regional training facility used to train police officers, fire fighters, emergency medical personnel, and other public safety officials.	NA	High	NA	Low
Cape May County Public Works Complex	Critical Facilities & Infrastructure Systems	County MUA facility that processes the sewage from Seven Mile Island. The facility also includes a large compost pile which is sold locally for fertilizer.	NA	Insignificant	NA	Insignificant
Cape May County Special Services	Community Resources & Amenities	A county social services and school for developmentally disabled individuals living in Cape May County.	NA	Insignificant	NA	Insignificant
Cape May County Technical High School	Community Resources & Amenities	A regional technical high school that serves the greater Cape May County region and municipalities.	NA	Insignificant	NA	Insignificant
Cedars Springs Mobile Home Park	Districts, Neighborhoods, & Population Clusters	A low income trailer park with 30+ single wide trailers.	NA	High	NA	High
City of Wildwood Pumping Station	Critical Facilities & Infrastructure Systems	The pumping station supplies ground water (drinking and safety) to the City of Wildwood and to the Rio Grande service area of Middle. The water supplies hydrants and fire suppression systems to the businesses within Rio Grande along the Route 47 corridor.	NA	High	NA	High
Del Haven	Districts, Neighborhoods, & Population Clusters	Year-round, single family homes, county park, a public access point (Norbury's Landing), a few local businesses, and some municipal stormwater infrastructure. The wetlands and beach are of high ecological value.	Moderate	High	High	High

Asset Name	Asset Category	Asset Function	2050 Vulnerability Rating		2050 Consequences Rating	
			Sea Level Rise	CAT1 Hurricane	Sea Level Rise	CAT1 Hurricane
Delaware Bay Beaches	Natural Resources & Ecosystems	The beaches provide active and passive recreation for local residents, as well as mitigation from storm surge and flooding events.	High	High	High	High
Delaware Bay Wetlands Complex	Natural Resources & Ecosystems	The salt marshes serve as wildlife habitat, storm protection and aesthetic backdrop for the seaside community.	High	High	High	Low
Garden Lake	Districts, Neighborhoods, & Population Clusters	Trailer park with 100+ trailers. Residents are mostly elderly, with a 1/3 being seasonal and 2/3 being year round residents.	NA	High	NA	Moderate
Garden State Parkway	Critical Facilities & Infrastructure Systems	State designated evacuation route. Major point of ingress and egress for Middle Township and all the barrier islands located offshore of the mainland in the Cape May Peninsula.	NA	Moderate	NA	Moderate
Grassy Sound	Districts, Neighborhoods, & Population Clusters	Neighborhood of about 65 seasonal homes and marina located over the wetlands; most of the homes are accessed via primitive roads and boardwalks.	Moderate	High	Low	Moderate
Hideaway Beach	Districts, Neighborhoods, & Population Clusters	300+ camp sites used by small recreational mobile trailers. Seasonal.	NA	High	NA	Low
Indian Trail Road (State 147)	Critical Facilities & Infrastructure Systems	The route is a state designated evacuation route.	NA	Moderate	NA	High
Laguna Oaks Golf Course	Natural Resources & Ecosystems	A private ten hole golf course.	NA	Moderate	NA	Low
N. Wildwood Boulevard (State 147)	Critical Facilities & Infrastructure Systems	The boulevard serves as the only access way for the Grassy Sound Neighborhood. The route is a state designated evacuation route.	NA	Moderate	NA	High
New Jersey National Guard Armory	Critical Facilities & Infrastructure Systems	A New Jersey National Guard Armory used for storage of military equipment and training of military personnel.	NA	Insignificant	NA	Insignificant

Asset Name	Asset Category	Asset Function	2050 Vulnerability Rating		2050 Consequences Rating	
			Sea Level Rise	CAT1 Hurricane	Sea Level Rise	CAT1 Hurricane
NJ State Route 47	Critical Facilities & Infrastructure Systems	State designated evacuation route.	NA	Moderate	NA	High
Norburys Landing	Natural Resources & Ecosystems	A public access point leading out to the Delaware Bay Shore.	Low	Moderate	Low	Moderate
Old Stage Coach Resort	Districts, Neighborhoods, & Population Clusters	100+ camp sites used by small recreational mobile trailers. Seasonal.	Moderate	High	Moderate	Moderate
Pierces Point	Districts, Neighborhoods, & Population Clusters	Residential neighborhood of 50+ single-family homes.	Low	High	Low	High
Reeds Beach	Districts, Neighborhoods, & Population Clusters	A residential neighborhood of 75+ homes.	Low	High	Low	High
Rio Grande Rescue Squad	Critical Facilities & Infrastructure Systems	A dispatch center for Middle Township emergency medical services.	NA	Low	NA	Insignificant
Rutgers Cape Shore Laboratory/ Haskin Shellfish Research Laboratory (HSRL)	Community Resources & Amenities	Research lab on all aspects of fisheries and aquaculture science, concentrating on species of commercial importance to New Jersey.	NA	Low	NA	Low
S. Wildwood Boulevard (State 47)	Critical Facilities & Infrastructure Systems	A state designated evacuation route.	NA	Moderate	NA	High
Stone Harbor Boulevard (County 657)	Critical Facilities & Infrastructure Systems	Connects Seven Mile Island and the Borough of Stone Harbor to the mainland and Middle Township. The boulevard also serves as the only access way for Stone Harbor Manor. State designated evacuation route.	NA	Moderate	NA	High

Asset Name	Asset Category	Asset Function	2050 Vulnerability Rating		2050 Consequences Rating	
			Sea Level Rise	CAT1 Hurricane	Sea Level Rise	CAT1 Hurricane
Stone Harbor Manor	Districts, Neighborhoods, & Population Clusters	Residential neighborhood, The Wetlands Institute, two marinas (Stone Harbor Marina and Camp Marine Services), and Pat's Lunch (a small, local restaurant).	Low	Moderate	Low	High
The Wetlands Institute	Community Resources & Amenities	Non-profit organization promotes research and stewards of coastal ecosystems.	Low	High	Insignificant	Moderate
Wildwood Golf & Country Club	Natural Resources & Ecosystems	A private nine-hole golf course.	Low	Moderate	Low	Low

V. Recommendations

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

Considerations

1. Coordinate community outreach and education on flood risks

In order for Middle 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 township should also consider special outreach to residents and property owners in the most vulnerable areas of Middle, educating them about future flood risks and working together to find solutions that will protect Middle at large and keep the fabric of the neighborhoods intact.

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 Middle'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. Middle 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 provide strategies to reduce many of these risks, but in the past the plans have typically been stand-alone documents, and sometimes with little or no cross reference to other municipal plans and policies. Ideally, hazard mitigation planning should be incorporated into all aspects of community planning. Integrating flood risks and hazard mitigation into 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 wetland education and outreach campaign on the importance of Middle's vast wetland complexes. Wetlands serve an important role in flood hazard mitigation. These systems dampen wave height and energy, decreasing the destructive power of a storm surge entering the township. Community education and outreach will raise awareness of the benefits these systems provide to the community both daily and during a storm event. An education and outreach campaign could include brochures for the boating community or citizen scientist wetland assessment program with a local non-profit. In addition, the municipality may benefit from a more in-depth assessment of the community wetland health, consider consulting with wetland ecologist from academia or the non-profit community.

Resources

- Paddle for the Edge, Barnegat Bay Partnership http://bbp.ocean.edu/pages/380.asp
- Wetlands- Frequently asked questions, municipality of Anchorage http://www.muni.org/Departments/OCPD/Planning/Physical/EnvPlanning/Pages/WetlandFAQs.aspx

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

Living shorelines are a shoreline stabilization practice that address erosion 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 flora and fauna habitat, flood mitigation, 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. Investigate areas within the Back Bay with natural shorelines currently experiencing erosion or infrastructure conflicts to install a living shoreline. Public lands including the Delaware Bay Shore would be an ideal location for a community demonstration project. The Coastal Restoration Explorer Mapping tool (link below) provides a high level screening for the type of living shorelines that may be appropriate for certain sections of the coastline.

Resources

- The Nature Conservancy. Coastal Restoration Explorer Mapping tool

7. Consider revising the municipal stormwater management and sewer plans to reflect the results of the CVA

The municipal stormwater management plan provides strategies for addressing current and future stormwater-related impacts that result from land use development, and strives to minimize flooding and protect community's water quantity & quality, groundwater recharge and aquatic habitats. Stormwater management strategies include recommended performance and design standards that are incorporated into ordinances, as well as management and maintenance requirements. Increases in the variability of weather patterns and the frequency of extreme weather events occurring in New Jersey are putting stress on municipal stormwater infrastructure systems. Middle's stormwater infrastructure, including culverts, retention and detention ponds, inlets, catch basins, and stormwater pipes are all vulnerable to increases in flow of which they were not designed to handle. The township should consider updating the municipal stormwater management plan to include the potential impacts of climate change and promote design and infrastructure projects that are more resilient. In addition the township may want to review its stormwater management policies and maintenance plans for municipally-owned facilities to assess for potential climate change impacts and whether changes are desirable to make these systems more resilient.

Resources

- The Township of Ottawa Wet Weather Infrastructure Management Plan
- The Township of Ottawa. Adaptive Approaches in Stormwater Management

Adaptation: A Long-Term Planning Process[4]

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 in projects that may be compromised by flooding in the near to distant future. This vulnerability assessment is an important first

[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.

step in planning for future flood 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. In addition to those recommendations is a suggested approach below for identifying, assessing, and implementing long-term solutions to reducing flood risks. The process will need to be repeated periodically to respond to new data, and changes in the physical environment and long-term horizon.

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

The township 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 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 should be implemented, if not all, 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 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 township 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 should be reviewed by 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 inevitably 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. Finally, 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. Middle Township Coastal Vulnerability Matrix

Asset Name	Asset Category	Asset Description	Asset Function	2050 Depth Projections		Exposure	Sensitivity	2050 Vulnerability		Consequences	2050 Consequences	
				Sea Level Rise	CAT1 Hurricane			Sea Level Rise	CAT1 Hurricane		Sea Level Rise	CAT1 Hurricane
Avalon Boulevard (County 601)	Critical Facilities & Infrastructure Systems	Major Access Corridor & State Designated Evacuation Route	A county roadway which connects Seven Mile Island and the Borough of Avalon to the mainland and Middle Township. The boulevard also serves as the only access way for Avalon Manor. The route is a state designated evacuation route.	NA	0-4	Not impacted by sea level rise. May see several feet of inundation during a CAT1 event.	During a major storm event the roadway may be inundated, making the roadway impassable. The roadway itself will suffer little to no damage.	NA	Moderate	During a major storm event if the roadway is impassable residents, visitors, and emergency personnel will not be able to move in or out of areas of Middle Township or the barrier island communities along east side of Middle. People may be stuck in place, may or may not be in harm's way, and emergency personnel will not be able to provide any services or rescue.	NA	High
Avalon Golf Club	Natural Resources & Ecosystems	Golf Course	A private eighteen hole golf club.	0-2	0-10	May see minor inundation in drainage areas during high tide due to sea level rise. May see major inundation during a CAT1 event.	A major storm event can substantially damage landscaping and golf features. Parts of the golf course may be inundated during high tide which might permanantly destroy or render unusable sections of the golf course features and landscaping.	Low	Moderate	The golf course could require extensive (and very expensive) renovation to landscaping and features at the expense of the owners. The golf course may be temporarily closed for renovation. If areas are unusable due to high tide inundation the course may need to undergo some redesign or install mitigation features.	NA	Low
Avalon Manor	Districts, Neighborhoods, & Population Clusters	Residential Neighborhood	A residential neighborhood located along Avalon and Old Avalon Boulevards, in the Back Bay, between the mainland of Middle and Avalon on Seven Mile Island. . The area also includes one marina, Avalon Marine Center.	0-3	2-9	May see several feet of inundation during high tide due to sea level rise. May see major inundation during a CAT1 event.	Over half of the single family residences are elevated above base flood elevation. A majority of the properties are also bulk-headed, however the bulkheads are of varying heights. Un-elevated residents may experience substantial damage from flooding inundation. The boats located in the two marinas are usually moved out of the marinas prior to a storm event. The marinas may experience substantial damage to piers, docks, and the buildings. The county roadway is elevated several feet above the minor local roads serving the neighborhood, which can exacerbate flooding runoff in the neighborhood. The boats located in the marina are usually moved out of the marinas prior to a storm event. The marina may experience substantial damage to piers, docks, and the buildings. Several of the roadways will experience daily inundation during high tide due to sea level rise.	Low	Moderate	Avalon Boulevard is slated to be raised further within the next 10 years, which could continue to exacerbate flooding issues in the neighborhood. Substantial damage to homes will result in long term and potentially permanent relocation of some residents living in the neighborhood. The loss of half the homes, un-elevated, will result in a major loss in ratables for the community. During the storm event, residents that do not evacuate (as seen in past events) may require rescue. Middle township does have high water vehicles that can forge through flood inundation, however it places emergency service personnel in danger. The loss or damage of the marina will result in the loss of seasonal business and storage.	Low	High
Back Bay Wetlands Complex	Natural Resources & Ecosystems	Wetlands	The salt marshes serve as wildlife habitat, storm protection and aesthetic backdrop for the seaside community.	1-5	12-15	May see a couple feet of inundation during high tide due to sea level rise. May see major inundation during a CAT1 event.	With continued inundation during daily high tide events these salt marshes will start "drowning" if the rate of sedimentation or wetland platform build-up does not keep pace with sea level rise. Plants die back and continued inundation will convert these systems into mudflats or open water. Critical wildlife habitat will vanish, important water purification processes occurring in the wetlands will be lost and the storm protection provided by the plants destroyed.	High	High	Salt marshes in the back bay currently provide the town flood mitigation to their adjacent development. Degradation of these salt marshes from continued inundation could lead to increased flood hazards in the adjacent residential and commercial areas. The extent of the consequence is yet unknown but could be significant. Fish and Wildlife is doing an experimental thin layer soil application to a portion of the Cape May Wetlands Wildlife management area marsh's. This practice is to assist wetland soil accretion to elevate the platform height. In addition to increasing flood hazards, accelerated storm damage to the wetlands would negatively effect property values within the area.	High	Low
Bay Shore Road (County 603)	Critical Facilities & Infrastructure Systems	Major Access Corridor & State Designated Evacuation Route	A county roadway that runs the length of the west side of Middle Township and serves as a major access corridor for the Del Haven Neighborhood of Middle and Lower Township. The route is a state designated evacuation route.	NA	0-4.5	Not impacted by sea level rise. May see several feet of inundation during a CAT1 event.	During a major storm event the roadway may be inundated, making the roadway impassable. The roadway itself will suffer little to no damage.	NA	Moderate	During a major storm event if the roadway is impassable residents, visitors, and emergency personnel will not be able to move in or out of areas of Middle Township. People may be stuck in place, may or may not be in harms way, and emergency personnel will not be able to provide any services or rescue.	NA	High
Big Timber Lake Resort	Districts, Neighborhoods, & Population Clusters	Recreational Campground	A large recreational campground that includes several cottages and recreational vehicle lots for seasonal tourists and travelers. The campground includes utility hook-ups and multiple active recreational opportunities. The campground is open from mid-May to mid-September.	NA	0-1	Not impacted by sea level rise. May see minor inundation surrounding the property during a CAT1 event.	Only a small section of the campground, with a few cottages and a few RV lots may be inundated with up to a foot of water. The cottages and RV lots would suffer little to no impacts.	NA	Low	The resort owner may have to make minor repairs to the few cottages and RV lots impacted.	NA	Insignificant
Briarwood Trailer Park	Districts, Neighborhoods, & Population Clusters	Trailer Park	A low to moderate income trailer park located off North Main Street consisting of approximately 75 single-wide trailers. The trailer park is mostly an elderly population.	NA	0-1.5	Not impacted by sea level rise. May see minor inundation on the northern edges of the trailer park during a CAT1 event.	Only one trailer within the trailer park may be impacted by a major storm event. The potential damage would be minimal, with only minor structural repairs necessary.	NA	Insignificant	None	NA	Insignificant

Cape May County Cemetery	Community Resources & Amenities	Cemetary	A Cape May County veterans cemetary.	NA	0-2	Not impacted by sea level rise. May see a couple feet of inundation on the eastern edge of the cemetery during a CAT1 event.	None	NA	NA	None	NA	NA
Cape May County Park & Zoo	Natural Resources & Ecosystems	Zoo	Cape May County Park Central is over 200 acres including the Zoo, with many forested areas maintained in their natural state. The park includes picnic areas, walking paths, bike paths, fishing ponds, picnic pavilions, disc golf course, playgrounds & more.	NA	0-1.5	Not impacted by sea level rise. May see minor inundation in small area to the east of the parking area.	Only the gazebo and pier in the pond area of the park entrance may be destroyed.	NA	Low	The gazebo and pier may need to be repaired or replaced.	NA	Insignificant
Cape May County Park South	Natural Resources & Ecosystems	Public Park	The Fishing Creek Wildlife Preserve is the largest of the county's three parks, consisting of more than 1,700 acres. Most of the Park is wetlands, providing habitat to diverse plant & animal life located in the Delaware Bay Estuary. The developed portion of the Park consists of approximately 10 acres, which include a soccer field, two basketball courts, barbeque grills, picnic pavilion, restroom facility and a playground.	0-2	1-6	May see a couple feet of inundation during high tide due to sea level rise. May see major inundation during a CAT1 event.	The developed area of the park may be susbstantially damaged including the restroom facility, recreational fields and courts, and landscaping.	Insignificant	Low	The county will need to replace restrooms, repair recreational courts and fields, and replace landscaping which may cost thousands of dollars to rennovate.	Insignificant	Low
Cape May County Police Academy	Community Resources & Amenities	Public Safety	A regional training facility used to train police officers, fire fighters, emergency medical personnel, and other public safety officials.	NA	0-5	Not impacted by sea level rise. May see major inundation during a CAT1 event.	The buildings on the property are old and not elevated. During a major storm event the buildings would suffer substantial damage or complete destruction.	NA	High	The county could lose its training facility and be forced to relocate somewhere else in the county. There are 19 other training facilities for public safety officials found through the state. Rebuilding a new facility in the same location or somewhere else will be costly for the county.	NA	Low
Cape May County Public Works Complex	Critical Facilities & Infrastructure Systems	Public Works	County MUA facility which processes the sewage from Seven Mile Island. The facility also includes a large compost pile which is sold locally for fertilizer.	NA	0-2	Not impacted by sea level rise. May see a couple feet of inundation during a CAT1 event.	During a major storm event the compost pile located in the back of the facility may be inundated. The compost pile may erode away and wash out into the immediate surrounding area. No other locations would be impacted.	NA	Insignificant	Minimal erosion of the compost pile would have an insignificant impact on the surrounding area.	NA	Insignificant
Cape May County Special Services	Community Resources & Amenities	Social Services	A county social services and school for developmentally disabled individuals living in Cape May County.	NA	0-2.5	Not impacted by sea level rise. May see a couple feet of inundation during a CAT1 event.	The building is elevated and inundation may only reach the parking lot with little to no damage expected.	NA	Insignificant	None	NA	Insignificant
Cape May County Technical High School	Community Resources & Amenities	Public School	A regional tehnical high school that serves the greater Cape May County region and municipalities.	NA	0-1.5	Not impacted by sea level rise. May see minor inundation in parking area in northern part of the property.	The majority of the property is not impacted by a major storm event; however, a small pier in the back of the property and located over the wetlands may be damaged or destroyed.	NA	Insignificant	School may have to repair or replace pier.	NA	Insignificant
Cape May Par 3 & Driving Range	Natural Resources & Ecosystems	Golf Course		NA	NA	Not impacted by sea level rise. Not impacted by a CAT1 event.	None	NA	NA	None	NA	NA
Cedars Springs Mobile Home Park	Districts, Neighborhoods, & Population Clusters	Trailer Park	A low income trailer park located along North Wildwood Boulevard and Back Bay of Middle. The trailer park has over 30 single wide trailers.	0-0.5	1-6	May see inundation during high tide on the edges of the property. May see major inundation during a CAT1 event.	The trailer park consists of older single-wide trailers, which are likely not compliant with current construction codes. The trailers are not elevated and the majority, if not all, would be completely destroyed in a major storm event.	NA	High	If destroyed by a major storm event, the residents would be displaced and may not have the resources to acquire new, temporary, or permanent locations. The residents would not likely return or rebuild and the property would be abondoned. The trailers themselves would become debris, causing potential damage to other nearby properties.	NA	High
City of Wildwood Pumping Station	Critical Facilities & Infrastructure Systems	Public Works	The pumping station supplies ground water (drinking and safety) to the City of Wildwood and to the Rio Grande service area of Middle. The water supplies hydrants and fire suppression systems to the busineses within Rio Grande along the Route 47 corridor.	0-1	0.5-4	May see minor inundation on edges of property during high tide due to sea level rise. May see several feet of inundation during a CAT1 event.	The building is not elevated; however, the building itself would suffer little to no damage. Mechanical and electrical equipment within would suffer substantial damage or complete destruction.	NA	High	Substantial damage to the pump station will close the facility for extended period of time. Repair and replacement of equipment would require millions of dollars. The City of Wildwood would lose their drinking water supply and the Rio Grande service area would lose its fire suppression systems. The population of Wildwood might not be able to return to the city without drinking water. The Rio Grande area will be left vulnerable to fires without an immediate way to suppress a fire.	NA	High

Del Haven	Districts, Neighborhoods, & Population Clusters	Residential Neighborhood	Del Haven is a year-round, working class, residential neighborhood located on the Delaware Bay Shore on the west side of Middle Township. The area also contains a county park (Cape May County Park South), a public access point (Norbury's Landing), a few local businesses, and some municipal stormwater infrastructure. The wetlands and beach area in the north of Del Haven is of high ecological value and has one of the highest concentrations of red knots and horse shoe crabs in the world.	0-1.5	0-6	May see a couple feet of inundation during high tide due to sea level rise. May see major inundation during a CAT1 event.	The area to the north of Del Haven is a flood basin. Water is coming in through the channel along the Delaware Bay Shore; west winds and current sea level rise are causing an increase in the opening of the channel and breach in the beaches and marsh. Sea level rise projections and future storm events will only exacerbate the problem. The majority of the homes located in the neighborhood are not elevated, with only a few new homes located along the Delaware Bay Shore having been elevated above base flood elevation.	Moderate	High	Increasing sea level rise and future storm events will continue to degrade and open the channel and breach in the beaches and marshes further. The destruction of the area will result in continued loss of habitat for red knots and horseshoe crabs. Continued flooding will result in substantial damage to residents, which will result in a loss of ratables, and the potential displacement of several hundred families. Many families, due to lower incomes, may not be able to rebuild or come back to the area. A loss of several hundred families may depress the local economy and result in a loss of jobs in Middle. The township is currently evaluating the breach area for potential mitigation.	High	High
Delaware Bay Beaches	Natural Resources & Ecosystems	Beaches	The beach along the Delaware Bay extending the length of Middle Township. The beach provides active and passive recreation for local residents, as well as mitigation from storm surge and flooding events.	0-4.5	0-9	May see major inundation during high tide due to sea level rise. May see major inundation during a CAT1 event.	Sea level rise will continue to erode the beach and major storm events will continue to erode and completely wash out the beaches.	High	High	Continuously eroding beaches will require ever increasing replenishment and maintenance. A continuous loss of the beaches will leave the township open to greater vulnerability from any storm event, increasing damages to the neighborhoods and homes located along the Delaware Bay Shore.	High	High
Delaware Bay Wetlands Complex	Natural Resources & Ecosystems	Wetlands	The salt marshes serve as wildlife habitat, storm protection and aesthetic backdrop for the seaside community.	1-5	12-15	May see a couple feet of inundation during high tide due to sea level rise. May see major inundation during a CAT1 event.	With continued inundation during daily high tide events these salt marshes will start "drowning" if the rate of sedimentation or wetland platform build-up does not keep pace with sea level rise. Plants may die back and continued inundation will convert these systems into mudflats or open water. Critical wildlife habitat will vanish, important water purification processes occurring in the wetlands will be lost and the storm protection provided by the plants destroyed.	High	High	Salt marshes in the back bay currently provide the town flood mitigation to their adjacent development. Degradation of these salt marshes continued inundation could lead to increased flood hazards in the adjacent residential and commercial areas. The extent of the consequence is yet unknown but could be significant. Fish and Wildlife is doing an experimental thin layer soil application to a portion of the Cape May Wetlands Wildlife management area marsh's. This practice is to assist wetland soil accretion to elevate platform height. In addition to increasing flood hazards, accelerated storm damage to the wetlands would negatively effect property values within the area.	High	Low
Garden Lake	Districts, Neighborhoods, & Population Clusters	Trailer Park	A large moderate to high income trailer park community located off U.S. Route 9, consisting of over a hundred trailers. The population of the trailer park is mostly elderly, with a 1/3 being seasonal and 2/3 being year round residents.	0-2	0-5	May see inundation in drainage area along the GSP during high tide due to sea level rise. May see several feet of inundation during a CAT1 event.	The majority of the trailers are elevated and within construction compliance to withstand a major storm event. A third of the trailer park may still be substantial damaged or destroyed.	NA	High	If a third of the trailers were destroyed by a major storm event a portion of the residences would be temporarily displaced; however, they may have other homes or have the resources to acquire temporary residence within Middle or somewhere else. The residents would likely rebuild and/or renovate their homes and return. The trailers themselves would become debris, causing damage to other nearby properties and trailers.	NA	Moderate
Garden State Parkway	Critical Facilities & Infrastructure Systems	Major Transportation Corridor	The Garden State Parkway (GSP) is a major transportation corridor and state designated evacuation route. The southern most stretch of the GSP runs through Middle Township for just over 13 miles. The GSP serves as a major point of ingress and egress for Middle Township and all the barrier islands located offshore of the mainland in the Cape May Peninsula.	NA	0-5	Not impacted by sea level rise. May see several feet of inundation during a CAT1 event.	The GSP may see several feet of inundation along many points of the corridor. The inundation may make several locations of the GSP impassable, however it will have little to no impact on the structure of the roadway or bridges itself.	NA	Moderate	Prior to a major storm event the barrier islands are typically evacuated before the storm makes landfall. Middle Township is typically not evacuated. Inundation on the GSP may trap certain populations in various geographic locations and may hinder ingress and egress for emergency services.	NA	Moderate
Grassy Sound	Districts, Neighborhoods, & Population Clusters	Residential Neighborhood	Grassy Sound is a residential neighborhood located within the Back Bay of Middle Township. The area consists of approximately 65 seasonal homes located over the wetlands, most of the homes are accessed via primitive roads and boardwalks. The boardwalk requires maintenance and in several locations is in severe disrepair. Several of the homes, on the north side, are being upgraded to sewers to meet state requirements, but a number of the homes are unable to upgrade and are in various states of degradation. The neighborhood also includes a private marina.	0-5	1-10	May see several feet of inundation during high tide due to sea level rise. May see major inundation during a CAT1 event.	During high tide due the area may become inaccessible via road ways. High tide may also inundate areas of the boardwalk that are not elevated. During a major storm event the entire area would be inaccessible for residents to leave and for emergency services to get in. Several of the homes and boardwalk are in a state of minor to severe disrepair, which will result in substantial damage to complete destruction of the structures located throughout. A few homes are elevated and currently being elevated.	Moderate	High	Substantial damage and complete destruction of homes and boardwalks will result in a permanent loss of homes, as many of the residents would likely not be able to get the permits to rebuild in their current location. The loss of the homes will decrease the municipal tax base. The home owners would likely want to return to the area and rebuild, however, it would be impossible in most cases. The loss of residents would have a minor impact on the seasonal business coming into the township. The residential neighborhood contains no municipal infrastructure that would need to be repaired.	Low	Moderate

Hideaway Beach	Districts, Neighborhoods, & Population Clusters	Recreational Campground	A large recreational campground that includes over 300 camp sites used by small recreational mobile trailers. The campground is seasonal open to residents between March and November. The residents are a low to moderate income population.	NA	0-3	Not impacted by sea level rise. May see several feet of inundation during a CAT1 event.	The trailers within the park are smaller than standard mobile homes and levels of repair and/or disrepair vary widely throughout. Approximately half the trailers in the park would be substantially damaged or destroyed during a major storm event.	NA	High	If half the trailers were destroyed by a major storm event it is unlikely that the current residents would return to the area. The owner of the campground would replace the lost trailers and a new seasonal population would come. The owner would be responsible for rebuilding and clean up efforts. Any impacts from a temporary loss of seasonal residents would have a minor short-term financial impact to the community.	NA	Low
Indian Trail Road (State 147)	Critical Facilities & Infrastructure Systems	Transporation Corridor & State Designated Evacuation Route	A county roadway which runs west to east connecting NJ State Route 47 with the Garden State Parkway. The route is a state designated evacuation route.	NA	0-2	Not impacted by sea level rise. May see a couple feet of inundation during a CAT1 event.	During a major storm event the roadway may be inundated, making the roadway impassable. The roadway itself will suffer little to no damage.	NA	Moderate	During a major storm event if the roadway is impassable residents, visitors, and emergency personnel will not be able to move in or out of areas of Middle Township. People may be stuck in place, may or may not be in harms way, and emergency personnel will not be able to provide any services or rescue.	NA	High
Laguna Oaks Golf Course	Natural Resources & Ecosystems	Golf Course	A private ten hole golf course.	NA	0-3	Not impacted by sea level rise. May see several feet of inundation during a CAT1 event.	A major storm event can substantially damage landscaping and golf features.	NA	Moderate	The golf course may require hundreds of thousands to millions of dollars of rennovation to landscaping and features at the expense of the owners. The golf course may be temporarily closed for rennovation.	NA	Low
N. Wildwood Boulevard (State 147)	Critical Facilities & Infrastructure Systems	Major Access Corridor & State Designated Evacuation Route	A county roadway which connects Wildwood Island and the City of North Wildwood to the mainland and Middle Township. The boulevard also serves as the only access way for the Grassy Sound Neighborhood. The route is a state designated evacuation route.	NA	0-1.5	Not impacted by sea level rise. May see minor inundation during a CAT1 event.	During a major storm event the roadway may be inundated, making the roadway impassable. The roadway itself will suffer little to no damage.	NA	Moderate	During a major storm event if the roadway is impassable residents, visitors, and emergency personnel will not be able to move in or out of areas of Middle Township or the barrier island communities along east side of Middle. People may be stuck in place, may or may not be in harms way, and emergency personnel will not be able to provide any services or rescue.	NA	High
New Jersey National Guard Armory	Critical Facilities & Infrastructure Systems	Military	A New Jersey National Guard Armory used for storage of military equipment and training of military personnel.	NA	0-2.5	Not impacted by sea level rise. May see a couple feet of inundation surrounding buildings and in the equipment yards during a CAT1 event.	The only area inundated would be the parking and storage area. The national guard moves all their equipment north prior to major storm events. The facility would suffer little to no impacts.	NA	Insignificant	None	NA	Insignificant
NJ State Route 47	Critical Facilities & Infrastructure Systems	Major Access Corridor & State Designated Evacuation Route	A state highway which runs north-south across the entire length of Middle Township. The route is a state designated evacuation route.	NA	0-2.5	Not impacted by sea level rise. May see a couple feet of inundation during a CAT1 event.	During a major storm event the roadway may be inundated, making the roadway impassable. The roadway itself will suffer little to no damage.	NA	Moderate	During a major storm event if the roadway is impassable residents, visitors, and emergency personnel will not be able to move in or out of areas of Middle Township. People may be stuck in place, may or may not be in harms way, and emergency personnel will not be able to provide any services or rescue.	NA	High
Norburys Landing	Natural Resources & Ecosystems	Public Access Point	A public access point leading out to the Delaware Bay Shore.	0-2	2-7	May see a couple feet of inundation during high tide due to sea level rise. May see major inundation during a CAT1 event.	The bulkhead is currently in disrepair and sea level rise may contribute to the erosion of the bulkhead; a major storm event may substantial damage or completely destroy the bulkhead.	Low	Moderate	The bulkhead at the public access point would need to be repaired and/or replaced, which will cost the township several thousand dollars.	Low	Moderate
Old Stage Coach Resort	Districts, Neighborhoods, & Population Clusters	Recreational Campground	A large recreational campground that includes over 100 camp sites used by small recreational mobile trailers. The campground is seasonal open to residents between March and November. The residents are a low to moderate income population.	0-2	0-6	May see a couple feet of inundation during high tide due to sea level rise. May see major inundation during a CAT1 event.	The trailers within the park are smaller than standard mobile homes and levels of repair and/or disrepair vary widely throughout. Almost all the trailers in the park would be substantially damaged or destroyed during a major storm event. During high tide a quarter of the trailers found along the edges of the nearby wetland would be inundated.	Moderate	High	Trailers and lots inundated during high tide in the future will cease to be usable lots. The campground may lose a quarter of its property to sea level rise which will limit income for the owners and reduce the tax assessed value of the property. If all the trailers were destroyed by a major storm event it is unlikely that the current residents would return to the area. The owner of the campground would replace the lost trailers and a new seasonal population would come. The owner would be responsible for rebuilding and clean up efforts. Any impacts from a temporary loss of seasonal residents would have a minor short-term financial impact to the community.	Moderate	Moderate
Pierces Point	Districts, Neighborhoods, & Population Clusters	Residential Neighborhood	A residential neighborhood running along the Delaware Bay Shore. The neighborhood consists of over 50 single-family residences.	0-1.5	0-6	May see several feet of inundation during high tide due to sea level rise. May see major inundation during a CAT1 event.	The neighborhood is protected by a beach and bulkheads; however, the bulkheads are of varying heights. The beach is also susceptible to erosion due to sea level rise and major storm events. Only a limited number of homes are elevated above base flood elevation. A majority of the homes could be substantially damaged or destroyed during a major storm event.	Low	High	Substantial damage and/or destruction of a majority of the homes will result in a large displaced population. The loss will also mean a major loss of ratables and income coming into the township for extended period of time. People are likely to come back and rebuild; however, it will take time (many years) to see complete recovery.	Low	High

Reeds Beach	Districts, Neighborhoods, & Population Clusters	Residential Neighborhood	A residential neighborhood running along North Beach Avenue and affronting the Delaware Bay Shore. The neighborhood consists of over 75 single-family residences.	0-1.5	0-6	May see several feet of inundation during high tide due to sea level rise. May see major inundation during a CAT1 event.	The neighborhood is protected by a beach and bulkheads; however, the bulkheads are of varying heights. The beach is also susceptible to erosion due to sea level rise and major storm events. Only a limited number of homes are elevated above base flood elevation. A majority of the homes could be substantially damaged or destroyed during a major storm event.	Low	High	Substantial damage and/or destruction of a majority of the homes will result in a large displaced population. The loss will also mean a major loss of ratables and income coming into the township for extended period of time. People are likely to come back and rebuild; however, it will take time (many years) to see complete recovery.	Low	High
Rio Grande Rescue Squad	Critical Facilities & Infrastructure Systems	Emergency Services	A dispatch center for Middle Township emergency medical services.	NA	0-1	Not impacted by sea level rise. May see minor inundation around the building and on the roadway during a CAT1 event.	If power were lost the building has no generator, otherwise the building is not impacted by a major storm event.	NA	Low	None	NA	Insignificant
Rutgers Cape Shore Laboratory	Community Resources & Amenities	University Research Facility	The Haskin Shellfish Research Laboratory (HSRL) is a New Jersey Agricultural Experiment Station (NJAES) and a field station for the Institute of Marine and Coastal Sciences (IMCS) both located at the School of Environmental and Biological Science, Rutgers University. HSRL generates and disseminates research information directly applicable to all aspects of fisheries and aquaculture science, concentrating on species of commercial importance to New Jersey.	0-1	1-5	May see minor inundation on roadways during high tide due to sea level rise. May see major inundation during a CAT1 event.	The main building is elevated and would suffer little to minor damage. The constuction of other buildings and storage onsite is unknown.	NA	Low	Damage to the facility may require current research to be delayed temporarily while the facility is rebuilt/repaired.	NA	Low
S. Wildwood Boulevard (State 47)	Critical Facilities & Infrastructure Systems	Major Access Corridor & State Designated Evacuation Route	A state highway which connects Wildwood Island and the City of Wildwood to the mainland and Middle Township. The route is a state designated evacuation route.	NA	0-3	Not impacted by sea level rise. May see several feet of inundation during a CAT1 event.	During a major storm event the roadway may be inundated, making the roadway impassable. The roadway itself will suffer little to no damage.	NA	Moderate	During a major storm event if the roadway is impassable residents, visitors, and emergency personnel will not be able to move in or out of areas of Middle Township or the barrier island communities along east side of Middle. People may be stuck in place, may or may not be in harm's way, and emergency personnel will not be able to provide any services or rescue.	NA	High
Stone Harbor Boulevard (County 657)	Critical Facilities & Infrastructure Systems	Major Access Corridor & State Designated Evacuation Route	A county roadway which connects Seven Mile Island and the Borough of Stone Habor to the mainland and Middle Township. The boulevard also serves as the only access way for Stone Harbor Manor. The route is a state designated evacuation route.	NA	0-3.5	Not impacted by sea level rise. May see several feet of inundation during a CAT1 event.	During a major storm event the roadway may be inundated, making the roadway impassable. The roadway itself will suffer little to no damage.	NA	Moderate	During a major storm event if the roadway is impassable residents, visitors, and emergency personnel will not be able to move in or out of areas of Middle Township or the barrier island communities along east side of Middle. People may be stuck in place, may or may not be in harm's way, and emergency personnel will not be able to provide any services or rescue.	NA	High
Stone Harbor Golf Club	Natural Resources & Ecosystems	Golf Course		NA	NA	Not impacted by sea level rise. Not impacted by a CAT1 event.	None	NA	NA	None	NA	NA
Stone Harbor Manor	Districts, Neighborhoods, & Population Clusters	Residential Neighborhood	A residential neighborhood located along Stone Harbor Boulevard, in the Back Bay, between the mainland of Middle and Stone Harbor on Seven Mile Island. The area consists of approximately XX single family homes. A few homes are accessed via boardwalk. The area also includes The Wetlands Institute, two marinas (Stone Harbor Marina and Camp Marine Services), and Pat's Lunch (a small, local restaurant). Atlantic City Electric is currently putting in a new conduit (26-69 kv) that will serve Stone Harbor.	0-2	1-7	May see a couple feet of inundation during high tide due to sea level rise. May see major inundation during a CAT1 event.	Approximately half of the residents found along Stone Harbor Boulevard are elevated. A majority of the properties are also bulk-headed, however the bulkheads are of varying heights. Un-elevated residents may experience substantial damage from flooding inundation. The boats located in the two marinas are usually moved out of the marinas prior to a storm event. The marinas may experience substantial damage to piers, docks, and the buildings.	Low	Moderate	Substantial damage to homes will result in long term and potential permanent relocation of some residents living in the neighborhood. The loss of half the homes, un-elevated, will result in a major loss in ratables for the community. During the storm event, residents that do not evacuate (as seen in past events) may require rescue. Middle Township does have high water vehicles that can forge through flood inundation, however it places emergency service personnel in danger. The loss or damage of the marinas will result in the loss of seasonal business and storage.	Low	High
The Wetlands Institute	Community Resources & Amenities	Non-Profit	The Wetlands Institute is a non-profit located in the Stone Harbor Manor Neighborhood, whose mission it is to promote appreciation, understanding & stewardship of wetlands and coastal ecosystems through our programs in research, conservation, and education.	0-0.5	3.5-4.5	May see minor inundation around the building during high tide due to sea level rise. May see several feet of inundation during a CAT1 event.	The building is elevated on pilings and would suffer little to no impact during a major storm event. The dock and elevated walkway may be substantially damaged or destroyed. The dock also houses a pump station which pumps salt water to the aquariam located in the main building. The pump station may also be destroyed.	Low	High	The replacement of the dock, walkway, and pump station will cost the the non-profit hundreds of thousands of dollars to replace. If the building was damaged and the institute was temporarily closed the surrounding communities would lose educational opportunities and public access to the facility for a time.	Insignificant	Moderate
Wildwood Golf & Country Club	Natural Resources & Ecosystems	Golf Course	A private nine hole golf course.	0-2.5	0-6	May see a couple feet of inundation during high tide due to sea level rise. May see major inundation during a CAT1 event.	A major storm event can substantially damage landscaping and golf features. Parts of the golf course may be inundated during high tide which might permanantly destroy or render unusable sections of the golf course features and landscaping.	Low	Moderate	The golf course may be require extensive (and expensive) renovation to landscaping and features at the expense of the owners. The golf course may be temporarily closed for renovation. If areas are unusable due to high tide inundation the course may need to undergo some redesign or install mitigation features.	Low	Low

Appendix B – Vulnerability Rating Key

Vulnerability Rating Key	
Level	**Vulnerability Rating Given Hazard Exposure and Sensitivity**
Insignificant	*Exposure to Flooding:* This community asset is located out of harm's way. *Physical/Structural Damage:* No physical/structural damages expected. *Disruption/Impairment:* 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. *Accessibility:* Key staff able to access facilities or locations without interruption.
Low	*Exposure to Flooding:* The majority of this community asset is located out of harm's way. *Physical/Structural Damage:* Minor physical/structural damages expected. *Disruption/Impairment:* 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. *Accessibility:* Key staff able to access facilities or locations with minimal interruption.
Moderate	*Exposure to Flooding:* A significant portion of this community asset is located in harm's way. *Physical/Structural Damage:* Moderate physical/structural damages sustained. *Disruption/Impairment:* 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. *Accessibility:* Secondary evacuation and access routes available for use if/when primary systems fail.
High	*Exposure to Flooding:* The majority of this community asset is located in harm's way. *Physical/Structural Damage:* 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. *Disruption/Impairment:* 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. *Accessibility:* 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.

Appendix C – Consequences Rating Key

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

Appendix D – Municipal CVA Committee

Municipal CVA Committee

Middle 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 16th, April 13th, and April 27th, 2016 at the Cape May Convention Center. The meeting attendees are shown below.

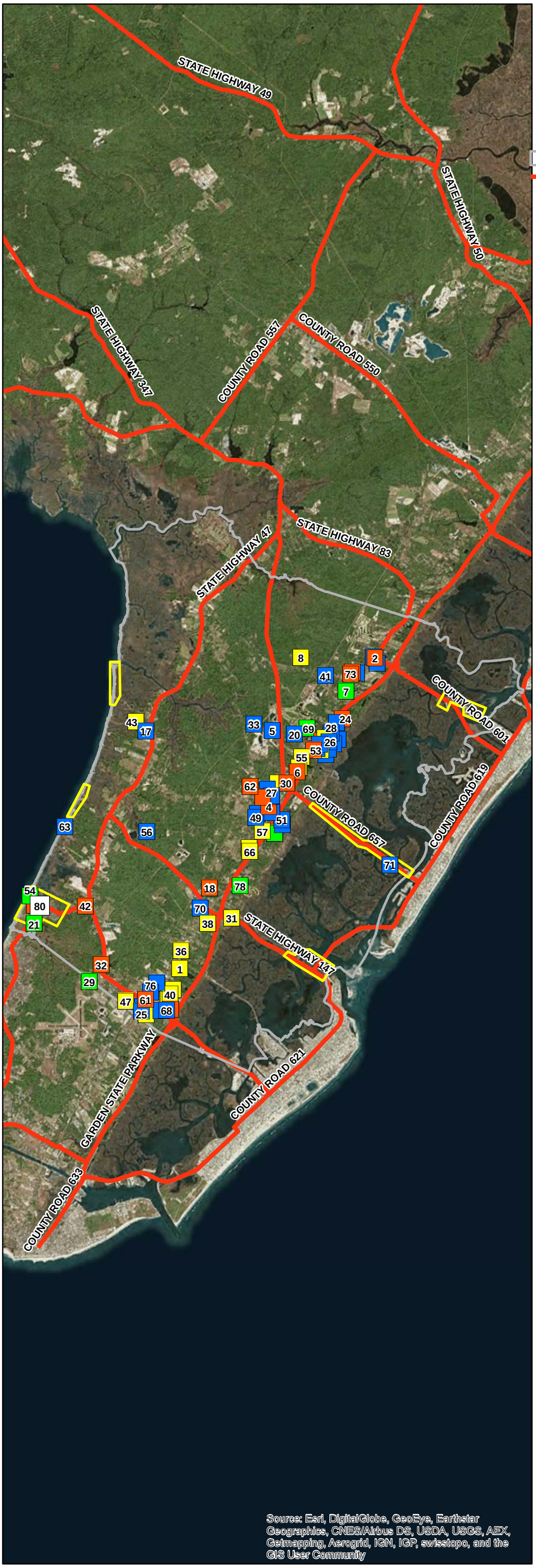
Participant	Title	Affiliation
Constance Mahon	Township Administrator	Township of Middle
Anne Garrison	Grants & Econ Development Coordinator	Township of Middle
Robert Flynn	Supervisor	Middle Public Works
Sal DeSimone	Construction Official / Floodplain Manager	Township of Middle
Sean McDevitt	Emergency Manager	Township of Middle
Lenore Tedesco	Executive Director	The Wetlands Institute
Marc DeBlasio	Township Engineer	Remington and Vernick
David May	Zoning Officer	Township of Middle
Rick Brown	Planner	NJDEP/CLUP
Bill Purdie	Planner	NJDEP/CLUP
Jack Heide	Resiliency Manager	Sustainable Jersey
Emma Melvin	Green Infrastructure Coordinator	Sustainable Jersey

Appendix E – Middle Coastal Vulnerability Assessment Maps

Table of Maps

Township of Middle Coastal Vulnerability Assessment

Community Assets



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N

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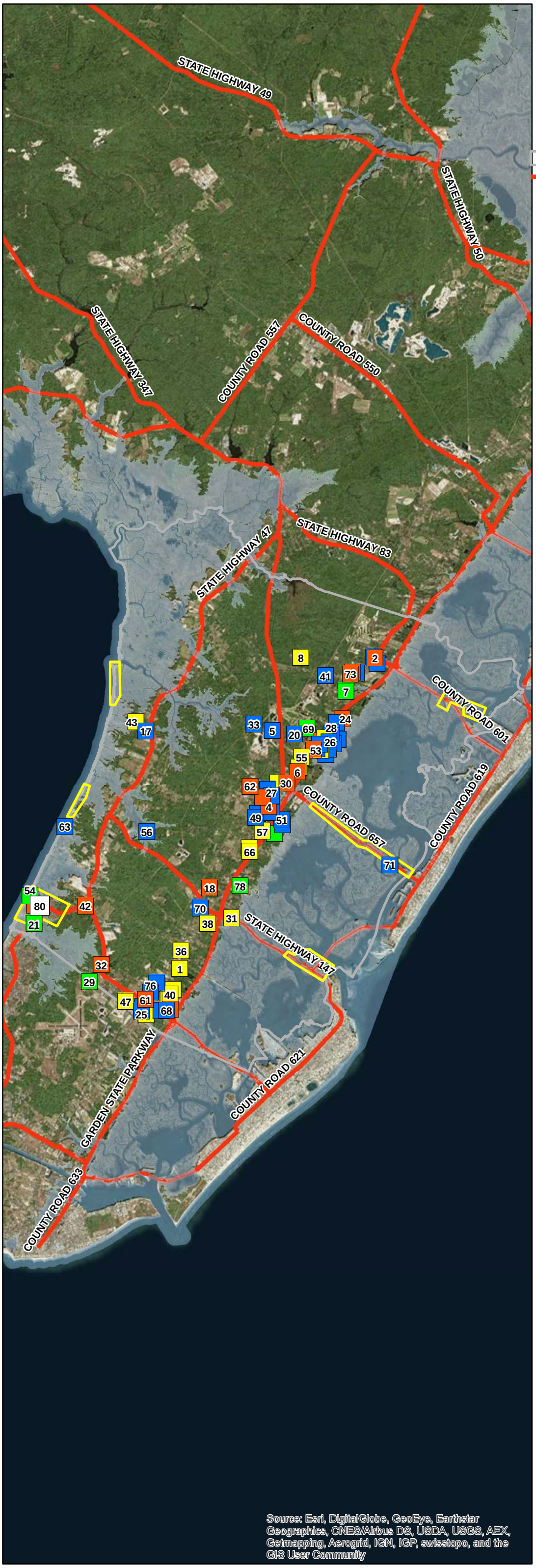
Prepared by Sustainable Jersey for the Township of Middle, August 2016

Township of Middle Coastal Vulnerability Assessment

2050 Sea Level Rise



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2050 Sea Level Rise

Depth

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Township of Middle Coastal Vulnerability Assessment

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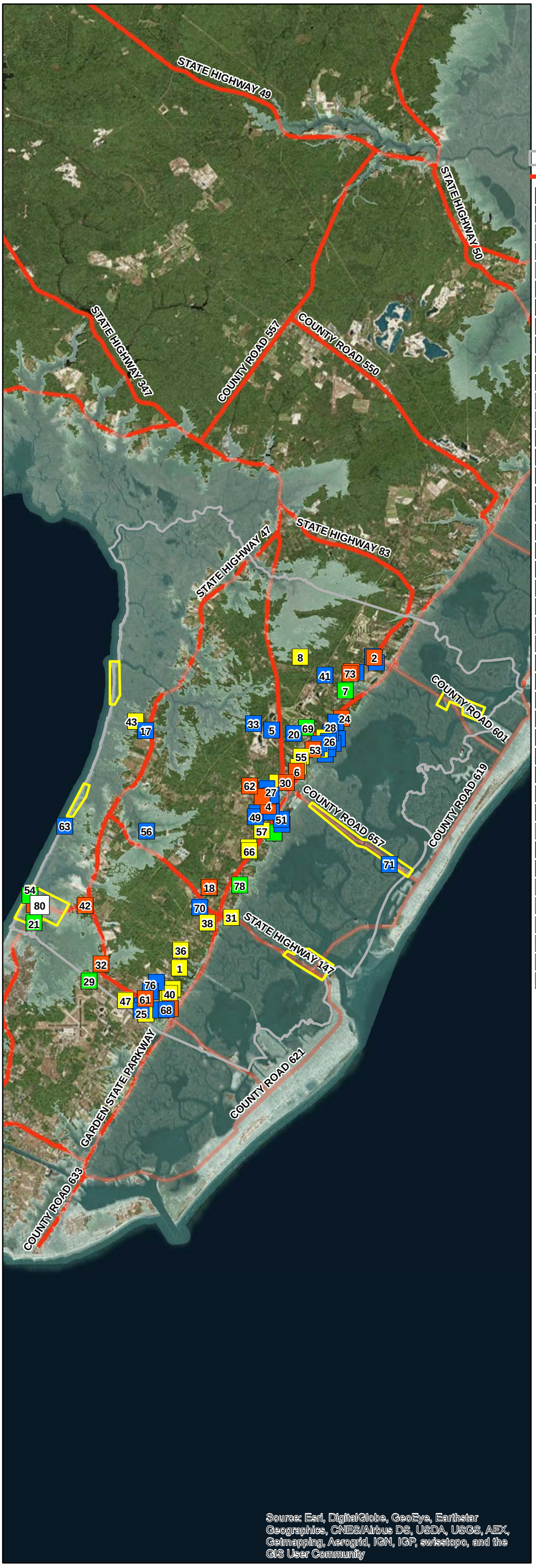

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2050 CAT1 Hurricane

Depth

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- Low : 0 ft.

0 1.25 2.5 5 7.5 10 Miles

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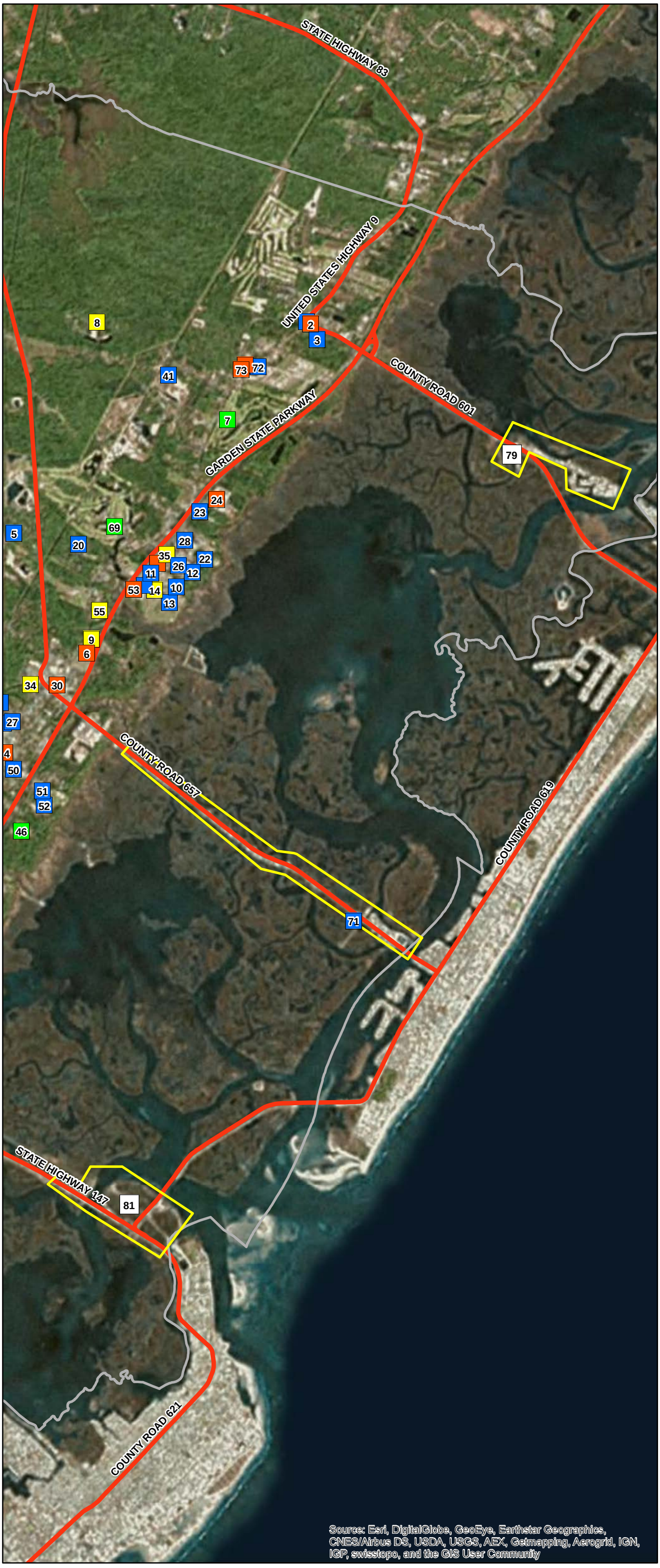
Prepared by Sustainable Jersey for the Township of Middle, August 2016

Township of Middle (Back Bay) Coastal Vulnerability Assessment

Community Assets



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0 0.375 0.75 1.5 2.25 3 Miles

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

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Township of Middle (Back Bay) Coastal Vulnerability Assessment

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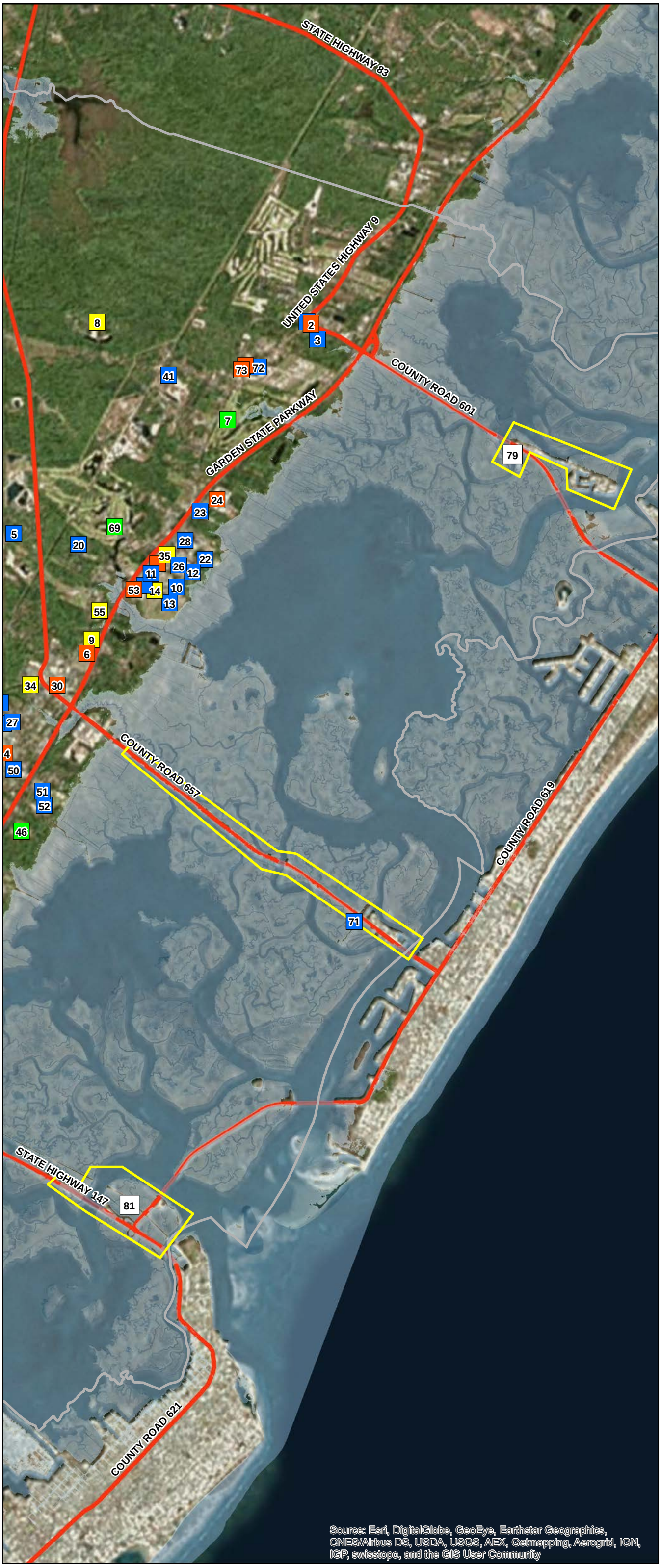

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Township of Middle (Delaware Bay) Coastal Vulnerability Assessment

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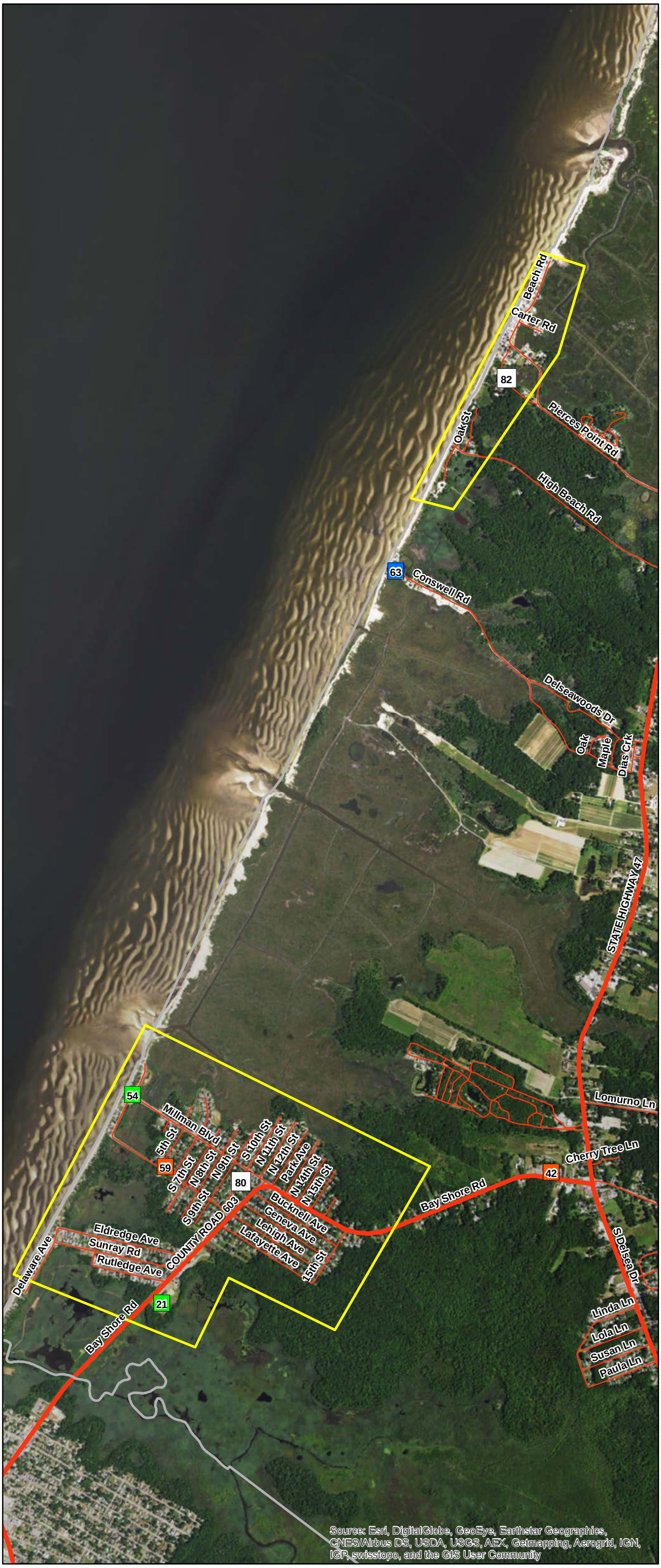

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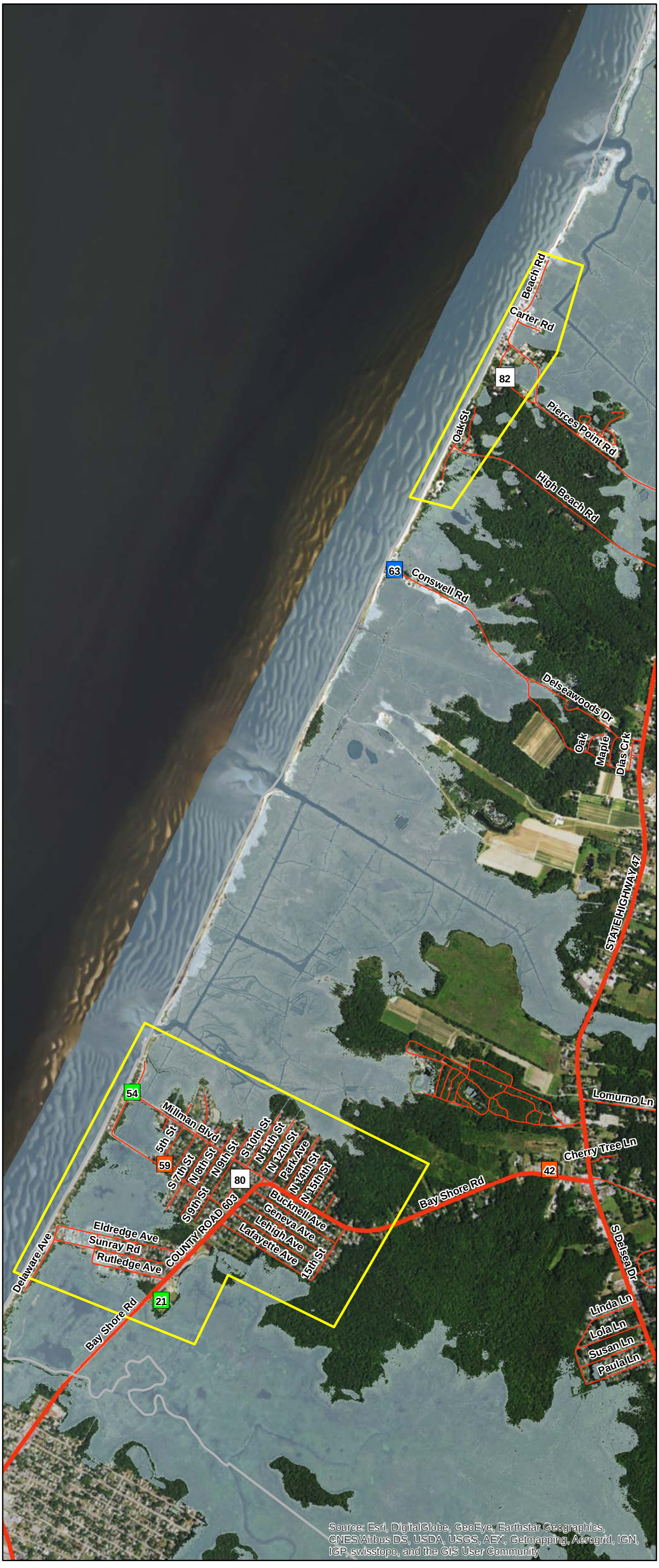

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