



BUILDING ECOLOGICAL SOLUTIONS TO COASTAL COMMUNITY HAZARDS (BESCCH)

Greenwich Township

Getting to Resilience Recommendation Report

December, 2015

Prepared by Sustainable Jersey
for Greenwich Township
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Gibbstown, NJ 08027



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“Getting to Resilience” Report

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“Getting to Resilience” Report

1. Introduction

The Getting to Resilience (GTR) questionnaire was originally developed and piloted by the New Jersey Department of Environmental Protection’s Office of Coastal Management in an effort to foster municipal resiliency in the face of flooding, coastal storms, and sea level rise. The questionnaire was designed to be used by municipalities to assist reduce vulnerability and increase preparedness by linking planning, mitigation, and adaptation. Developed by the State of New Jersey’s Coastal Management Program, the Getting to Resilience process was later adapted by the Coastal Training Program of the Jacques Cousteau National Estuarine Research Reserve (JCNERR), converted into a digital format, and placed on an interactive website. JCNERR further amended the GTR by adding linkages to programs that offer credits or points for conducting some of the activities referenced in the questionnaire, including the National Flood Insurance Program’s (NFIP) Community Rating System (CRS)’s and Sustainable Jersey’s municipal certification program. The GTR is available on a publically accessible website, in which any municipality can complete and create a report based on the results at any time. The GTR has become an important first step towards municipal flood disaster preparedness and resilience in New Jersey.

Getting to Resilience – Five Topic Areas

The GTR questionnaire includes five separate sections that focus on the various aspects of municipal resilience. The five sections include:

1. Risk & Vulnerability – an assessment of how a community has assessed risk & vulnerability of coastal hazards in the past. It includes discussion on sea level rise, types of risk & vulnerability assessments completed, and how assessments are shared within the community.
2. Public Engagement – an assessment of how a community communicates with the local residents and businesses about hazards, sea level rise, risk, and vulnerability.
3. Planning Integration – an assessment of how a community integrates hazard mitigation, sea level rise, and resilience into its long-term planning efforts and municipal documents, ordinances, and policy. Documents to be considered include the master plan, land use ordinances, open space management, all-hazard mitigation plan, floodplain management Plan, stormwater management plan, capital improvements plan, economic development strategy, and special area management plans.
4. Disaster Preparedness & Recovery – an assessment of how a community has and continues to prepare for disaster events through community-wide preparation activities. The section also includes discussion of post-disaster recovery planning efforts.
5. Hazard Mitigation Implementation – an assessment of how a community participated in and implements respective County-Wide All-Hazard Mitigation plans within the community.

What is Resilience?

Municipal resilience is defined by Sustainable Jersey as the ability of a community to adapt and thrive in the face of extreme events and stresses. The Municipal Resilience Cycle (Figure 1 below) illustrates a strategic process for local governments to build and strengthen resilience. The cycle begins with encouraging municipal leaders to achieve early “wins” by shoring up the internal systems that increase their readiness to respond – and bounce back from – disasters of all kinds. The following four steps outline a traditional planning process, highlighting the importance of effective planning for the localized impacts of climate change. The cycle ends with a phase focused on iterative, data-driven management and emphasizes the importance of building a culture of learning in the face of uncertainty. The GTR rests with in step 2 of the Municipal Resilience Cycle, Risk & Vulnerability Assessments. The GTR helps municipalities start the discussion of risk and vulnerability in relation to future sea level rise, flooding, and storm events.

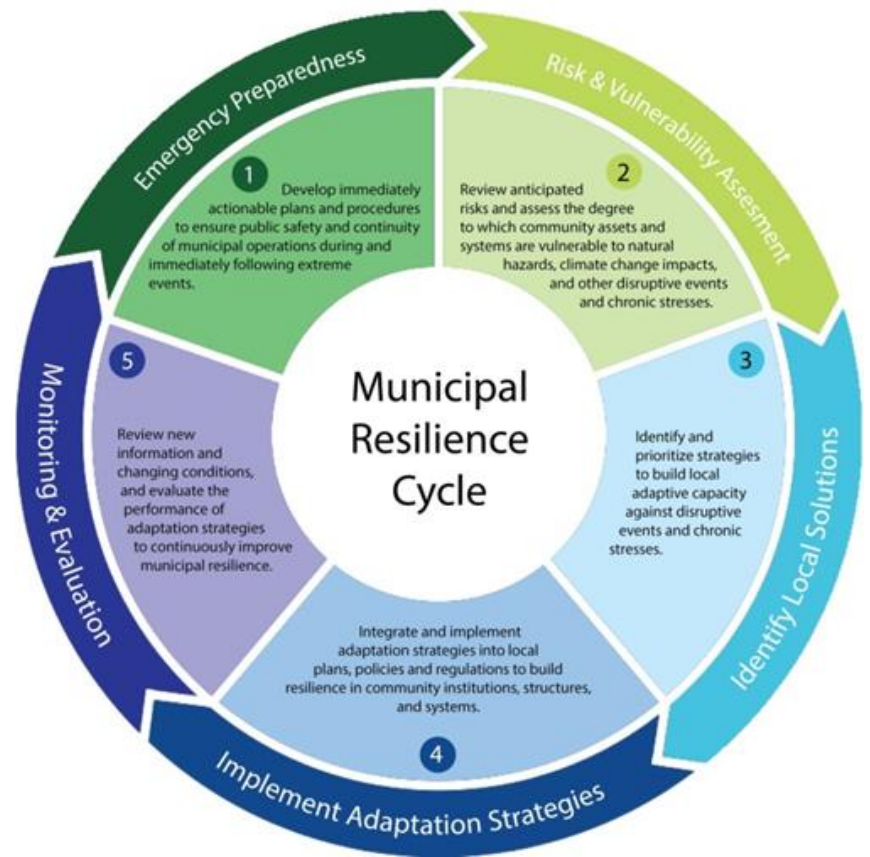


Figure 1. Municipal Resilience Cycle Diagram

In addition to being a starting point to discussing Municipal Resilience, the GTR report is eligible for points in the Sustainable Jersey’s Municipal Certification Program under the Flood Risk Action. Sustainable Jersey certification is a prestigious designation for municipal governments in New Jersey. Municipalities that achieve the certification are considered by their peers, by state government and by the experts and civic organizations in New Jersey, to be among the leading municipalities in sustainability.

2. Greenwich Township - Background

Greenwich is a historic Delaware Bay community located on the banks of the Cohansey River in western Cumberland County. Greenwich Township is comprised of over 12,000 acres with over 63 miles of coastline along the Delaware Bay. With a population of approximately 800 residents in 2010, Greenwich is governed by a 3-person Township Committee and other active municipal organizations. Greenwich shares various government services with neighboring townships in order to maintain its rural character and remain affordable to its residents. Greenwich has a middle-aged population, with a median age of 45.5. The Township is almost entirely comprised of wetlands and farmland. As of 2010, over 31.1% of Greenwich’s 5,168 farmland assessed acres are permanently preserved through farmland easements.

3. Greenwich Getting to Resilience Process

The Getting to Resilience tool is a municipal self-assessment process that helps communities identify vulnerabilities and increase preparedness by linking planning and mitigation efforts. The resiliency team at Sustainable Jersey facilitated the GTR process for Greenwich in August 2015. The process started with the convening of a working group of municipal officials and community members (see Table 1, below, for a list of participants) to represent the Township throughout the GTR process.

Table 1. Municipal Officials and Process Participants

Participant	Title	Affiliation
Eric Port	Steering Committee	Greenwich Township
Michael Ivanick	Planning Board	Greenwich Township
Jim Carluzzo	Dike Committee	Greenwich Township
Mark Showers	Environmental Commission	Greenwich Township
Michael C. Henry	Planning Board	Greenwich Township
Richard E. Domduco	Environmental Commission	Greenwich Township
Steve Carahan	Dike Committee	Greenwich Township
Penny Watson	Steering Committee	Greenwich Township
Rick Brown	Planner	NJ Department of Environmental Protection
Jack Heide	Resiliency Manager	Sustainable Jersey
Emma Melvin	Green Infrastructure Manager	Sustainable Jersey

In addition to convening a working group, Greenwich was asked to familiarize themselves with specific municipal plans, ordinances, and policies (see Table 2, below), and forward them to Sustainable Jersey for review. These documents comprise the key policy documents that the community will use base its responses to the GTR questionnaire. Working Group members and facilitators reviewed the municipal documents prior to the GTR meeting.

Table 2. Greenwich Municipal documents used in GTR process

Plans, Ordinances, and Codes	Y	N	Adoption Year	Notes
Municipal Master Plan	X		2010	
All-Hazards Mitigation Plan	X		Updating	Cumberland County Plan
Floodplain Management Plan		X		
Evacuation Plan		X		
Emergency Operations Plan		X		
Continuity of Operations Plans		X		
Post-Disaster Recovery Plan		X		
Capital Improvements Plan	X		Yearly	Township Budget
Economic Development Plan		X		
Coastal Plan or Element		X		
Open Space Plan		X		Conservation Element
Stormwater Management Plan	X		2006	
Historic Preservation Plan	X		2010	Environmental Resource Inventory

Flood Damage Prevention Ordinance		X		
Environmental Resource Inventory	X		2010	

The Getting to Resilience process was facilitated on August 3, 2015 in the Greenwich Township Building. The meeting was attended by representatives of Greenwich, Sustainable Jersey, and NJ Department of Environmental Protection (DEP) (See Table 1 above).

The remainder of this report summarizes the GTR process and the discussions and recommendations that followed. These steps included:

- Review of flood hazard maps and potential impacts on selected community assets
- The Getting to Resilience questionnaire
- Summary of the Townships’ resiliency initiatives
- Recommendations to increase preparedness for disaster and strengthen resiliency based upon responses to the questionnaire

4. Greenwich Flood Hazards and Impacts

The GTR process began with a review of flood hazard maps to help the township officials understand potential future storm and flooding risks, and help frame the context for the GTR questionnaire. For this mapping exercise, Sustainable Jersey used NJ Flood Mapper, an interactive mapping website designed and created by the NOAA Coastal Services Center and Rutgers University. The flood hazard maps were reviewed for their potential impact on select community assets. The following data layers were used in this discussion:

- 1) FEMA Preliminary Flood Insurance Rate Maps (PFIRM) - This includes the high risk flood zones, known as the 1% flood events or 100 year floodplain, of the FEMA Special Flood Hazard Area
- 2) Estimated sea level rise data at increasing one foot intervals up to a maximum of six feet.
- 3) Estimated sea level rise data at increasing one foot intervals up to a maximum of six feet, and how it will impact marsh areas located within the municipality. The model looks at where marshes are located and how sea level rise will impact marsh lands. Potential impacts include marsh retreat, marsh impediments, and marsh conversion.

Five community assets were chosen for this assessment because they represented the most significant civic buildings, emergency facilities, civic and ecosystem locations found within township limits. The five assets, listed below, were evaluated for potential flood or sea level rise impacts.

1. Greenwich Fire Station
2. Greenwich Elementary School
3. Greenwich Evacuation Route
4. Greenwich Downtown Area
5. Greenwich Wetlands

A review of the flood hazard maps and their potential impact on the critical assets follows. Note that while this mapping exercise provided an important overview of the potential impacts of flood hazards and sea level rise, it is limited in scope. For example, the sea level rise maps are not associated with any given time horizon, the maps may not account for possible mitigation activities practiced by the community, and the available community assets shown on the maps are few.

4.1 FEMA PFIRM Flood Risk Data Layer

The FEMA Preliminary Flood Insurance Rate Maps (PFIRM) Flood Risk data is a data layer derived from the official preliminary FEMA Flood Insurance Rate Maps and provide maps of the currently accepted flood risk data for the community. This data is depicted in Map 1 and includes A zones (shown in blue) representing the 100 year flood zone, the 500 year floodplain (shown in beige), and the V or velocity action zone (shown in pink) representing areas at risk from wave forces and flooding near the coastline.

According to Map 1, the VE zone (coastal flooding zone) is located along the Greenwich wetland areas along the Delaware Bayshore. No community assets, beside the wetlands, are located within the VE zone of Greenwich. The 100 year floodplain (A zones) is located mainly along the Cohansey River and inland to a minimum extent.

With the exception of Greenwich's extensive wetland system, the township's critical facilities are located outside the floodplain. The wetlands provide several miles of buffer between potential coastal flooding and the majority of the township's residents and facilities. In the past, the wetlands have mitigated a large portion of the flooding impacts.

Map 1. FEMA Preliminary Flood Insurance Rate Map



4.2 Sea Level Rise Layer at one foot increments

The data represented in Map 2, illustrates the extent of inundation due to sea level rise at mean high high water (MHHW) tide at one foot increments. There are no timeframes associated with sea level rise projections found in the mapping tool. (Note that they do not include the 1% storm as in the previous map.) Areas described as “hydrologically connected” in NJ Flood Mapper (e.g., part of an existing water body such as the ocean, river, creek, or bay) are shown in shades of blue (darker blue = greater depth). Low-lying areas described as “hydrologically unconnected” in NJ Flood Mapper are areas not connected to a water body (e.g., low lying depressions or low elevation urban areas) that may flood more often under future sea level rise conditions. It should be noted that these are estimated impacts, and the maps show a large area of flooding. For more accurate projections, additional analysis of these areas is required to determine the actual susceptibility to flooding at a neighborhood level scale.

Overall, most Greenwich residents and facilities are not affected by the maximum 6 ft. of sea level rise provided in this exercise, with the exception of the marinas and a few residences that would be completely under water. Map 2 indicates potential areas of concern with 6 ft. of sea level rise; the major point of concern under this condition is the Greenwich Evacuation route which would be completely under water.

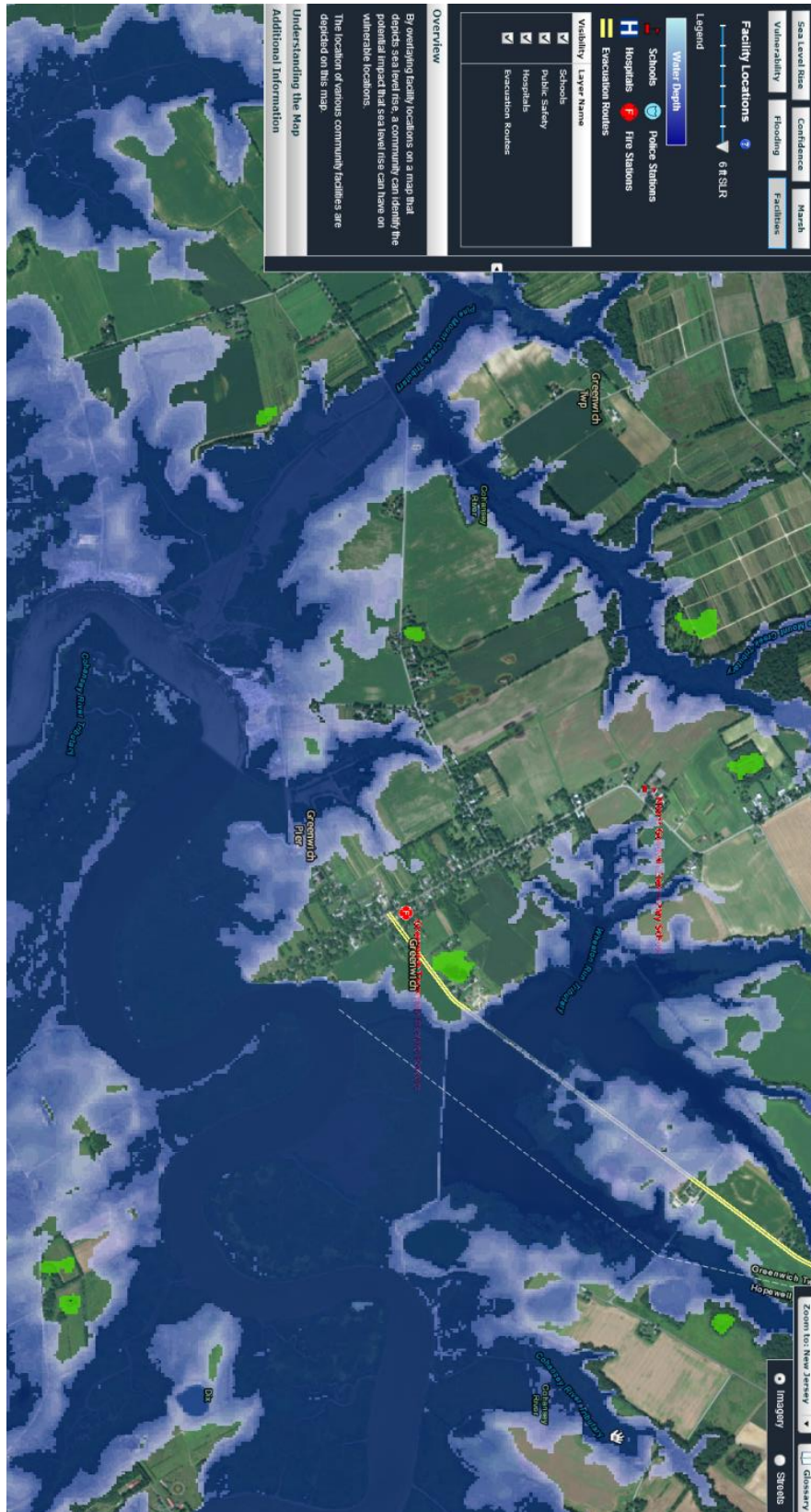
Sea level rise does pose a problem for Greenwich’s wetlands in the 1-6 foot scenarios. Map 3 shows sea level rise at 6 ft. and how it affects the marshes in the area. The green areas indicate current marsh areas, the purple shows unimpeded marsh retreat, the pink shows impeded marsh retreat, the blue represents conversation to open water, and the light green represents conversions to sand/mud flat areas. With 6 feet of sea level rise, large areas of wetlands start to retreat and disappear. This is of concern because the wetlands provide essential natural protection through flood water storage and mitigation through storm surge attenuation. A decrease in wetlands that help protect the community will cause greater impacts to the township during flooding events.

Again, it is important to note that the sea level rise maps reviewed in this exercise are not associated with a specific time horizon. However, a leading publication describing future flood risks across the Mid-Atlantic¹ provides a strong scientific basis for municipal officials to plan for future sea level rise impacts to their community in the very near future. The publication suggests that “coastal plain sites impacted by groundwater and natural compaction will experience a rise 45 cm by 2050 (range 33–71 cm), and 106 cm by 2100 (range 76–180 cm). Coastal locations with lower groundwater extraction rates and coastal plain locations closer to the Fall Line (...) will experience sea-level rise intermediate between these two estimates.”

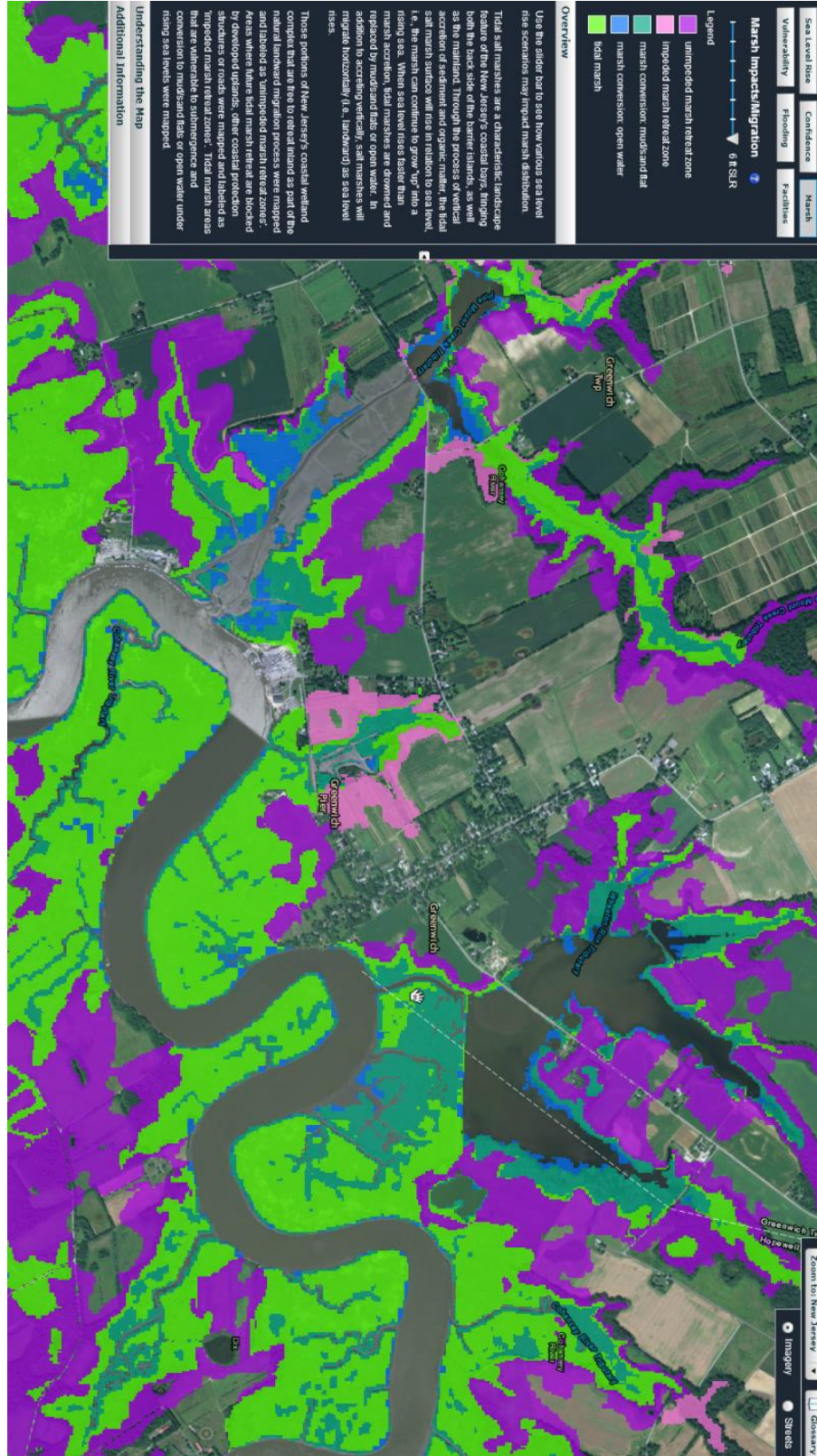
The above projected flood hazard maps are intended to be a high-level screening-level tool to introduce the magnitude and extent of flood hazard events and sea level rise to the community. However, to fully understand the impacts of these flood hazards, a more detailed mapping analysis is necessary to determine the potential impacts on specific community assets. Given the extent of current and projected flooding shown on these maps, the township is advised to conduct a coastal vulnerability assessment, as described later in this report.

¹ <http://onlinelibrary.wiley.com/doi/10.1002/2013EF000135/full>

Map 2. Six Feet of Sea Level Rise



Map 3. 6 Feet of Sea Level Rise and the Impacts on Marshes



4.3 Summary of Flood Hazard Mapping

Key findings from the discussion surrounding this mapping exercise of flood and sea level rise inundation are:

- 1 Community assets, defined as a fire station, school, evacuation route, downtown core, and wetlands, are largely located outside the floodplain and future sea level rise areas, with the exception of the wetlands.
- 2 The township's V zones are located along the Bay Shore and wetlands away from residents and critical facilities.
- 3 Wetlands are located extensively throughout Greenwich providing essential protection through flood water storage and storm surge attenuation. Under any feet of sea level rise the loss of the wetlands will result in likely increased impacts to nearby properties from flooding and reduced natural protection measures. Therefore, a more detailed vulnerability analysis should be conducted, and include a broader range of community assets and a predicted hurricane storm surge in addition to future sea level rise.

5. Greenwich Getting to Resilience Questionnaire

After a thorough review and discussion of the mapping exercise, the working group started the GTR online questionnaire. Questions were a 'yes' or 'no' format and asked one by one. Clarification of questions and answers were facilitated through group discussion led by Sustainable Jersey staff. The questionnaire relied on a wide-range of local knowledge of policies, plans and regulations related to emergency preparedness and resiliency.

Greenwich's Resiliency Initiatives

Greenwich answered 'yes' to the majority of questions in the GTR questionnaire. Several questions were not applicable to the township. As a self-assessment, the township's response of 'yes' to most questions reflects Greenwich's positive commitment and activities towards building resilience. Through the questionnaire and subsequent discussions, the following three areas of past and current resilience planning were identified by the Greenwich group:

1. Greenwich has an engaged and active citizen base. Both the appointed and volunteer citizens of the various boards, commissions, and committees of Greenwich show a true commitment to the historic and rural nature of the community. As such, citizens strive to maintain the community by increasing Greenwich's municipal resilience and sustainability.
2. Greenwich has been engaged in hazards mitigation planning over many years and has benefited from the consistent leadership of Greenwich elected officials and engaged citizens that support such efforts. Some examples of resilience planning actions are the sharing of FEMA flood risk mapping with the public, and a wide range of communication efforts aimed at ensuring safety prior to, during, and after storm and flooding events.
3. Greenwich is working closely with Cumberland County on updating the county All-Hazards Mitigation Plan. Close integration with Cumberland County helps ensure that Greenwich

hazards and vulnerabilities are identified and mitigation measures are proposed and implemented.

Recommendations to Improve Disaster Preparedness and Resiliency

Based upon the answers and discussions of the township's GTR questionnaire this report offers additional actions Greenwich should consider to further and enhance resiliency efforts within the township. Recommendations are separated by the five sections of the Getting to Resilience questionnaire.

5.1 Risk and Vulnerability Assessment

5.1.1 Complete a Coastal Vulnerability Assessment

Greenwich should complete a coastal vulnerability assessment (CVA) following this Getting to Resilience process. A vulnerability assessment analyzes the potential impact of future flood hazards on community assets, and the consequences they pose to the entire community. The assessment includes not only the depth and extent of flooding but the impact of flooding on the function and services of the built, social and natural environment. Flood hazards should include both sea level rise and future episodic flood events, e.g. the 1% storm, hurricane storm surge. If data is available, precipitation and 10% flood events should also be included.

Communities can receive CRS points under section 410 by completing this activity.

Resources

- Municipal Coastal Vulnerability Assessment. A flyer and facilitator's guidance document is available from Sustainable Jersey upon request.

5.2 Public Engagement

5.2.1 Community education on the natural and beneficial functions of wetlands and floodplains

Much of Greenwich's wetlands border agricultural lands or forested areas and are essential to protecting the community. Public education is critical for ensuring community buy-in on decisions to further protect the wetlands and mitigate the impacts of inundation.

Greenwich could receive CRS points under Section 330 by participating in community outreach projects on hazard mitigation strategies such as wetland protection.

Resources

- Protecting Floodplain Resources - A Guidebook for Communities is a FEMA publication and provides a good introduction to the benefit of wetlands and natural resources. The guide can be found through a simple Internet search, or at this address:
<https://www.fema.gov/media-library/assets/documents/475>

5.3 Planning Integration

5.3.1. Form Flood Risk Team/Complete the Sustainable Jersey Flooding Risk Action

Greenwich has begun the process of completing the Sustainable Jersey Climate Adaption: Flooding Risk action. This action is worth 20 points in Sustainable Jersey's municipal certification program. A benefit

of completing this action is the creation of a Flood Risk Team, a working group of municipal officials and citizens working directly on flood mitigation and resiliency issues in Greenwich. Sustainable Jersey recommends this group continue to meet on a regular basis to continue their work in making Greenwich a more flood resilient community.

Resource

- More information on the Sustainable Jersey Climate Adaptation: Flooding Risk action is found at: <http://www.sustainablejersey.com/actions-certification/actions/#/open/action/513>.

5.3.2. Continue close participation in the Cumberland County All-Hazard Mitigation Plan

The County All-Hazard Mitigation Plan provides a county wide risk and vulnerability assessment of important county and municipal assets. The plan includes a prioritization of assets, policies, and projects for the county and each municipality. The plan can also be used as the basis for pursuing FEMA related grants to help fund mitigation projects that are important for municipal resilience. Greenwich should continue to work closely with Cumberland County to identify opportunities for mutually beneficial hazard mitigation projects. Completing a coastal vulnerability assessment (5.1.1) will provide a detailed list of assets at risk and can serve as a basis for considering which local assets should be recognized and included in the county plan. In addition, the township should integrate the current and future planning efforts of the plan into all municipal plans, policies, and ordinances.

5.3.3 Cross-reference flood risks and vulnerabilities in relevant sections of the municipal master 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 these risks but typically are stand-alone documents that sometimes do not cross-reference municipal planning policies. 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.

Resource

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

5.4 Disaster Preparedness and Recovery

5.4.1. Register and Participate in the Storm Ready Community Program

The Storm Ready Community Program is a National Weather Service sponsored program that enables communities to be more prepared for storms and flooding through more effective communication. Greenwich could receive 25 CRS points under Section 610 by participating in the Storm Ready Community program.

Resource

- More information on Storm Ready Communities is found at: <http://www.stormready.noaa.gov/communities.htm>.

5.4.2. Form a Community Emergency Response Team (CERT) Program

Greenwich currently has two volunteers who are trained in the CERT program, but no formal team exists. The Community Emergency Response Team (CERT) program educates people about disaster preparedness for hazards that may impact their area and trains them in basic disaster response skills, such as fire safety, light search and rescue, team organization, and disaster medical operations. Using the training learned in the classroom and during exercises, CERT members can assist others in their neighborhood or workplace following an event when professional responders are not immediately available to help. CERT members also are encouraged to support emergency response agencies by taking a more active role in emergency preparedness projects in their community.

Resource

- More information on the CERT program is found at: <http://www.fema.gov/community-emergency-response-teams>

5.4.3. Digitize and Back-Up all Municipal Public Records, Past and Present

Municipal public records are important to the history, place making, and understanding of how a community was formed, changed or stayed the same throughout its history. Public records are also important for the day-to-day operations of a municipality. The ability of a municipality to keep thorough, detailed public records prior to, during, and after disaster events is critical to the continuity and recovery of municipalities. Only recently has the township maintained a digital, back-up, copies of public records. Greenwich should conduct a needs assessment of the township's public records to determine which documents should be digitized based upon their importance, fragility, etc. With a needs assessment of public records the township can pursue grant opportunities available in the state to digitize their records.

5.5 Hazard Mitigation Implementation

5.5.1 Determine the need and benefits of participating in the NFIP's Community Rating System (CRS)

The CRS program awards points for emergency preparedness and flood risk reduction activities that are credited towards reduced flood insurance premiums for all floodplain property owners in the participating community. Participation in the CRS program not only increases local resiliency, but can provide substantial savings in flood insurance for publicly owned facilities as well as private residences and businesses across the municipality. Greenwich has extensive FEMA designated floodplains along the Cohansey River and throughout the wetland areas of the township. The township should consider conducting a floodplain analysis to determine the number of properties located within a Special Flood Hazard Area (SFHA) that are required to have national flood insurance. Depending upon the number of properties affected, Greenwich should consider enrolling in the NFIP's Community Rating System to help lower the cost of the community's flood insurance premiums.

Resources

- Numerous web-based technical guides and manuals are available on the FEMA website, and can be found through a simple Internet search of "FEMA Community Rating System".
- For specific questions or technical assistance, contact the NJDEP Flood Unit at 609-202-2296.

5.5.2 Assess the impacts of rising sea levels on wetlands

The natural systems within Greenwich play a critical role in hazard mitigation, particularly the extensive wetlands complex located along the shores of the Delaware River, Cohansey River and Stowe Creek. The township should consider assessing the ability of the wetlands to play this mitigation role given future sea level rise. The assessment should review current conditions, the potential impacts of rising sea level and the extent of possible marsh migration. Following this assessment, the community should review its plans and ordinances to manage its wetlands, allow for migrating wetlands, and limit future disturbances.

6. Conclusions

Increasing resilience to flood hazards is a long term process that involves moving through multiple phases ranging from assessing hazards to identifying and implementing adaptation strategies. The Municipal Resilience Cycle provides a path for communities to move through various phases of resilience: emergency preparedness, risk and vulnerability assessment, identifying local solutions, implementing adaptation strategies, and engaging in monitoring and evaluation to close the loop. The recommended next steps for Greenwich are to:

- 1) Circulate this summary report to the township's Planning Board and Environmental Commission for their review, and make it available to the public on the township's website.
- 2) Engage in a more comprehensive vulnerability and risk analysis by conducting a Coastal Vulnerability Assessment (CVA)
- 3) Begin to address the recommendations provided in this summary report
- 4) Review all the automated responses provided in the township's Getting to Resilience Linkages Report, and attached in the Appendix of this report
- 4) Continue to incorporate flood hazards and sea level rise into all planning processes.

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