# CHATHAM COUNTY MULTI-JURISDICTION PRE-DISASTER HAZARD MITIGATION PLAN

Developed on cooperation from the governments of:

Chatham County
City of Bloomingdale
City of Garden City
City of Pooler
City of Port Wentworth
City of Savannah
Town of Thunderbolt
City of Tybee Island

December 2015

Chatham Emergency Management Agency
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## ANNEXES

# CHAPTER 1 – INTRODUCTION TO THE PLANNING PROCESS

| 44 CFR Requirement |
|---|
| ***44 CFR Part 201.6(c)(1):*** The plan shall include documentation of the planning process used to develop the plan, including how it was prepared, who was involved in the process and how the public was involved. |

This chapter provides information on the overall planning process undertaken to develop the plan. It consists of eight sections:

I. Purpose and Need for the Plan, Authority and Statement of Problem
II. Methodology, Planning Process, and Participation
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VI. Multi-jurisdictional Participation and Special Considerations
VII. Adoption, Implementation, Monitoring and Evaluation Process
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**Table 1.1** provides a brief description of each section in this chapter and a summary of the changes that have been made. Details are to be provided in the subsequent sections.

**Table 1.1: Overview of updates to Chapter 1: Introduction to the Planning Process**

| Chapter 1 Section | Updates to Section |
|---|---|
| I. Purpose and Need for the Plan, Authority and Statement of Problem | Only minor edits have been made to this section. |
| II. Methodology, Planning Process, and Participation | This section has been updated to include a description of the 2015 Update process including participants. |
| III. Updates and Revisions to the Hazard Mitigation Plan by Section | This section has been updated to include a description of the changes made to each section. |
| IV. Organization of the Plan | This section has been updated to include a description of the differences in organization between this update and the previous document. |
| V. Local Hazard, Risk, and Vulnerability (HRV) Summary | Data on hazard occurrences and property and infrastructure vulnerability have been updated with local mitigation goals and objectives identified based on analysis of cumulative and current data. |
| VI. Multi-Jurisdictional Special Considerations | Updated information on vulnerable populations, growth and development trends and other issues have been incorporated. |
| VII. Adoption, Implementation, Monitoring and Evaluation Process | Minor edits have been made to this section. |

| Chapter 1 Section | Updates to Section |
|---|---|
| VIII. Community Data | This section has been updated to include population data from 2013 and updated demographic information. |

# I. Purpose and Need for the Plan, Authority and Statement of Problem

Local hazard mitigation planning is the process of organizing community resources, identifying and assessing hazard risks, and determining how to best minimize or manage those risks. This process culminates in a hazard mitigation plan that identifies specific mitigation actions, each designed to achieve both short-term planning objectives and a long-term community vision.

To ensure the functionality of a hazard mitigation plan, responsibility is assigned for each proposed mitigation action to a specific individual, department, or agency along with a schedule or target completion date for its implementation (see *Chapter 5 - Executing the Plan*). Plan maintenance procedures are established for the routine monitoring of implementation progress, as well as the evaluation and enhancement of the mitigation plan itself. These plan maintenance procedures ensure that the Plan remains a current, dynamic, and effective planning document over time that becomes integrated into the routine local decision making process.

Communities that participate in hazard mitigation planning have the potential to accomplish many benefits, including:

- saving lives and property,
- saving money,
- speeding recovery following disasters,
- reducing future vulnerability through wise development and post-disaster recovery and reconstruction,
- expediting the receipt of pre-disaster and post-disaster grant funding, and
- demonstrating a firm commitment to improving community health and safety.

Typically, communities that participate in mitigation planning are described as having the potential to produce long-term and recurring benefits by breaking the repetitive cycle of disaster loss. A core assumption of hazard mitigation is that the investments made before a hazard event will significantly reduce the demand for post-disaster assistance by lessening the need for emergency response, repair, recovery, and reconstruction. Furthermore, mitigation practices will enable local residents, businesses, and industries to re-establish themselves in the wake of a disaster, getting the community economy back on track sooner and with less interruption.

The benefits of mitigation planning go beyond solely reducing hazard vulnerability. Mitigation measures such as the acquisition or regulation of land in known hazard areas can help achieve multiple community goals, such as preserving open space, maintaining environmental health, and enhancing recreational opportunities. Thus, it is vitally important that any local mitigation planning process be integrated with other concurrent local planning efforts, and any proposed

mitigation strategies must take into account other existing community goals or initiatives that will help complement or hinder their future implementation.
Jurisdictions are required to update their hazard mitigation plans every five years so the jurisdictions can remain eligible for federal mitigation funding. To prepare the *2015 Pre-Disaster Hazard Mitigation Plan*, Atkins was hired as an outside consultant to provide professional mitigation planning services. To meet requirements of the Community Rating System, the region ensured that the planning process was facilitated under the direction of a professional planner. Nathan Slaughter from Atkins served as the lead planner for this project and is a member of the American Institute of Certified Planners (AICP).

Per the contractual scope of work, the consultant team followed the mitigation planning process recommended by FEMA (Publication Series 386 and Local Mitigation Plan Review Guide) and guidance provided by the Georgia Emergency Management Agency (GEMA). The Local Mitigation Plan Review Tool, found in Appendix I, provides a detailed summary of FEMA's current minimum standards of acceptability for compliance with DMA 2000 and notes the location where each requirement is met within this Plan. These standards are based upon FEMA's Final Rule as published in the Federal Register in Part 201 of the Code of Federal Regulations (CFR). The planning team used FEMA's Local Mitigation Plan Review Guide (October 2011) for reference as they completed the Plan.

The updated Chatham County Pre-Disaster Hazard Mitigation Plan provides a coordinated structure to guide county hazard mitigation efforts and investments in the coming years. The purpose of the plan is to consolidate, collate, and organize data from the Chatham County Emergency Management Agency (CEMA) capabilities assessment (see Annex H) and analysis of existing conditions and to make Chatham County eligible for federal hazard mitigation grant programs such as: Pre-Disaster Mitigation (PDM), Flood Mitigation Assistance (FMA), and the Hazard Mitigation Grant Program (HMGP).

Chatham County has a history of both natural and technological disasters, with potential for future impacts. To reduce the financial, economic and human impacts of disasters, the Chatham County Commission and local municipalities authorized CEMA to develop and implement a plan for mitigation actions. As did the 2010 plan, this updated plan addresses all-hazard mitigation for Chatham County, Georgia, including the municipalities of Bloomingdale, Garden City, Pooler, Port Wentworth, Savannah, Thunderbolt, and Tybee Island, and unincorporated Chatham County.

The Hazard Mitigation Planning Team conducted a capabilities assessment and analysis of existing conditions and then developed an inventory of potential mitigation actions. Individuals as well as public and private organizations that could be affected by mitigation actions were invited to participate in the development of a plan to implement those actions. This resulting plan will be made available for public comment, with potential for incorporation of any additional comments received to still further improve it and meet the needs of the people of Chatham County.

The Georgia Emergency Management Act of 1981 authorizes local emergency management agencies such as CEMA to conduct emergency management activities for the County. CEMA was authorized to develop and implement a plan for mitigation actions by Local Government Resolution for Emergency Management executed by the Chatham County Commission and local municipalities on 25 April 2000.

An approved mitigation plan pursuant to part 44 of the Code of Federal Regulations (44CFR201), sections 206, et seq., and adherence to any additional requirements of Federal Emergency Management Agency (FEMA) Region IV are needed to receive HMGP, PDM, FMA, and other grants. Without these grants, many needed mitigation actions may have to be deferred.

## II. Methodology, Planning Process and Participation

### 2015 Hazard Mitigation Plan Update

CEMA is charged with coordinating emergency mitigation, preparedness, response and recovery activities for the County and is guiding and overseeing the plan update. Chatham County contracted Atkins, North America as their consultant to provide hazard mitigation planning services. An initial meeting between representatives of CEMA and the Atkins Project Manager was held on September 16, 2014, to discuss the process of the plan update and the needs of the County. During this meeting, the overall process was discussed and the roles and responsibilities for the County and Atkins were determined as well as the involvement of all of the municipalities during the previous planning process. Five meetings were planned for the entire process to include the final presentation to the County Council. The formatting of the document as well as the adherence to the STAPLEE method for mitigation actions was outlined.

Prior to the public planning meetings, notices and invitations were distributed through multiple mechanisms to include website announcements, email, and social media to CEMA's public and private partners to include the local media stations. This process was utilized for meeting notification for all of the planning meetings. CEMA has an Alert subscriber system in place that encompasses all of the County's partners and is disseminated on a weekly basis. This system was also used for meeting invitations. All meeting notifications and media coverage are included in Annex F of this plan. The meeting agendas, sign-in sheets, and full meeting minutes are also included in Annex F.

### First Meeting with the Steering Committee

In the last plan update, CEMA utilized a Steering Committee with liaisons from each jurisdiction to build the list of invitees to participate in the broader Hazard Mitigation Planning Team. This Steering Group was convened on October 7, 2014 in the County Commissioners' Room at the Old County Courthouse in downtown, Savannah, GA. Kate Busbee, Chatham County's Emergency Management Planning Lead and local point of contact for the project, started the meeting by welcoming the representatives from the participating municipal jurisdictions. The jurisdictions of Chatham County, City of Pooler, City of Bloomingdale, and the City of Garden City all had representatives present.

Ms. Walton led the Steering Committee meeting. She began by providing an overview of the items to be discussed at the meeting, and then she asked the meeting attendees to introduce themselves. Following introductions, she provided a brief overview of mitigation and then explained the six different categories of mitigation techniques (emergency services; prevention; natural resource protection; structural projects; public education and awareness; and property protection) and gave examples of each. Ms. Walton outlined the key objectives of the planning efforts as well as the municipalities' role in the process.

Each project task was detailed to include the risk assessment, hazard identification, and capability assessment along with the most important piece of the mitigation strategy. The necessary documentation and the roles and responsibilities of all of the stakeholders were shared as well as the next steps for the project.

The discussion continued amongst the attendees regarding the Community Rating System benefits to the jurisdictions. Ms. Walton emphasized some additional benefits to the process and how the jurisdictions can implement them.

The next meeting was planned for the official All-Hands Project Kick-off later in October.

**Hazard Mitigation Planning Team Meetings**

**Kick-off Meeting**
Clayton Scott, Director for Chatham County Emergency Management Agency, thanked everyone for attending and shared the type of funding that would be available for participating jurisdictions.

Margaret Walton, Project Manager from the project consultant Atkins, led the meeting and began by providing an overview of the agenda items and briefly reviewed each of the handouts that were distributed in the meeting packets (agenda and presentation slides). She then asked each of the meeting attendees to introduce themselves. Following introductions, she provided a brief overview of the meeting agenda and the stages of the mitigation planning process that would be addressed through this plan. Ms. Walton emphasized that mitigation refers to actions (projects, policies, plans) to reduce the impacts of future hazard events. The hazard mitigation planning process looks at hazards, capability to conduct mitigation, and specific activities to reduce impacts of hazards. She explained how Federal legislation requires local governments to have a hazard mitigation plan in place to remain eligible for federal mitigation grants (e.g., HMGP, FMAP, and PDM). So, there is funding to implement some of the actions that this plan may identify.

Nathan Slaughter, Mitigation Planning Lead, then laid out all of the mitigation techniques/categories that mitigation actions fall into. He walked through the PowerPoint presentation to outline various examples of each technique and began a discussion of projects that the County and participating jurisdictions might pursue. Following this discussion, Mr. Slaughter led an icebreaker exercise.

He provided instructions to attendees on how to complete the exercise. Attendees were given an equal amount of fictitious FEMA money ($20 each) and asked to spend it in the various mitigation categories. Money could be thought of as grant money that communities received towards mitigation. Given the windfall of financial resources, attendees target their money towards areas of mitigation that are of greatest concern. Ideally, the exercise helps pinpoint areas of mitigation that the community may want to focus on when developing mitigation grants. Mr. Slaughter explained that the results would be presented at the end of the meeting and also reviewed at the next Hazard Mitigation Planning Committee meeting.

The results were:

- Emergency Services - $192
- Prevention - $147
- Structural Projects - $115
- Property Protection - $111
- Public Education and Awareness - $82
- Natural Resource Protection - $73

**Risk Assessment**

Mr. Slaughter explained that FEMA requires that plans address natural hazards, but all-hazards approach is becoming more prevalent. Some manmade/technological hazards have been included in the hazard identification, but vulnerability assessment focuses more on the natural hazards since more mitigation funding is available for natural hazards. Mr. Slaughter presented the list of hazards to be addressed in the plan. The Hazard Mitigation Planning Committee made the following suggestions regarding the Hazard Identification:

- Consider adding additional hazard: **sea level rise**
  It has become a more prominent issue.

- Consider adding additional hazard: **Depletion of wetlands**
  It was determined that this might be under coastal erosion.

- Consider additional hazard: **tsunami**
  This has not been addressed because evacuation is already confusing for the general public. The County has tried to make the evacuation route less specific and not solely for hurricanes.

- Consider adding additional hazard: **infectious disease**
  Currently, this is in the forefront of today's society and it is included in the public health plan.

- Consider adding additional hazard: **Dam failure/inundation**
  Currently, the US Army Corps of Engineers has a plan for this hazard.

**Capability Assessment**
Mr. Slaughter explained the community capability assessment and discussed how capability is divided primarily into 3 categories:

- Administrative
- Technical
- Fiscal

**Mitigation Strategy**
Mr. Slaughter discussed mitigation strategy and how it is developed. He stated that mitigation goals come from the existing plan and the current mitigation actions will be updated. However, all of the jurisdictions will need to develop new actions as well based on the risk assessment.

He continued the presentation by discussing the necessary documentation for the planning process, the current project schedule, and the project team.

**Public Involvement**
Ms. Walton explained how public comment and participation is a required part of this process. A public survey was developed that the County will be placing on their website. The link will be shared electronically following the meeting and the jurisdictions were asked to post the link on their sites also.

Next, Ms. Walton discussed the roles and responsibilities of all the parties involved as well as the expectations on the level of involvement. The Atkins team will provide technical assistance, data collection, facilitation, and plan preparation. The County and jurisdictions were asked to be active participants by assisting with data collection, public awareness, hosting committee meetings, mitigation strategy, plan feedback, and plan adoption.

The next steps are to initiate data collection with the risk assessment and capability assessment. The floor was opened for questions and comments.

Clayton Scott closed the meeting by thanking everyone for attending and reiterating the importance of participation.

**Table 1.2: Hazard Mitigation Planning Team**

| Name | Organization | Title/Department |
|---|---|---|
| Lewis Tuttle | Magnolia Manor/Richmond Hill | Maintenance Director |
| Ed Ditommaso | Geo Rec | Owner |
| James Eaberson | Chatham County | ADA Coordinator |
| Ron Alexander | City of Garden City | Planning and Development Director |
| Sara Berry | City of Garden City | Public Works Director |
| Bob Merriman | Town of Thunderbolt Police Department | Police Chief |
| Diane Proudfoot | City of Bloomingdale | Assist. City Clerk/Zoning |

| Name | Organization | Title/Department |
|---|---|---|
| | | Administrator |
| Ernest C. Grizzard | City of Bloomingdale | Public Works Superintendent |
| Ashley Fields | City of Port Wentworth | Fire Chief |
| Lance Moore | City of Port Wentworth | Fire Lieutenant |
| Blair Jeffcoat | City of Bloomingdale | Police Department Captain |
| Shawn McNelly | City of Pooler | Superintendent of Streets and Sanitation |
| Amy Davis | Chatham County | Finance Department |
| Lara Hall | Chatham County | SAGIS |
| Stephen Andrews | Chatham County | Health Department |
| Cindy Coe | Gulfstream | Security Specialist |
| Jubal Rogers | Gulfstream | Security Specialist |
| Tom McDonald | City of Savannah | Floodplain Administrator |
| Ron Feldner | City of Garden City | City Manager |
| Elijah J. Powell | Chatham County | |
| Jill Growe | Chatham County | Engineering Department |
| Michael Blakely | Chatham County | Engineering Department |
| Maryellen Burner | Chatham County | Tax Assessor's Office |
| Carmen Young | American Red Cross | Southeast and Coastal Georgia Chapter |
| Gary Jarriel | Southside Fire/EMS | Chief of Security |
| Tom Thomson | Metropolitan Planning Commission | Executive Director |
| Richard Lambeth | Coastal EMS | Director |
| Jimmy Brown | City of Tybee Island | Emergency Management Coordinator |
| Henry Lewandowski | Chatham County | Mosquito Control |
| Gregori Anderson | Chatham County | Director of Building Safety and Regulatory Services |
| Al Jelinski | City of Garden City | Police Department |
| Karen Jenkins | Savannah Tree Foundation | Executive Director |
| Caroline Nguyen | Town of Thunderbolt | Town Administrator |
| Wade Simmons | City of Pooler | Fire Department |
| Lawrence Wright | Chatham County | Sheriff's Department |
| Patricia Gibbs | Chatham County | CERT/SAR |
| Jackie Carver | City of Pooler | Planning and Zoning Administrator |
| Kate Busbee | Chatham County | Emergency Management Agency |
| Dennis Jones | Chatham County | EMA Deputy Director |
| Clayton Scott | Chatham County | EMA Director |

**Risk Assessment and Mitigation Strategy Meeting**

Ms. Walton initiated the meeting with a review of the meeting handouts, which included an agenda and presentation slides and stating that this would be an interactive meeting. Introductions were made and Ms. Walton began by emphasizing community participation in this planning process. The jurisdictions of Chatham County, City of Bloomingdale, City of Garden City, City of Pooler, City of Port Wentworth, City of Savannah, Town of Thunderbolt, and the City of Tybee Island were all present. Ms. Walton provided a refresher on the definition of mitigation and mitigation techniques.

Ryan Wiedenman with Atkins then presented the findings of the risk assessment. He reviewed the Presidential Disaster Declarations that have impacted the region. He then explained the process for preparing Hazard Profiles and discussed how each hazard falls into one of four basic categories: Atmospheric, Hydrologic, Geologic, and Other. He indicated that each hazard must be evaluated and formally ruled out if it is not applicable to the study area, even where it seems obvious (such as in the case of volcano).

Mr. Wiedenman reviewed the Hazard Profiles and the following bullets summarize the information presented:

- DROUGHT. There have been 67 events since 1996 where drought conditions have been reported as severe, extreme or exceptional in the County.
- EXTREME HEAT. There have only been 37 recorded extreme heat events reported since 1996.
- HAILSTORM. There have been 150 recorded events since 1957. Future occurrences are highly likely.
- LIGHTNING. There have been 21 recorded lightning events since 1996 causing 2.7 million in reported property damages. Future occurrences are highly likely.
- TORNADOES. There have been 23 recorded tornado events reported in the region since 1955. There was 16.4 million in property damages. 21 injuries were reported. Future occurrences are likely.
- HURRICANES AND TROPICAL STORMS. NOAA data shows that 115 storm tracks have come within 75 miles of the region since 1850. Future occurrences are likely.
- STORM SURGE. Category 5 Storm Surge is possible and highly likely.
- SEA LEVEL RISE. Has been measured to some degree but future occurrences are highly likely.

- SEVERE THUNDERSTORM WINDS. There have been 387 severe thunderstorm events reported since 1960 with $6 million in reported property damages. 1 death and 7 injuries have been reported. Future occurrences are highly likely.

- WINTER STORM. There have been 24 recorded winter events in the region since 1996 resulting in $1.6 million in reported property damages. Future occurrences are likely.

- EARTHQUAKES. There have been 18 recorded earthquake events in the area since 1811. The strongest had a recorded magnitude of VIII (MMI). Future occurrences are possible.

- DAM FAILURE. There are 3 dams in the County. There have been no reported significant failures. Future occurrences are unlikely.

- EROSION. Gradual shore line erosion has occurred. Future occurrences are possible.

- FLOOD. There have been 79 flood events recorded in the County since 1996, resulting in $11,981,397 in property damage. There have been 2,615 NFIP losses since 1978 and approximately $35.6 million in claims. Future occurrences are likely. There have been 399 repetitive loss properties with approximately $21,117,280 in damages.

- WILDFIRE. There is an average of 73 fires per year reported in the area. Future occurrences are likely.

- HAZARDOUS MATERIALS INCIDENTS. There have been 644 reported events since 1971. Future occurrences are highly likely.

- TERROR THREAT. No historic record of major terrorist events in Chatham County, but events have occurred in Georgia.

The results of the hazard identification process were used to generate a Priority Risk Index (PRI), which categorizes and prioritizes potential hazards as high, moderate or low risk based on probability, impact, spatial extent, warning time, and duration. The highest PRI was assigned to Flood, followed by Storm Surge, Hurricane/Tropical Storm, Severe/Thunderstorm and High Wind, and Tornadoes. It was decided that Lightning should be combined with Thunderstorm/High Wind. Extreme Heat was moved up to moderate risk and Drought was moved down to the low risk.

Discussion of hazardous materials occurred and committee members suggested that transportation of chemicals on the County's roadways might be a hazard. The port was also suggested as an area of interest in regards to hazardous materials because it affects land and water.

An in-depth terrorism discussion also followed. The definition of terrorism was addressed and two additional concerns for the County were raised, St. Paddy's Day festivities and the Rock and Roll Marathon. The St. Paddy's Day activities are the 2$^{nd}$ largest in the US and all of the local

transportation means are at risk. The marathon could pose a threat to the Talmadge Bridge which lends into South Carolina.

Two other issues that were broached were flooding clarification and fixed nuclear facilities in neighboring counties. An open discussion continued on whether the types of flooding in the County should be more diversified between localized flooding and rainwater flooding.

In concluding the review of Hazard Profiles, Mr. Wiedenman stated if anyone had additional information for the hazard profiles, or disagreed with any of the data presented, they should call or email him with their concerns.

Ms. Walton then provided an overview of the Capability Assessment Findings. Atkins has developed a scoring system that was used to rank the participating jurisdictions in terms of capability in four major areas (Planning and Regulatory; Administrative and Technical; Fiscal; Political). Important capability indicators include National Flood Insurance Program (NFIP) participation, Building Code Effective Grading Schedule (BCEGS) score, Community Rating System (CRS) participation, and the Local Capability Assessment Survey conducted by Atkins. Each jurisdiction was asked to review the completed capability assessments and provide feedback later in February.

Ms. Walton then began the mitigation strategy discussion. The existing mitigation goals, mitigation action worksheets, current mitigation actions for each jurisdiction, and mitigation action recommendations were distributed. The goals currently address protecting people, improving education and outreach, improving capabilities and coordination, and improving data collection. It was agreed that the goals were still appropriate and just needed some minor adjustments to include all of the hazards and protecting the County's resources. She stated that each jurisdiction would need to update their implementation status of their current goals as well as create new ones. Every jurisdiction was instructed to develop new goals for each hazard and to ensure that they had an action addressing flood since all of the jurisdictions are in the NFIP. Ms. Walton stated that she would be available to assist with mitigation action development. She then thanked the group for taking the time to attend and the meeting was adjourned.

**Additional Meetings**

Mitigation strategy meetings with the City of Pooler, Port Wentworth, and Garden City were held with the municipal liaisons and the consultant. Another mitigation strategy took place with all of the Chatham County departments to include separate meetings with the facilities staff and the Floodplain Administrator.

An overview of the Hazard Mitigation Plan and the planning process was outlined at the Chatham County Hurricane Conference on April 7, 2015.

The next meeting with the Hazard Mitigation Planning Team will take place June 15, 2015. At this meeting, the draft of plan will be rolled out to the municipalities and stakeholders for their review and comments.

During this planning process, the consultant and CEMA staff worked with the municipality liaisons to gather all of the necessary data through correspondence. This included reviewing all of the current plans and ordinances to determine the strengths and weakness through the capability assessment.

A Haz510 Advisory Group was also instated by the Community Rating System's Users' (CRS) Group in the County. All of the jurisdictions are members of the National Flood Insurance Program and all but one are members of the CRS which lowers the flood insurance premiums for citizens. The Haz510 Advisory Group allowed and will continue to allow for expanded citizen input and comments on the hazard mitigation process.

The following table summarizes all of the hazard mitigation planning team meetings:

**Table 1.3: Planning Meetings**

| Date | Meeting | Overview |
|---|---|---|
| October 7, 2014 | Steering Committee - Kick-off Meeting | This initial meeting brought together the key point of contacts for the jurisdictions to discuss the planning process. Participants were provided with an overview of the hazard mitigation planning process and their roles and responsibilities within it. |
| October 21, 2014 | Hazard Mitigation Planning Team – Kick-off Meeting | HMP Team was convened to kick-off the project. The Team was provided with a mitigation overview along with all the steps in the planning process as well as laying the foundation for the project. |
| January 22, 2015 | Hazard Mitigation Planning Team – Risk Assessment and Mitigation Strategy Meeting | The full risk assessment was provided and meeting participants were asked to provide interactive feedback. The mitigation strategy was explained and all of the existing mitigation actions were reviewed. The Team reviewed and updated the overarching mitigation goals. |
| June 15, 2015 | Hazard Mitigation Planning Team – Draft Review Meeting | This meeting provides the final draft of the County plan to allow for comments and feedback on the document. The plan will also be available for public involvement and citizen input. |

| Date | Meeting | Overview |
|---|---|---|
| Fall 2015 | County Council Presentation | The final meeting will be once FEMA has approved the document pending local adoption. The final plan will be presented to County Commissioners for Adoption. This meeting will be open to the public. |

**2010 Hazard Mitigation Plan Update**

CEMA determined the need for a broad Steering Committee for the hazard mitigation plan update and developed a list of invitees to participate. A kickoff meeting was held on May 27, 2009, at the Department of Family and Child Services (DFACS) building in Savannah. Invitations were distributed two weeks prior to the meeting to individuals and agencies by mass fax, email, media outlet distribution and public television to the members of the Local Emergency Planning Committee (LEPC), public and private partners and the general public. A similar process was followed for three subsequent planning meetings. Notice of meetings were distributed electronically to CEMA Alert subscribers (free and open to public; 3,000 subscribers). A copy of written public notices and press releases and media and web page coverage are available in Annex F. Copies of attendee lists for meetings are also available in Annex F.

In addition, JLWA provided a briefing regarding the Hazard Mitigation Plan and update process at the Chatham County Hurricane Conference on May 4, 2009. The one-hour workshop offered information to attendees regarding mitigation planning, the process for the plan update, types of information needed, and need for agency and public input to the process.

A second Steering Committee meeting was held at the Pooler City Hall in the evening on August 13, 2009, during which the Steering Committee was provided with an update regarding the planning process. The group discussed changes to the original plan, including additional data and studies that were not available during the 2005 planning process.

A hazard-by-hazard exercise was used to gather participants' input regarding risk designations. Each hazard was discussed in detail, including results of an initial quantitative risk assessment based on available local and national data, as well as the generation of a qualitative risk assessment by the Steering Committee. Low, moderate and high designations were determined by the committee, based upon past occurrences, specific vulnerabilities, and several other factors. Risk assessments were determined for people, buildings and infrastructure.

Municipality meetings were held with the City of Savannah and with the City of Tybee Island on August 14, 2009, as well as with the City of Bloomingdale on September 15 and the City of Garden City on September 11, 2009. A municipal meeting with the Town of Thunderbolt was held on September 24, 2009, as well as one with the City of Port Wentworth on February 22, 2010. Municipal meetings were intended to gather further historical data and other information relevant to the planning process, as well as to address any concerns specific to individual

municipalities. During these meetings initial municipal project lists were developed. The City of Pooler contributed its mitigation actions early in the process, and a follow-up meeting was held in November 2009.

A third Steering Committee Meeting was held at the Coastal Georgia Center on the morning on September 15, 2009. The Steering Committee was again provided with an update regarding the planning process and then asked to review the draft goals and objectives which had been drafted to date. The group discussed the goals and objectives for each hazard and suggested additional objectives as well as potential projects.

A meeting regarding mitigation actions also was held on September 15, 2009, with representatives from the unincorporated areas of Chatham County. Information was shared regarding the planning process to date. Historical data and specific concerns related to the unincorporated areas of the County were discussed. Additional objectives and mitigation actions were discussed for potential inclusion into the plan.
A presentation was given at the LEPC meeting on September 16, 2009. The 20-minute presentation offered a brief overview of the Hazard Mitigation Plan update process and the previous planning meetings. Each hazard was described with associated risk and vulnerabilities.

Throughout the process, the planning team reviewed and discussed with representatives of municipalities, Chatham County, and planning organizations the existing plans and studies relevant to the Hazard Mitigation Plan Update, including a newly revised City of Savannah Flood Mitigation Plan and other ongoing planning initiatives.

CEMA utilized the STAPLEE worksheets provided by GEMA to prioritize all action items within this plan. These worksheets can be found in Annex E.

The Draft Pre-Disaster Hazard Mitigation Plan Update was made available to the Steering Committee and the public for a 30-day comment period beginning on October 23, 2009. The plan was provided electronically and, upon request, in hard copy. A public meeting will be held for final review of the updated Hazard Mitigation Plan on November 2, 2010, after notification of FEMA approval pending adoption by local governments. A participant list and materials from this meeting will be included in Annex F.

## III. Updates and Revisions to the Hazard Mitigation Plan by Section

Chatham County conducted an inclusive planning process to update the Chatham County Pre-Disaster Hazard Mitigation Plan (Chatham County HMP). The County's 2010 plan was taken as a base into which updated hazard and vulnerability data were incorporated. Representatives from municipalities, the County, private and non-profit organizations and the general public were engaged in the planning process. **Table 1.1** provides a brief description of each section in this chapter and a summary of the changes that have been made.

Chapter one has been updated to include information on the 2015 planning process.

Chapter two discusses natural and technological hazards with risks and vulnerabilities for Chatham County. This chapter combined chapters two and three from the 2010 plan. Updated information regarding events and studies completed since the 2010 planning process has been added. The hazard list has also been expanded to include the following hazards: drought, extreme heat, hailstorm, hurricane and tropical storm, lightning, severe thunderstorm / high wind, tornado, winter storm and freeze, earthquake, dam and levee failure, erosion, flood, storm surge, sea level rise, hazardous materials incident, terror threat, and wildfire.

Chapter three is a new chapter. This chapter builds upon the information provided in Chapter 2 by identifying and characterizing an inventory of assets in Chatham County. In addition, the potential impact and expected amount of damages caused to these assets by each identified hazard event is assessed.

Chapter four addresses the overarching community and County mitigation goals which have been condensed and updated for the plan. All of the mitigation actions for each jurisdiction are profiled together and categorized based on the mitigation technique that they fall within. The existing mitigation actions have been updated for their current implementation status as of 2015. The updates included deferred actions as well as completed, and deleted actions. All of this is noted in the chart outlining the actions for each jurisdiction.

Chapter five outlines the process for the implementation of the mitigation action items, evaluation and monitoring of the plan, and procedures for the update and maintenance of the plan.

Chapter six provides a conclusion and summarizes the County's risk and vulnerability to the identified hazards. The information was revised to reflect the updated information included in chapters two and three.

## IV. Organization of the Plan

### 2015 Hazard Mitigation Plan Update

The 2015 Hazard Mitigation Plan update follows a similar plan organization that was used in the 2010 plan, however some of the chapter titles have changed. The update addresses the planning process, natural and technological hazard identification and risk and vulnerability assessment, mitigation goals and objectives, mitigation strategy, and plan implementation. Supporting worksheets and other documentation are included as annexes. The term annex is used for consistency with the structure of other CEMA and Chatham County emergency and related plans.

The 2015 Chatham County Hazard Mitigation Plan follows the Georgia Emergency Management Agency's (GEMA's) 2009 GEMA Plan Update Guidance.

## V. Local Hazard, Risk, and Vulnerability (HRV) Summary

Hazards addressed in this plan were determined by the Hazard Mitigation Planning Team based on available data and consideration of hazard frequency and potential severity of damage. Where available, hazard frequency based on past occurrence data is used to suggest future probability

For each hazard addressed in the plan, a qualitative damage/loss estimate was developed using low/moderate/high designations, based upon local knowledge of the community and municipal and county facilities. Team members looked at potential risk to people (loss of life or injury), risk to facilities and critical facilities (primarily damage to the physical structure), and risk to infrastructure (utilities and roads primarily). While specific areas of concern or increased vulnerability are discussed in Chapters 2 and 3, the overall impact to the County was determined as follows:

**Table 1.4: Summary of Qualitative Risk Assessment**

| Hazard Type | Risk to People | Risk to Buildings | Risk to Infrastructure |
|---|---|---|---|
| **Atmospheric Hazards** | | | |
| Drought | Moderate | Low | Low |
| Extreme Heat | Moderate | Low | Low |
| Hailstorm | Low | High | Moderate |
| Hurricane and Tropical Storm | High | High | High |
| Lightning | Moderate | Moderate | Moderate |
| Thunderstorm / High Wind | Moderate | High | High |
| Tornado | High | High | Moderate |
| Winter Storm and Freeze | Moderate | Low | Moderate |
| **Geologic Hazards** | | | |
| Earthquake | Moderate | Moderate | Moderate |
| **Hydrologic Hazards** | | | |
| Dam and Levee Failure | Low | Low | Low |
| Erosion | Low | Moderate | Low |
| Flood | Moderate | High | Low |
| Storm Surge | High | High | High |
| Sea Level Rise | Low | Moderate | Moderate |
| **Other Hazards** | | | |
| Wildfire | Moderate | Moderate | Moderate |
| Hazardous Materials Incident | High | High | High |
| Terror Threat | High | High | High |

Quantitative risk assessments were conducted based on the best data available at this time. These assessments are summarized in the following table. Information regarding the process

used for these risk assessments can be found in Annex A along with a list of critical facilities and their specific hazard risks and a comprehensive list of historic occurrences of hazards.

**Table 1.5: Summary of Quantitative Risk Assessment**

| Hazard Type | Population at Risk | Critical Facilities at Risk | Buildings at Risk |
|---|---|---|---|
| **Atmospheric Hazards** | | | |
| Drought | 271,102 | 750 | 134,783 |
| Extreme Heat | 271,102 | 750 | 134,783 |
| Hailstorm | 271,102 | 750 | 134,783 |
| Hurricane and Tropical Storm | 271,102 | 750 | 134,783 |
| Lightning | 271,102 | 750 | 134,783 |
| Thunderstorm / High Wind | 271,102 | 750 | 134,783 |
| Tornado | 271,102 | 750 | 134,783 |
| Winter Storm and Freeze | 271,102 | 750 | 134,783 |
| **Geologic Hazards** | | | |
| Earthquake | 271,102 | 750 | 134,783 |
| **Hydrologic Hazards** | | | |
| Dam and Levee Failure | <2,600 | 3 | <1,000 |
| Erosion | <10,500 | 37 | <4,000 |
| Flood (All Flood Zones) | 135,405 | 213 | 52,079 |
| Storm Surge (Cat 4) | 250,673 | 490 | 96,413 |
| Sea Level Rise (4 feet) | >17,000 | 323 | >7,000 |
| **Other Hazards** | | | |
| Wildfire | 111,324 | 171 | 42,817 |
| Hazardous Materials Incident | 271,102 | 695 (Fixed)<br>648 (Mobile) | 123,944 (Fixed)<br>111,074 (Mobile) |
| Terror Threat | 271,102 | 750 | 134,783 |

*In cases where population could not be easily calculated because detailed data was not available, estimates for structures and population were made using a 2.6 multiplier of average number of persons per household in the United States in 2012 (U.S. Census).

Quantitative risk assessment can be improved for future plan updates by gathering more detailed data on critical facilities and their vulnerabilities. During this plan update, more detailed assessments at the individual facility level regarding the vulnerabilities to each hazard were carried out. Inventories of contents at risk would improve this methodology. This is addressed in several of the action items within Chapters 4.

The overarching goal of hazard mitigation is to reduce or eliminate damage, injury, and loss of life when disasters occur. Chatham County has set forth specific goals to meet the unique needs of the communities within Chatham County.

Overall goals for each hazard include the protection of people and structures within the County, improvement of education and outreach efforts regarding potential impacts and mitigation

measures, improvement of capabilities and coordination, and an increase and improvement in data collection for use in reduction of further impacts from future disaster events. The County's mitigation strategy, including goals and actions, is described in Chapters 4.

## VI. Multi-Jurisdictional Participation and Special Considerations

The Chatham County Pre-Disaster Hazard Mitigation Plan includes the unincorporated County as well as seven municipalities. To satisfy multi-jurisdictional participation requirements, each participating jurisdiction was required to perform the following tasks:

- Participate in mitigation planning workshops;
- Identify completed mitigation projects, if applicable; and
- Develop (and/or update) and adopt their local Mitigation Action Plan.

Each jurisdiction participated in the planning process and has developed a local Mitigation Action Plan unique to their jurisdiction. Each jurisdiction will adopt their Mitigation Action Plan separately. This provides the means for jurisdictions to monitor and update their Plan on a regular basis.

In developing this mitigation action plan, Chatham County invited representatives of special needs groups to incorporate mitigation actions that will reduce the effects of high-probability high-impact hazards on specially vulnerable segments of the County's population. Foreseeable factors are: early warning specifically directed to those groups to facilitate preparations for evacuation, identification of transportation system elements adapted to their needs, and preparation of shelters/reception areas for special needs.

Many of the mitigation actions in Chapter 4 apply to and benefit the County as a whole in that they address broad issues or critical infrastructure. There also are mitigation actions that address hazard impacts in specific jurisdictions and hazard vulnerability associated with specific populations. As a basis for these actions, information on the seven municipalities within the County and municipality-specific information on key indicators of vulnerability are found in Section VIII, Community Data. For example, Tybee Island has the highest per capita concentration of elderly residents in the County, with almost 19 percent of the population over the age of 65. This may be accounted for as a desire to retire near the beach; it must be considered when looking at the risk to individuals from natural hazards.

The City of Savannah has the highest concentration of families living below the poverty level as well as almost all of the historic properties within the County. It is therefore necessary to consider the financial ability of individuals to mitigate, evacuate or recover from an event. It is also necessary to limit mitigation of structures to activities that will not impact their historic designation.

Garden City has several mobile home communities as well as a significant Hispanic population. Some hazard information and preparedness materials are available in Spanish, but there is a need to consider this special needs group when planning.

Chatham County attracts more than six million tourists annually which can present challenges with regard to informing the public, including visitors, about hazards and mitigation and preparedness measures.

Risk to facilities and students at the universities and colleges located within the planning area were calculated when possible. The Savannah State University campus straddles the Savannah-Chatham County boundary near the Wilmington River and includes more than 40 structures, several of which are in a Category 3 Storm Surge zone or lie near the 100-year flood plain. All three of the Georgia Institute of Technology Savannah buildings fall within the Category 4 storm surge risk zone and can be considered to be at risk from tornadoes or coastal storm winds. The Armstrong Atlantic State University (AASU) campus can be considered at risk from tornadoes or coastal storm winds. There are a total of 64 buildings on the AASU campus.

Addressing information was not available for the approximately 60 structures scattered throughout the Savannah Historic District and in other locations that are part of the Savannah College of Art and Design, so risk to facilities and students could not be directly calculated. However, given the broad area covered by the campus; it can reasonably be stated that SCAD faces similar risks to those faced by the City of Savannah as a whole. Additional information regarding universities and colleges can be found below. However, addressing information was not available for all campuses and detailed analyses could not be conducted.

## VII. Adoption, Implementation, Monitoring and Evaluation Processes

Upon FEMA approval, this plan will be submitted to Chatham County's seven local municipalities for adoption and subsequently, by action requesting a Local Government Resolution, to the Chatham County Commission for approval.

Because of the several types of mitigation actions to be employed, implementation methodologies will vary. See Chapter 6, Executing the Plan. For practicality, mitigation actions that can be accomplished through policy adoption by County governmental bodies, accompanied by mitigation actions likely to incur low local budgetary impacts, will be selected as pilot actions to demonstrate feasibility.

County and municipal officials designated to implement this plan will include suitable reporting procedures to ensure effectiveness in implementation by providing a project status report that will include which implementation processes worked well, any difficulties encountered, the progress and success of coordination efforts, and which strategies should be revised. To maximize benefits, prior to funding, a formal cost-benefit analysis will be conducted to the satisfaction of the funding institution (e.g. county, municipality, or outside agency).

CEMA will establish a biennial schedule of monitoring, evaluating, and updating the mitigation plan by March 31 every even-numbered year throughout the five-year cycle. When the provisions of this plan are put to the test by an occurrence of the hazard types addressed, updated data and lessons will be collected and collated. A review and analysis will then be conducted by CEMA, and appropriate findings made public and provided to participating organizations by the same methods used to develop this plan, with periods for public and organizations' comments.

The public's and organizations' comments will be considered by CEMA and appropriate data from the review, analysis and public comments used to modify the provisions of this plan. The modifications shall be promulgated by the same methods used to develop this plan. Summary reports will be provided to the County's policy-making bodies and to GEMA.

## VIII. Community Data

The planning area includes all of Chatham County, Georgia, with an estimated 2013 population of 271,102 (a 2.3 percent increase from 2010) based on the U.S. Census Bureau's American Community Survey Data. The American Community Survey data is used to provide detailed demographic data. This information can be found in Tables 1.3 through 1.5. **Map 1.1** shows the planning area.

**Map 1.1: Planning Area**

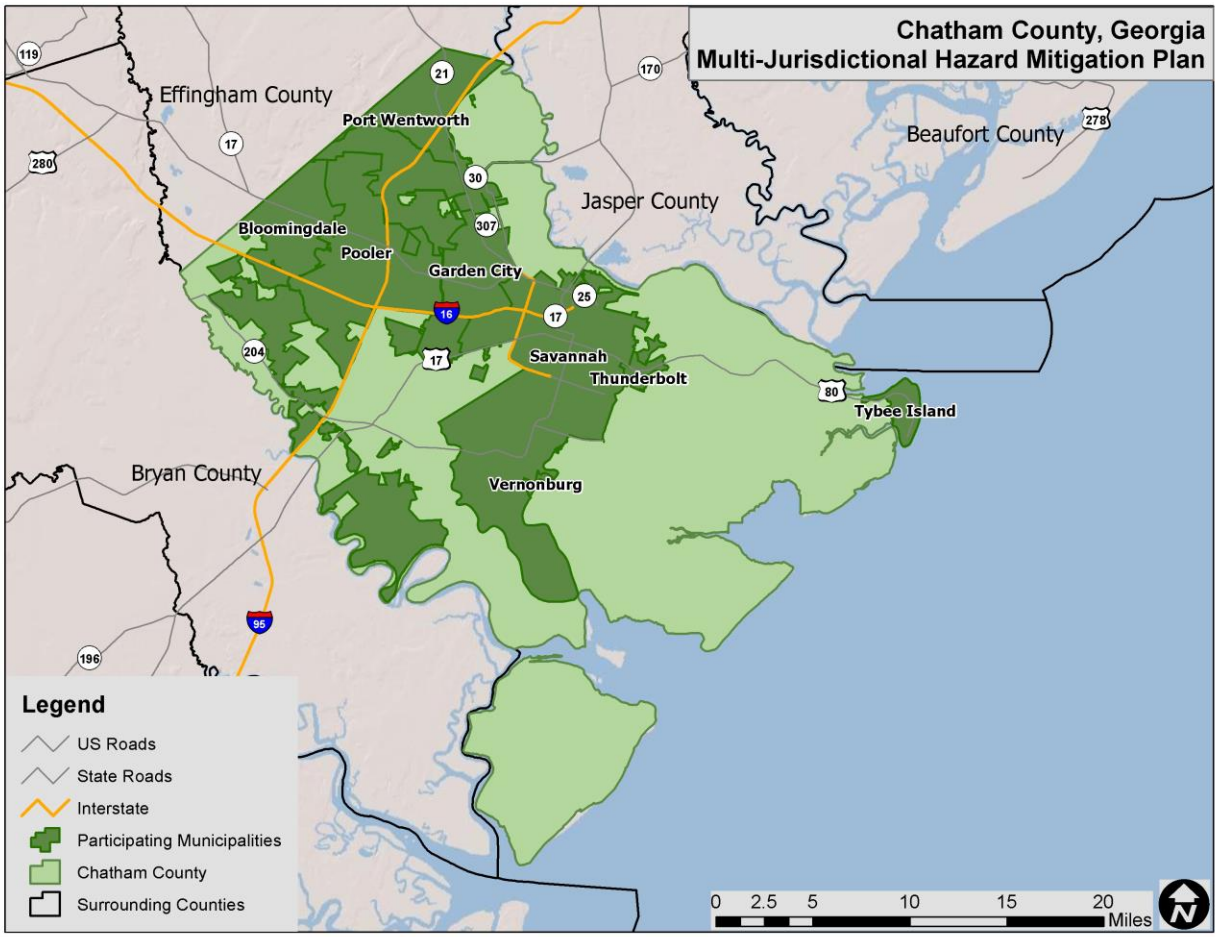



**Table 1.6** summarizes local population estimates for 2013.

**Table 1.6 Summary of 2013 Population Estimates-Chatham County, Georgia**

| Chatham County, GA | |
|---|---|
| Bloomingdale | 2,720 |
| Garden City | 8,888 |
| Pooler | 19,821 |
| Port Wentworth | 5,817 |
| Savannah | 139,620 |
| Thunderbolt | 2,583 |
| Tybee Island | 3,032 |
| Unincorporated County | 88,621 |
| Chatham County Total | 271,102 |

Tables 1.7 through 1.8 summarize relevant American Community Survey data.

**Table 1.7: Summary of 2013 Demographic Data – Chatham County, Georgia**

| Chatham County, GA Population | |
|---|---|
| Population in 2013 | 271,102 |
| Persons Under 5 years old | 6.9 percent |
| Persons under 18 years old | 15.5 percent |
| Persons 65 years old and over | 12.7 percent |
| Persons per square mile | 635.7 |
| Foreign born persons | 6.5 percent |
| Language other than English spoken at home (age 5+) | 8.0 percent |
| Persons with a disability (ages 5+) | 30,401 |
| White persons | 54.4 percent |
| Black persons | 39.9 percent |
| Asian persons | 2.4 percent |
| Persons of Hispanic or Latino origin | 5.7 percent |
| Persons below poverty level | 19.1 percent |
| High school graduates (age 25+) | 27.6 percent |
| Bachelor's degree (age 25+) | 19.9 percent |
| Median Household Income | $45,794 |

**Table 1.8: Summary of 2013 Homeownership Data**

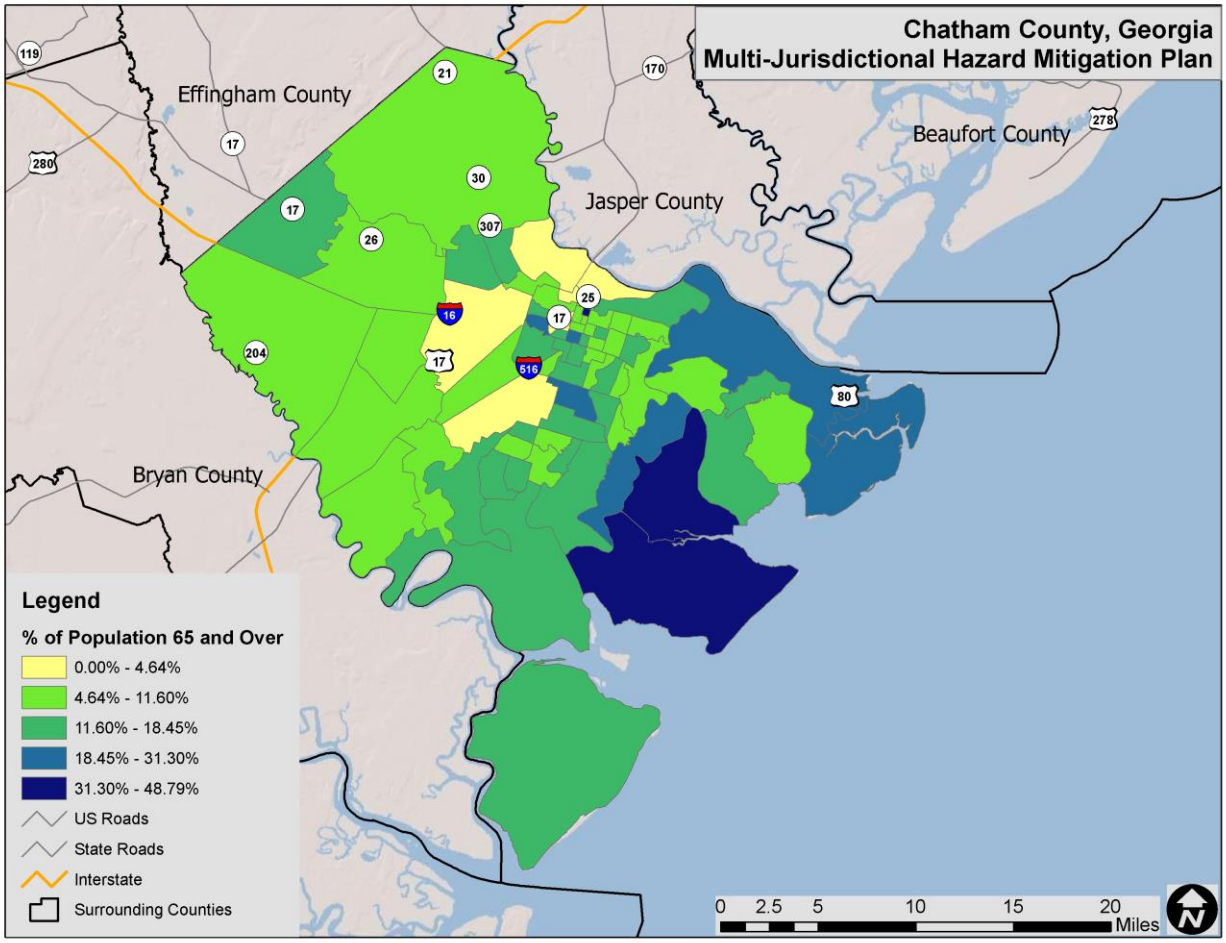
| Chatham County, GA Home Ownership | |
|---|---|
| Housing Units | 120,146 |
| Homeownership rate | 57.5 percent |
| Housing units in multi-unit structures | 28.0 percent |
| Median value of owner-occupied housing unit | $174,500 |
| Owner-Occupied Units | 58,886 |

**Table 1.9: Summary of Land Area and Employer Data**

| Chatham County Land Area and Employer Data | |
|---|---|
| Land Area, 2010 | 426.44 square miles |
| Persons per square mile, 2013 | 635.7 |
| Private nonfarm establishments, 2012 | 7,140 |
| Non-employer establishments, 2012 | 18,818 |
| Total number of firms, 2007 | 23,990 |

**Map 1.2** illustrates the percentage of the population over age 65 – a population group often experiencing increased vulnerability to hazards.* **Table 1.10** shows the breakdown by municipality.

**Map 1.2: Percentage of Population Over the Age of 65***




This map illustrates the percentage of the population over 65 that resides in locations throughout the County (as compared to per capita elderly population as may be discussed elsewhere in the text). American Community Survey estimates for 2013 were used, as that was the last year for which population estimates by age were available. See **Table 1.10** below.

**Table 1.10: Elderly Population (over the age of 65)**

| | Percent of Population Over 65 | Total Population 2013 | Total >65 |
|---|---|---|---|
| County-wide total | 12.7 percent | 271,102 | 34,430 |
| Bloomingdale | 15.6 percent | 2,720 | 424 |
| Garden City | 13.3 percent | 8,888 | 1,182 |
| Pooler | 8.2 percent | 19,821 | 1,625 |
| Port Wentworth | 10.9 percent | 5,817 | 634 |
| Savannah | 11.8 percent | 139,620 | 16,475 |
| Thunderbolt | 17.4 percent | 2,583 | 449 |
| Tybee Island | 30.2 percent | 3,032 | 916 |
| Unincorporated | 14.4 percent | 88,621 | 12,725 |

Income also can have an impact on vulnerability and on ability to engage in household hazard mitigation activities, such as purchasing flood insurance. **Table 1.11** shows the population classified as at or below the poverty level. Data is based on the 2013 American Community Survey estimates, the last year for which municipal poverty data is available.

**Table 1.11 Chatham County & Municipality Population at or below the Poverty Level***

| | *Population at or below poverty level | *Total Population for whom Poverty Status is Determined | % of population at or below poverty level |
|---|---|---|---|
| County-wide total | 49,959 | 261,230 | 19.1 percent |
| Bloomingdale | 319 | 2,710 | 11.8 percent |
| Garden City | 2,291 | 8,791 | 26.1 percent |
| Pooler | 1,865 | 19,732 | 9.5 percent |
| Port Wentworth | 798 | 5,739 | 13.9 percent |
| Savannah | 34,417 | 132,380 | 26.0 percent |
| Thunderbolt | 320 | 2,437 | 13.1 percent |
| Tybee Island | 393 | 2,915 | 13.5 percent |
| Unincorporated | 9,556 | 86,526 | 11.0 percent |

*Please note that for this table, the most recent data available is from 2013.

The most current county tax assessor data for properties in Chatham County, which serves as the basis for the risk assessments, is found in **Table 1.12**. The assessed value for each property, which consists of land plus improvements, is used as the basis for the tabulations of loss to properties found in the risk assessment for each hazard. A listing of critical facilities by category, also utilized for risk assessment is found in **Table 1.13**.

**Table 1.12: Chatham County Tax Assessor Data**

| Use Type | Total Properties | Total Assessed Value | Percent of Total Value |
|---|---|---|---|
| **Chatham County** | | | **100 percent** |
| Agricultural | 39 | $7,477,256 | |
| Commercial | 9,975 | $3,992,726,244 | |
| Historic | 201 | $34,602,809 | |
| Industrial | 1,166 | $1,114,256,450 | |
| Forest Land Protection Act | 7 | $3,727,000 | |
| Residential | 100,2200 | $6,802,872,377 | |
| Transitional | 4 | $879,240 | |
| Utility | 239 | $16,128,729 | |
| Conservation | 166 | $20,084,104 | |
| **Bloomingdale** | | | **0.8 percent** |
| Agricultural | 7 | $665,520 | |
| Commercial | 87 | $26,469,816 | |
| Historic | 0 | $0 | |
| Industrial | 4 | $9,000,360 | |
| Forest Land Protection Act | 3 | $189,200 | |
| Residential | 1,325 | $5,2742,463 | |
| Transitional | 0 | $0 | |
| Utility | 4 | $97,674 | |
| Conservation | 37 | $3,735,600 | |
| **Garden City** | | | **4.4 percent** |
| Agricultural | 0 | $0 | |
| Commercial | 755 | $340,136,572 | |
| Historic | 0 | $0 | |
| Industrial | 258 | $97,858,788 | |
| Forest Land Protection Act | 0 | $0 | |
| Residential | 2,498 | $84,272,179 | |
| Transitional | 0 | $0 | |
| Utility | 30 | $2,498,415 | |
| Conservation | 7 | $1,201,440 | |
| **Pooler** | | | **10.2 percent** |
| Agricultural | 15 | $2,528,208 | |
| Commercial | 810 | $575,126,282 | |
| Historic | 0 | $0 | |

| Use Type | Total Properties | Total Assessed Value | Percent of Total Value |
|---|---|---|---|
| Industrial | 91 | $140,074,260 | |
| Forest Land Protection Act | 0 | $0 | |
| Residential | 7,563 | $495,587,469 | |
| Transitional | 3 | $714,840 | |
| Utility | 17 | $672,233 | |
| Conservation | 21 | $3,948,480 | |
| **Port Wentworth** | | | **2.9 percent** |
| Agricultural | 11 | $2,571,088 | |
| Commercial | 258 | $70,422,355 | |
| Historic | 0 | $0 | |
| Industrial | 102 | $116,575,804 | |
| Forest Land Protection Act | 0 | $0 | |
| Residential | 3,993 | $150,314,654 | |
| Transitional | 0 | $0 | |
| Utility | 25 | $495,544 | |
| Conservation | 31 | $2,317,424 | |
| **Savannah** | | | **46.5 percent** |
| Agricultural | 7 | $2,527,840 | |
| Commercial | 6,683 | $2,844,303,791 | |
| Historic | 194 | $33,310,209 | |
| Industrial | 595 | $486,696,474 | |
| Forest Land Protection Act | 0 | $0 | |
| Residential | 47,699 | $2,192,512,256 | |
| Transitional | 1 | $164,400 | |
| Utility | 110 | $11,210,769 | |
| Conservation | 17 | $2,290,040 | |
| **Thunderbolt** | | | **0.9 percent** |
| Agricultural | 0 | $0 | |
| Commercial | 170 | $46,379,475 | |
| Historic | 0 | $0 | |
| Industrial | 0 | $0 | |
| Forest Land Protection Act | 0 | $0 | |
| Residential | 1,087 | $60,661,566 | |
| Transitional | 0 | $0 | |
| Utility | 3 | $4,739 | |

| Use Type | Total Properties | Total Assessed Value | Percent of Total Value |
|---|---|---|---|
| Conservation | 0 | $0 | |
| **Tybee Island** | | | **4.5 percent** |
| Agricultural | 0 | $0 | |
| Commercial | 183 | $51,623,180 | |
| Historic | 7 | $1,292,600 | |
| Industrial | 0 | $0 | |
| Forest Land Protection Act | 0 | $0 | |
| Residential | 3,666 | $485,277,040 | |
| Transitional | 0 | $0 | |
| Utility | 2 | $17,894 | |
| Conservation | 0 | $0 | |
| **Unincorporated Chatham County** | | | **32.8 percent** |
| Agricultural | 10 | $1,755,688 | |
| Commercial | 1287 | $108,687,128 | |
| Historic | 0 | $0 | |
| Industrial | 218 | $380,626,568 | |
| Forest Land Protection Act | 4 | $3,537,800 | |
| Residential | 938362 | $3,431,819,404 | |
| Transitional | 0 | $0 | |
| Utility | 73 | $1,627,005 | |
| Conservation | 84 | $8,908,544 | |

**Table 1.13: Chatham County Critical Facilities Data**

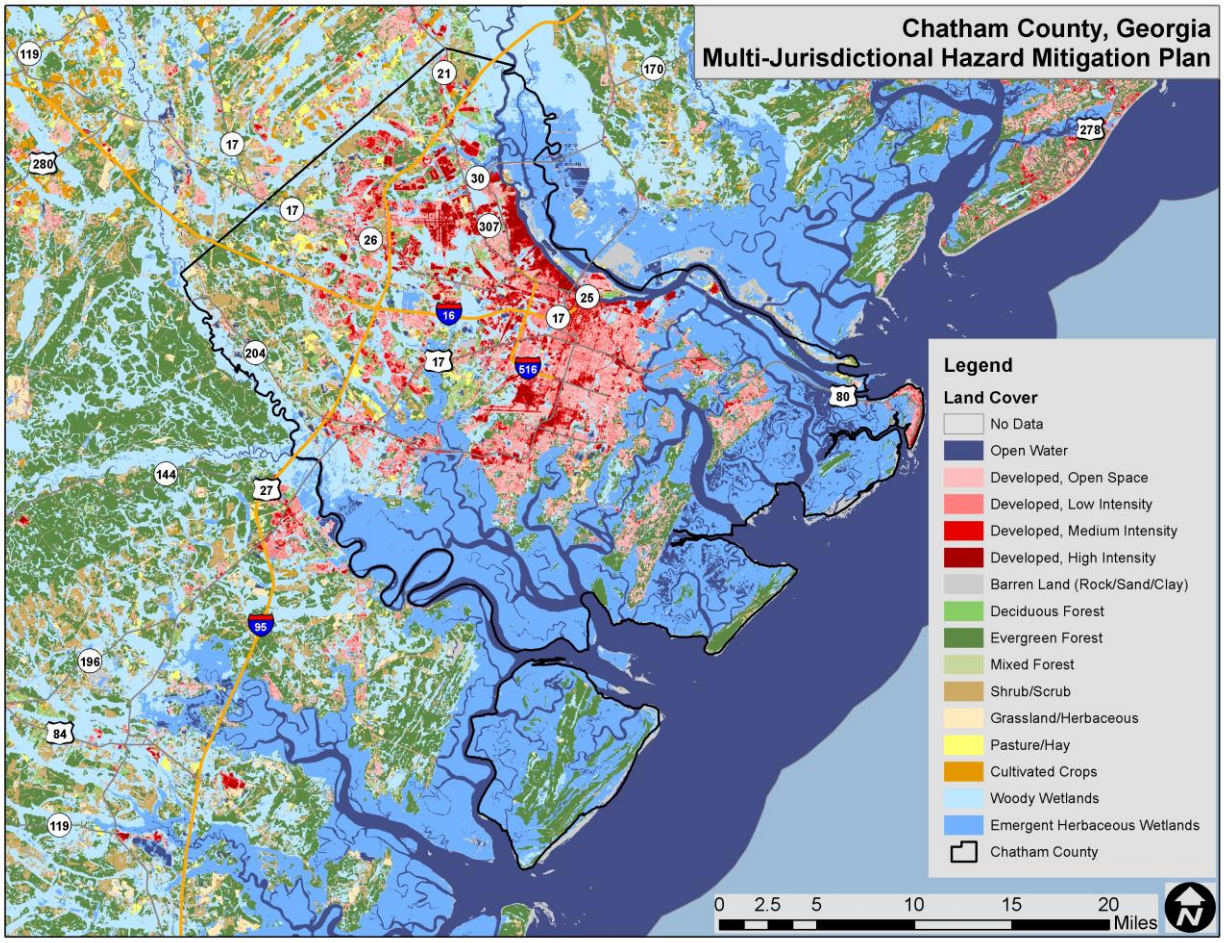
| Use Type | Total Properties |
|---|---|
| Communications/Power | 10 |
| Cultural | 70 |
| Emergency Operations Center | 1 |
| Fire Station | 45 |
| Government | 73 |
| Hazardous Materials | 4 |
| Hospital | 3 |
| Police Station | 21 |
| School | 56 |
| Transportation | 22 |
| Vulnerable Populations | 11 |
| Water | 432 |
| Other | 2 |

The Hazard Mitigation Planning Team identified several critical facilities that were considered to be at particularly high risk from the hazards identified. These facilities are:

- Georgia Regional Hospital at Savannah
- Natural Gas Pressure Center
- County EOC
- Fort Pulaski National Monument
- County and Municipal Police / Sheriff's Offices
- Grayson Stadium
- Savannah / Hilton Head International Airport
- Savannah Civic Center

**Map 1.3** illustrates land use designations based on the 2011 National Land Cover Database.

**Map 1.3: Land Use Designations**



The map shows that a high percentage of Chatham County is wetlands, along with small pockets of forest. The remainder of the County is largely developed. As this map illustrates, future development is limited by the presence of the wetlands.

**Historic-Cultural**

Representative of Chatham County's historical attractions, the Savannah Historic District, a National Historic Landmark, is significant for its distinctive grid plan as well as its 18th and 19th century architecture. The district encompasses the original town plan laid out in 1733 by Gen. James E. Oglethorpe, founder of the British colony of Georgia. Most of the original squares remain and are surrounded by fine examples of buildings in the Georgian, Greek revival and Gothic styles. Overall there are nine National Register Historic Districts in the City of Savannah. The County includes numerous historic structures and public buildings, such as Fort Pulaski, including several important sites associated with the African American community exist in the district, including the city's first black school, and the 1896 home of a working-class African American family.

**Recreation**

Eighteen miles east of Savannah, Tybee Island with its wide, three-mile long beach backed by sand dunes is another tourist destination for sunbathers, people-watchers and those who enjoy water activities associated with the Atlantic Ocean. The island's south-end pier and pavilion provides strolling above the ocean and listening to the music of live bands. Tybee Beach activities are a key Chatham County attraction for visitors, who expand Tybee's population significantly during the summer months.

The area's waterways, including the Intracoastal Waterway, provide numerous opportunities for boating, fishing, and water sports enthusiasts, and multiple venues and businesses serve these recreational activities. These recreational pursuits often are enjoyed in close proximity to industrial and marine transport activities.

**Economic Drivers**

In addition to the tourism industry, other industries such as healthcare, manufacturing, and shipping, are vital components of the Chatham County economy. Examples include Memorial Health University Medical Center and St. Joseph's-Candler Health System, Gulfstream Aerospace Corporation, and Georgia Ports Authority.

The Georgia Ports Authority (GPA) owns and operates two port facilities in the County. The Garden City Terminal in Garden City is the fourth-busiest container port in the United States and the busiest single-terminal container facility in North America. The Garden City Terminal is served by two Class I rail providers and offers interstate access to more than 100 trucking companies that serve the Savannah area.

GPA's Ocean Terminal in Savannah has a range of shipments including forest and solid wood products, steel, industrial and farm equipment, automobiles, project shipments, and heavy-lift cargoes. The Ocean Terminal includes a 208-acre, 10-berth facility, with 6,674 linear feet of deep water berthing, 1.5 million square feet of covered storage, and 83 acres of open storage.

The port of Savannah includes multiple other industrial facilities owned and operated by private companies, including one of the few liquefied natural gas (El Paso/Southern LNG) storage and transfer facilities in the U.S., located on Elba Island in the Savannah River, off President's Street/Highway 80 in unincorporated Chatham County.

The preservation of these economic drivers is an important motivator to quality construction and implementation of this mitigation plan.

A list of major employees in Chatham County can be found in Annex C.

**Colleges and Universities**

Chatham County is home to many colleges and universities that provide resources and expertise to the local community and that may be impacted by hazards identified in this plan.

Armstrong Atlantic State University (AASU), located on a 268-acre campus in southside Savannah, has approximately 7,100 students, 263 faculty, and 351 staff. The university accommodates nearly 1,500 students in on-campus housing. AASU offers more than 100 academic programs at the associate's, bachelors, and master's degree levels, including degrees in education, health professions, liberal arts, and science and technology.

The Georgia Tech Savannah (Georgia Institute of Technology) campus includes two modern buildings in its campus off Interstate 95 west of Savannah. It offers bachelors, masters and doctoral degrees in multiple engineering fields, including civil, mechanical, electrical and environmental engineering. Its campus does not include on-campus housing.

The Savannah College of Art and Design (SCAD), is a private non-profit institution known for its art and design programs at the bachelor's and master's levels. With more than 9,000 students at its Savannah location, SCAD is a visible presence in downtown Savannah. SCAD facilities include more than 70 structures, including multiple student residential facilities, located throughout Savannah, many of which are located in the historic downtown area, totaling approximately two million square feet of space.

Savannah State University (SSU) has a total enrollment of about 4,600 students, with 145 faculty. SSU academic programs offer bachelor's and master's degrees in 22 areas, including degrees in business, marine sciences, urban studies and planning, social work, engineering technology, and homeland security and emergency management. The campus covers over 200 acres partially within the City of Savannah and within unincorporated Chatham County and abutting the Town of Thunderbolt. Campus housing accommodates over 2,700 students.

South University, located in Savannah, offers students the ability to earn in the areas of pharmacy, arts and science, business, health professions, and nursing at the associate's, bachelor's, master's, and doctorate levels. Located on nine acres in midtown Savannah, the university provides higher education opportunities to students from the surrounding areas. There are no student housing facilities on campus; the university offers school-sponsored apartments near the campus.

Savannah Technical College is a two-year institution that offers certificate programs, diplomas, and associate degree programs in the areas of health sciences, business and technology, economic development, general studies, and industrial and public services. Enrollment in the Chatham, Bryan, Effingham, and Liberty county locations totals around 6,000 students per quarter, more than half of whom are part-time students. The Savannah campuses are located on White Bluff Road (main campus) and off of Interstate 95 in the Crossroads Business Park (Technology Campus). There is no student housing on campus.

**Planning and Development**

Chatham County maintains ongoing professional and inclusive planning activities addressing emergency management, development, and other needs. The 2015 Pre-Disaster Pre-Disaster Hazard Mitigation Plan was prepared to build upon, inform and work in conjunction with local plans, including the Chatham County Emergency Operations Plan (EOP), Savannah Flood Hazard Mitigation Plan, County Comprehensive Plan, and other local plans and related initiatives. A summary of the Chatham County-Savannah Comprehensive Plan can be found in Annex C.

The Chatham County-Savannah Metropolitan Planning Commission (MPC) is a joint planning agency for the City of Savannah and Chatham County. Each governmental body appoints seven members to the board. These 14 members serve without pay and represent government, private enterprise, and citizens' interest groups. Commissioners are appointed for three-year overlapping terms. MPC staff, headed by an executive director, research and evaluate issues, and prepare information for the board's consideration and action.

Active since 1955, the Metropolitan Planning Commission provides for joint city-county planning. The scope of the MPC includes Savannah and unincorporated Chatham County, encompassing responsibilities in land use, transportation, environmental quality, water quality, water resources, and growth management. In addition to these, the MPC also administers the Victorian District development controls supporting the Savannah-Chatham County Historic Site and Monument Commission and participates in the Savannah Economic Development Partnership.

The Port Wentworth Planning Commission consists of 5-15 members who are appointed by the mayor and city council. Commission members serve overlapping terms of 3 to 5 years and do so without compensation. The Planning Commission is responsible for the preparation and amendment of overall plans for the orderly growth and development of the City of Port

Wentworth, the regulation of the subdivision of lands within the corporate limits of the city, and the regulation of structures within the city.

The City of Pooler Planning and Zoning Board is appointed by the Pooler City Council. Its duties include reviewing and deciding on cases requesting variances and/or code interpretations on the regulatory ordinances of the city including but not limited to the Zoning Ordinance, Land Subdivision Regulations, and Planned Urban Development Regulations. The Pooler Planning and Zoning Board is a recommendatory board that forwards its findings and recommendations to the Pooler City Council for approval and ratification.

The City of Tybee Island Planning Commission includes seven members who are residents within the city limits of Tybee Island, appointed by the mayor and City Council for two-year staggered terms of office. The purpose of the Planning Commission is to promote the health, safety, morals, convenience, order, prosperity, and general welfare and to provide for the orderly development of the City of Tybee Island.

**Future Development**

Detailed predictions regarding the type and location of future development were not available at this time. However, it is possible to conduct a rough estimate based upon census data and residential growth predictions. According to the census data, shown above, there are currently 120,146 housing units in Chatham County with a median value of $174,500. Although the assessor data base is a more exact representation of the amount of residential properties currently within the County, the census data is being used in order to maintain consistency with the median value.

The Chatham County-Savannah MPC has predicted a 4.0 percent increase in Chatham County's population from 2015 by the year 2020. According to Georgia Coast 2030, by 2020, the Chatham County population is expected to reach 286,869, a 4.3 percent increase over the 2015 population. The analysis in this plan will utilize the 4.0 percent prediction as a conservative estimate.

Assuming a corresponding 4.0 percent increase in housing units county-wide and maintaining a median housing value of $174,500, Chatham County would have approximately 124,952 housing units in 2020 with an additional total residential value of $838,619,000. However, it is not possible at this time to determine the potential location of these buildings and therefore not possible to assess their exposure to specific hazards.

Local data can suggest growth and development trends in municipalities within the County. Based on population forecasts that were adjusted to reflect current building trends, the City of Pooler is experiencing significant population growth, with 2030 projections predicting a large increase (107 percent), as compared with 2000 Census data. Population is also expected to increase in the other incorporated municipalities but at a lower rate (32.5 percent).

Future assessment of growth and development trends could be improved through:

- Tracking of new construction permits, particularly in hazard-prone locations;
- Detailed future development scenarios as part of the Comprehensive Planning process.

**Local Capabilities and Support**

Chatham County and its municipalities have demonstrated the ability and willingness to identify, invest in, and successfully manage mitigation projects (see completed mitigation items in each section in Chapter 4). In addition to leveraging federal mitigation funds, Chatham County has used the state-authorized Special Purpose Local Option Sales Tax (SPLOST), voted on regularly by citizens, and other local funding to fund capital improvement projects, including stormwater drainage and flood control projects.

# CHAPTER 2 – LOCAL HAZARD IDENTIFICATION AND RISK

The 2005 Hazard Mitigation Plan addressed issues related to the hazards of hurricanes, rainwater flooding, storm surge, and tornado activity. In the original plan, the threat of the fire hazard was listed as possible but unlikely. In addition to the natural hazards addressed in the 2005 plan, the 2010 plan update addressed fires and explored the potential for this hazard within Chatham County.

During the 2015 update of this plan, the Steering Committee determined it useful to re-evaluate all of the potential hazards that could impact the jurisdiction. Therefore, in addition to 5 natural hazards and 3 human caused hazards assessed in the 2010 plan, 9 other hazards were ultimately evaluated in terms of their potential risk to impact people and property in Chatham County.

Updated information from the U.S. Census Bureau and the County's geographic information system (GIS) system has been utilized throughout the plan update process. Hazard data collected between the 2010 plan and the current planning process has been incorporated.

**Table 2.1** provides a brief description of each section in this chapter and a summary of the changes that have been made. Chapter 2 of the 2015 plan combines the hazard risk information previously presented in Chapters 2 and 3 of the 2010 plan.

**Table 2.1: Overview of updates to Chapter 2: Local Hazard Identification and Risk**

| Chapter 2 Section | Updates to Section |
|---|---|
| I. Hazard Identification | This is a new section that identifies the natural and technological hazards to be included in the plan. |
| II. Hazard Profiles | This is a new section that combines the hazard profile information previously included in Chapters 2 and 3 of the 2010 plan. The following are new hazards that have been added to the 2015 plan: Drought, Extreme Heat, Hailstorm, Lightning, Severe Thunderstorm/High Wind, Winter Storm and Freeze, Earthquake, Dam and Levee Failure, Erosion, and Sea Level Rise. Hazard information available since 2010 has also been included in this section. |

## I. Hazard Identification

This section describes how the planning team identified the hazards to be included this plan. It consists of the following five subsections:

A. Overview
B. Description of Full Range of Hazards
C. Disaster Declarations
D. Hazard Evaluation

E. Hazard Identification Results

**44 CFR Requirement**

***44 CFR Part 201.6(c)(2)(i):*** The risk assessment shall include a description of the type, location and extent of all natural hazards that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events.

## A. Overview

Chatham County is vulnerable to a wide range of natural and human-caused hazards that threaten life and property. Current FEMA regulations and guidance under the Disaster Mitigation Act of 2000 (DMA 2000) require, at a minimum, an evaluation of a full range of natural hazards. An evaluation of human-caused hazards (i.e., technological hazards, terrorism, etc.) is encouraged, though not required, for plan approval. Chatham County has included both types of hazards.

Upon a review of the full range of natural hazards suggested under FEMA planning guidance, the participating jurisdictions in Chatham County (Bloomingdale, Garden City, Pooler, Port Wentworth, Savannah, Thunderbolt, and Tybee Island) have identified a number of hazards that are to be addressed in their Multi-Jurisdictional Hazard Mitigation Plan. These hazards were identified through an extensive process that utilized input from the Chatham County Hazard Mitigation Planning Team members, research of past disaster declarations in the County[1], and review of the Georgia State Hazard Mitigation Plan (2010). Readily available information from reputable sources (such as federal and state agencies) was also evaluated to supplement information from these key sources.

**Table 2.2** lists the full range of natural hazards initially identified for inclusion in the Plan and provides a brief description for each. This table includes 25 individual hazards. Some of these hazards are considered to be interrelated or cascading, but for preliminary hazard identification purposes these individual hazards are broken out separately.

Next, **Table 2.3** lists the disaster declarations in Chatham County.

Next, **Table 2.4** documents the evaluation process used for determining which of the initially identified hazards are considered significant enough to warrant further evaluation in the risk assessment. For each hazard considered, the table indicates whether or not the hazard was identified as a significant hazard to be further assessed, how this determination was made, and why this determination was made. The table works to summarize not only those hazards that *were* identified (and why) but also those that *were not* identified (and why not). Hazard events not identified for inclusion at this time may be addressed during future evaluations and updates of the risk assessment if deemed necessary by the Hazard Mitigation Planning Team during the plan update process.

[1] A complete list of disaster declarations for Chatham County can be found below in *Chapter 2 – Local Hazard Identification and Risk.*.

Lastly, **Table 2.5** provides a summary of the hazard identification and evaluation process noting that 17 of the 25 initially identified hazards are considered significant enough for further evaluation through this Plan's risk assessment (marked with a "☑").

## B. Description of Full Range of Hazards

**Table 2.2: Descriptions of the Full Range of Initially Identified Hazards**

| Hazard | Description |
|---|---|
| **ATMOSPHERIC HAZARDS** | |
| **Avalanche** | A rapid fall or slide of a large mass of snow down a mountainside. |
| **Drought** | A prolonged period of less than normal precipitation such that the lack of water causes a serious hydrologic imbalance. Common effects of drought include crop failure, water supply shortages, and fish and wildlife mortality. High temperatures, high winds, and low humidity can worsen drought conditions and also make areas more susceptible to wildfire. Human demands and actions have the ability to hasten or mitigate drought-related impacts on local communities. |
| **Extreme Heat** | A heat wave may occur when temperatures hover 10 degrees or more above the average high temperature for the region and last for several weeks. Humid or muggy conditions, which add to the discomfort of high temperatures, occur when a "dome" of high atmospheric pressure traps hazy, damp air near the ground. Excessively dry and hot conditions can provoke dust storms and low visibility. A heat wave combined with a drought can be very dangerous and have severe economic consequences on a community. |
| **Hailstorm** | Any storm that produces hailstones that fall to the ground; usually used when the amount or size of the hail is considered significant. Hail is formed when updrafts in thunderstorms carry raindrops into parts of the atmosphere where the temperatures are below freezing. |
| **Hurricane and Tropical Storm** | Hurricanes and tropical storms are classified as cyclones and defined as any closed circulation developing around a low-pressure center in which the winds rotate counter-clockwise in the Northern Hemisphere (or clockwise in the Southern Hemisphere) and with a diameter averaging 10 to 30 miles across. When maximum sustained winds reach or exceed 39 miles per hour, the system is designated a tropical storm, given a name, and is closely monitored by the National Hurricane Center. When sustained winds reach or exceed 74 miles per hour the storm is deemed a hurricane. The primary damaging forces associated with these storms are high-level sustained winds, heavy precipitation and tornadoes. Coastal areas are also vulnerable to the additional forces of storm surge, wind-driven waves and tidal flooding which can be more destructive than cyclone wind. The majority of hurricanes and tropical storms form in the Atlantic Ocean, Caribbean Sea and Gulf of Mexico during the official Atlantic hurricane season, which extends from June through November. |
| **Lightning** | Lightning is a discharge of electrical energy resulting from the buildup of positive and negative charges within a thunderstorm, creating a "bolt" when the buildup of charges becomes strong enough. This flash of light usually occurs within the clouds or between the clouds and the ground. A bolt of lightning can reach temperatures approaching 50,000 degrees Fahrenheit. Lightning rapidly heats the sky as it flashes, but the surrounding air cools following the bolt. This rapid heating and cooling of the surrounding air causes thunder. On average, 73 people are killed each year by lightning strikes in the United States. |

| Hazard | Description |
|---|---|
| **Nor'easter** | Similar to hurricanes, nor'easters are ocean storms capable of causing substantial damage to coastal areas in the Eastern United States due to their associated strong winds and heavy surf. Nor'easters are named for the winds that blow in from the northeast and drive the storm up the East Coast along the Gulf Stream, a band of warm water that lies off the Atlantic coast. They are caused by the interaction of the jet stream with horizontal temperature gradients and generally occur during the fall and winter months when moisture and cold air are plentiful. Nor'easters are known for dumping heavy amounts of rain and snow, producing hurricane-force winds, and creating high surf that causes severe beach erosion and coastal flooding. |
| **Severe Thunderstorm** | Thunderstorms are caused by air masses of varying temperatures meeting in the atmosphere. Rapidly rising warm moist air fuels the formation of thunderstorms. Thunderstorms may occur singularly, in lines, or in clusters. They can move through an area very quickly or linger for several hours. Thunderstorms may result in hail, tornadoes, or straight-line winds. Windstorms pose a threat to lives, property, and vital utilities primarily due to the effects of flying debris and can down trees and power lines. |
| **Tornado** | A tornado is a violently rotating column of air that has contact with the ground and is often visible as a funnel cloud. Its vortex rotates cyclonically with wind speeds ranging from as low as 40 mph to as high as 300 mph. Tornadoes are most often generated by thunderstorm activity when cool, dry air intersects and overrides a layer of warm, moist air forcing the warm air to rise rapidly. The destruction caused by tornadoes ranges from light to catastrophic depending on the intensity, size and duration of the storm. |
| **Winter Storm and Freeze** | Winter storms may include snow, sleet, freezing rain, or a mix of these wintry forms of precipitation. Blizzards, the most dangerous of all winter storms, combine low temperatures, heavy snowfall, and winds of at least 35 miles per hour, reducing visibility to only a few yards. Ice storms occur when moisture falls and freezes immediately upon impact on trees, power lines, communication towers, structures, roads and other hard surfaces. Winter storms and ice storms can down trees, cause widespread power outages, damage property, and cause fatalities and injuries to human life. |
| **GEOLOGIC HAZARDS** | |
| **Earthquake** | A sudden, rapid shaking of the Earth caused by the breaking and shifting of rock beneath the surface. This movement forces the gradual building and accumulation of energy. Eventually, strain becomes so great that the energy is abruptly released, causing the shaking at the earth's surface which we know as an earthquake. Roughly 90 percent of all earthquakes occur at the boundaries where plates meet, although it is possible for earthquakes to occur entirely within plates. Earthquakes can affect hundreds of thousands of square miles; cause damage to property measured in the tens of billions of dollars; result in loss of life and injury to hundreds of thousands of persons; and disrupt the social and economic functioning of the affected area. |

| Hazard | Description |
|---|---|
| **Expansive Soils** | Soils that will exhibit some degree of volume change with variations in moisture conditions. The most important properties affecting degree of volume change in a soil are clay mineralogy and the aqueous environment. Expansive soils will exhibit expansion caused by the intake of water and, conversely, will exhibit contraction when moisture is removed by drying. Generally speaking, they often appear sticky when wet, and are characterized by surface cracks when dry. Expansive soils become a problem when structures are built upon them without taking proper design precautions into account with regard to soil type. Cracking in walls and floors can be minor, or can be severe enough for the home to be structurally unsafe. |
| **Landslide** | The movements of a mass of rock, debris, or earth down a slope when the force of gravity pulling down the slope exceeds the strength of the earth materials that comprise to hold it in place. Slopes greater than 10 degrees are more likely to slide, as are slopes where the height from the top of the slope to its toe is greater than 40 feet. Slopes are also more likely to fail if vegetative cover is low and/or soil water content is high. |
| **Land Subsidence** | The gradual settling or sudden sinking of the Earth's surface due to the subsurface movement of earth materials. Causes of land subsidence include groundwater pumpage, aquifer system compaction, drainage of organic soils, underground mining, hydrocompaction, natural compaction, sinkholes, and thawing permafrost. |
| **Tsunami** | A series of waves generated by an undersea disturbance such as an earthquake. The speed of a tsunami traveling away from its source can range from up to 500 miles per hour in deep water to approximately 20 to 30 miles per hour in shallower areas near coastlines. Tsunamis differ from regular ocean waves in that their currents travel from the water surface all the way down to the sea floor. Wave amplitudes in deep water are typically less than one meter; they are often barely detectable to the human eye. However, as they approach shore, they slow in shallower water, basically causing the waves from behind to effectively "pile up", and wave heights to increase dramatically. As opposed to typical waves which crash at the shoreline, tsunamis bring with them a continuously flowing 'wall of water' with the potential to cause devastating damage in coastal areas located immediately along the shore. |
| **Volcano** | A mountain that opens downward to a reservoir of molten rock below the surface of the earth. While most mountains are created by forces pushing up the earth from below, volcanoes are different in that they are built up over time by an accumulation of their own eruptive products: lava, ash flows, and airborne ash and dust. Volcanoes erupt when pressure from gases and the molten rock beneath becomes strong enough to cause an explosion. |
| **HYDROLOGIC HAZARDS** | |
| **Dam and Levee Failure** | Dam failure is the collapse, breach, or other failure of a dam structure resulting in downstream flooding. In the event of a dam failure, the energy of the water stored behind even a small dam is capable of causing loss of life and severe property damage if development exists downstream of the dam. Dam failure can result from natural events, human-induced events, or a combination of the two. The most common cause of dam failure is prolonged rainfall that produces flooding. Failures due to other natural events such as hurricanes, earthquakes or landslides are significant because there is generally little or no advance warning. |

| Hazard | Description |
|---|---|
| **Erosion** | Erosion is the gradual breakdown and movement of land due to both physical and chemical processes of water, wind, and general meteorological conditions. Natural, or geologic, erosion has occurred since the Earth's formation and continues at a very slow and uniform rate each year. |
| **Flood** | The accumulation of water within a water body which results in the overflow of excess water onto adjacent lands, usually floodplains. The floodplain is the land adjoining the channel of a river, stream ocean, lake or other watercourse or water body that is susceptible to flooding. Most floods fall into the following three categories: riverine flooding, coastal flooding, or shallow flooding (where shallow flooding refers to sheet flow, ponding and urban drainage). |
| **Storm Surge** | A storm surge is a large dome of water often 50 to 100 miles wide and rising anywhere from four to five feet in a Category 1 hurricane up to more than 30 feet in a Category 5 storm. Storm surge heights and associated waves are also dependent upon the shape of the offshore continental shelf (narrow or wide) and the depth of the ocean bottom (bathymetry). A narrow shelf, or one that drops steeply from the shoreline and subsequently produces deep water close to the shoreline, tends to produce a lower surge but higher and more powerful storm waves. Storm surge arrives ahead of a storm's actual landfall and the more intense the hurricane is, the sooner the surge arrives. Storm surge can be devastating to coastal regions, causing severe beach erosion and property damage along the immediate coast. Further, water rise caused by storm surge can be very rapid, posing a serious threat to those who have not yet evacuated flood-prone areas. |
| **Sea Level Rise** | Sea level rise is a hazard that is becoming a larger threat to many communities, especially along the coast. As its name suggests, this hazard is the rising of the seas above their current levels. Sea level rise can have potentially major impacts by causing inundation of areas not previously inundated with water and exacerbating other hazards such as storm surge. Sea level rise is generally the result of two major causes: thermal expansion of the oceans and loss of land-based ice. Historic records indicate that sea level rise has been an ongoing process over the last several thousand years. However, a major concern is that recent studies show that the rate of sea level rise has been increasing steadily over the past century. This increase in rate will likely have a quicker and potentially more devastating effect on people and property than any sea level rise that has taken place in the past. |
| **OTHER HAZARDS** | |
| **Hazardous Materials Incident** | Hazardous material (HAZMAT) incidents can apply to fixed facilities as well as mobile, transportation-related accidents in the air, by rail, on the nation's highways and on the water. HAZMAT incidents consist of solid, liquid and/or gaseous contaminants that are released from fixed or mobile containers, whether by accident or by design as with an intentional terrorist attack. A HAZMAT incident can last hours to days, while some chemicals can be corrosive or otherwise damaging over longer periods of time. In addition to the primary release, explosions and/or fires can result from a release, and contaminants can be extended beyond the initial area by persons, vehicles, water, wind and possibly wildlife as well. |

| Hazard | Description |
|---|---|
| **Nuclear Accident** | A nuclear and radiation accident is defined by the International Atomic Energy Agency as "an event that has led to significant consequences to people, the environment or the facility. Often, this type of incident results from damage to the reactor core of a nuclear power plant which can release radioactivity into the environment. The degree of exposure from nuclear accidents has varied from serious to catastrophic. |
| **Terror Threat** | Terrorism is defined by FEMA as, "the use of force or violence against persons or property in violation of the criminal laws of the United States for purposes of intimidation, coercion, or ransom." Terrorist acts may include assassinations, kidnappings, hijackings, bomb scares and bombings, cyber attacks (computer-based), and the use of chemical, biological, nuclear and radiological weapons. |
| **Wildfire** | An uncontrolled fire burning in an area of vegetative fuels such as grasslands, brush, or woodlands. Heavier fuels with high continuity, steep slopes, high temperatures, low humidity, low rainfall, and high winds all work to increase risk for people and property located within wildfire hazard areas or along the urban/wildland interface. Wildfires are part of the natural management of forest ecosystems, but most are caused by human factors. Over 80 percent of forest fires are started by negligent human behavior such as smoking in wooded areas or improperly extinguishing campfires. The second most common cause for wildfire is lightning. |

## C. Disaster Declarations

Disaster declarations provide initial insight into the hazards that may impact the Chatham County planning area. Since 1977, 7 presidential disaster declarations have been reported in Chatham County. This includes a variety of event types including drought, winter weather, tornado/high wind events, severe storms, flooding, and hurricane/tropical storms.

**Table 2.3: Chatham County Disaster Declarations**

| Year | Disaster Number | Description |
|---|---|---|
| 1977 | 536 | Shrimp Loss Due to Cold Weather |
| 1977 | 3044 | Drought |
| 1993 | 3097 | Severe Snowfall, Winter Storm |
| 1994 | 1042 | Heavy Rains, Tornados, Flooding, High Winds |
| 1998 | 1209 | Severe Storms and Flooding |
| 1999 | 3144 | Hurricane Floyd Emergency Declarations |
| 1999 | 3144 | Hurricane Floyd Evacuation |
| 2005 | 3218 | Hurricane Katrina Evacuation |

## D. Hazard Evaluation

**Table 2.4: Documentation of the Hazard Evaluation Process**

| Natural Hazards Considered | Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No) | How was this determination made? | Why was this determination made? |
|---|---|---|---|
| **ATMOSPHERIC HAZARDS** | | | |
| Avalanche | NO | • Review of FEMA's Multi-Hazard Identification and Risk Assessment<br>• Review of the GA State Hazard Mitigation Plan<br>• Review of the previous Chatham County hazard mitigation plan<br>• Review of US Forest Service National Avalanche Center website | • The United States avalanche hazard is limited to mountainous western states including Alaska, as well as some areas of low risk in New England.<br>• Avalanche hazard was removed from the Georgia State Hazard Mitigation Plan after determining the mountain elevations in Georgia did have enough snow to produce this hazard.<br>• Avalanche is not included in the previous Chatham County hazard mitigation plan.<br>• There is no risk of avalanche events in Georgia. |
| Drought | YES | • Review of FEMA's Multi-Hazard Identification and Risk Assessment<br>• Review of the GA State Hazard Mitigation Plan<br>• Review of the previous Chatham County hazard mitigation plan<br>• Review of the Georgia Automated Environmental Monitoring Network website | • Drought is a normal part of virtually all climatic regimes, including areas with high and low average rainfall.<br>• Droughts are discussed in GA State Hazard Mitigation Plan as a lesser hazard.<br>• The GA State Hazard Mitigation Plan lists drought as a high hazard for the state.<br>• There are reports of precipitation deficits in six of the last nine years in Chatham County, according to the Georgia Automated Environmental Monitoring Network. |

| Natural Hazards Considered | Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No) | How was this determination made? | Why was this determination made? |
|---|---|---|---|
| Extreme Heat | YES | • Review of FEMA's Multi-Hazard Identification and Risk Assessment<br>• Review of the Georgia State Hazard Mitigation Plan<br>• Review of the previous Chatham County hazard mitigation plan<br>• Review of NOAA NCDC Storm Events Database | • Many areas of the United States are susceptible to heat waves, including Georgia.<br>• The state of Georgia and Chatham County are located in an area of the southeastern United States where high temperatures are often recorded.<br>• NCDC reports 37 extreme heat events for Chatham County and the highest temperature recorded in the County was 104.4°F. |
| Hailstorm | YES | • Review of FEMA's Multi-Hazard Identification and Risk Assessment<br>• Review of GA State Hazard Mitigation Plan<br>• Review of the previous Chatham County hazard mitigation plan<br>• Review of NOAA NCDC Storm Events Database | • Although hailstorms occur primarily in the Midwestern states, they do occur in every state on the mainland U.S. Most inland regions experience hailstorms at least two or more days each year.<br>• Hailstorm events are discussed in the GA State Hazard Mitigation Plan under the Severe Weather hazard.<br>• NCDC reports 150 hailstorm events (0.75 to 3.5 inch size hail) for Chatham County between 1957 and 2014. For these events there was over $800,000 (2014 dollars) in property damages. |

| Natural Hazards Considered | Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No) | How was this determination made? | Why was this determination made? |
|---|---|---|---|
| Hurricane and Tropical Storm | YES | • Review of FEMA's Multi-Hazard Identification and Risk Assessment<br>• Review of GA State Hazard Mitigation Plan<br>• Review of the previous Chatham County hazard mitigation plan<br>• Analysis of NOAA historical tropical cyclone tracks and National Hurricane Center Website<br>• Review of NOAA NCDC Storm Events Database<br>• Review of historical presidential disaster declarations<br>• FEMA Hazus-MH storm return periods | • The Atlantic and Gulf regions are most prone to landfall by hurricanes and tropical storms.<br>• Hurricane and tropical storm events are discussed in the GA State Hazard Mitigation Plan and are listed as a medium hazard in the state.<br>• Hurricanes and tropical weather were addressed in the previous Chatham County hazard mitigation plan under the coastal storms hazard.<br>• NOAA historical records indicate 115 storm tracks have come within 75 miles of Chatham County since 1850.<br>• NCDC reports 53 hurricane events since 1996 for Chatham County.<br>• 2 out of 7 disaster declarations in Chatham County are directly related to hurricane events.<br>• The 50-year return period peak gust for hurricane and tropical storm events in Chatham County is around 95 mph. |

| Natural Hazards Considered | Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No) | How was this determination made? | Why was this determination made? |
|---|---|---|---|
| Lightning | YES | • Review of FEMA's Multi-Hazard Identification and Risk Assessment<br>• Review of GA State Hazard Mitigation Plan<br>• Review of the previous Chatham County hazard mitigation plan Review of NOAA NCDC Storm Events Database<br>• Review of Vaisala's NLDN Lightning Flash Density Map | • The central region of the Florida has the highest density of lightning strikes in the mainland U.S.; however, lightning events are experienced in nearly every region of the country.<br>• Lightning events are discussed in the GA State Hazard Mitigation Plan as part of the severe weather hazard.<br>• NCDC reports 21 lightning events for Chatham County since 1996. These events have resulted in over $2.7 million (2014 dollars) in property damage.<br>• According to Vaisala's U.S. National Lightning Detection Network, Chatham County is located in an area that experienced an average of 6 to 8 lightning flashes per square kilometer per year between 1997 and 2010. |
| Nor'easter | NO | • Review of GA State Hazard Mitigation Plan<br>• Review of the previous Chatham County hazard mitigation plan<br>• Review of NOAA NCDC Storm Events Database | • Nor'easters are not discussed in the state plan.<br>• Nor'easters were not identified in the previous Chatham County hazard mitigation plan.<br>• NCDC does not report any nor'easter activity for Chatham County. However, nor'easters may have affected the area as severe winter storms. In this case, the activity would be reported under winter storm events. |

| Natural Hazards Considered | Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No) | How was this determination made? | Why was this determination made? |
|---|---|---|---|
| Severe Thunderstorm | YES | • Review of FEMA's Multi-Hazard Identification and Risk Assessment<br>• Review of GA State Hazard Mitigation Plan<br>• Review of the previous Chatham County hazard mitigation plan<br>• Review of NOAA NCDC Storm Events Database<br>• Review of historical presidential disaster declarations | • Over 100,000 thunderstorms are estimated to occur each year on the U.S. mainland, and they are experienced in nearly every region.<br>• Severe thunderstorm events are discussed in the GA State Hazard Mitigation Plan and are listed as a very high hazard in the state.<br>• NCDC reports 387 thunderstorm/high wind events in Chatham County since 1960. These events have resulted in 1 death, 7 injuries, and $6 million (2014 dollars) in property damage. |
| Tornado | YES | • Review of FEMA's Multi-Hazard Identification and Risk Assessment<br>• Review of GA State Hazard Mitigation Plan<br>• Review of the previous Chatham County hazard mitigation plan<br>• Review of NOAA NCDC Storm Events Database<br>• Review of historical presidential disaster declarations | • Tornado events are discussed in the GA State Hazard Mitigation Plan and are identified as a medium hazard.<br>• Tornado events were addressed in the previous Chatham County hazard mitigation plan.<br>• NCDC reports 23 tornado events in Chatham County since 1955. These events have resulted in 21 recorded injuries and $16.4 million (2014 dollars) in property damage with the most severe event being an F2.<br>• 1 of the County's 7 disaster declarations was related to tornadoes. |

| Natural Hazards Considered | Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No) | How was this determination made? | Why was this determination made? |
|---|---|---|---|
| Winter Storm and Freeze | YES | • Review of FEMA's Multi-Hazard Identification and Risk Assessment<br>• Review of GA State Hazard Mitigation Plan<br>• Review of the previous Chatham County hazard mitigation plan<br>• Review of NOAA NCDC Storm Events Database<br>• Review of historical presidential disaster declarations | • Winter storms affect every state in the continental U.S. and Alaska.<br>• Severe winter storms, including snow storms and ice storms, are discussed in the GA State Hazard Mitigation Plan as a high hazard<br>• NCDC reports that Chatham County has been affected by 24 snow and ice events since 1996. These events resulted in $1.6 million (2014dollars) in damages but did not cause any deaths or injuries in Chatham County.<br>• 1 of the County's 7 disaster declarations was directly related to winter storm events. |

| Natural Hazards Considered | Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No) | How was this determination made? | Why was this determination made? |
|---|---|---|---|
| **GEOLOGIC HAZARDS** | | | |
| Earthquake | YES | • Review of FEMA's Multi-Hazard Identification and Risk Assessment<br>• Review of GA State Hazard Mitigation Plan<br>• Review of the previous Chatham County hazard mitigation plan<br>• Review of the National Geophysical Data Center<br>• USGS Earthquake Hazards Program website | • Although the zone of greatest seismic activity in the United States is along the Pacific Coast, eastern regions have experienced significant earthquakes.<br>• Earthquake events are discussed in the GA State Hazard Mitigation Plan and the state is considered to be at low risk to an earthquake event.<br>• Earthquakes have occurred in and around the State of Georgia in the past. The state is affected by the Charleston, New Madrid, and Southern Appalachia fault lines, the first of which has generated a magnitude 8.0 earthquake in the last 200 years.<br>• 18 events are known to have occurred in the County according to the National Geophysical Data Center. The greatest MMI reported was a VIII.<br>• According to USGS seismic hazard maps, the peak ground acceleration (PGA) with a 10% probability of exceedance in 50 years for Chatham County is approximately 4 to 8%g. FEMA recommends that earthquakes be further evaluated for mitigation purposes in areas with a PGA of 3%g or more. |

| Natural Hazards Considered | Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No) | How was this determination made? | Why was this determination made? |
|---|---|---|---|
| Expansive Soils | NO | • Review of FEMA's Multi-Hazard Identification and Risk Assessment<br>• Review of GA State Hazard Mitigation Plan<br>• Review of the previous Chatham County hazard mitigation plan<br>• Review of USDA Soil Conservation Service's Soil Survey | • The effects of expansive soils are most prevalent in parts of the Southern, Central, and Western U.S.<br>• Expansive soils are not identified in the GA State Hazard Mitigation Plan under the geologic hazards.<br>• Chatham County is located in an area that has little to no clay swelling potential.<br>• The previous Chatham County Hazard Mitigation Plan did not identify expansive soils as a potential hazard. |
| Landslide | NO | • Review of FEMA's Multi-Hazard Identification and Risk Assessment<br>• Review of GA State Hazard Mitigation Plan<br>• Review of the previous Chatham County hazard mitigation plan<br>• Review of USGS Landslide Incidence and Susceptibility Hazard Map<br>• Review of the Georgia Geological Survey database of historic landslides | • Landslides occur in every state in the U.S, and they are most common in the coastal ranges of California, the Colorado Plateau, the Rocky Mountains, and the Appalachian Mountains.<br>• Landslide/debris flow events are discussed in the state plan under geologic hazards which are considered low vulnerability for the state.<br>• The previous Chatham County hazard mitigation plan did not address landslides.<br>• USGS landslide hazard maps indicate that a low incidence rate is found across the County.<br>• Data provided by NCGS indicate there are no recorded landslide events in the Chatham County. |

| Natural Hazards Considered | Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No) | How was this determination made? | Why was this determination made? |
|---|---|---|---|
| Land Subsidence | NO | • Review of FEMA's Multi-Hazard Identification and Risk Assessment<br>• Review of GA State Hazard Mitigation Plan<br>• Review of the previous Chatham County hazard mitigation plan | • Land subsidence affects at least 45 states, including Georgia. However, because of the broad range of causes and impacts, there has been limited national focus on this hazard.<br>• The state plan identifies land subsidence hazards in Georgia under geologic hazards; however the state has low vulnerability.<br>• The previous Chatham County hazard mitigation plan did not identify land subsidence. |
| Tsunami | NO | • Review of FEMA's Multi-Hazard Identification and Risk Assessment<br>• Review of GA State Hazard Mitigation Plan<br>• Review of the previous Chatham County hazard mitigation plan<br>• Review of FEMA "How-to" mitigation planning guidance (Publication 386-2, "Understanding Your Risks – Identifying Hazards and Estimating Losses). | • No record exists of a catastrophic Atlantic basin tsunami impacting the mid-Atlantic coast of the United States.<br>• Tsunami inundation zone maps are not available for communities located along the U.S. East Coast.<br>• Tsunamis are not discussed in the state plan.<br>• The previous Chatham County hazard mitigation plan did not address tsunamis.<br>• FEMA mitigation planning guidance suggests that locations along the U.S. East Coast have a relatively low tsunami risk and need not conduct a tsunami risk assessment at this time. |

| Natural Hazards Considered | Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No) | How was this determination made? | Why was this determination made? |
|---|---|---|---|
| Volcano | NO | • Review of FEMA's Multi-Hazard Identification and Risk Assessment<br>• Review of GA State Hazard Mitigation Plan<br>• Review of USGS Volcano Hazards Program website | • More than 65 potentially active volcanoes exist in the United States and most are located in Alaska. The Western states and Hawaii are also potentially affected by volcanic hazards.<br>• There are no active volcanoes in Georgia.<br>• There has not been a volcanic eruption in Georgia in over 1 million years.<br>• No volcanoes are located near Chatham County. |
| **HYDROLOGIC HAZARDS** | | | |
| Dam and Levee Failure | YES | • Review of FEMA's Multi-Hazard Identification and Risk Assessment<br>• Review of GA State Hazard Mitigation Plan<br>• Review of the previous Chatham County hazard mitigation plan<br>• Review of Georgia Safe Dams Program Data | • The National Inventory of Dams shows dams are located in every state.<br>• Dam failure is discussed in the GA State Hazard Mitigation Plan and is listed a low hazard of concern for the state.<br>• Of the 2 dams reported by the Georgia Safe Dams Program, both are considered "significant." |
| Erosion | YES | • Review of GA State Hazard Mitigation Plan<br>• Review of the previous Chatham County hazard mitigation plan | • Coastal erosion is incorporated under several different hazards in the GA State Hazard Mitigation Plan.<br>• Coastal erosion remains a natural, dynamic, and continuous process that has the potential to affect Chatham County since it is located on the coast. This warrants inclusions as a potential hazard. |

| Natural Hazards Considered | Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No) | How was this determination made? | Why was this determination made? |
|---|---|---|---|
| Flood | YES | • Review of FEMA's Multi-Hazard Identification and Risk Assessment<br>• Review of GA State Hazard Mitigation Plan<br>• Review of the previous Chatham County hazard mitigation plan<br>• Review of NOAA NCDC Storm Events Database<br>• Review of historical disaster declarations<br>• Review of FEMA DFIRM data<br>• Review of FEMA's NFIP Community Status Book and Community Rating System (CRS) | • Floods occur in all 50 states and in the U.S. territories.<br>• The flood hazard is thoroughly discussed in the GA State Hazard Mitigation Plan as both coastal flooding and inland flooding.<br>• The previous Chatham County hazard mitigation plan addresses the flood hazard.<br>• NCDC reports that Chatham County has been affected by 79 flood events since 1996. In total, these events caused 2 injuries and almost $12 million (2014 dollars) in property damages.<br>• At least one of the County's Presidential Disaster Declarations was flood-related and others were hurricane-related which caused flooding issues.<br>• 71.7% of Chatham County is located in an identified floodplain (100- or 500-year).<br>• All communities participate in the NFIP. |
| Storm Surge | YES | • Review of FEMA's Multi-Hazard Identification and Risk Assessment<br>• Review of GA State Hazard Mitigation Plan<br>• Review of the previous Chatham County hazard mitigation plan<br>• Review of NOAA NCDC Storm Events Database | • Given the coastal location of Chatham County, storm surge has the potential to affect the area.<br>• Storm surge is discussed in the GA State Hazard Mitigation Plan under the coastal hazards.<br>• The previous Chatham County hazard mitigation plan addresses storm surge under coastal storms.<br>• Several historical hurricane events were reported by NCDC. |

| Natural Hazards Considered | Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No) | How was this determination made? | Why was this determination made? |
|---|---|---|---|
| Sea Level Rise | YES | • Review of NOAA's Coastal Sea Level Rise Viewer<br>• Review of GA State Hazard Mitigation Plan<br>• Review of the previous Chatham County hazard mitigation plan | • Sea level rise is a growing concern throughout the world, but is especially important to consider in coastal areas like Chatham County.<br>• The NOAA Sea Level Rise Viewer indicates that many areas in Chatham County will be impacted by sea level rise.<br>• FEMA guidance currently recommends that all coastal areas begin incorporating sea level rise into their future planning. |
| **OTHER HAZARDS** | | | |
| Hazardous Materials Incident | YES | • Review of FEMA's Multi-Hazard Identification and Risk Assessment<br>• Review of the previous Chatham County hazard mitigation plan<br>• Review Facility Registry Services data<br>• Review of USDOT Pipeline and Hazardous Materials Safety Administration (PHMSA) incident database | • Cities, counties, and towns where hazardous materials fabrication, processing, and storage sites are located, and those where hazardous waste treatment, storage or disposal facilities operate are at risk for hazardous materials events.<br>• The previous Chatham County hazard mitigation plan included hazardous materials incidents and it is identified in other county planning documents.<br>• A number of fixed hazardous materials facilities are located in Chatham County.<br>• 35 of the 644 PHMSA-reported HAZMAT incidents in the County were classified as "serious" incidents. In total, these incidents have resulted in 30 injuries and over $30,000 (2014 dollars) in property damages. |

| Natural Hazards Considered | Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No) | How was this determination made? | Why was this determination made? |
|---|---|---|---|
| Nuclear Accident | NO | • Review of IAEA data on the location of nuclear reactors<br>• Review of the previous Chatham County hazard mitigation plan<br>• Discussion with local officials about location of nuclear power stations | • There is no nuclear facility near Chatham County.<br>• The previous Chatham County hazard mitigation plan did not include nuclear accident.<br>• A nuclear accident is unlikely to occur, but could cause severe damage in the event of a major incident. |
| Terror Threat | YES | • Review of the previous Chatham County hazard mitigation plan<br>• Review of local official knowledge | • The previous Chatham County hazard mitigation plan included terrorism.<br>• There are several high profiles targets in the area that caused the planning team to determine that the hazard should be evaluated further. |
| Wildfire | YES | • Review of FEMA's Multi-Hazard Identification and Risk Assessment<br>• Review of GA State Hazard Mitigation Plan<br>• Review of the previous Chatham County hazard mitigation plan<br>• Review of Southern Wildfire Risk Assessment (SWRA) Data<br>• Review of the Chatham County Community Wildfire Protection Plan (CWPP) | • Wildfires occur in virtually all parts of the United States. Wildfire hazard risks will increase as low-density development along the urban/wildland interface increases.<br>• Wildfires are discussed in the state plan as a medium hazard of concern.<br>• The previous Chatham County hazard mitigation plan addressed fire.<br>• A review of SWRA data indicates that there are some areas of elevated concern in Chatham County.<br>• According to the Chatham County CWPP, Chatham County experiences an average of 73 fires each year which burn a combined 475 acres on average.<br>• Wildfire hazard risks will increase as low-density development along the urban/wildland interface increases. |

## E. Hazard Identification Results

**Table 2.5: Summary Results of the Hazard Identification and Evaluation Process**

| ATMOSPHERIC HAZARDS | GEOLOGIC HAZARDS |
|---|---|
| ☐ Avalanche | ☑ Earthquake |
| ☑ Drought | ☐ Expansive Soils |
| ☑ Hailstorm | ☐ Landslide |
| ☑ Extreme Heat | ☐ Land Subsidence |
| ☑ Hurricane and Tropical Storm | ☐ Tsunami |
| ☑ Lightning | ☐ Volcano |
| ☐ Nor'easter | **OTHER HAZARDS** |
| ☑ Severe Thunderstorm | ☑ Hazardous Materials Incident |
| ☑ Tornado | ☐ Nuclear Accident |
| ☑ Winter Storm and Freeze | ☑ Terror Threat |
| **HYDROLOGIC HAZARDS** | ☑ Wildfire |
| ☑ Dam and Levee Failure | |
| ☑ Erosion | |
| ☑ Flood | |
| ☑ Storm Surge | |
| ☑ Sea Level Rise | |

# II. Hazard Profiles

This section includes detailed hazard profiles for each of the hazards identified in the previous section (*Hazard Identification*) as significant enough for further evaluation in the Chatham County Hazard Mitigation Plan. It contains the following subsections:

A. Overview
B. Study Area
C. Drought
D. Extreme Heat
E. Hailstorm
F. Hurricane and Tropical Storm
G. Lightning
H. Severe Thunderstorm /High Wind
I. Tornado
J. Winter Storm and Freeze
K. Earthquake
L. Dam and Levee Failure
M. Erosion
N. Flood
O. Storm Surge
P. Sea Level Rise
Q. Hazardous Materials Incident
R. Terror Threat
S. Wildfire
T. Conclusions on Hazard Risk
U. Final Determinations

**44 CFR Requirement**

***44 CFR Part 201.6(c)(2)(i):*** The risk assessment shall include a description of the type, location and extent of all natural hazards that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events

## A. Overview

This section includes detailed hazard profiles for each of the hazards identified in the previous section (*Hazard Identification*) as significant enough for further evaluation in Chatham County hazard risk assessment by creating a hazard profile. Each hazard profile includes a general description of the hazard, its location and extent, notable historical occurrences, and the probability of future occurrences. Each profile also includes specific items noted by members of the Chatham County Hazard Mitigation Planning Team as it relates to unique historical or anecdotal hazard information for Chatham County or a participating municipality within it.

The following hazards were identified:

**Atmospheric**

- Drought
- Extreme Heat
- Hailstorm
- Hurricane and Tropical Storm
- Lightning

- Severe Thunderstorm/High Wind (including straight-line winds)
- Tornado
- Winter Storm and Freeze

**Geologic**

- Earthquake

**Hydrologic**

- Dam and Levee Failure
- Erosion
- Flood
- Storm Surge
- Sea Level Rise

**Other**

- Hazardous Materials Incident
- Terror Threat
- Wildfire

## B. Study Area

Chatham County includes seven municipalities: Bloomingdale, Garden City, Pooler, Port Wentworth, Savannah, Thunderbolt, and Tybee Island. **Table 2.6** provides a summary table of the participating jurisdictions. In addition, **Figure 2.1** provides a base map, for reference, of Chatham County.

**Table 2.6: Participating Jurisdictions in the Chatham County Hazard Mitigation Plan**

| Chatham County | |
|---|---|
| Bloomingdale | Savannah |
| Garden City | Thunderbolt |
| Pooler | Tybee Island |
| Port Wentworth | |

**Figure 2.1: Chatham County Base Map**

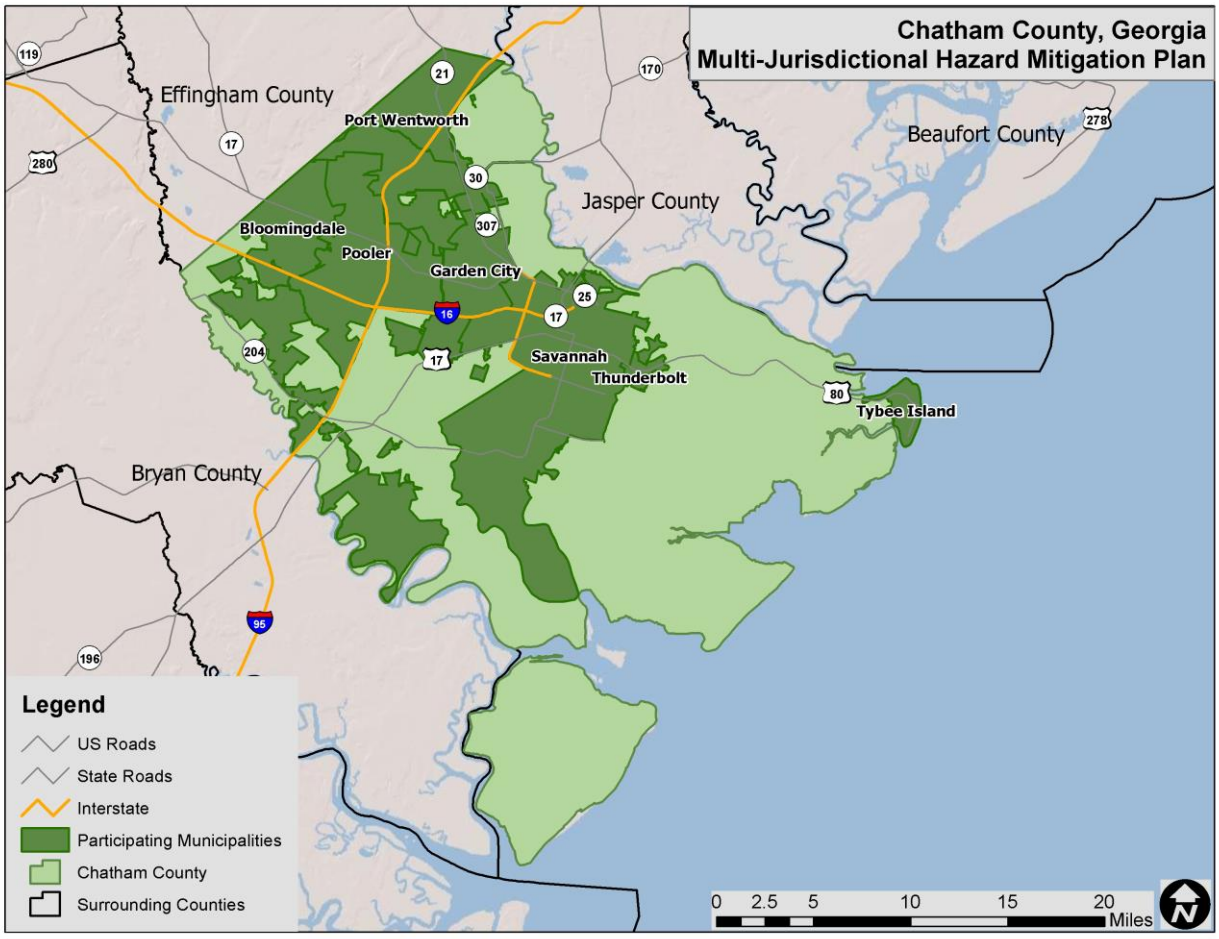



**Table 2.7** lists each significant hazard for Chatham County and identifies whether or not it has been determined to be a specific hazard of concern for the 7 municipal jurisdictions and the County's unincorporated areas. This is the based on the best available data and information from the Chatham County Hazard Mitigation Planning Committee. (● = hazard of concern)

**Table 2.7: Summary of Identified Hazard Events in Chatham County**

| | Atmospheric | | | | | | | | Geo | Hydrologic | | | | | Other | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Jurisdiction** | **Drought** | **Extreme Heat** | **Hailstorm** | **Hurricane and Tropical Storm** | **Lightning** | **Severe Thunderstorm** | **Tornado** | **Winter Storm** | **Earthquake** | **Dam and Levee Failure** | **Erosion** | **Flood** | **Storm Surge** | **Sea Level Rise** | **HAZMAT** | **Terror Threat** | **Wildfire** |
| Chatham County | | | | | | | | | | | | | | | | | | |
| Bloomingdale | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | |
| Garden City | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | |
| Pooler | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | |

| Jurisdiction | Atmospheric | | | | | | | | Geo | Hydrologic | | | | Other | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Drought | Extreme Heat | Hailstorm | Hurricane and Tropical Storm | Lightning | Severe Thunderstorm | Tornado | Winter Storm | Earthquake | Dam and Levee Failure | Erosion | Flood | Storm Surge | Sea Level Rise | HAZMAT | Terror Threat | Wildfire |
| Port Wentworth | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Savannah | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Thunderbolt | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Tybee Island | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Unincorporated Area | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |

# *Atmospheric Hazards*

## C. Drought

### 1. Background

Drought is a normal part of virtually all climatic regions, including areas with high and low average rainfall. Drought is the consequence of a natural reduction in the amount of precipitation expected over an extended period of time, usually a season or more in length. High temperatures, high winds, and low humidity can exacerbate drought conditions. In addition, human actions and demands for water resources can hasten drought-related impacts. Drought may also lead to more severe wildfires.

Droughts are typically classified into one of four types: 1) meteorological, 2) hydrologic, 3) agricultural, or 4) socioeconomic. **Table 2.8** presents definitions for these types of drought.

**Table 2.8 Drought Classification Definitions**

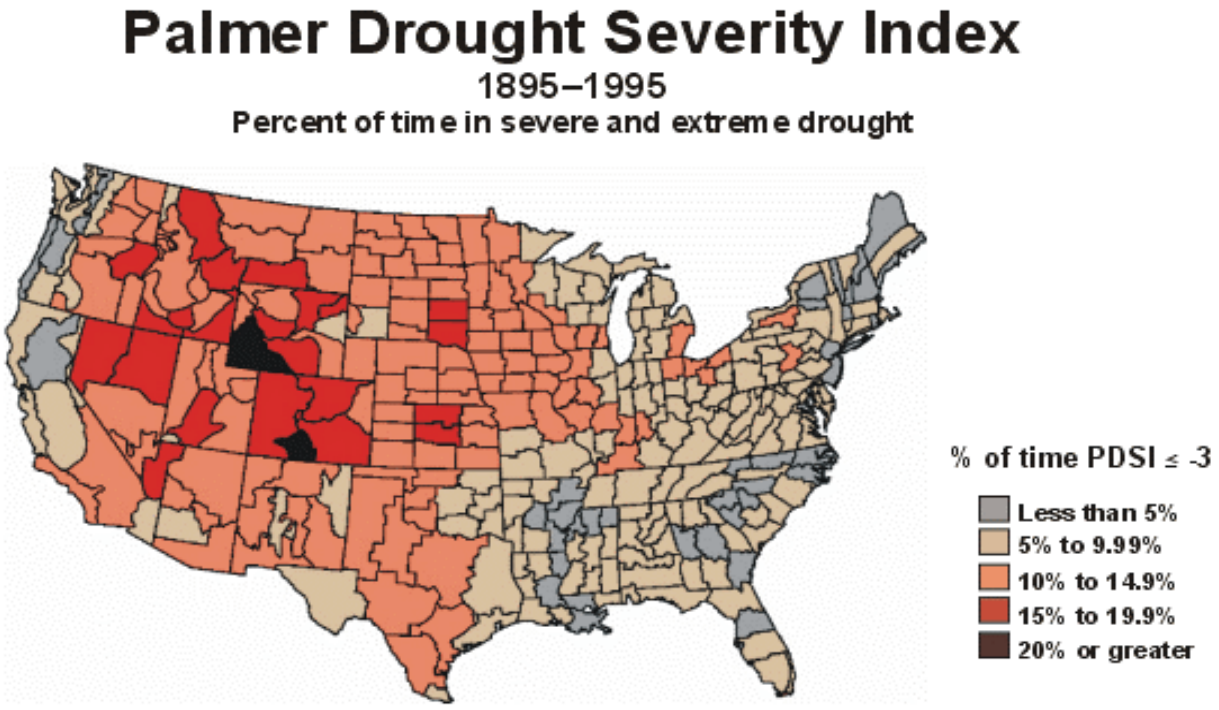
| | |
|---|---|
| **Meteorological Drought** | The degree of dryness or departure of actual precipitation from an expected average or normal amount based on monthly, seasonal, or annual time scales. |
| **Hydrologic Drought** | The effects of precipitation shortfalls on stream flows and reservoir, lake, and groundwater levels. |
| **Agricultural Drought** | Soil moisture deficiencies relative to water demands of plant life, usually crops. |
| **Socioeconomic Drought** | The effect of demands for water exceeding the supply as a result of a weather-related supply shortfall. |

*Source: Multi-Hazard Identification and Risk Assessment: A Cornerstone of the National Mitigation Strategy, FEMA*

Droughts are slow-onset hazards, but, over time, can have very damaging affects to crops, municipal water supplies, recreational uses, and wildlife. If drought conditions extend over a number of years, the direct and indirect economic impact can be significant.

The Palmer Drought Severity Index (PDSI) is based on observed drought conditions and range from -0.5 (incipient dry spell) to -4.0 (extreme drought). Evident in **Figure 2.2**, the Palmer Drought Severity Index Summary Map for the United Stated, drought affects most areas of the United States, but is less severe in the Eastern United States.

**Figure 2.2: Palmer Drought Severity Index Summary Map for the United States**




*Source: National Drought Mitigation Center*

2. Location and Spatial Extent

Drought typically covers a large area and cannot be confined to any geographic or political boundaries. According to the Palmer Drought Severity Index, Eastern Georgia has a low-moderate risk for drought hazard compared to the rest of the United States. However, local areas may experience much more severe and/or frequent drought events than what is represented on the Palmer Drought Severity Index map. Furthermore, it is assumed that Chatham County would be uniformly exposed to drought, making the spatial extent potentially widespread. It is also notable that drought conditions typically do not cause significant damage to the built environment.

3. Historical Occurrences

Data from the Georgia Automated Environmental Monitoring Network (GAEMK) was obtained used to ascertain historical drought conditions for Chatham County. (Data was only available at the county level, so each jurisdiction is not shown separately.) Data was available from January 2006 through November 2014. The GAEMK provides annual updates on precipitation deficits

and surpluses by county. The data show the departure from normal precipitation levels (average from 1971-2000) each year and are described in **Table 2.9**:

**Table 2.9 : Departure from Normal Precipitation Levels**

| Year | Chatham County |
|---|---|
| 2006 | -13.15 |
| 2007 | -3.99 |
| 2008 | -8.60 |
| 2009 | 14.60 |
| 2010 | -8.02 |
| 2011 | -5.43 |
| 2012 | -6.69 |
| 2013 | 5.36 |
| 2014* | 3.10 |

*Through November 2014

*Source: GAEMK*

The greatest magnitude of drought on this scale was reported in 2006-2008 when precipitation deficits over the three year period amounted to more than 25 inches. Chatham County experienced precipitation deficits conditions in six of the past nine years. It should also be noted that all areas of the County may not have experienced the most severe condition reported.

Additionally, data from the National Climatic Data Center (NCDC) was collected to provide a source of historical drought occurrences. The NCDC reported 67 drought events since 1996 and a report from May of 2007 describes conditions close to the peak of that drought period:

*May 2007 Drought*

Drought conditions continued to worsen across the entire state during May. Rainfall deficits across many counties of north and central Georgia continued to grow as well as the number of counties classified in severe and extreme drought conditions. By the end of May 2007, 74 Georgia counties were classified as being in extreme drought, 79 in severe drought, and six in moderate drought.[2]

4. Probability of Future Occurrences

Based on historical occurrence information, it is assumed that all of Chatham County has a probability level of highly likely (near 100 percent annual probability) for future drought events. This hazard may vary slightly by location but each area has an equal probability of experiencing a drought. However, historical information also indicates that there is a much lower probability for extreme, long-lasting drought conditions.

[2] National Climatic Data Center, NOAA

## D. Extreme Heat

1. Background

Extreme heat, like drought, poses little risk to property. However, extreme heat can have devastating effects on health. Extreme heat is often referred to as a "heat wave." According to the National Weather Service, there is no universal definition for a heat wave, but the standard U.S. definition is any event lasting at least three days where temperatures reach ninety degrees Fahrenheit or higher. However, it may also be defined as an event at least three days long where temperatures are ten degrees greater than the normal temperature for the affected area. Heat waves are typically accompanied by humidity but may also be very dry. These conditions can pose serious health threats causing an average of 1,500 deaths each summer in the United States[3].

According to the National Oceanic and Atmospheric Administration, heat is the number one weather-related killer among natural hazards, followed by frigid winter temperatures[1]. The National Weather Service devised the Heat Index as a mechanism to better inform the public of heat dangers. The Heat Index Chart, shown in **Figure 2.3**, uses air temperature and humidity to determine the heat index or apparent temperature. **Table 2.10** shows the dangers associated with different heat index temperatures. Some populations, such as the elderly and young, are more susceptible to heat danger than other segments of the population.

**Figure 2.3: Heat Index Chart**

| Air Temp (in F) \ Relative Humidity (in percent) | 0 | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 100 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 140 | 125 | | | | | | | | | | | | | | | | | | | | |
| 135 | 120 | 128 | | | | | | | | | | | | | | | | | | | |
| 130 | 117 | 122 | 131 | | | | | | | | | | | | | | | | | | |
| 125 | 111 | 116 | 123 | 131 | 141 | | | | | | | | | | | | | | | | |
| 120 | 107 | 111 | 116 | 123 | 130 | 139 | 148 | | | | | | | | | | | | | | |
| 115 | 103 | 107 | 111 | 115 | 120 | 127 | 135 | 143 | 151 | | | | | | | | | | | | |
| 110 | 99 | 102 | 105 | 108 | 112 | 117 | 123 | 130 | 137 | 143 | 150 | | | | | | | | | | |
| 105 | 95 | 97 | 100 | 102 | 105 | 109 | 113 | 118 | 123 | 129 | 135 | 142 | 149 | | | | | | | | |
| 100 | 91 | 93 | 95 | 97 | 99 | 101 | 104 | 107 | 110 | 115 | 120 | 126 | 132 | 138 | 144 | | | | | | |
| 95 | 87 | 88 | 90 | 91 | 93 | 94 | 96 | 98 | 101 | 104 | 107 | 110 | 114 | 119 | 124 | 130 | 136 | | | | |
| 90 | 83 | 84 | 85 | 86 | 87 | 88 | 90 | 91 | 93 | 95 | 96 | 98 | 100 | 102 | 106 | 109 | 113 | 117 | 122 | | |
| 85 | 78 | 79 | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 93 | 95 | 97 | 99 | 102 | 105 | 108 |
| 80 | 73 | 74 | 75 | 76 | 77 | 77 | 78 | 79 | 79 | 80 | 81 | 81 | 82 | 83 | 85 | 86 | 86 | 87 | 88 | 89 | 91 |
| 75 | 69 | 69 | 70 | 71 | 72 | 72 | 73 | 73 | 74 | 74 | 75 | 75 | 76 | 76 | 77 | 77 | 78 | 78 | 79 | 79 | 80 |
| 70 | 64 | 64 | 65 | 65 | 66 | 66 | 67 | 67 | 68 | 68 | 69 | 69 | 70 | 70 | 70 | 70 | 71 | 71 | 71 | 71 | 72 |

***Source: National Oceanic and Atmospheric Administration***

[3] http://www.noaawatch.gov/themes/heat.php

**Table 2.10: Heat Disorders Associated with Heat Index Temperature**

| Heat Index Temperature (Fahrenheit) | Description of Risks |
|---|---|
| **80°- 90°** | Fatigue possible with prolonged exposure and/or physical activity |
| **90°- 105°** | Sunstroke, heat cramps, and heat exhaustion possible with prolonged exposure and/or physical activity |
| **105°- 130°** | Sunstroke, heat cramps, and heat exhaustion likely, and heatstroke possible with prolonged exposure and/or physical activity |
| **130° or higher** | Heatstroke or sunstroke is highly likely with continued exposure |

*Source: National Weather Service, National Oceanic and Atmospheric Administration*

In addition, NOAA has seventeen metropolitan areas participating in the Heat HealthWatch/Warning System in order to better inform and warn the public of heat dangers. A Heat HealthWatch is issued when conditions are favorable for an excessive heat event in the next 12 to 48 hours. A Heat Warning is issued when an excessive heat event is expected in the next 36 hours. Furthermore, a warning is issued when the conditions are occurring, imminent, or have a high likelihood of occurrence. Urban areas participate in the Heat Health Watch/Warning System because urban areas are at greater risk to heat affects. Stagnant atmospheric conditions trap pollutants, thus adding unhealthy air to excessively hot temperatures. In addition, the "urban heat island effect" can produce significantly higher nighttime temperatures because asphalt and concrete (which store heat longer) gradually release heat at night.

2. Location and Spatial Extent

Excessive heat typically impacts a large area and cannot be confined to any geographic or political boundaries. The entire county is susceptible to extreme heat conditions.

3. Historical Occurrences

Data from the National Climatic Data Center was used to determine historical extreme heat and heat wave events in Chatham County. Thirty-seven events were reported and a description of some of several of these are recorded below:

**June 1, 1998** –*Heat* – Temperatures were well into the 90s and occasionally exceeded 100 degrees throughout the month with heat indices near 110 degrees on several days. Rainfall was well below normal across southeast Georgia which caused the area to approach the incipient drought stage.

**July 27, 2005** –*Heat* – An upper ridge of high pressure settled over the region bringing extreme heat to portions of southeast Georgia. The extreme heat combined with high humidity to create heat indices that averaged between 110 and 120 degrees across inland areas with indices of 105 to 110 at the beaches. While temperatures cooled slightly on 7/28/05 heat indices still averaged around 110 degrees.

**August 4, 2011** –*Excessive Heat* – A strong mid and upper level ridge produced large thickness values over the southeast. These thickness values supported afternoon high temperatures in the upper 90s to low 100s inland and mid 90s along the coast. These temperatures in combination with low to mid 70s dew points pooling along an afternoon sea breeze, produced dangerous heat indices over portions of southeast Georgia.

In addition, information from the Georgia Automated Environmental Monitoring Network (GAEK) was reviewed to obtain historical temperature records in the County. The recorded maximum for the County can be found below in **Table 2.11**:

**Table 2.11: Highest Recorded Temperature in Chatham County**

| Location | Temperature (°F) |
|---|---|
| **Chatham County** | 104.4 |

4. Probability of Future Occurrences

Based on historical occurrence information, it is assumed that all of Chatham County has a probability level of highly likely (near 100 percent annual probability) for future extreme heat events to impact the County.

## E. Hailstorm

1. Background

Hailstorms are a potentially damaging outgrowth of severe thunderstorms (thunderstorms are discussed separately in subsection H). Early in the developmental stages of a hailstorm, ice crystals form within a low-pressure front due to the rapid rising of warm air into the upper atmosphere and the subsequent cooling of the air mass. Frozen droplets gradually accumulate on the ice crystals until they develop to a sufficient weight and fall as precipitation. Hail typically takes the form of spheres or irregularly-shaped masses greater than 0.75 inches in diameter. The size of hailstones is a direct function of the size and severity of the storm. High velocity updraft winds are required to keep hail in suspension in thunderclouds. The strength of the updraft is a function of the intensity of heating at the Earth's surface. Higher temperature gradients relative to elevation above the surface result in increased suspension time and hailstone size. **Table 2.12** shows the TORRO Hailstorm Intensity Scale which is a way of measuring hail severity.

**Table 2.12: TORRO Hailstorm Intensity Scale**

| | Intensity Category | Typical Hail Diameter (mm)* | Probable Kinetic Energy, J-m$^2$ | mm to inch conversion (inches) | Typical Damage Impacts |
|---|---|---|---|---|---|
| **H0** | Hard Hail | 5 | 0-20 | 0 - 0.2 | No damage |
| **H1** | Potentially Damaging | 5-**15** | >20 | 0.2 - 0.6 | Slight general damage to plants, crops |

| | Intensity Category | Typical Hail Diameter (mm)* | Probable Kinetic Energy, J-m$^2$ | mm to inch conversion (inches) | Typical Damage Impacts |
|---|---|---|---|---|---|
| **H2** | Significant | 10-**20** | >100 | 0.4 - 0.8 | Significant damage to fruit, crops, vegetation |
| **H3** | Severe | 20-**30** | >300 | 0.8 - 1.2 | Severe damage to fruit and crops, damage to glass and plastic structures, paint and wood scored |
| **H4** | Severe | 25-**40** | >500 | 1.0 - 1.6 | Widespread glass damage, vehicle bodywork damage |
| **H5** | Destructive | 30-**50** | >800 | 1.2 - 2.0 | Wholesale destruction of glass, damage to tiled roofs, significant risk of injuries |
| **H6** | Destructive | 40-**60** | | 1.6 - 2.4 | Bodywork of grounded aircraft dented, brick walls pitted |
| **H7** | Destructive | 50-**75** | | 2.0 - 3.0 | Severe roof damage, risk of serious injuries |
| **H8** | Destructive | 60-**90** | | 1.6 - 3.5 | (Severest recorded in the British Isles) Severe damage to aircraft bodywork |
| **H9** | Super Hailstorms | 75-**100** | | 3.0 - 3.9 | Extensive structural damage. Risk of severe or even fatal injuries to persons caught in the open |
| **H10** | Super Hailstorms | >100 | | | Extensive structural damage. Risk of severe or even fatal injuries to persons caught in the open |

*Source: http://www.torro.org.uk/site/hscale.php*

2. Location and Spatial Extent

Hailstorms frequently accompany thunderstorms, so their locations and spatial extents coincide. It is assumed that Chatham County is uniformly exposed to severe thunderstorms; therefore, all areas of the County are equally exposed to hail which may be produced by such storms.

3. Historical Occurrences

According to the National Climatic Data Center, 150 recorded hailstorm events have affected Chatham County since 1957.[4] **Table 2.13** is a summary of the hail events in Chatham County. In all, hail occurrences resulted in over $800,000 (2014 dollars) in property damages.[5] Hail ranged in diameter from 0.75 inches to 3.5 inches. It should be noted that hail is notorious for causing substantial damage to cars, roofs, and other areas of the built environment that may not be reported to the National Climatic Data Center. It is likely that damages are greater than the reported value.

[4] These hail events are only inclusive of those reported by the National Climatic Data Center (NCDC) from 1957 through 2014. It is likely that additional hail events have affected Chatham County. As additional local data becomes available, this hazard profile will be amended.
[5] Adjusted dollar values were calculated based on the average Consumer Price Index for a given calendar year. This index value has been calculated every year since 1913. The 2014 index value was used.

**Table 2.13: Summary of Hail Occurrences in Chatham County**

| Location | Number of Occurrences | Deaths / Injuries | Property Damage (2014) |
|---|---|---|---|
| Bloomingdale | 7 | 0/0 | $0 |
| Garden City | 1 | 0/0 | $0 |
| Pooler | 5 | 0/0 | $0 |
| Port Wentworth | 7 | 0/0 | $0 |
| Savannah | 48 | 0/0 | $832,673 |
| Thunderbolt | 14 | 0/0 | $0 |
| Tybee Island | 0 | 0/0 | $0 |
| Unincorporated Area | 64 | 0/0 | $0 |
| **CHATHAM COUNTY TOTAL** | **150** | **0/0** | **$832,673** |

*Source: National Climatic Data Center*

4. Probability of Future Occurrences

Based on historical occurrence information, it is assumed that the probability of future hail occurrences is highly likely (100 percent annual probability). Since hail is an atmospheric hazard (coinciding with thunderstorms), it is assumed that the entire county has equal exposure to this hazard. It can be expected that future hail events will continue to cause minor damage to property and vehicles throughout the County.

## F. Hurricane and Tropical storm

1. Background

Hurricanes and tropical storms are classified as cyclones and defined as any closed circulation developing around a low-pressure center in which the winds rotate counter-clockwise in the Northern Hemisphere (or clockwise in the Southern Hemisphere) and whose diameter averages 10 to 30 miles across. A tropical cyclone refers to any such circulation that develops over tropical waters. Tropical cyclones act as a "safety-valve," limiting the continued build-up of heat and energy in tropical regions by maintaining the atmospheric heat and moisture balance between the tropics and the pole-ward latitudes. The primary damaging forces associated with these storms are high-level sustained winds, heavy precipitation, and tornadoes.

The key energy source for a tropical cyclone is the release of latent heat from the condensation of warm water. Their formation requires a low-pressure disturbance, warm sea surface temperature, rotational force from the spinning of the earth, and the absence of wind shear in the lowest 50,000 feet of the atmosphere. The majority of hurricanes and tropical storms form in the Atlantic Ocean, Caribbean Sea, and Gulf of Mexico during the official Atlantic hurricane season, which encompasses the months of June through November. The peak of the Atlantic hurricane season is in early to mid-September and the average number of storms that reach hurricane intensity per year in the Atlantic basin is about six.

As an incipient hurricane develops, barometric pressure (measured in millibars or inches) at its center falls and winds increase. If the atmospheric and oceanic conditions are favorable, it can intensify into a tropical depression. When maximum sustained winds reach or exceed 39 miles per hour, the system is designated a tropical storm, given a name, and is closely monitored by the National Hurricane Center in Miami, Florida. When sustained winds reach or exceed 74 miles per hour the storm is deemed a hurricane. Hurricane intensity is further classified by the Saffir-Simpson Scale (**Table 2.14**), which rates hurricane intensity on a scale of 1 to 5, with 5 being the most intense.

**Table 2.14: Saffir-Simpson Scale**

| Category | Maximum Sustained Wind Speed (MPH) | Minimum Surface Pressure (Millibars) |
|---|---|---|
| 1 | 74–95 | Greater than 980 |
| 2 | 96–110 | 979–965 |
| 3 | 111–129 | 964–945 |
| 4 | 130–156 | 944–920 |
| 5 | 157 + | Less than 920 |

*Source: National Hurricane Center (2012)*

The Saffir-Simpson Scale categorizes hurricane intensity linearly based upon maximum sustained winds and barometric pressure, which are combined to estimate potential damage. Categories 3, 4, and 5 are classified as "major" hurricanes and, while hurricanes within this range comprise only 20 percent of total tropical cyclone landfalls, they account for over 70 percent of the damage in the United States. **Table 2.15** describes the damage that could be expected for each category of hurricane. Damage during hurricanes may also result from spawned tornadoes, storm surge, and inland flooding associated with heavy rainfall that usually accompanies these storms.

**Table 2.15: Hurricane Damage Classifications**

| Storm Category | Damage Level | Description of Damages | Photo Example |
|---|---|---|---|
| **1** | MINIMAL | No real damage to building structures. Damage primarily to unanchored mobile homes, shrubbery, and trees. Also, some coastal flooding and minor pier damage. |  |
| **2** | MODERATE | Some roofing material, door, and window damage. Considerable damage to vegetation, mobile homes, etc. Flooding damages piers and small craft in unprotected moorings may break their moorings. |  |
| **3** | EXTENSIVE | Some structural damage to small residences and utility buildings, with a minor amount of curtain wall failures. Mobile homes are destroyed. Flooding near the coast destroys smaller structures, with larger structures damaged by floating debris. Terrain may be flooded well inland. |  |
| **4** | EXTREME | More extensive curtain wall failures with some complete roof structure failure on small residences. Major erosion of beach areas. Terrain may be flooded well inland. |  |
| **5** | CATASTROPHIC | Complete roof failure on many residences and industrial buildings. Some complete building failures with small utility buildings blown over or away. Flooding causes major damage to lower floors of all structures near the shoreline. Massive evacuation of residential areas may be required. |  |

*Source: National Hurricane Center; Federal Emergency Management Agency*

2. Location and Spatial Extent

Hurricanes and tropical storms threaten the entire Atlantic and Gulf seaboard of the United States. Because coastal areas are most directly exposed to the brunt of landfalling storms, their impacts are certainly felt in Chatham County. All areas in Chatham County are equally susceptible to hurricane and tropical storm winds, but areas along the coast will likely also be affected by storm surge.

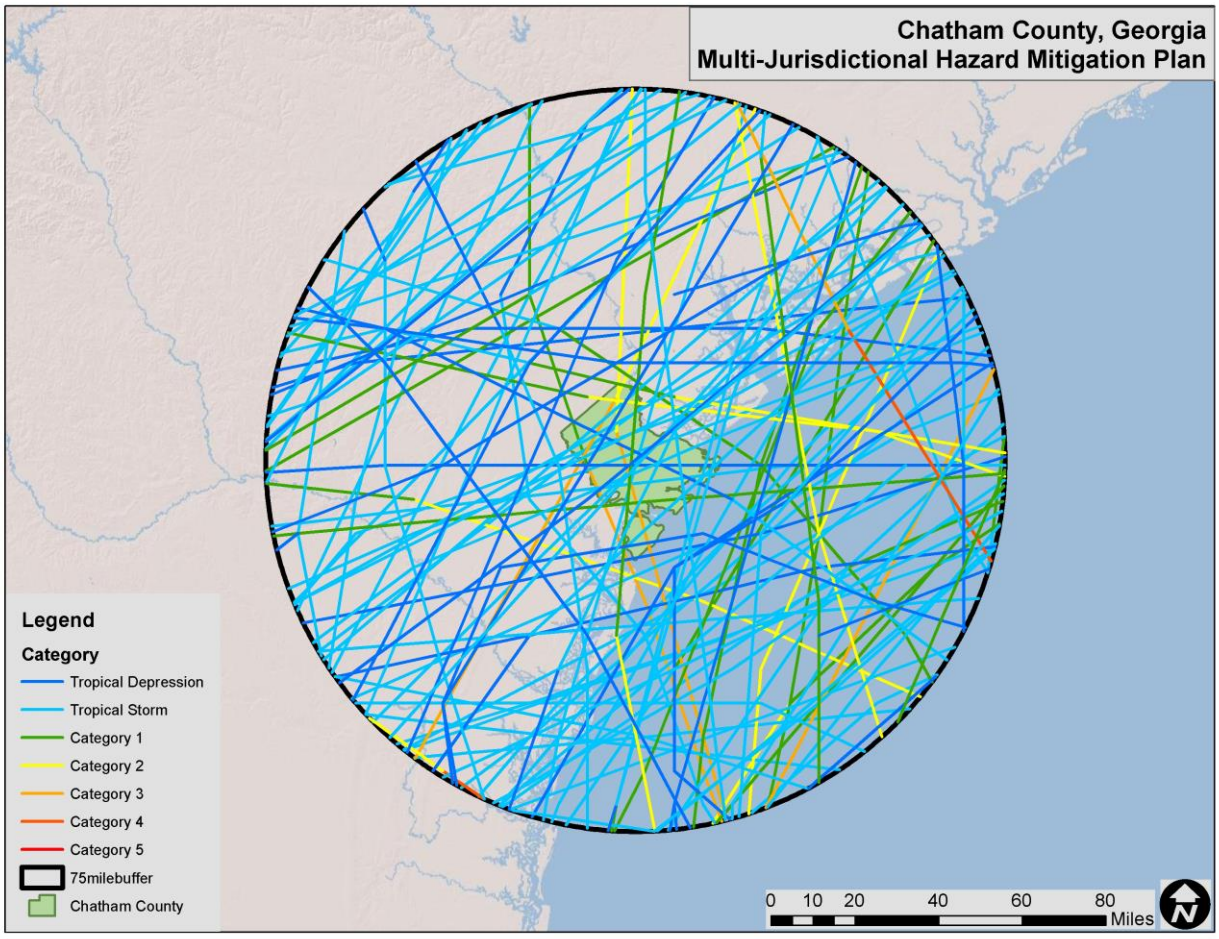
3. Historical Occurrences

According to the National Hurricane Center's historical storm track records, 114 hurricane/tropical storm tracks have passed within 75 miles of Chatham County since 1859.[6] This includes 27 hurricanes, 66 tropical storms and 21 tropical depressions.

Of the recorded storm events, 32 have traversed directly through Chatham County as shown in **Figure 2.4**. **Table 2.16** provides for each event the date of occurrence, name (if applicable), maximum wind speed (as recorded within 75 miles of Chatham County) and Category of the storm based on the Saffir-Simpson Scale.

[6] These storm track statistics do not include extra-tropical storms. Though these related hazard events are less severe in intensity, they may cause significant local impact in terms of rainfall and high winds.

**Figure 2.4: Historical Hurricane Storm Tracks within 75 Miles of Chatham County**




*Source: National Oceanic and Atmospheric Administration; National Hurricane Center*

**Table 2.16: Historical Storm Tracks within 75 Miles of Chatham County (1850–2014)**

| Date of Occurrence | Storm Name | Wind Speed Within 75 miles of County (knots) | Maximum Storm Category Achieved Within 75 miles of County |
|---|---|---|---|
| 10/10/1852 | UNNAMED | 60 | Tropical Storm |
| 10/21/1853 | UNNAMED | 90 | Category 2 |
| 9/8/1854 | UNNAMED | 110 | Category 3 |
| 8/31/1856 | UNNAMED | 60 | Tropical Storm |
| 8/13/1860 | UNNAMED | 40 | Tropical Storm |
| 6/22/1867 | UNNAMED | 70 | Category 1 |
| 10/5/1868 | UNNAMED | 40 | Tropical Storm |
| 10/6/1871 | UNNAMED | 40 | Tropical Storm |
| 8/19/1871 | UNNAMED | 60 | Tropical Storm |

| Date of Occurrence | Storm Name | Wind Speed Within 75 miles of County (knots) | Maximum Storm Category Achieved Within 75 miles of County |
|---|---|---|---|
| 8/28/1871 | UNNAMED | 30 | Tropical Depression |
| 9/7/1871 | UNNAMED | 60 | Tropical Storm |
| 9/19/1873 | UNNAMED | 60 | Tropical Storm |
| 9/28/1874 | UNNAMED | 70 | Category 1 |
| 9/20/1877 | UNNAMED | 40 | Tropical Storm |
| 10/11/1878 | UNNAMED | 40 | Tropical Storm |
| 9/11/1878 | UNNAMED | 80 | Category 1 |
| 9/9/1880 | UNNAMED | 60 | Tropical Storm |
| 8/27/1881 | UNNAMED | 90 | Category 2 |
| 10/12/1882 | UNNAMED | 60 | Tropical Storm |
| 9/10/1884 | UNNAMED | 40 | Tropical Storm |
| 10/12/1885 | UNNAMED | 50 | Tropical Storm |
| 8/25/1885 | UNNAMED | 90 | Category 2 |
| 8/31/1885 | UNNAMED | 40 | Tropical Storm |
| 9/21/1885 | UNNAMED | 40 | Tropical Storm |
| 7/1/1886 | UNNAMED | 55 | Tropical Storm |
| 10/11/1888 | UNNAMED | 70 | Category 1 |
| 9/9/1888 | UNNAMED | 40 | Tropical Storm |
| 10/13/1893 | UNNAMED | 105 | Category 3 |
| 6/16/1893 | UNNAMED | 50 | Tropical Storm |
| 8/28/1893 | UNNAMED | 100 | Category 3 |
| 10/9/1894 | UNNAMED | 70 | Category 1 |
| 9/27/1894 | UNNAMED | 75 | Category 1 |
| 9/29/1896 | UNNAMED | 100 | Category 3 |
| 10/2/1898 | UNNAMED | 115 | Category 4 |
| 8/30/1898 | UNNAMED | 75 | Category 1 |
| 10/12/1900 | UNNAMED | 35 | Tropical Storm |
| 9/18/1901 | UNNAMED | 35 | Tropical Storm |
| 6/15/1902 | UNNAMED | 35 | Tropical Storm |
| 11/4/1904 | UNNAMED | 30 | Tropical Depression |
| 10/20/1906 | UNNAMED | 70 | Category 1 |
| 6/29/1907 | UNNAMED | 55 | Tropical Storm |
| 9/29/1907 | UNNAMED | 40 | Tropical Storm |
| 7/3/1909 | UNNAMED | 30 | Tropical Depression |

| Date of Occurrence | Storm Name | Wind Speed Within 75 miles of County (knots) | Maximum Storm Category Achieved Within 75 miles of County |
|---|---|---|---|
| 10/19/1910 | UNNAMED | 60 | Tropical Storm |
| 8/5/1911 | UNNAMED | 25 | Tropical Depression |
| 8/28/1911 | UNNAMED | 85 | Category 2 |
| 7/15/1912 | UNNAMED | 45 | Tropical Storm |
| 9/6/1912 | UNNAMED | 30 | Tropical Depression |
| 8/2/1915 | UNNAMED | 40 | Tropical Storm |
| 5/15/1916 | UNNAMED | 35 | Tropical Storm |
| 10/4/1916 | UNNAMED | 50 | Tropical Storm |
| 9/30/1919 | UNNAMED | 40 | Tropical Storm |
| 6/27/1923 | UNNAMED | 40 | Tropical Storm |
| 9/16/1924 | UNNAMED | 40 | Tropical Storm |
| 9/30/1924 | UNNAMED | 55 | Tropical Storm |
| 10/3/1927 | UNNAMED | 50 | Tropical Storm |
| 9/18/1928 | UNNAMED | 75 | Category 1 |
| 10/1/1929 | UNNAMED | 50 | Tropical Storm |
| 9/15/1932 | UNNAMED | 45 | Tropical Storm |
| 9/5/1935 | UNNAMED | 55 | Tropical Storm |
| 8/11/1940 | UNNAMED | 85 | Category 2 |
| 10/8/1941 | UNNAMED | 45 | Tropical Storm |
| 10/19/1944 | UNNAMED | 60 | Tropical Storm |
| 9/17/1945 | UNNAMED | 65 | Category 1 |
| 10/8/1946 | UNNAMED | 35 | Tropical Storm |
| 11/2/1946 | UNNAMED | 25 | Tropical Depression |
| 9/24/1947 | UNNAMED | 45 | Tropical Storm |
| 10/15/1947 | UNNAMED | 75 | Category 1 |
| 8/31/1952 | ABLE | 90 | Category 2 |
| 9/1/1953 | UNNAMED | 40 | Tropical Storm |
| 9/20/1953 | UNNAMED | 40 | Tropical Storm |
| 9/27/1953 | FLORENCE | 50 | Tropical Storm |
| 9/25/1956 | FLOSSY | 35 | Tropical Storm |
| 6/9/1957 | UNNAMED | 35 | Tropical Storm |
| 9/29/1959 | GRACIE | 120 | Category 4 |
| 7/29/1960 | BRENDA | 45 | Tropical Storm |
| 6/7/1964 | UNNAMED | 30 | Tropical Depression |

| Date of Occurrence | Storm Name | Wind Speed Within 75 miles of County (knots) | Maximum Storm Category Achieved Within 75 miles of County |
|---|---|---|---|
| 8/29/1964 | CLEO | 45 | Tropical Storm |
| 9/13/1964 | DORA | 40 | Tropical Storm |
| 6/10/1966 | ALMA | 55 | Tropical Storm |
| 6/7/1968 | ABBY | 50 | Tropical Storm |
| 8/31/1968 | UNNAMED | 25 | Tropical Depression |
| 5/25/1970 | ALMA | 25 | Tropical Depression |
| 9/11/1971 | UNNAMED | 20 | Tropical Depression |
| 5/27/1972 | ALPHA | 50 | Tropical Storm |
| 9/13/1972 | DAWN | 30 | Tropical Depression |
| 5/24/1976 | SUBTROP:UNNAMED | 40 | Tropical Storm |
| 8/20/1976 | DOTTIE | 40 | Tropical Storm |
| 9/15/1976 | SUBTROP:UNNAMED | 40 | Tropical Storm |
| 6/16/1979 | UNNAMED | 30 | Tropical Depression |
| 9/4/1979 | DAVID | 85 | Category 2 |
| 7/3/1981 | UNNAMED | 30 | Tropical Depression |
| 8/19/1981 | DENNIS | 45 | Tropical Storm |
| 6/18/1982 | SUBTROP:UNNAMED | 60 | Tropical Storm |
| 9/29/1984 | ISIDORE | 45 | Tropical Storm |
| 7/24/1985 | BOB | 65 | Category 1 |
| 8/9/1985 | CLAUDETTE | 25 | Tropical Depression |
| 10/11/1985 | ISABEL | 30 | Tropical Depression |
| 11/22/1985 | KATE | 65 | Category 1 |
| 8/15/1986 | CHARLEY | 15 | Tropical Depression |
| 8/17/1987 | UNNAMED | 10 | Tropical Depression |
| 8/28/1988 | CHRIS | 45 | Tropical Storm |
| 11/21/1994 | GORDON | 20 | Tropical Depression |
| 6/6/1995 | ALLISON | 35 | Tropical Storm |
| 10/8/1996 | JOSEPHINE | 45 | Tropical Storm |
| 9/3/1998 | EARL | 40 | Tropical Storm |
| 9/18/2000 | GORDON | 30 | Tropical Depression |
| 10/11/2002 | KYLE | 35 | Tropical Storm |
| 7/26/2003 | UNNAMED | 30 | Tropical Depression |
| 8/12/2004 | BONNIE | 30 | Tropical Depression |
| 8/14/2004 | CHARLEY | 75 | Category 1 |

| Date of Occurrence | Storm Name | Wind Speed Within 75 miles of County (knots) | Maximum Storm Category Achieved Within 75 miles of County |
|---|---|---|---|
| 6/14/2006 | ALBERTO | 35 | Tropical Storm |
| 6/3/2007 | BARRY | 40 | Tropical Storm |
| 5/30/2012 | BERYL | 35 | Tropical Storm |

*Source: National Hurricane Center*

The National Climatic Data Center reported two events associated with a hurricane or tropical storm in Chatham County since 1996. Additionally, Federal records indicate that disaster declarations were made in 1999 (Hurricane Floyd) and 2005 (Hurricane Katrina Evacuation).[7]

Flooding is often the greatest hazard of concern with hurricane and tropical storm events in Chatham County, though many events carry winds that are extremely strong as well and can impact the County. Although in recent years there have not been any major storms that directly hit Chatham County, some anecdotal information is available from storms in the distant past:

**Sea Islands Hurricane** – August 28, 1893
The Sea Islands Hurricanes was one of three major hurricanes during the 1893 Atlantic hurricane season. Though precise data was not kept, some estimates indicate that somewhere between 1,000 and 2,000 fatalities occurred as a result of the storm, mainly due to storm surge. This puts the storm on par with Hurricane Katrina as one of the deadliest hurricanes ever to impact the United States. Indeed, in some places storm surge may have inundated areas as much as 30 feet.

**1898 Hurricane** – October 2, 1898
This hurricane was the most recent major hurricane to directly hit the state of Georgia and reached a peak wind speed of around 135 mph. Overall, some estimates of the damage were in the range of over $1 million as the storm made landfall on Cumberland Island. Storm surges occurred along most areas of the Georgia coastline and a number of people were killed or injured during the event. In addition, crops were destroyed and many boats were damaged or destroyed.

4. Probability of Future Occurrences

Given the location of the County on the coast, it is likely to be affected by a hurricane or tropical storm system in the future, including impacts from both storm surge and high winds. Based on historical evidence, the probability level of future occurrence is likely (between 10 and 100 percent annual probability). Given the regional nature of the hazard, all areas are equally exposed to the wind impacts of this hazard. However, the coastal areas are most likely to be impacted by storm surge in addition to high winds. Given the County's geographic location, the damage could be catastrophic, threatening lives and property throughout the planning area.

[7] A complete listing of historical disaster declarations can be found in *Chapter 2 – Local Hazard Identification and Risk*.

## G. Lightning

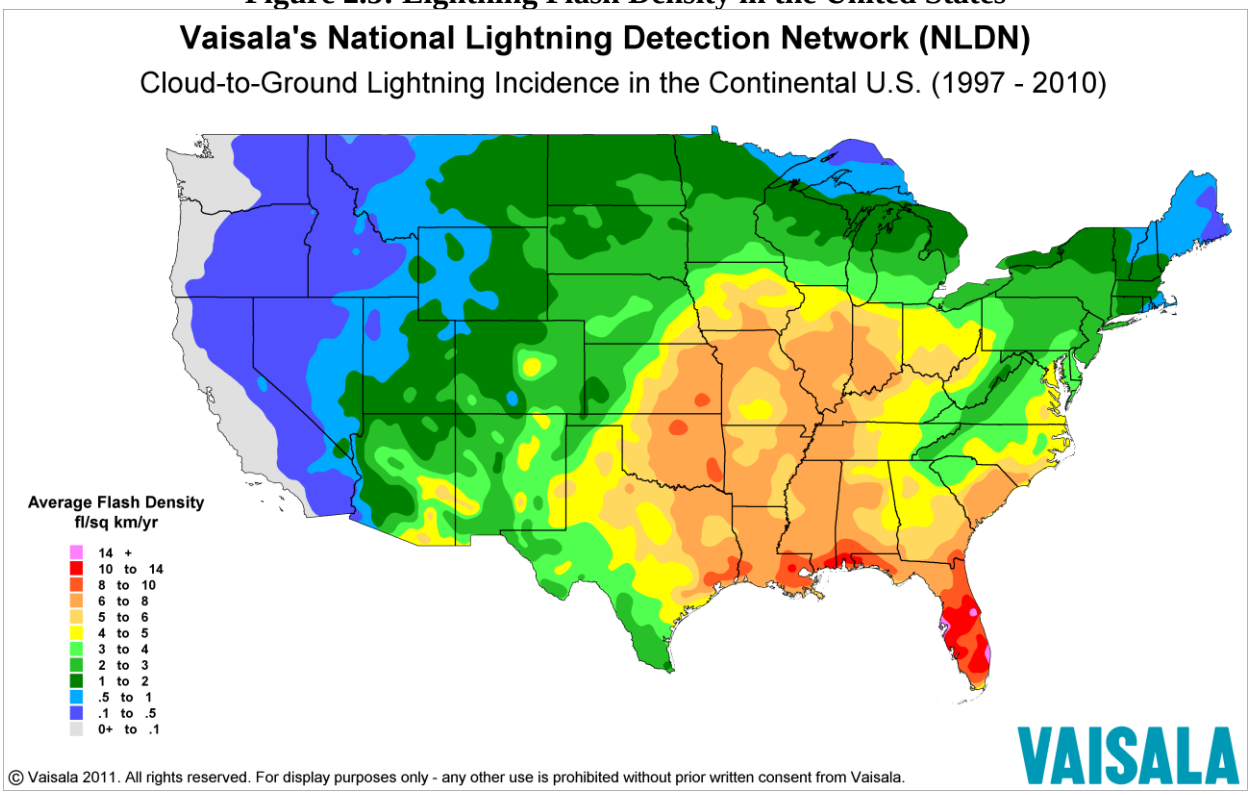
1. Background

Lightning is a discharge of electrical energy resulting from the buildup of positive and negative charges within a thunderstorm, creating a "bolt" when the buildup of charges becomes strong enough. This flash of light usually occurs within the clouds or between the clouds and the ground. A bolt of lightning can reach temperatures approaching 50,000 degrees Fahrenheit. Lightning rapidly heats the sky as it flashes but the surrounding air cools following the bolt. This rapid heating and cooling of the surrounding air causes the thunder which often accompanies lightning strikes. While most often affiliated with severe thunderstorms, lightning may also strike outside of heavy rain and might occur as far as 10 miles away from any rainfall.

Lightning strikes occur in very small, localized areas. For example, they may strike a building, electrical transformer, or even a person. According to FEMA, lightning injures an average of 300 people and kills 80 people each year in the United States. Direct lightning strikes also have the ability to cause significant damage to buildings, critical facilities, and infrastructure largely by igniting a fire. Lightning is also responsible for igniting wildfires that can result in widespread damages to property.

**Figure 2.5** shows a lightning flash density map for the years 1997-2010 based upon data provided by Vaisala's U.S. National Lightning Detection Network (NLDN®).

**Figure 2.5: Lightning Flash Density in the United States**




*Source: Vaisala United States National Lightning Detection Network*

2. Location and Spatial Extent

Lightning occurs randomly, therefore it is impossible to predict where and with what frequency it will strike. It is assumed that all of Chatham County is uniformly exposed to lightning.

3. Historical Occurrences

According to the National Climatic Data Center, there have been a total of 21 recorded lightning events in Chatham County since 1996.[8] These events resulted in almost $2.7 million (2014 dollars) in damages, as listed in summary **Table 2.17**.[9] Furthermore, lightning caused 1 death and 13 injuries throughout Chatham County.

It is certain that more than 21 events have impacted the County. Many of the reported events are those that caused damage, and it should be expected that damages are likely much higher for this hazard than what is reported.

[8] These lightning events are only inclusive of those reported by the National Climatic Data Center (NCDC) from 1996 through 2014. It is certain that additional lightning events have occurred in Chatham County. As additional local data becomes available, this hazard profile will be amended.
[9] Adjusted dollar values were calculated based on the average Consumer Price Index for a given calendar year. This index value has been calculated every year since 1913. The 2014 index value was used.

**Table 2.17: Summary of Lightning Occurrences in Chatham County**

| Location | Number of Occurrences | Deaths / Injuries | Property Damage (2014) |
|---|---|---|---|
| Bloomingdale | 0 | 0/0 | $0 |
| Garden City | 0 | 0/0 | $0 |
| Pooler | 3 | 0/4 | $20,384 |
| Port Wentworth | 0 | 0/0 | $0 |
| Savannah | 11 | 1/7 | $78,415 |
| Thunderbolt | 0 | 0/0 | $0 |
| Tybee Island | 0 | 0/0 | $0 |
| Unincorporated Area | 7 | 0/0 | $2,569,249 |
| **CHATHAM COUNTY TOTAL** | **21** | **1/13** | **$2,668,048** |

*Source: National Climatic Data Center*

4. Probability of Future Occurrences

Although there were not a high number of historical lightning events reported throughout Chatham County via NCDC data, it is considered a regular occurrence, especially accompanied by thunderstorms. In fact, lightning events will assuredly happen on an annual basis, though not all events will cause damage. According to Vaisala's U.S. National Lightning Detection Network (NLDN®), Chatham County is located in an area of the country that experienced an average of 6 to 8 lightning flashes per square kilometer per year between 1997 and 2010. Therefore, the probability of future events is highly likely (100 percent annual probability). It can be expected that future lightning events will continue to threaten life and cause minor property damages throughout the County.

## H. Thunderstorm Wind / High Wind

1. Background

Thunderstorms can produce a variety of accompanying hazards including wind (discussed here), hail, and lightning.[10] Although thunderstorms generally affect a small area, they are very dangerous and may cause substantial property damage.

Three conditions need to occur for a thunderstorm to form. First, it needs moisture to form clouds and rain. Second, it needs unstable air, such as warm air that can rise rapidly (this often referred to as the "engine" of the storm). Third, thunderstorms need lift, which comes in the form of cold or warm fronts, sea breezes, mountains, or the sun's heat. When these conditions occur simultaneously, air masses of varying temperatures meet, and a thunderstorm is formed. These storm events can occur singularly, in lines, or in clusters. Furthermore, they can move through an area very quickly or linger for several hours.

[10]Lightning and hail hazards are discussed as separate hazards in this section.

According to the National Weather Service, more than 100,000 thunderstorms occur each year, though only about 10 percent of these storms are classified as "severe." A severe thunderstorm occurs when the storm produces at least one of these three elements: 1) hail at least one inch in diameter, 2) a tornado, or 3) winds of at least 58 miles per hour.

Thunderstorm events have the capability of producing straight-line winds that can cause severe destruction to communities and threaten the safety of a population. Such wind events, sometimes separate from a thunderstorm event, are common throughout Chatham County. Therefore, high winds are also reported in this section.

High winds can form due to pressure of the Northeast coast that combines with strong pressure moving through the Ohio Valley. This creates a tight pressure gradient across the region, resulting in high winds which increase with elevation. It is common for gusts of 30 to 60 miles per hour during the winter months.

Downbursts are also possible with thunderstorm events. Such events are an excessive burst of wind in excess of 125 miles per hour. They are often confused with tornadoes. Downbursts are caused by down drafts from the base of a convective thunderstorm cloud. It occurs when rain-cooled air within the cloud becomes heavier than its surroundings. Thus, air rushes towards the ground in a destructive yet isolated manner. There are two types of downbursts. Downbursts less than 2.5 miles wide, duration less than 5 minutes, and winds up to 168 miles per hour are called "microbursts." Larger events greater than 2.5 miles at the surface and longer than 5 minutes with winds up to 130 miles per hour are referred to as "macrobursts."

2. Location and Spatial Extent

A wind event is an atmospheric hazard, and thus has no geographic boundaries. It is typically a widespread event that can occur in all regions of the United States. However, thunderstorms are most common in the central and southern states because atmospheric conditions in those regions are favorable for generating these powerful storms. Also, Chatham County typically experiences several straight-line wind events each year. These wind events can and have caused significant damage. It is assumed that Chatham County has uniform exposure to a thunderstorm/wind event and the spatial extent of an impact could be large.

3. Historical Occurrences

According to NCDC, there have been 387 reported thunderstorm wind and high wind events since 1960 in Chatham County.[11] These events caused just over $6 million (2014 dollars) in damages.[12] There were reports of 1 fatality and 7 injuries. **Table 2.18** summarizes this information.

[11] These thunderstorm events are only inclusive of those reported by the National Climatic Data Center (NCDC) from 1960 through 2014 and these high wind events are only inclusive of those reported by NCDC from 1996 through October 2014. It is likely that additional thunderstorm and high wind events have occurred in Chatham County. As additional local data becomes available, this hazard profile will be amended.
[12] Adjusted dollar values were calculated based on the average Consumer Price Index for a given calendar year. This index value has been calculated every year since 1913. The 2014 index value was used.

**Table 2.18: Summary of Thunderstorm / High Wind Occurrences in Chatham County**

| Location | Number of Occurrences | Deaths / Injuries | Property Damage (2014) |
|---|---|---|---|
| Bloomingdale | 17 | 0/0 | $38,615 |
| Garden City | 10 | 0/0 | $6,324 |
| Pooler | 16 | 0/0 | $93,527 |
| Port Wentworth | 11 | 0/0 | $12,487 |
| Savannah | 95 | 1/4 | $3,013,782 |
| Thunderbolt | 11 | 0/0 | $15,636 |
| Tybee Island | 0 | 0/0 | $0 |
| Unincorporated Area | 213 | 0/3 | $2,785,690 |
| **CHATHAM COUNTY TOTAL** | **387** | **1/7** | **$6,040,434** |

*Source: National Climatic Data Center*

4. Probability of Future Occurrences

Given the high number of previous events, it is certain that wind events, including straight-line wind and thunderstorm wind, will occur in the future. This results in a probability level of highly likely (100 percent annual probability) for future wind events for the entire planning area.

## I. Tornado

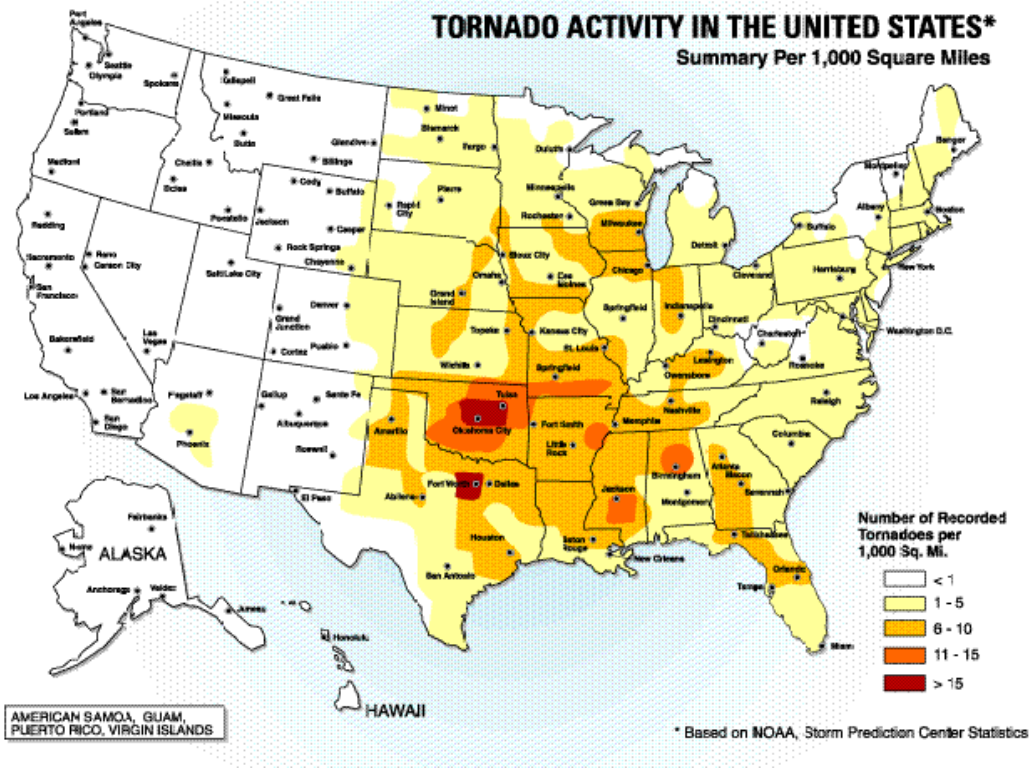
1. Background

A tornado is a violent windstorm characterized by a twisting, funnel-shaped cloud extending to the ground. Tornadoes are most often generated by thunderstorm activity (but sometimes result from hurricanes and other tropical storms) when cool, dry air intersects and overrides a layer of warm, moist air forcing the warm air to rise rapidly. The damage caused by a tornado is a result of the high wind velocity and wind-blown debris, also accompanied by lightning or large hail. According to the National Weather Service, tornado wind speeds normally range from 40 miles per hour to more than 300 miles per hour. The most violent tornadoes have rotating winds of 250 miles per hour or more and are capable of causing extreme destruction and turning normally harmless objects into deadly missiles.

Each year, an average of over 800 tornadoes is reported nationwide, resulting in an average of 80 deaths and 1,500 injuries.[13] According to the NOAA Storm Prediction Center (SPC), the highest concentration of tornadoes in the United States has been in Oklahoma, Texas, Kansas, and Florida respectively. Although the Great Plains region of the Central United States does favor the development of the largest and most dangerous tornadoes (earning the designation of "tornado alley"), Florida experiences the greatest number of tornadoes per square mile of all U.S. states (SPC, 2002). **Figure 2.6** shows tornado activity in the United States based on the number of recorded tornadoes per 1,000 square miles.

[13] NOAA, 2009.

**Figure 2.6: Tornado Activity in the United States**




*Source: Federal Emergency Management Agency*

Tornadoes are more likely to occur during the months of March through May and are most likely to form in the late afternoon and early evening. Most tornadoes are a few dozen yards wide and touch down briefly, but even small short-lived tornadoes can inflict tremendous damage. Highly destructive tornadoes may carve out a path over a mile wide and several miles long.

The destruction caused by tornadoes ranges from light to inconceivable depending on the intensity, size, and duration of the storm. Typically, tornadoes cause the greatest damage to structures of light construction, including residential dwellings (particularly mobile homes). Tornadic magnitude is reported according to the Fujita and Enhanced Fujita Scales. Tornado magnitudes prior to 2005 were determined using the traditional version of the Fujita Scale (**Table 2.19**). Tornado magnitudes that were determined in 2005 and later were determined using the Enhanced Fujita Scale (**Table 2.20**).

**Table 2.19: The Fujita Scale (Effective Prior to 2005)**

| F-SCALE NUMBER | INTENSITY | WIND SPEED | TYPE OF DAMAGE DONE |
|---|---|---|---|
| **F0** | GALE TORNADO | 40–72 MPH | Some damage to chimneys; breaks branches off trees; pushes over shallow-rooted trees; damages to sign boards. |
| **F1** | MODERATE TORNADO | 73–112 MPH | The lower limit is the beginning of hurricane wind speed; peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos pushed off the roads; attached garages may be destroyed. |
| **F2** | SIGNIFICANT TORNADO | 113–157 MPH | Considerable damage. Roofs torn off frame houses; mobile homes demolished; boxcars pushed over; large trees snapped or uprooted; light object missiles generated. |
| **F3** | SEVERE TORNADO | 158–206 MPH | Roof and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted. |
| **F4** | DEVASTATING TORNADO | 207–260 MPH | Well-constructed houses leveled; structures with weak foundations blown off some distance; cars thrown and large missiles generated. |
| **F5** | INCREDIBLE TORNADO | 261–318 MPH | Strong frame houses lifted off foundations and carried considerable distances to disintegrate; automobile sized missiles fly through the air in excess of 100 meters; trees debarked; steel re-enforced concrete structures badly damaged. |
| **F6** | INCONCEIVABLE TORNADO | 319–379 MPH | These winds are very unlikely. The small area of damage they might produce would probably not be recognizable along with the mess produced by F4 and F5 wind that would surround the F6 winds. Missiles, such as cars and refrigerators would do serious secondary damage that could not be directly identified as F6 damage. If this level is ever achieved, evidence for it might only be found in some manner of ground swirl pattern, for it may never be identifiable through engineering studies. |

*Source: National Weather Service*

**Table 2.20: The Enhanced Fujita Scale (Effective 2005 and Later)**

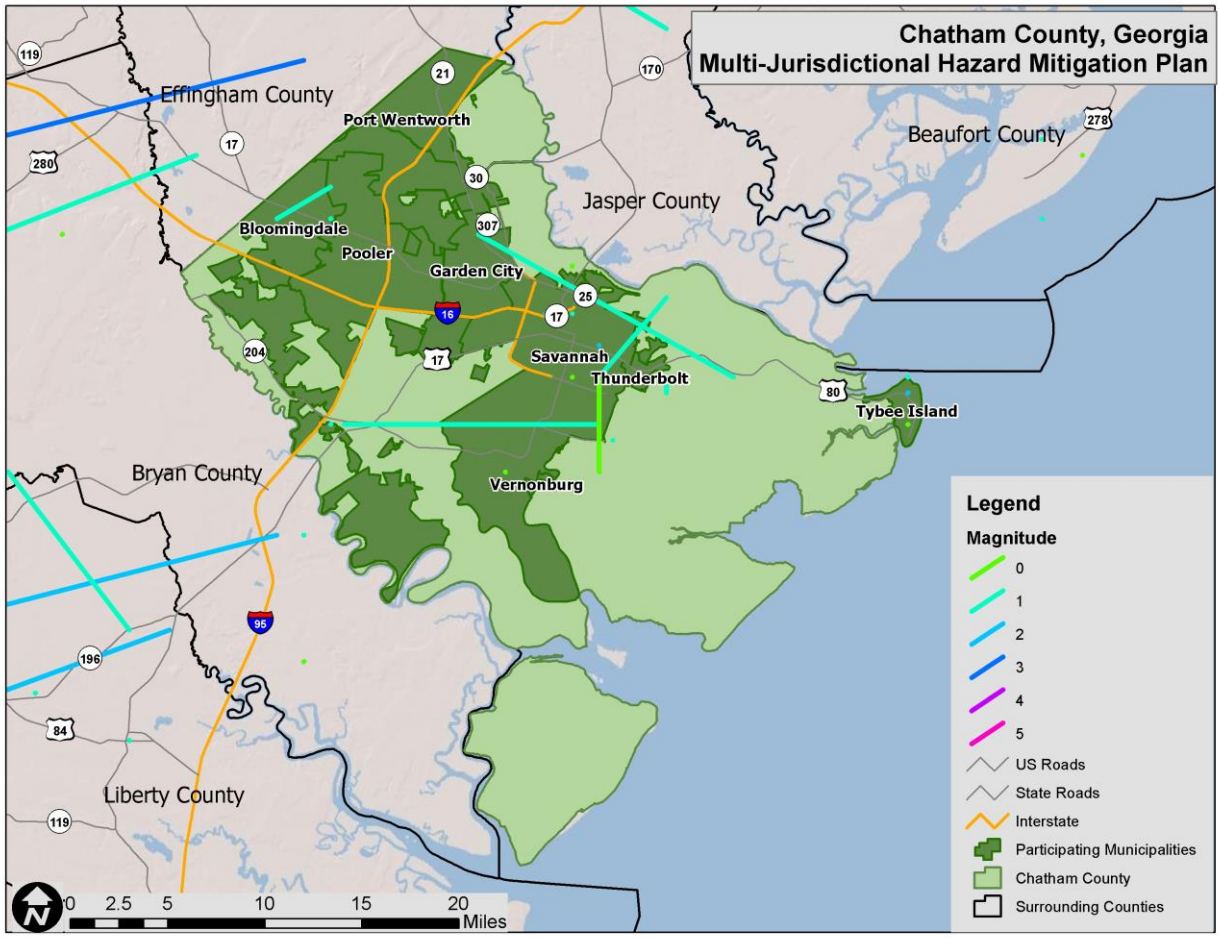
| EF-SCALE NUMBER | INTENSITY PHRASE | 3 SECOND GUST (MPH) | TYPE OF DAMAGE DONE |
|---|---|---|---|
| **F0** | GALE | 65–85 | Some damage to chimneys; breaks branches off trees; pushes over shallow-rooted trees; damages to sign boards. |
| **F1** | MODERATE | 86–110 | The lower limit is the beginning of hurricane wind speed; peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos pushed off the roads; attached garages may be destroyed. |
| **F2** | SIGNIFICANT | 111–135 | Considerable damage. Roofs torn off frame houses; mobile homes demolished; boxcars pushed over; large trees snapped or uprooted; light object missiles generated. |
| **F3** | SEVERE | 136–165 | Roof and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted. |
| **F4** | DEVASTATING | 166–200 | Well-constructed houses leveled; structures with weak foundations blown off some distance; cars thrown and large missiles generated. |
| **F5** | INCREDIBLE | Over 200 | Strong frame houses lifted off foundations and carried considerable distances to disintegrate; automobile sized missiles fly through the air in excess of 100 meters; trees debarked; steel re-enforced concrete structures badly damaged. |

*Source: National Weather Service*

## 2. Location and Spatial Extent

Tornadoes occur throughout the state of Georgia, and thus in Chatham County. Tornadoes typically impact a relatively small area, but damage may be extensive. Event locations are completely random and it is not possible to predict specific areas that are more susceptible to tornado strikes over time. Therefore, it is assumed that Chatham County is uniformly exposed to this hazard. With that in mind, **Figure 2.7** shows tornado track data for many of the major tornado events that have impacted the County. While no definitive pattern emerges from this data, some areas that have been impacted in the past may be potentially more susceptible in the future.

**Figure 2.7: Historical Tornado Tracks in Chatham County**




*Source: National Weather Service Storm Prediction Center*

## 3. Historical Occurrences

Tornadoes were at least partially responsible for one disaster declaration in Chatham County in 1994.[14] According to the National Climatic Data Center, there have been a total of 23 recorded tornado events in Chatham County since 1955 (**Table 2.21**), resulting in $16.4 million (2014 dollars) in property damages.[15] [16] In addition 21 injuries were reported. The magnitude of these tornadoes ranges from F0 to F2 in intensity, although an EF4 or EF5 event is possible. It is important to note that only tornadoes that have been reported are factored into this risk assessment. It is likely that a high number of occurrences have gone unreported over the past 60 years.

[14] A complete listing of historical disaster declarations can be found in *Chapter 2- Local Hazard Identification and Risk*.
[15] These tornado events are only inclusive of those reported by the National Climatic Data Center (NCDC) from 1955 through 2014. It is likely that additional tornadoes have occurred in Chatham County. As additional local data becomes available, this hazard profile will be amended.
[16] Adjusted dollar values were calculated based on the average Consumer Price Index for a given calendar year. This index value has been calculated every year since 1913. The 2014 index value was used.

**Table 2.21: Summary of Tornado Occurrences in Chatham County**

| Location | Number of Occurrences | Deaths / Injuries | Property Damage (2014) |
|---|---|---|---|
| Bloomingdale | 0 | 0/0 | $0 |
| Garden City | 0 | 0/0 | $0 |
| Pooler | 0 | 0/0 | $0 |
| Port Wentworth | 0 | 0/0 | $0 |
| Savannah | 1 | 0/0 | $0 |
| Thunderbolt | 2 | 0/0 | $588,872 |
| Tybee Island | 0 | 0/0 | $0 |
| Unincorporated Area | 20 | 0/21 | $15,809,147 |
| **CHATHAM COUNTY TOTAL** | **23** | **0/21** | **$16,398,019** |

*Source: National Climatic Data Center*

4. Probability of Future Occurrences

According to historical information, tornado events are not an annual occurrence for the County. However, given the County's location in the southeastern United States and history of tornadoes, an occurrence is possible every few years. While the majority of the reported tornado events are small in terms of size, intensity, and duration, they do pose a significant threat should Chatham County experience a direct tornado strike. The probability of future tornado occurrences affecting Chatham County is likely (10 to 100 percent annual probability).

## J. Winter Storm and freeze

1. Background

A winter storm can range from a moderate snow over a period of a few hours to blizzard conditions with blinding wind-driven snow that lasts for several days. Events may include snow, sleet, freezing rain, or a mix of these wintry forms of precipitation. Some winter storms might be large enough to affect several states, while others might affect only localized areas. Occasionally, heavy snow might also cause significant property damages, such as roof collapses on older buildings.

All winter storm events have the potential to present dangerous conditions to the affected area. Larger snowfalls pose a greater risk, reducing visibility due to blowing snow and making driving conditions treacherous. A heavy snow event is defined by the National Weather Service as an accumulation of 4 of more inches in 12 hours or less. A blizzard is the most severe form of winter storm. It combines low temperatures, heavy snow, and winds of 35 miles per hour or more, which reduces visibility to a quarter mile or less for at least 3 hours. Winter storms are often accompanied by sleet, freezing rain, or an ice storm. Such freeze events are particularly hazardous as they create treacherous surfaces.

Ice storms are defined as storms with significant amounts of freezing rain and are a result of cold air damming (CAD). CAD is a shallow, surface-based layer of relatively cold, stably-stratified air entrenched against the eastern slopes of the Appalachian Mountains. With warmer air above, falling precipitation in the form of snow melts, then becomes either super-cooled (liquid below the melting point of water) or re-freezes. In the former case, super-cooled droplets can freeze on impact (freezing rain), while in the latter case, the re-frozen water particles are ice pellets (or sleet). Sleet is defined as partially frozen raindrops or refrozen snowflakes that form into small ice pellets before reaching the ground. They typically bounce when they hit the ground and do not stick to the surface. However, it does accumulate like snow, posing similar problems and has the potential to accumulate into a layer of ice on surfaces. Freezing rain, conversely, usually sticks to the ground, creating a sheet of ice on the roadways and other surfaces. All of the winter storm elements – snow, low temperatures, sleet, ice, etc – have the potential to cause significant hazard to a community. Even small accumulations can down power lines and trees limbs and create hazardous driving conditions. Furthermore, communication and power may be disrupted for days.

2. Location and Spatial Extent

Nearly the entire continental United States is susceptible to winter storm and freeze events. Some ice and winter storms may be large enough to affect several states, while others might affect limited, localized areas. The degree of exposure typically depends on the normal expected severity of local winter weather. Chatham County is accustomed to severe winter weather conditions and often receives winter weather during the winter months. Given the atmospheric nature of the hazard, the entire county has uniform exposure to a winter storm.

3. Historical Occurrences

Winter weather has resulted in one disaster declaration in Chatham County in 1993.[17] According to the National Climatic Data Center, there have been a total of 24 recorded winter storm events in Chatham County since 1996 (**Table 2.22**).[18] These events resulted in over $1.6 million (2014 dollars) in damages.[19]

**Table 2.22: Summary of Winter Storm Events in Chatham County**

| Location | | Number of Occurrences | Deaths / Injuries | Property Damage (2014) |
|---|---|---|---|---|
| **Chatham County** | | 24 | 0/0 | $1,624,005 |

*Source: National Climatic Data Center*

[17] A complete listing of historical disaster declarations can be found in *Chapter 2 – Local Hazard Identification and Risk*.
[18] These ice and winter storm events are only inclusive of those reported by the National Climatic Data Center (NCDC) from 1996 through 2014. It is likely that additional winter storm conditions have affected Chatham County.
[19] Adjusted dollar values were calculated based on the average Consumer Price Index for a given calendar year. This index value has been calculated every year since 1913. The 2014 index value was used.

There have been several severe winter weather events in Chatham County. The text below describes two recent events and associated impacts on the County. Similar impacts can be expected with severe winter weather.

**February 2010 Winter Storm** – February 12, 2010
A strong storm system tracked across northern Florida and then northeastward off the Georgia and South Carolina coast. Precipitation initially fell in the form of rain, but quickly changed over to snow in the late afternoon and evening hours as winds shifted to the north and allowed colder air to wrap back into the region. Heavy snow accumulated across much of southeast Georgia.

**January 2014 Ice Storm** – January 29, 2014
Precipitation fell as freezing rain and sleet most of the evening of 1/28 and the early morning of 1/29 north of I-16; this precipitation briefly changed to snow from north to south late night into early Wednesday morning 1/29. Along and south of I-16, temperatures just above 32F persisted longer, and rain mixed with sleet prevailed through Tuesday evening 1/28; then, temperatures fell to around 32F, and freezing rain and sleet fell overnight into the daylight hours of Wednesday 1/29. Freezing rain persisted across far southern counties of coastal GA into Wednesday night as another weak wave of low pressure lifted northeast, and this wave even spread a bit of light freezing rain/freezing drizzle into coastal SC counties. Through Wednesday 1/29, storm total ice accretion amounts around 0.25 inch were common along/north of I-16, and a few inland locations reported as much as 0.75 to 1.00 inch of ice.

Law Enforcement had numerous reports of bridges closed in Chatham County due to ice. Bridges include: Houlihan Bridge/Jimmy Deloach Flyover in Port Wentworth, Monteith Road in Meinhard, Sam Varnadoe Bridge in Thunderbolt and the Islands Expressway Drawbridge. The Forest River Bridge on Highway 204, near Windsor Forest, was closed due to icing and multiple vehicle accidents.

Winter storms throughout the planning area have several negative externalities including hypothermia, cost of snow and debris cleanup, business and government service interruption, traffic accidents, and power outages. Furthermore, citizens may resort to using inappropriate heating devices that could to fire or an accumulation of toxic fumes.

4. Probability of Future Occurrences

Winter storm events will remain a somewhat regular occurrence in Chatham County. According to historical information, Chatham County generally experiences several winter storm events each year. Therefore, the annual probability is highly likely (100 percent).

## *Geologic Hazards*

### K. Earthquake

1. Background

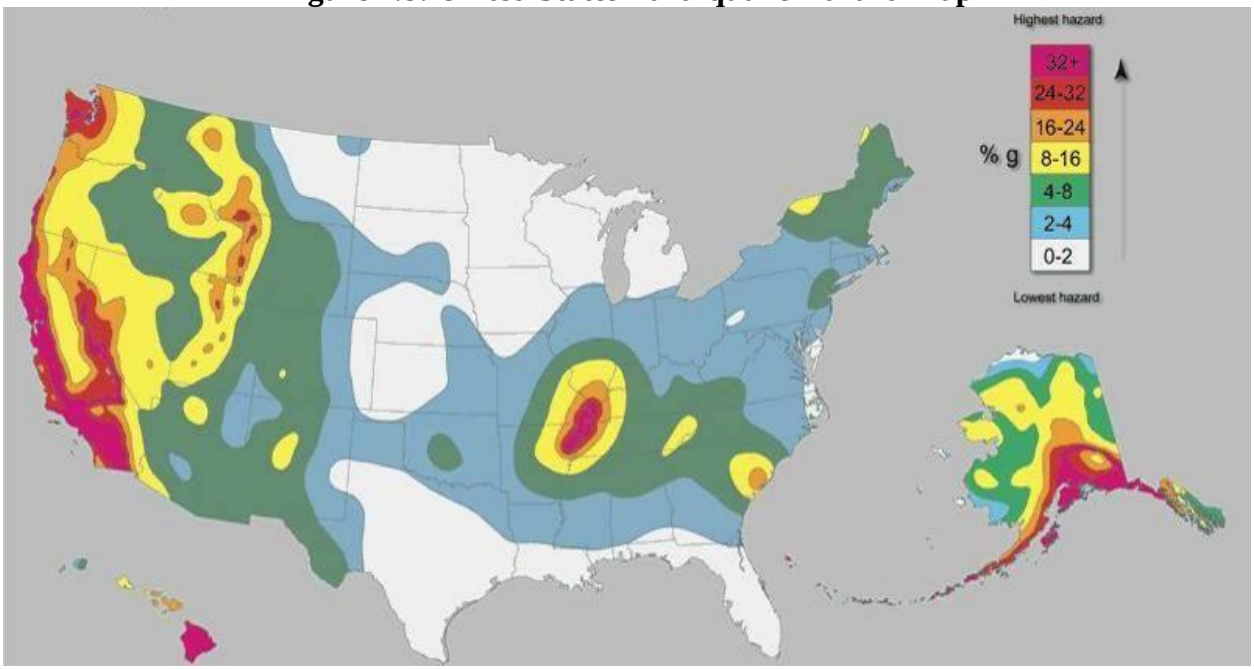
An earthquake is movement or trembling of the ground produced by sudden displacement of rock in the Earth's crust. Earthquakes result from crustal strain, volcanism, landslides, or the collapse of caverns. Earthquakes can affect hundreds of thousands of square miles, cause damage to property measured in the tens of billions of dollars, result in loss of life and injury to hundreds of thousands of persons, and disrupt the social and economic functioning of the affected area.

Most property damage and earthquake-related deaths are caused by the failure and collapse of structures due to ground shaking. The level of damage depends upon the amplitude and duration of the shaking, which are directly related to the earthquake size, distance from the fault, site, and regional geology. Other damaging earthquake effects include landslides, the down-slope movement of soil and rock (mountain regions and along hillsides), and liquefaction, in which ground soil loses the ability to resist shear and flows much like quick sand. In the case of liquefaction, anything relying on the substrata for support can shift, tilt, rupture, or collapse.

Most earthquakes are caused by the release of stresses accumulated as a result of the rupture of rocks along opposing fault planes in the Earth's outer crust. These fault planes are typically found along borders of the Earth's 10 tectonic plates. The areas of greatest tectonic instability occur at the perimeters of the slowly moving plates, as these locations are subjected to the greatest strains from plates traveling in opposite directions and at different speeds. Deformation along plate boundaries causes strain in the rock and the consequent buildup of stored energy. When the built-up stress exceeds the rocks' strength a rupture occurs. The rock on both sides of the fracture is snapped, releasing the stored energy and producing seismic waves, generating an earthquake.

The greatest earthquake threat in the United States is along tectonic plate boundaries and seismic fault lines located in the central and western states; however, the Eastern United State does face moderate risk to less frequent, less intense earthquake events. **Figure 2.8** shows relative seismic risk for the United States.

**Figure 2.8: United States Earthquake Hazard Map**




*Source: United States Geological Survey*

Earthquakes are measured in terms of their magnitude and intensity. Magnitude is measured using the Richter Scale, an open-ended logarithmic scale that describes the energy release of an earthquake through a measure of shock wave amplitude (**Table 2.23**). Each unit increase in magnitude on the Richter Scale corresponds to a 10-fold increase in wave amplitude, or a 32-fold increase in energy. Intensity is most commonly measured using the Modified Mercalli Intensity (MMI) Scale based on direct and indirect measurements of seismic effects. The scale levels are typically described using roman numerals, ranging from "I" corresponding to imperceptible (instrumental) events to "XII" for catastrophic (total destruction). A detailed description of the Modified Mercalli Intensity Scale of earthquake intensity and its correspondence to the Richter Scale is given in **Table 2.24**.

**Table 2.23: Richter Scale**

| RICHTER MAGNITUDES | EARTHQUAKE EFFECTS |
|---|---|
| **< 3.5** | Generally not felt, but recorded. |
| **3.5 - 5.4** | Often felt, but rarely causes damage. |
| **5.4 - 6.0** | At most slight damage to well-designed buildings. Can cause major damage to poorly constructed buildings over small regions. |
| **6.1 - 6.9** | Can be destructive in areas up to about 100 kilometers across where people live. |
| **7.0 - 7.9** | Major earthquake. Can cause serious damage over larger areas. |
| **8 or >** | Great earthquake. Can cause serious damage in areas several hundred kilometers across. |

*Source: Federal Emergency Management Agency*

**Table 2.24: Modified Mercalli Intensity Scale for Earthquakes**

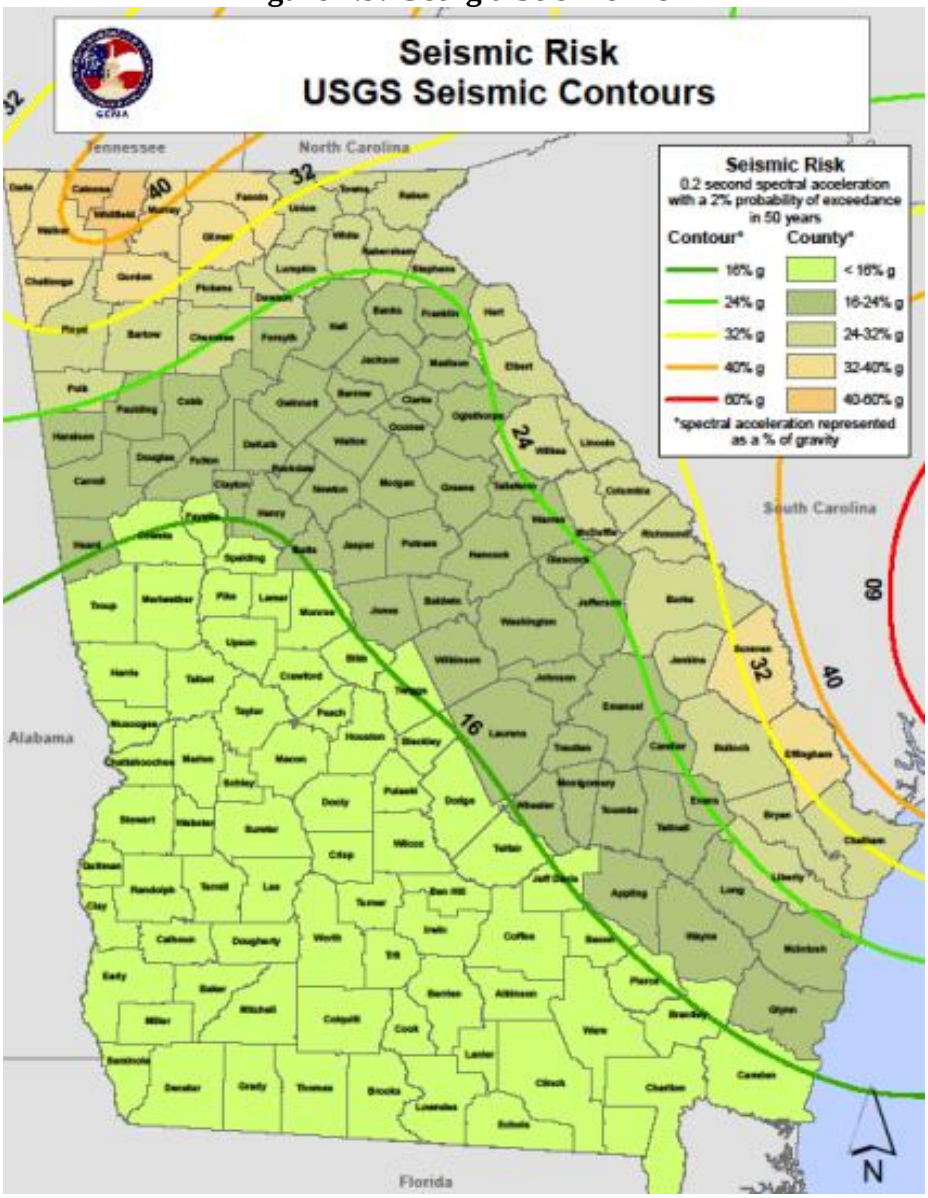
| SCALE | INTENSITY | DESCRIPTION OF EFFECTS | CORRESPONDING RICHTER SCALE MAGNITUDE |
|---|---|---|---|
| **I** | INSTRUMENTAL | Detected only on seismographs. | |
| **II** | FEEBLE | Some people feel it. | < 4.2 |
| **III** | SLIGHT | Felt by people resting; like a truck rumbling by. | |
| **IV** | MODERATE | Felt by people walking. | |
| **V** | SLIGHTLY STRONG | Sleepers awake; church bells ring. | < 4.8 |
| **VI** | STRONG | Trees sway; suspended objects swing, objects fall off shelves. | < 5.4 |
| **VII** | VERY STRONG | Mild alarm; walls crack; plaster falls. | < 6.1 |
| **VIII** | DESTRUCTIVE | Moving cars uncontrollable; masonry fractures, poorly constructed buildings damaged. | |
| **IX** | RUINOUS | Some houses collapse; ground cracks; pipes break open. | < 6.9 |
| **X** | DISASTROUS | Ground cracks profusely; many buildings destroyed; liquefaction and landslides widespread. | < 7.3 |
| **XI** | VERY DISASTROUS | Most buildings and bridges collapse; roads, railways, pipes and cables destroyed; general triggering of other hazards. | < 8.1 |
| **XII** | CATASTROPHIC | Total destruction; trees fall; ground rises and falls in waves. | > 8.1 |

*Source: Federal Emergency Management Agency*

## 2. Location and Spatial Extent

While much of the north and western part of the state is subject to earthquakes from the southern Appalachia and New Madrid faults, Chatham County is located much closer to the Charleston seismic zone. This fault has generated earthquakes measuring greater than 8 on the Richter Scale during the last 200 years. In addition, there are several smaller fault lines throughout Georgia. **Figure 2.9** shows the seismic risk in the state. It can be observed that the highest risk of earthquakes is in northwest Georgia, though Chatham County has a relatively high risk among counties in the state.

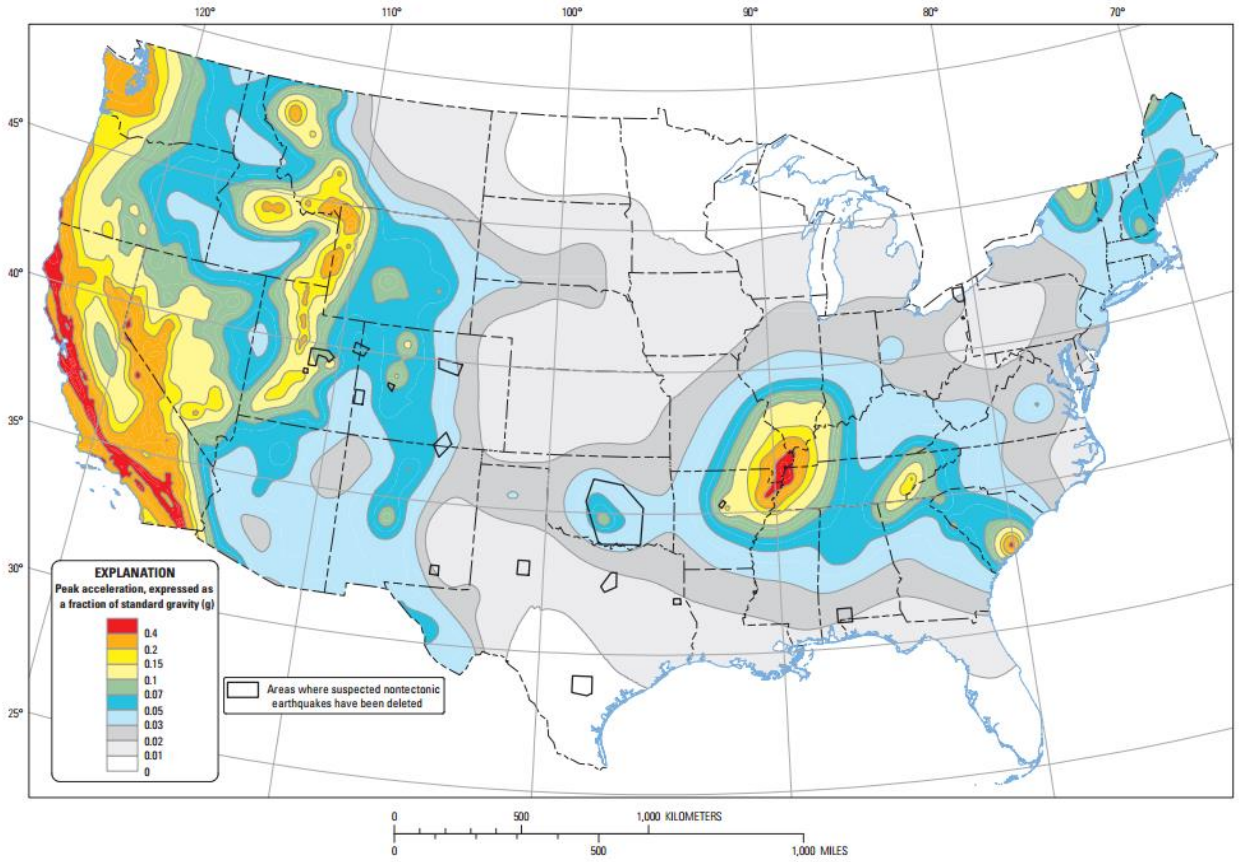
**Figure 2.9: Georgia Seismic Risk**




*Source: USGS*

**Figure 2.10** shows the intensity level associated with Chatham County, based on the national USGS map of peak acceleration with 10 percent probability of exceedance in 50 years. It is the probability that ground motion will reach a certain level during an earthquake. The data show peak horizontal ground acceleration (the fastest measured change in speed, for a particle at ground level that is moving horizontally due to an earthquake) with a 10 percent probability of exceedance in 50 years. The map was compiled by the U.S. Geological Survey (USGS) Geologic Hazards Team, which conducts global investigations of earthquake, geomagnetic, and landslide hazards. According to this map, at least part of Chatham County lies within an approximate zone of .05 to .07 peak ground acceleration. This indicates that the County is within an area of moderate seismic risk.

**Figure 2.10: Peak Acceleration with 10 Percent Probability of Exceedance in 50 Years**




**Ten-percent probability of exceedance in 50 years map of peak ground acceleration**

*Source: United States Geological Survey, 2014*

3. Historical Occurrences

At least 18 earthquakes are known to have affected Chatham County since 1811. The strongest of these measured a VIII on the Modified Mercalli Intensity (MMI) scale. **Table 2.25** provides a summary of earthquake events reported by the National Geophysical Data Center between 1638 and 1985. [20]

**Table 2.25: Summary of Seismic Activity in Chatham County**

| Location | Number of Occurrences | Greatest MMI Reported | Richter Scale Equivalent |
|---|---|---|---|
| Bloomingdale | 0 | -- | -- |
| Garden City | 0 | -- | -- |
| Pooler | 0 | -- | -- |

[20] Due to reporting mechanisms, not all earthquakes events were recorded during this time. Furthermore, some are missing data, such as the epicenter location, due to a lack of widely used technology. In these instances, a value of "unknown" is reported.

| Location | Number of Occurrences | Greatest MMI Reported | Richter Scale Equivalent |
|---|---|---|---|
| Port Wentworth | 0 | -- | -- |
| Savannah | 14 | VIII | >6.1 |
| Thunderbolt | 2 | IV | <4.8 |
| Tybee Island | 2 | VI | <5.4 |
| Unincorporated Area | 0 | -- | -- |
| **CHATHAM COUNTY TOTAL** | **18** | **VIII** | **>6.1** |

*Source: National Geophysical Data Center*

SHELDUS reports no earthquake events, meaning that no major events occurred in Georgia during 1960 – 2012. However, Georgia has been seismically active throughout that time period, consisting of minor to light earthquakes. No disasters have been declared for the State of Georgia related to earthquake events due to the lack of losses associated with seismic activity during this timeframe.

4. Probability of Future Occurrences

The probability of significant, damaging earthquake events affecting Chatham County is unlikely. However, it is possible that future earthquakes resulting in light to moderate perceived shaking and damages ranging from none to moderate will affect the County. The annual probability level for the County is estimated between 1 and 10 percent (possible).

## *Hydrologic Hazards*

### L. Dam and levee Failure

1. Background

Worldwide interest in dam and levee safety has risen significantly in recent years. Aging infrastructure, new hydrologic information, and population growth in floodplain areas downstream from dams and near levees have resulted in an increased emphasis on safety, operation, and maintenance.

There are approximately 80,000 dams in the United States today, the majority of which are privately owned. Other owners include state and local authorities, public utilities, and federal agencies. The benefits of dams are numerous: they provide water for drinking, navigation, and agricultural irrigation. Dams also provide hydroelectric power, create lakes for fishing and recreation, and save lives by preventing or reducing floods.

Though dams have many benefits, they also can pose a risk to communities if not designed, operated, and maintained properly. In the event of a dam failure, the energy of the water stored behind even a small dam is capable of causing loss of life and great property damage if development exists downstream. If a levee breaks, scores of properties may become submerged

in floodwaters and residents may become trapped by rapidly rising water. The failure of dams and levees has the potential to place large numbers of people and great amounts of property in harm's way.

2. Location and Spatial Extent

Dam extent can be determined using the dam classification system which used a high (category I), significant (category II), exempt, and breached classification systems. Hazard classifications systems are based on the consequences of failure, not the condition of the dam. According to the "Georgia Safe Dams Act of 1978":

- **Category I dams** are those for which improper operation or dam failure would result in probable loss of human life. Situations constituting 'probable loss of life' are those situations involving frequently occupied structures or facilities, including but not limited to, residences, commercial and manufacturing facilities, schools, and churches.

- **Category II dams** are those for which improper operation or dam failure would not be expected to result in probable loss of human life.

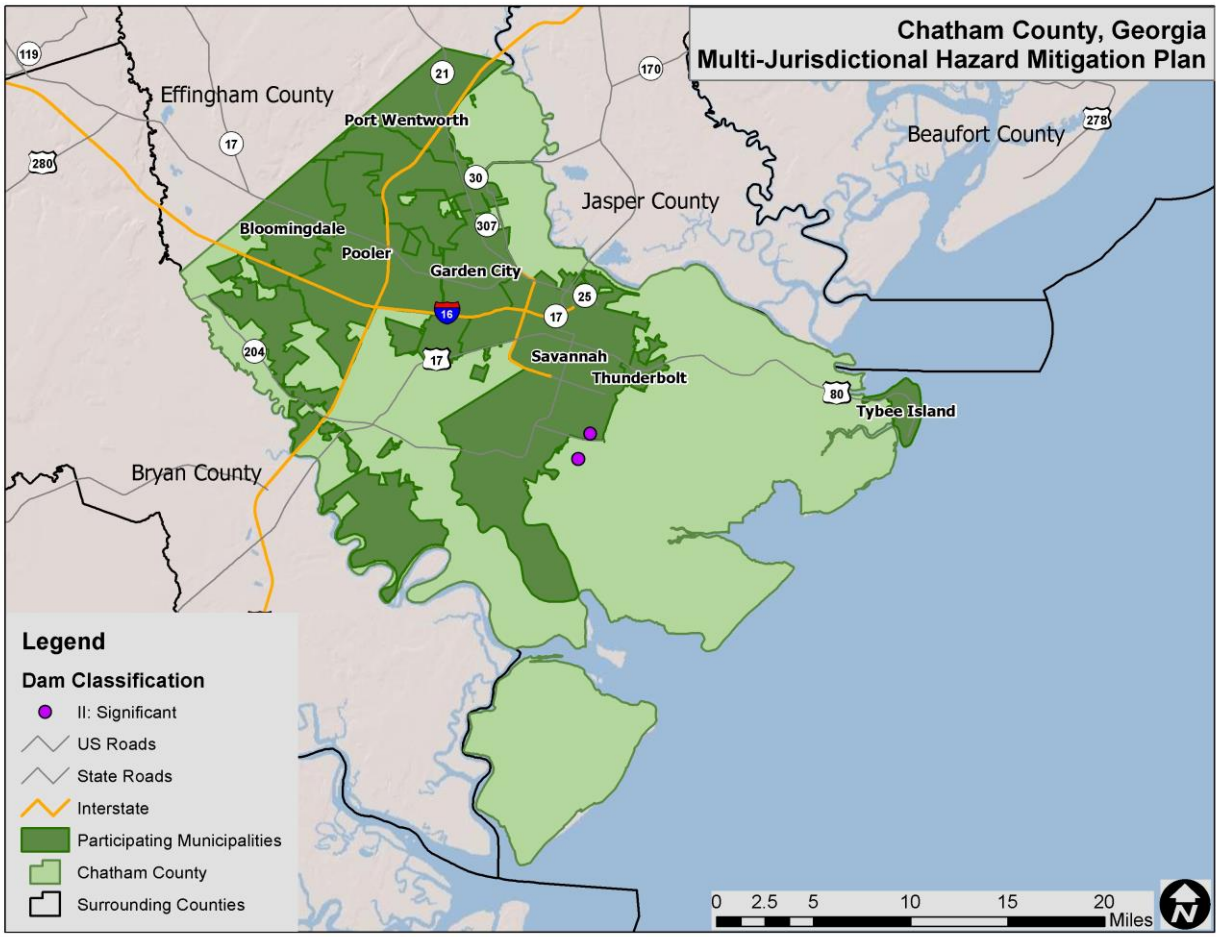
As of 2014, there were only 2 identified dams in the County and both were classified as Category II hazard dams. These dams are listed in the **Table 2.26** below and **Figure 2.11** shows the location of inventoried dams in the County.

**Table 2.26: Summary of High Hazard Dam Location**

| Location | Number High Hazard Dams |
|---|---|
| Bloomingdale | 0 |
| Garden City | 0 |
| Pooler | 0 |
| Port Wentworth | 0 |
| Savannah | 2 |
| Thunderbolt | 0 |
| Tybee Island | 0 |
| Unincorporated Area | 0 |
| **CHATHAM COUNTY TOTAL** | **2** |

***Source: Georgia Safe Dams Program***

**Figure 2.11: Chatham County Dam Location and Hazard Ranking**




*Source: Georgia Safe Dams Program, 2014*

It should be noted that dam regulations for classifying dams was recently changed. As a result, generally more dams are classified as high hazard.

3. Historical Occurrences

According to local sources and a review of the past hazard mitigation plan, there has been no history of dam breach in Chatham County.

4. Probability of Future Occurrence

Given the current dam inventory and historic data, a dam breach is unlikely (less than 1 percent annual probability) in the future. However, as has been demonstrated in the past, regular monitoring is necessary to prevent these events. No further analysis will be completed in *Chapter 3 – Local Hazard Vulnerability* as more sophisticated dam breach plans (typically completed by the U.S. Army Corp of Engineers) have been completed for dams of concern in the County.

## M. Erosion

1. Background

Erosion is the gradual breakdown and movement of land due to both physical and chemical processes of water, wind, and general meteorological conditions. Natural, or geologic, erosion has occurred since the Earth's formation and continues at a very slow and uniform rate each year.

There are two types of soil erosion: wind erosion and water erosion. Wind erosion can cause significant soil loss. Winds blowing across sparsely vegetated or disturbed land can pick up soil particles and carry them through the air, thus displacing them. Water erosion can occur over land or in streams and channels. Water erosion that takes place over land may result from raindrops, shallow sheets of water flowing off the land, or shallow surface flow, which becomes concentrated in low spots. Stream channel erosion may occur as the volume and velocity of water flow increases enough to cause movement of the streambed and bank soils. Major storms, such hurricanes in coastal areas, may cause significant erosion by combining high winds with heavy surf and storm surge to significantly impact the shoreline.

An area's potential for erosion is determined by four factors: soil characteristics, vegetative cover, topography climate or rainfall, and topography. Soils composed of a large percentage of silt and fine sand are most susceptible to erosion. As the clay and organic content of these soils increases, the potential for erosion decreases. Well-drained and well-graded gravels and gravel-sand mixtures are the least likely to erode. Coarse gravel soils are highly permeable and have a good capacity for absorption, which can prevent or delay the amount of surface runoff. Vegetative cover can be very helpful in controlling erosion by shielding the soil surface from falling rain, absorbing water from the soil, and slowing the velocity of runoff. Runoff is also affected by the topography of the area including size, shape, and slope. The greater the slope length and gradient, the more potential an area has for erosion. Climate can affect the amount of runoff, especially the frequency, intensity, and duration of rainfall and storms. When rainstorms are frequent, intense, or of long duration, erosion risks are high. Seasonal changes in temperature and rainfall amounts define the period of highest erosion risk of the year.

During the past 20 years, the importance of erosion control has gained the increased attention of the public. Implementation of erosion control measures consistent with sound agricultural and construction operations is needed to minimize the adverse effects associated with harmful chemicals run-off due to wind or water events. The increase in government regulatory programs and public concern has resulted in a wide range of erosion control products, techniques, and analytical methodologies in the United States. The preferred method of erosion control in recent years has been the restoration of vegetation.

2. Location and Spatial Extent

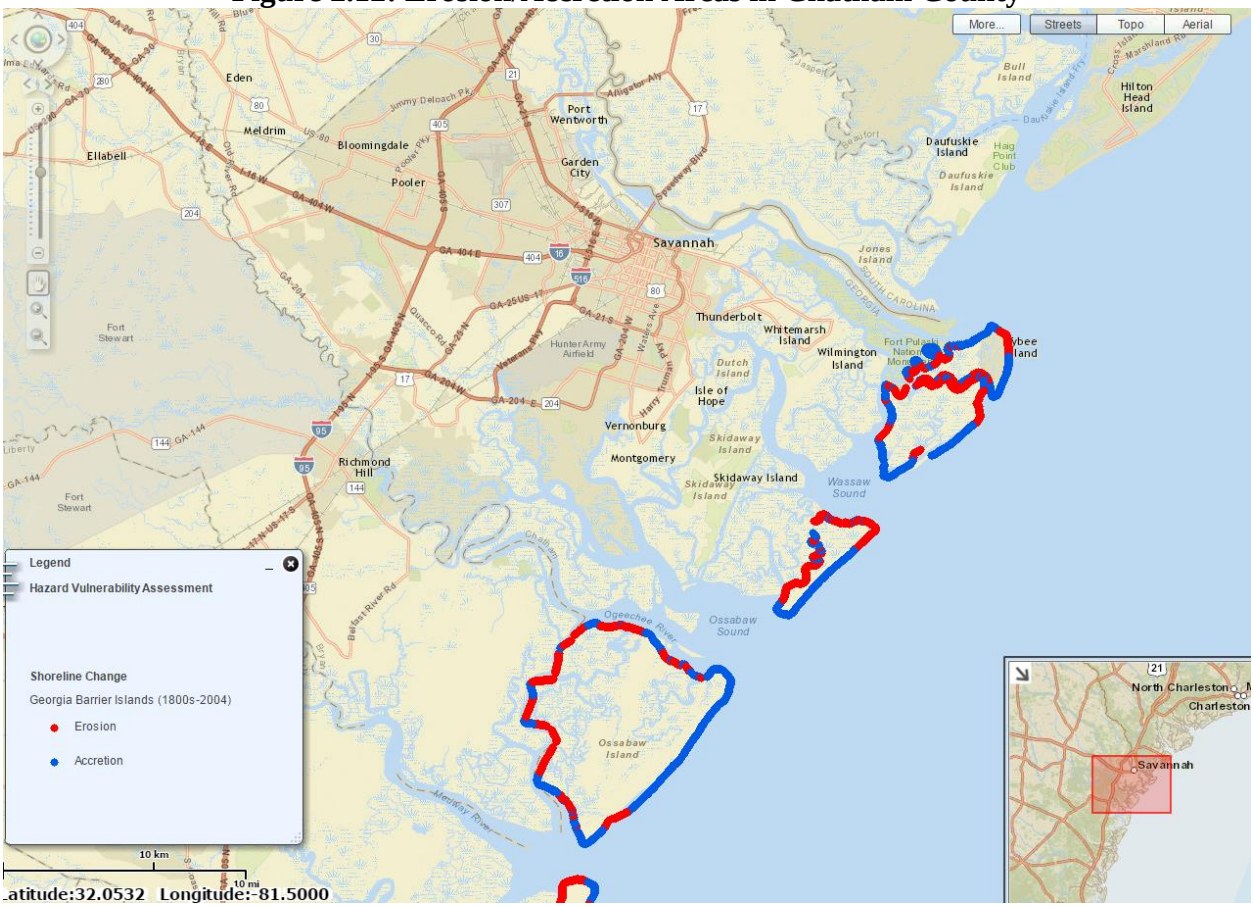
Erosion in Chatham County is typically caused by coastal tides, ocean currents, and storm events. Unlike inland areas, where the soil has greater organic matter content, coastal soils are

mainly composed of fine grained particles such as sand. This makes coastal soils much more susceptible to erosion. Although much of the Chatham County coast is protected and natural erosion processes are allowed to take place for the most part, areas near Tybee Island where development has occurred are especially susceptible.

3. Historical Occurrences

Several sources were vetted to identify areas of erosion in Chatham County. This includes searching local newspapers, interviewing local officials, and reviewing previous hazard mitigation plans. In addition information was pulled from the USGS coastal map viewer to determine historical occurrences. These sources helped identify annual erosion rates of around 1 to 3 meters per year on some parts of Tybee Island with accretion taking place at many locations on the island. However, it should be noted that major erosion events are most likely to take place during a large hurricane or tropical storm and there is not a record of such a large event occurring. These areas are identified in **Figure 2.12**.

**Figure 2.12: Erosion/Accretion Areas in Chatham County**



4. Probability of Future Occurrences

Erosion remains a natural, dynamic, and continuous process for Chatham County, and it will continue to occur. The annual probability level assigned for erosion is possible (between 1 and 10 percent).

## N. Flood

1. Background

Flooding is the most frequent and costly natural hazard in the United States and is a hazard that has caused more than 10,000 deaths since 1900. Nearly 90 percent of presidential disaster declarations result from natural events where flooding was a major component.

Floods generally result from excessive precipitation and can be classified under two categories: general floods, precipitation over a given river basin for a long period of time along with storm-induced wave action, and flash floods, the product of heavy localized precipitation in a short time period over a given location. The severity of a flooding event is typically determined by a combination of several major factors, including stream and river basin topography and physiography, precipitation and weather patterns, recent soil moisture conditions, and the degree of vegetative clearing and impervious surface.

General floods are usually long-term events that may last for several days. The primary types of general flooding include riverine, coastal, and urban flooding. Riverine flooding is a function of excessive precipitation levels and water runoff volumes within the watershed of a stream or river. Coastal flooding is typically a result of storm surge, wind-driven waves, and heavy rainfall produced by hurricanes, tropical storms, and other large coastal storms. Urban flooding occurs where manmade development has obstructed the natural flow of water and decreased the ability of natural groundcover to absorb and retain surface water runoff.

Most flash flooding is caused by slow-moving thunderstorms in a local area or by heavy rains associated with hurricanes and tropical storms. However, flash flooding events may also occur from a dam or levee failure within minutes or hours of heavy amounts of rainfall or from a sudden release of water held by a retention basin or other stormwater control facility. Although flash flooding occurs most often along mountain streams, it is also common in urbanized areas where much of the ground is covered by impervious surfaces.

The periodic flooding of lands adjacent to rivers, streams, and shorelines (land known as a floodplain) is a natural and inevitable occurrence that can be expected to take place based upon established recurrence intervals. The recurrence interval of a flood is defined as the average time interval, in years, expected between a flood event of a particular magnitude and an equal or larger flood. Flood magnitude increases with increasing recurrence interval.

Floodplains are designated by the frequency of the flood that is large enough to cover them. For example, the 10-year floodplain will be covered by the 10-year flood and the 100-year floodplain

by the 100-year flood. Flood frequencies, such as the 100-year flood, are determined by plotting a graph of the size of all known floods for an area and determining how often floods of a particular size occur. Another way of expressing the flood frequency is the chance of occurrence in a given year, which is the percentage of the probability of flooding each year. For example, the 100-year flood has a 1 percent chance of occurring in any given year and the 500-year flood has a 0.2 percent chance of occurring in any given year.

2. Location and Spatial Extent

There are areas in Chatham County that are susceptible to flood events. Special flood hazard areas in Chatham County were mapped using Geographic Information System (GIS) and FEMA Digital Flood Insurance Rate Maps (DFIRM).[21] This includes Zone A (1-percent annual chance floodplain), Zone V (1-percent annual chance floodplain in a velocity zone), and Zone X500 (0.2-percent annual chance floodplain). According to GIS analysis, of the 426 square miles of land area that make up Chatham County, there are 305 square miles of land in one of the identified floodplain zones. The County totals are presented below in **Table 2.27**.

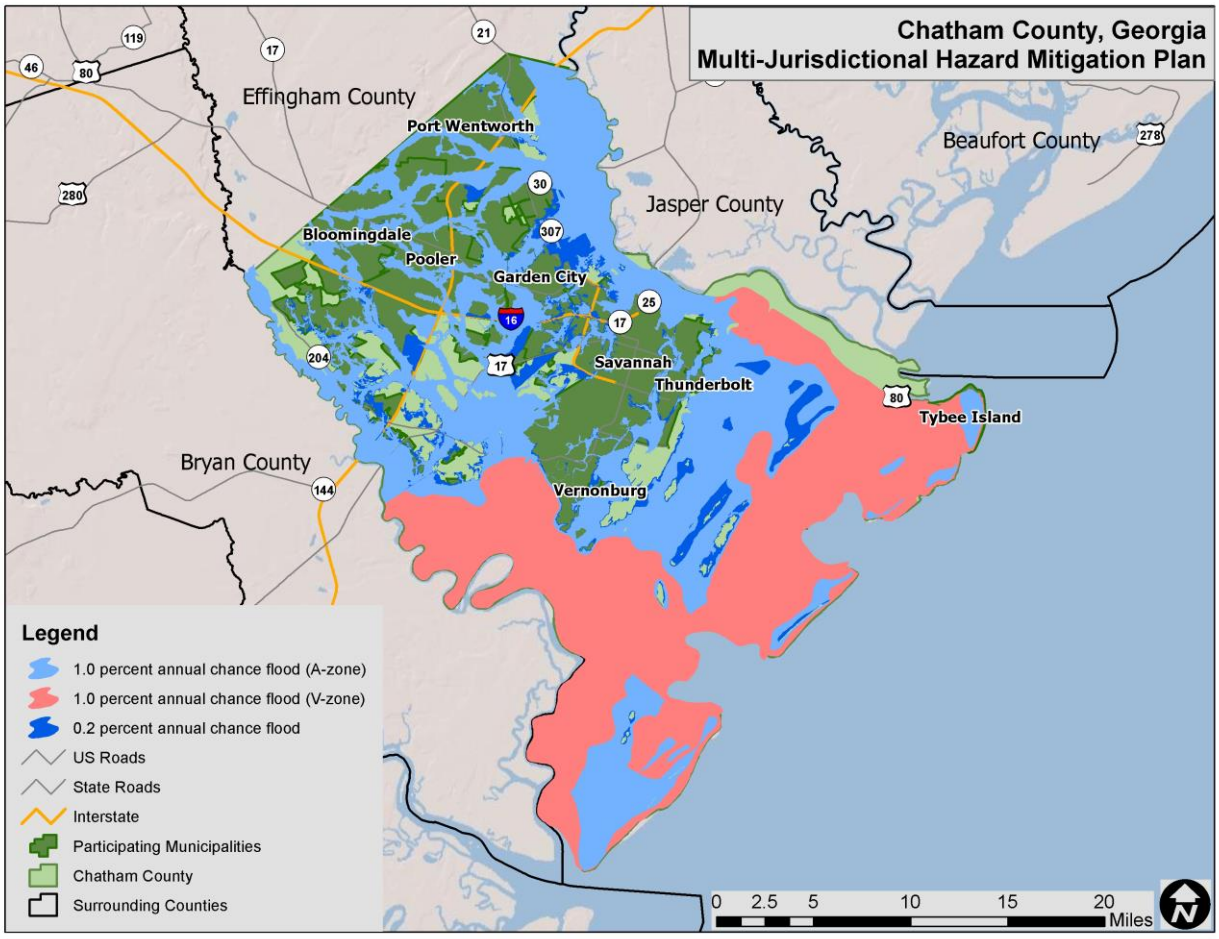
**Table 2.27: Summary of Floodplain Areas in Chatham County**

| Location | 100-year (A-zone) area (square miles) | 100-year (V-zone) area (square miles) | 500-year area (square miles) |
|---|---|---|---|
| Bloomingdale | 0.96 | 0.00 | 0.04 |
| Garden City | 0.16 | 0.00 | 0.06 |
| Pooler | 2.76 | 0.00 | 0.21 |
| Port Wentworth | 1.22 | 0.00 | 0.13 |
| Savannah | 5.65 | 0.00 | 2.07 |
| Thunderbolt | 0.00 | 0.00 | 0.00 |
| Tybee Island | 1.88 | 0.05 | 0.00 |
| Unincorporated Area | 132.48 | 118.05 | 12.75 |
| **CHATHAM COUNTY TOTAL** | **145.11** | **118.10** | **15.26** |

These flood zone values account for 71.7% percent of the total land area in Chatham County. It is important to note that while FEMA digital flood data is recognized as best available data for planning purposes, it does not always reflect the most accurate and up-to-date flood risk. Flooding and flood-related losses often do occur outside of delineated special flood hazard areas. **Figure 2.13** illustrates the location and extent of currently mapped special flood hazard areas for Chatham County based on best available FEMA DFIRM data.

[21] The county-level DFIRM used for Chatham County was updated in 2008.

**Figure 2.13: Special Flood Hazard Areas in Chatham County**




*Source: Federal Emergency Management Agency*

## 3. Historical Occurrences

Information from the National Climatic Data Center was used to ascertain historical flood events. The National Climatic Data Center reported a total of 79 events throughout Chatham County since 1996.[22] A summary of these events is presented in **Table 2.28**. These events accounted for almost $12 million (2014 dollars) in property damage throughout the County and 2 injuries.[23]

**Table 2.28: Summary of Flood Occurrences in Chatham County**

| Location | Number of Occurrences | Deaths / Injuries | Property Damage (2014) |
|---|---|---|---|
| Bloomingdale | 0 | 0/0 | $0 |
| Garden City | 2 | 0/0 | $110,672 |

[22] These flood events are only inclusive of those reported by the National Climatic Data Center (NCDC) from 1996 through 2014. It is likely that additional occurrences have occurred and have gone unreported.
[23] Adjusted dollar values were calculated based on the average Consumer Price Index for a given calendar year. This index value has been calculated every year since 1913. The 2014 index value was used.

| Location | Number of Occurrences | Deaths / Injuries | Property Damage (2014) |
|---|---|---|---|
| Pooler | 0 | 0/0 | $0 |
| Port Wentworth | 1 | 0/0 | $0 |
| Savannah | 33 | 0/2 | $1,710,550 |
| Thunderbolt | 1 | 0/0 | $5,278 |
| Tybee Island | 0 | 0/0 | $0 |
| Unincorporated Area | 40 | 0/0 | $10,153,878 |
| **CHATHAM COUNTY TOTAL** | **79** | **0/0** | **$11,981,397** |

*Source: National Climatic Data Center*

4. Historical Summary of Insured Flood Losses

According to FEMA flood insurance policy records as of November 2014, there have been 2,615 flood losses reported in Chatham County through the National Flood Insurance Program (NFIP) since 1978, totaling over $35 million in claims payments. A summary of these figures for each jurisdiction is provided in **Table 2.29**. It should be emphasized that these numbers include only those losses to structures that were insured through the NFIP policies, and for losses in which claims were sought and received. It is likely that many additional instances of flood loss in Chatham County were either uninsured, denied claims payment, or not reported.

**Table 2.29: Summary of Insured Flood Losses in Chatham County**

| Location | Number of Policies | Number of Claims | Claims Payments |
|---|---|---|---|
| Bloomingdale | 203 | 20 | $292,523 |
| Garden City | 231 | 21 | $184,235 |
| Pooler | 1,282 | 134 | $463,616 |
| Port Wentworth | 238 | 29 | $252,035 |
| Savannah | 7,387 | 1,609 | $26,435,513 |
| Thunderbolt | 330 | 14 | $361,486 |
| Tybee Island | 2,506 | 123 | $778,904 |
| Unincorporated Area | 40 | 1 | $14,629 |
| **CHATHAM COUNTY TOTAL** | **30,149** | **2,615** | **$35,601,882** |

*Source: Federal Emergency Management Agency, National Flood Insurance Program Source: National Climatic Data Center*

5. Repetitive Loss Properties

FEMA defines a repetitive loss property as any insurable building for which two or more claims of more than $1,000 were paid by the NFIP within any rolling 10-year period, since 1978. A repetitive loss property may or may not be currently insured by the NFIP. Currently there are over 140,000 repetitive loss properties nationwide.

As of November 2014, there are 395 non-mitigated repetitive loss properties located in Chatham County, which accounted for 1,010 losses and over $21 million in claims payments under the

NFIP. The average claim amount for these properties is $20,908. Nearly all of the properties are single-family residential buildings, and the remaining few are non-residential (commercial). Without mitigation these properties will likely continue to experience flood loses. **Table 2.30** presents a summary these figures for Chatham County.

**Table 2.30: Summary of Repetitive Loss Properties in Chatham County**

| Location | Number of Properties | Number of Losses | Total Payments |
|---|---|---|---|
| Bloomingdale | 1 | 2 | $5,944 |
| Garden City | 2 | 4 | $197,318 |
| Pooler | 5 | 12 | $184,446 |
| Port Wentworth | 7 | 16 | $245,680 |
| Savannah | 327 | 844 | $17,969,552 |
| Thunderbolt | 2 | 4 | $13,110 |
| Tybee Island | 9 | 32 | $207,915 |
| Unincorporated Area | 42 | 96 | $2,293,316 |
| **CHATHAM COUNTY TOTAL** | **395** | **1,010** | **$21,117,280** |

*Source: National Flood Insurance Program*

6. Probability of Future Occurrences

Flood events will remain a threat in Chatham County, and the probability of future occurrences will remain highly likely (around 100 percent annual probability). The probability of future flood events based on magnitude and according to best available data is illustrated in the figures above**,** which indicates those areas susceptible to the 1-percent annual chance flood (100-year floodplain) and the 0.2-percent annual chance flood (500-year floodplain).

It can be inferred from the floodplain location maps, previous occurrences, and repetitive loss properties that risk is relatively high throughout Chatham County. Coastal areas are likely at higher risk because they have more floodplain, but all areas have at least some risk. Mitigation actions may be warranted, particularly for repetitive loss properties.

## O. Storm Surge

1. Background

Storm surge occurs when the water level of a tidally influenced body of water increases above the normal astronomical high tide, and are most common in conjunction with coastal storms with massive low-pressure systems with cyclonic flows such as hurricanes, tropical storms and nor'easters. The low barometric pressure associated with these storms cause the water surface to rise, and storms making landfall during peak tides have surge heights and more extensive flood inundation limits. Storm surges will inundate coastal floodplains by dune overwash, tidal elevation rise in inland bays and harbors, and backwater flooding through coastal river mouths. The duration of a storm is the most influential factor affecting the severity and impact of storm surges.

A storm surge is often described as a wave that has outrun its generating source and become a long period swell. It is often recognized as a large dome of water that may be 50 to 100 miles wide and generally rising anywhere from four to five feet in a Category 1 hurricane to over 20 feet in a Category 5 storm. The storm surge arrives ahead of the storm center's actual landfall and the more intense the storm is, the sooner the surge arrives. Water rise can be very rapid, posing a serious threat to those who have not yet evacuated flood-prone areas. The surge is always highest in the right-front quadrant of the direction in which the storm is moving. As the storm approaches shore, the greatest storm surge will be to the north of the low-pressure system or hurricane eye. Such a surge of high water topped by waves driven by hurricane force winds can be devastating to coastal regions, causing severe beach erosion and property damage along the immediate shoreline.

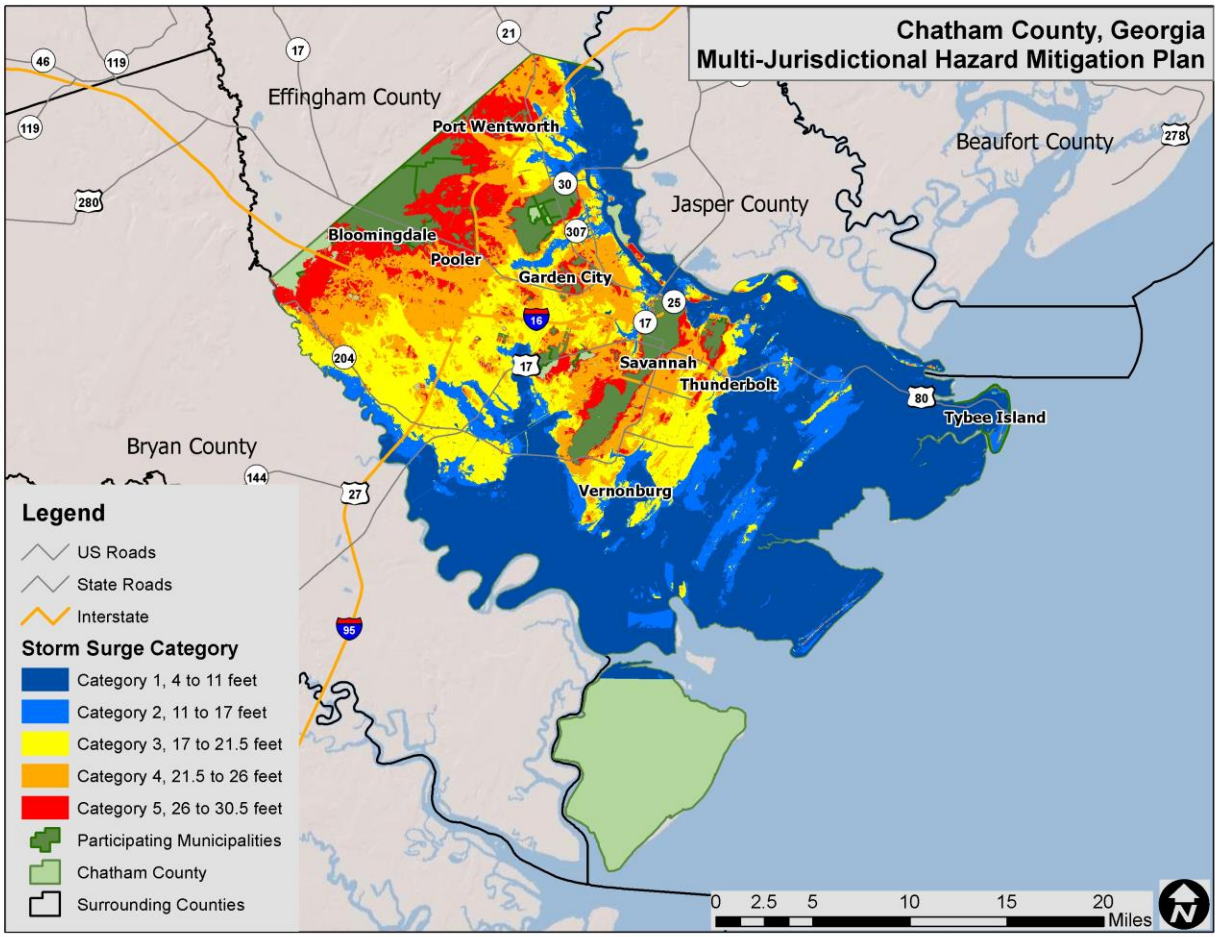
Storm surge heights and associated waves are dependent on not only the storm's intensity but also upon the shape of the offshore continental shelf (narrow or wide) and the depth of the ocean bottom (bathymetry). A narrow shelf, or one that drops steeply from the shoreline and subsequently produces deep water close to the shoreline, tends to produce a lower surge but higher and more powerful storm waves. The storms that generate the largest coastal storm surges can develop year-round, but they are most frequent from late summer to early spring.

2. Location and Spatial Extent

To determine surge hazard location, a SLOSH (Sea, Lake, and Overland Surges from Hurricane) ArcGIS shapefile was used. The SLOSH Maximum of the Maximums (MOM) data was used to determine SLOSH location and vulnerability in Chapter – 3 Local Hazard Vulnerability.[24] MOM is a composite of the Maximum Envelope of Water (MEOW), which is generated by running several hypothetical hurricanes and collecting their associated surge heights. The MOM uses the maximum recorded surge height from the MEOW scenarios for each grid block. The storm surge data below is from the Comprehensive Hurricane Preparedness Study that was carried out by the National Oceanic and Atmospheric Administration (NOAA) Coastal Services Center and Chatham County Emergency Management (CEMA) and reflects the best available data in terms of inundation levels and areas in the County. **Figure 2.14** shows the surge hazard location for Category 1 through Category 5 storms in Chatham County.

[24] The SLOSH training manual indicates that SLOSH is accurate within +/- 20 percent.

**Figure 2.14: Storm Surge Categories and Inundation Levels in Chatham County**




*Source: NOAA, CEMA*

3. Historical Occurrences

Although no storm surge events have had a major, direct impact on Chatham County, it should be noted that any hurricane event has brought with it some level of storm surge. Therefore, a historical listing of storm surge events would include all past hurricane events *(*see above *Subsection F: Hurricane and Tropical storm).*

4. Probability of Future Occurrences

Given the location of the County on the coast, it is likely to be affected by storm surge from a hurricane or tropical storm system in the future. Based on historical evidence, the probability level of future occurrence is likely (between 10 and 100 percent annual probability). For storm surge, coastal areas are most likely to be impacted which means areas such as Tybee Island are at the highest level of risk. Given the County's geographic location, the damage could be catastrophic, threatening lives and property throughout much of the planning area.

## P. Sea Level Rise

1. Background

Sea Level Rise is defined by NOAA as the mean rise in sea level. It is caused by two factors: 1) as the ocean warms, sea water expands in volume; 2) continental ice shelves melt, increasing the amount of water in the oceans. This leads to a greater area of land being inundated by sea water.

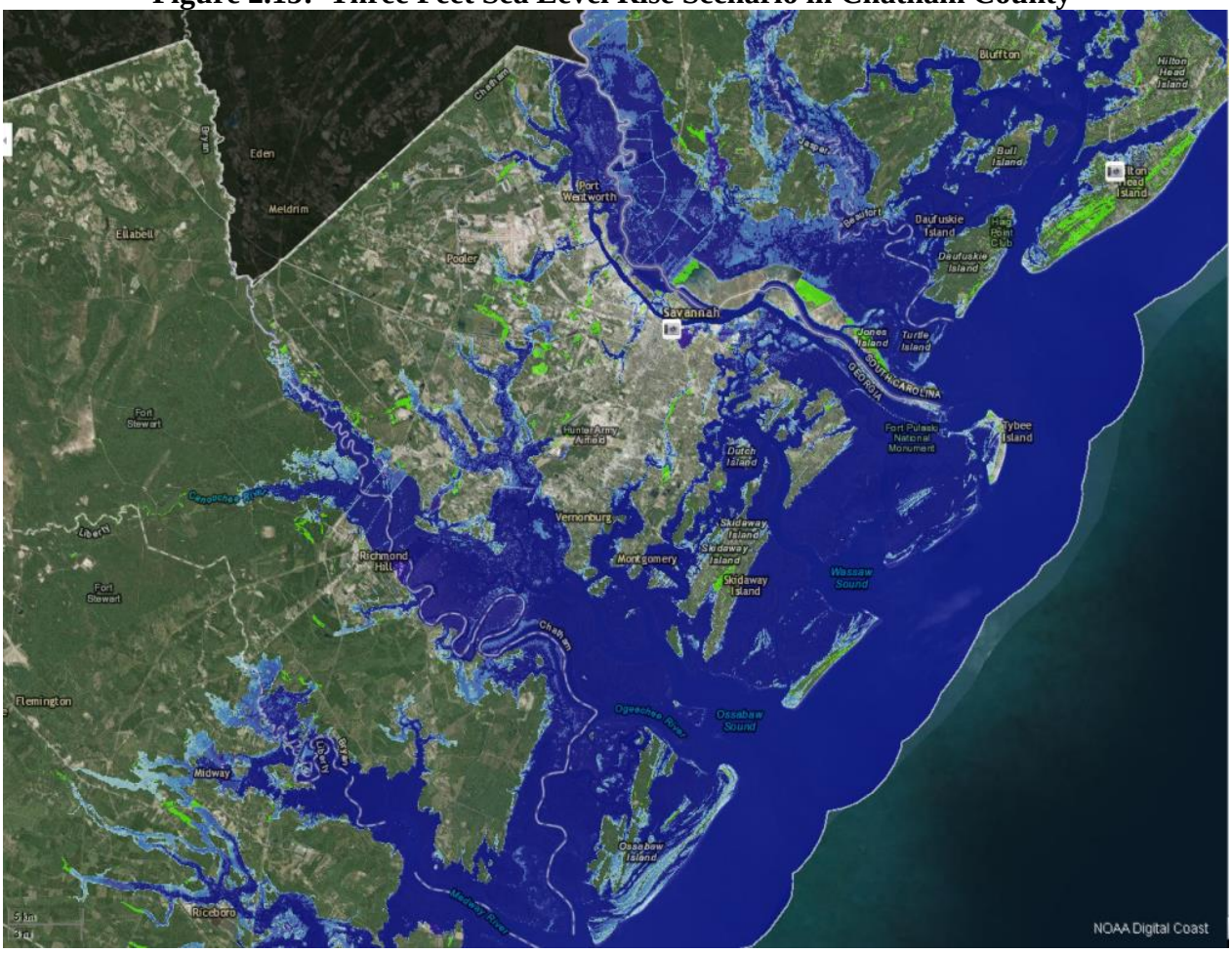
Rising sea level contributes to the loss of coastal wetlands (which provide protective buffers from flood events), beach erosion, population and property in low areas, coastal habitats and species. Further, flooding and hurricane events are more severe and affect a greater area.

Given that 600 million people live in an area that is less than 10 meters (33 feet) above sea level, and the coastal population has doubled in the last 50 years, sea level rise is a formidable threat.

2. Location and Spatial Extent

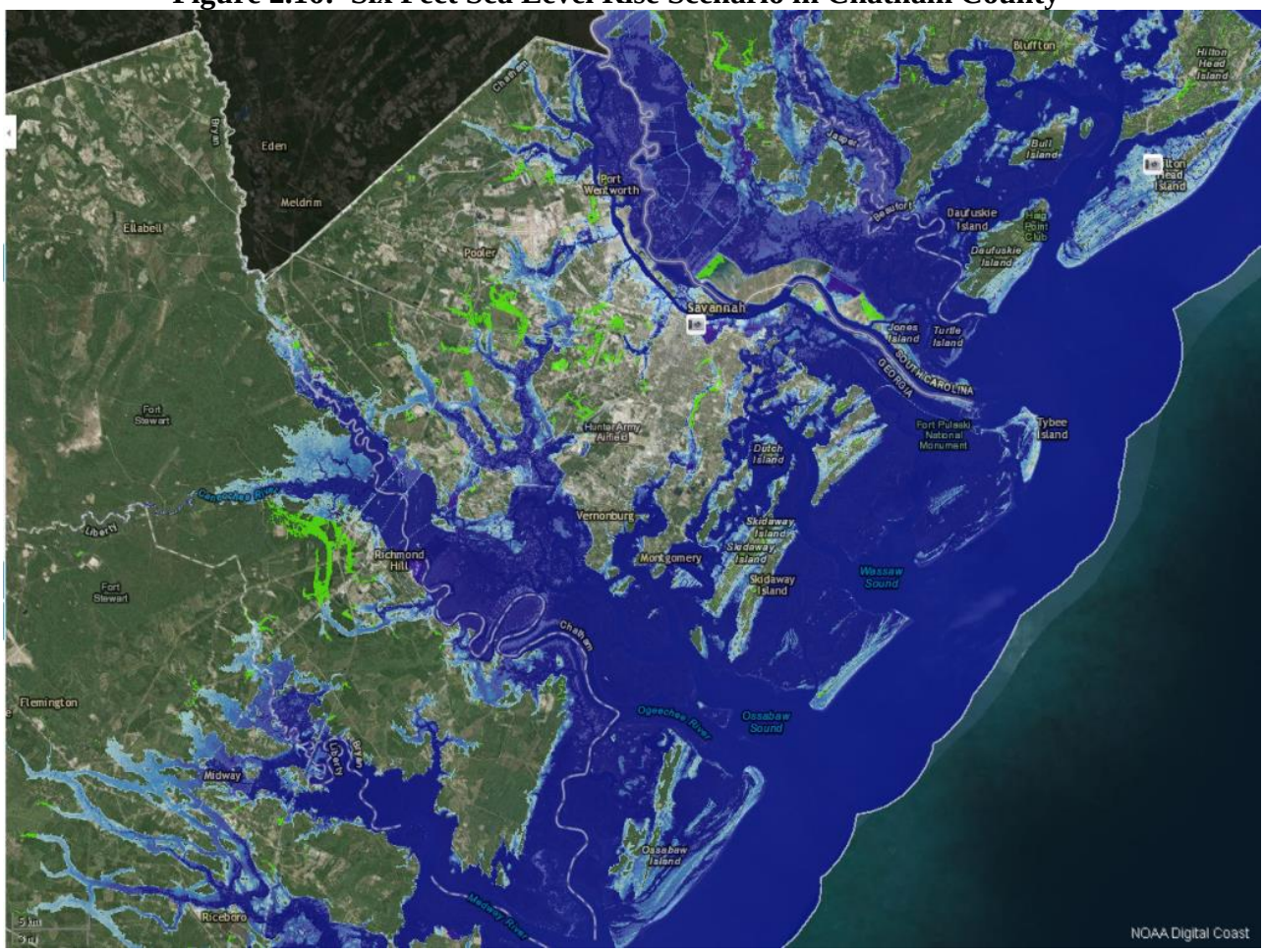
**Figure 2.15** identifies areas in Chatham County that would be inundated by water as a result of three feet in sea level rise. This map shows that most of the areas on the coast would be impacted to some degree and that many areas further inland would also be impacted, especially along rivers and streams. The next highest level of sea level rise is shown in **Figure 2.16**. This figure shows the inundation areas in the case of six feet of sea level rise. This demonstrates the additional areas that would be impacted beyond the three feet scenario. Finally, **Figure 2.17** focuses in on Tybee Island as the incorporated jurisdiction that would be most directly impacted by sea level rise.

**Figure 2.15: Three Feet Sea Level Rise Scenario in Chatham County**




*Source: NOAA*

**Figure 2.16: Six Feet Sea Level Rise Scenario in Chatham County**




*Source: NOAA*

**Figure 2.17: Three Feet Sea Level Rise Scenario in Tybee Island**


*Source: NOAA*

3. Historical Occurrences

Historically, there has been some level of sea level rise in the past several thousand years. However, in the last century (and in the latter half of the last century in particular), there has been a marked increase in the rate at which sea level rise is taking place. Some reports indicate that the rate of sea level rise has increased from 1.7mm per year during the 20th century to 3.0mm per year over the last 20 years,[25] which indicates a much more rapid rise in sea level than local governments have had to deal with in the past. Given this increase in the rate of sea level rise, mitigation action is likely warranted to reduce future risk.

4. Probability of Future Occurrences

Given the location of the County on the coast, it will be affected by sea level rise. Based on a number of projections, the probability level of future occurrence is likely (between 10 and 100

[25] Intergovernmental Panel on Climate Change, 2013

percent annual probability). It should also be noted that sea level rise has an exacerbating effect on a number of other hazards such as flooding and storm surge.

# *Other Hazards*

## Q. Hazardous Materials Incidents

1. Background

Hazardous materials can be found in many forms and quantities that can potentially cause death; serious injury; long-lasting health effects; and damage to buildings, homes, and other property in varying degrees. Such materials are routinely used and stored in many homes and businesses and are also shipped daily on the nation's highways, railroads, waterways, and pipelines. This subsection on the hazardous material hazard is intended to provide a general overview of the hazard, and the threshold for identifying fixed and mobile sources of hazardous materials is limited to general information on rail, highway, and FEMA-identified fixed HAZMAT sites determined to be of greatest significance as appropriate for the purposes of this plan.

Hazardous material (HAZMAT) incidents can apply to fixed facilities as well as mobile, transportation-related accidents in the air, by rail, on the nation's highways, and on the water. Approximately 6,774 HAZMAT events occur each year, 5,517 of which are highway incidents, 991 are railroad incidents, and 266 are due to other causes.[26] In essence, HAZMAT incidents consist of solid, liquid, and/or gaseous contaminants that are released from fixed or mobile containers, whether by accident or by design as with an intentional terrorist attack. A HAZMAT incident can last hours to days, while some chemicals can be corrosive or otherwise damaging over longer periods of time. In addition to the primary release, explosions and/or fires can result from a release, and contaminants can be extended beyond the initial area by persons, vehicles, water, wind, and possibly wildlife as well.

HAZMAT incidents can also occur as a result of or in tandem with natural hazard events, such as floods, hurricanes, tornadoes, and earthquakes, which in addition to causing incidents can also hinder response efforts. In the case of Hurricane Floyd in September 1999, communities along the Eastern United States were faced with flooded junkyards, disturbed cemeteries, deceased livestock, floating propane tanks, uncontrolled fertilizer spills, and a variety of other environmental pollutants that caused widespread toxological concern.

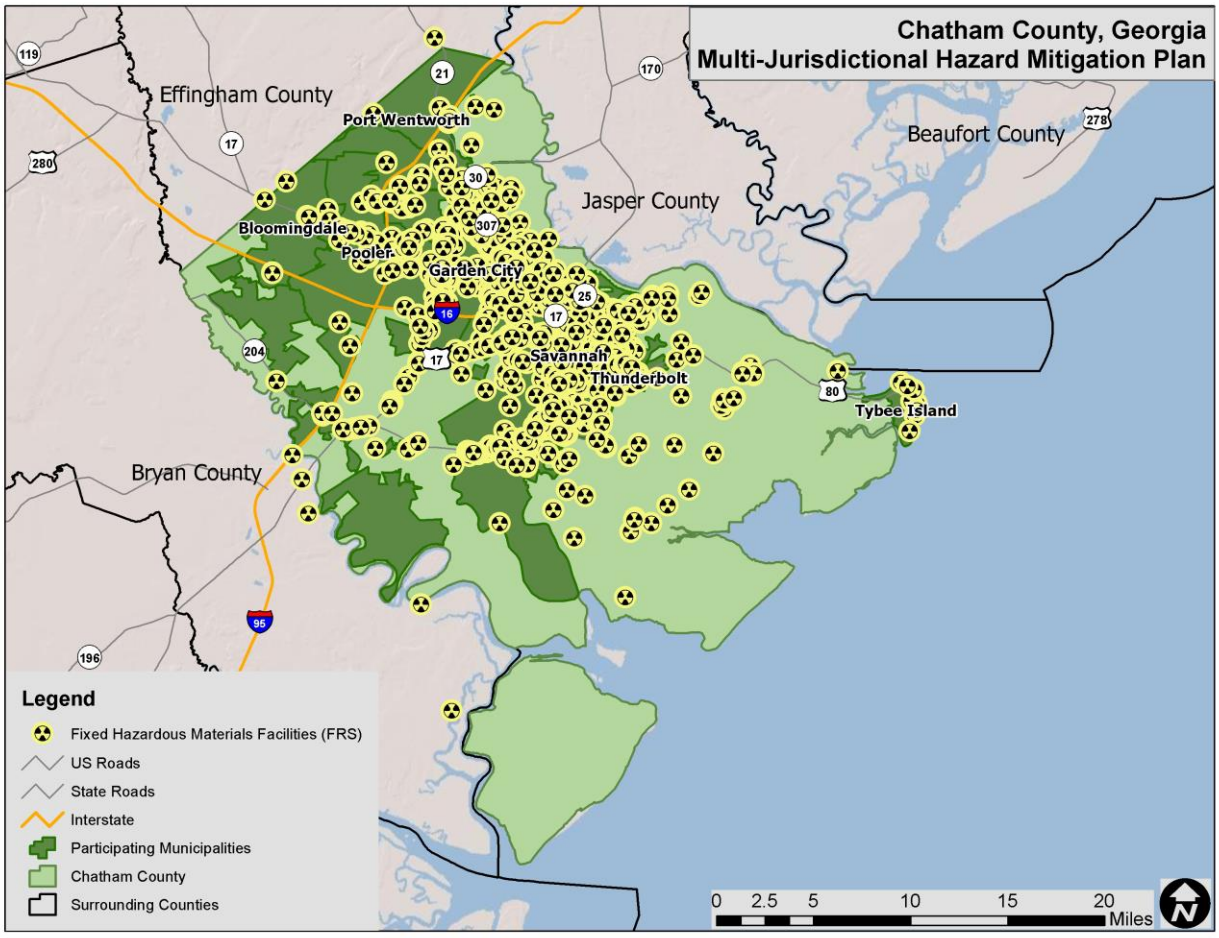
Hazardous material incidents can include the spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping, or disposing into the environment of a hazardous material, but exclude: (1) any release which results in exposure to poisons solely within the workplace with respect to claims which such persons may assert against the employer of such persons; (2) emissions from the engine exhaust of a motor vehicle, rolling stock, aircraft, vessel or pipeline pumping station engine; (3) release of source, byproduct, or special nuclear material from a nuclear incident; and (4) the normal application of fertilizer.

[26] FEMA, 1997.

2. Location and Spatial Extent

As a result of the 1986 Emergency Planning and Community Right to Know Act (EPCRA), the Environmental Protection Agency provides public information on hazardous materials. One facet of this program is to collect information from industrial facilities on the releases and transfers of certain toxic agents. This information is then reported on the Facility Registry Services site and is available to the public. These identified sites are facilities where some level of toxic chemicals are located on site or are being released. Chatham County has 1,199 TRI sites. These sites are shown in **Figure 2.18.**

**Figure 2.18: Toxic Release Inventory (TRI) Sites in Chatham County**




*Source: Environmental Protection Agency*

In addition to "fixed" hazardous materials locations, hazardous materials may also impact the County via roadways and rail. Many roads in the County are subject to hazardous materials transport and all roads that permit hazardous material transport are considered potentially at risk to an incident.

3. Historical Occurrences

The U.S. Department of Transportation Pipeline and Hazardous Materials Safety Administration (PHMSA) lists historical occurrences throughout the nation. A "serious incident" is a hazardous materials incident that involves:

- a fatality or major injury caused by the release of a hazardous material,
- the evacuation of 25 or more persons as a result of release of a hazardous material or exposure to fire,
- a release or exposure to fire which results in the closure of a major transportation artery,
- the alteration of an aircraft flight plan or operation,
- the release of radioactive materials from Type B packaging,
- the release of over 11.9 galls or 88.2 pounds of a severe marine pollutant, or
- the release of a bulk quantity (over 199 gallons or 882 pounds) of a hazardous material.

However, prior to 2002, a hazardous materials "serious incident" was defined as follows:

- a fatality or major injury due to a hazardous material,
- closure of a major transportation artery or facility or evacuation of six or more person due to the presence of hazardous material, or
- a vehicle accident or derailment resulting in the release of a hazardous material.

**Table 2.31** summarizes the HAZMAT incidents reported in Chatham County.

**Table 2.31: Summary of HAZMAT Incidents in Chatham County**

| Location | Number of Occurrences | Deaths / Injuries | Property Damage (2014) |
|---|---|---|---|
| Bloomingdale | 0 | 0/0 | $0 |
| Garden City | 74 | 0/2 | $15,051 |
| Pooler | 10 | 0/0 | $0 |
| Port Wentworth | 18 | 0/0 | $8,605 |
| Savannah | 540 | 0/28 | $10,312 |
| Thunderbolt | 0 | 0/0 | $0 |
| Tybee Island | 0 | 0/0 | $0 |
| Unincorporated Area | 2 | 0/0 | $0 |
| **CHATHAM COUNTY TOTAL** | **644** | **0/30** | **$33,968** |

*Source: Untied States Department of Transportation Pipeline and Hazardous Materials Safety Administration*

4. Probability of Future Occurrence

Given the location of 1,199 toxic release inventory sites in Chatham County and 644 prior roadway, railway, air, fixed facility, and other incidents it is highly likely that a hazardous material incident may occur in the County (100 percent annual probability). However, county

and municipal officials are mindful of this possibility and take precautions to prevent such an event from occurring. Additionally, there are detailed plans in place to respond to an occurrence.

## R. Terror Threat

### 1. Background

Terrorism is defined in the United States by the Code of Federal Regulations as: "the unlawful use of force and violence against persons or property to intimidate or coerce a government, the civilian population, or any segment thereof, in furtherance of political or social objectives."[27] Academic literature identifies some overarching political goals that terrorism seeks to achieve, including spreading anxiety and alarm among immediate victims, families, and the general public; eliminating opponents and destroying symbolic targets; and generating direct damage on society, such as affecting business confidence. In the following sections, some general background information about terrorism is presented prior to the County's hazard identification and risk assessment findings.

There are two general types of terrorist groups: network and hierarchical. The type of organization a group adopts largely depends on how long the group has existed. More recently developed groups tend to organize or adapt to the possibilities of the network model. Older, more established groups lean toward the hierarchical structure and are often more associated with violence of a political nature.[28] Terrorist acts can be committed by large, formally organized groups with terrorist cells in different parts of the world, or they can originate from smaller groups or individuals from a small city or domestic "homegrown" location. In the United States, terrorists that are "homegrown" do not belong to a defined group, may operate very effectively "under the radar," and may pose the biggest threat initially at the local level.[29]

### 2. Location and Spatial Extent

A terror threat could potentially occur at any location in the County. However, the very definition of a terrorist event indicates that it is most likely to be targeted at a critical or symbolic resource/location. Ensuring and protecting the continuity of critical infrastructure and key resources (CIKR) of the United States is essential to the Nation's security, public health and safety, economic vitality, and way of life. CIKR includes physical and/or virtual systems or assets that, if damaged, would have a detrimental impact on national security, including large-scale human casualties, property destruction, economic disruption, and significant damage to morale and public confidence. **Table 2.32** lists the U.S. Department of Homeland Security's (DHS) identified main critical infrastructure sectors.

[27] U.S. Code of Federal Regulations. 23 C.F.R. Section 0.85
[28] Terrorism Research. *Terrorist groups*. Retrieved December 27, 2011, from http://www.terrorism-research.com/groups/
[29] *Ibid.*

**Table 2.32: U.S. Department of Homeland Security Critical Infrastructure Sectors**

- Agriculture and Food
- Banking and Finance
- Chemical
- Commercial Facilities
- Communications
- Critical Manufacturing
- Dams
- Defense Industrial Base
- Emergency Services
- Energy
- Government Facilities
- Healthcare and Public Health
- Information Technology
- National Monuments and Icons
- Nuclear Reactors, Materials, and Waste
- Postal and Shipping
- Transportation Systems
- Water

Although all critical facilities (see *Chapter 3 – Local Hazard Vulnerability*) are at a heightened level of risk in Chatham County, there are several that have been identified as the likely primary targets. These are listed in **Table 2.33.**

**Table 2.33: Critical Facilities at Elevated Risk of Terror Threat in Chatham County**

| Critical Facility |
|---|
| **Chatham County** |
| Georgia Regional Hospital at Savannah |
| Natural Gas Pressure Center |
| County EOC |
| Fort Pulaski National Monument |
| County and Municipal Police/Sheriff's Offices |
| Grayson Stadium |
| Savannah/Hilton Head International Airport |
| Savannah Civic Center |

*Source: Local Governments*

3. Historical Occurrences

Although there have been no major terror events in Chatham County, there is some possibility that one could occur in the future as there have been incidents in the United States in the past and there are several facilities that could be potential targets.

4. Probability of Future Occurrences

Chatham County has had no recorded terrorist events. Due to no recorded incidents against the County, the probability of future occurrences of a terrorist attack is possible (1-10 percent annual probability).

## S. Wildfire

1. Background

A wildfire is any outdoor fire (i.e. grassland, forest, brush land) that is not under control, supervised, or prescribed.[30] Wildfires are part of the natural management of forest ecosystems, but may also be caused by human factors.

Nationally, over 80 percent of forest fires are started by negligent human behavior such as smoking in wooded areas or improperly extinguishing campfires. The second most common cause for wildfire is lightning. In North Carolina, a majority of fires are caused by debris burning.

There are three classes of wildland fires: surface fire, ground fire, and crown fire. A surface fire is the most common of these three classes and burns along the floor of a forest, moving slowly and killing or damaging trees. A ground fire (muck fire) is usually started by lightning or human carelessness and burns on or below the forest floor. Crown fires spread rapidly by wind and move quickly by jumping along the tops of trees. Wildfires are usually signaled by dense smoke that fills the area for miles around.

Wildfire probability depends on local weather conditions, outdoor activities such as camping, debris burning, and construction, and the degree of public cooperation with fire prevention measures. Drought conditions and other natural hazards (such as tornadoes, hurricanes, etc.) increase the probability of wildfires by producing fuel in both urban and rural settings.

Many individual homes and cabins, subdivisions, resorts, recreational areas, organizational camps, businesses, and industries are located within high wildfire hazard areas. Furthermore, the increasing demand for outdoor recreation places more people in wildlands during holidays, weekends, and vacation periods. Unfortunately, wildland residents and visitors are rarely educated or prepared for wildfire events that can sweep through the brush and timber and destroy property within minutes.

Wildfires can result in severe economic losses as well. Businesses that depend on timber, such as paper mills and lumber companies, experience losses that are often passed along to consumers through higher prices and sometimes jobs are lost. The high cost of responding to and recovering from wildfires can deplete state resources and increase insurance rates. The economic impact of wildfires can also be felt in the tourism industry if roads and tourist attractions are closed due to health and safety concerns.

State and local governments can impose fire safety regulations on home sites and developments to help curb wildfire. Land treatment measures such as fire access roads, water storage, helipads, safety zones, buffers, firebreaks, fuel breaks, and fuel management can be designed as part of an

[30] Prescription burning, or "controlled burn," undertaken by land management agencies is the process of igniting fires under selected conditions, in accordance with strict parameters.

overall fire defense system to aid in fire control. Fuel management, prescribed burning, and cooperative land management planning can also be encouraged to reduce fire hazards.

2. Location and Spatial Extent

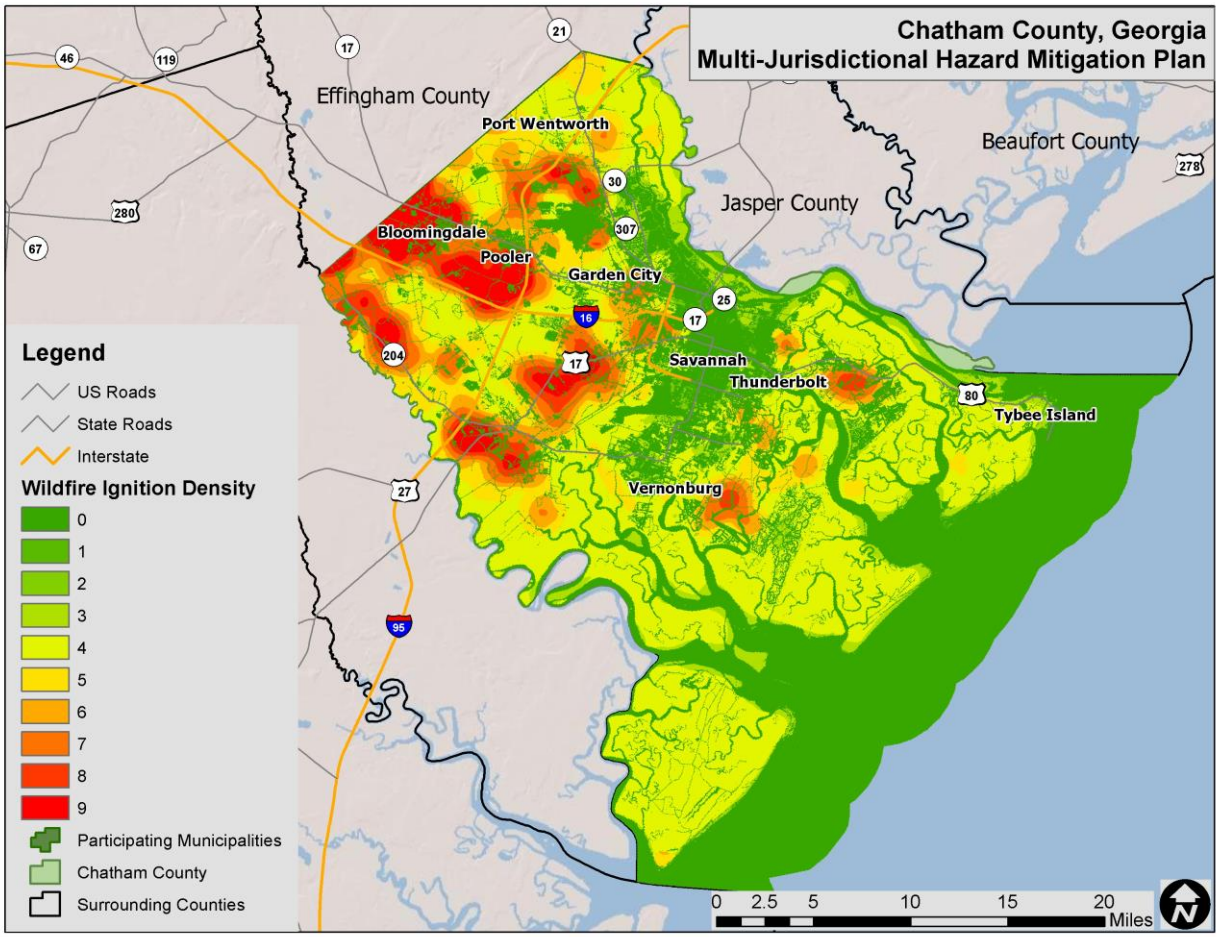
The entire county is at risk to a wildfire occurrence. However, several factors such as drought conditions or high levels of fuel on the forest floor may make a wildfire more likely. Furthermore, areas in the urban-wildland interface are particularly susceptible to fire hazard as populations abut formerly undeveloped areas. The Wildfire Ignition Density shown in the figure below gives an indication of historic location.

3. Historical Occurrences

**Figure 2.19** shows the Wildfire Ignition Density in Chatham County based on data from the Southern Wildfire Risk Assessment. This data is based on historical fire ignitions and the likelihood of a wildfire igniting in an area. Occurrence is derived by modeling historic wildfire ignition locations to create an average ignition rate map. This is measured in the number of fires per year per 1,000 acres.[31]

[31] Southern Wildfire Risk Assessment, 2014.

**Figure 2.19: Wildfire Ignition Density in Chatham County**




*Source: Southern Wildfire Risk Assessment*

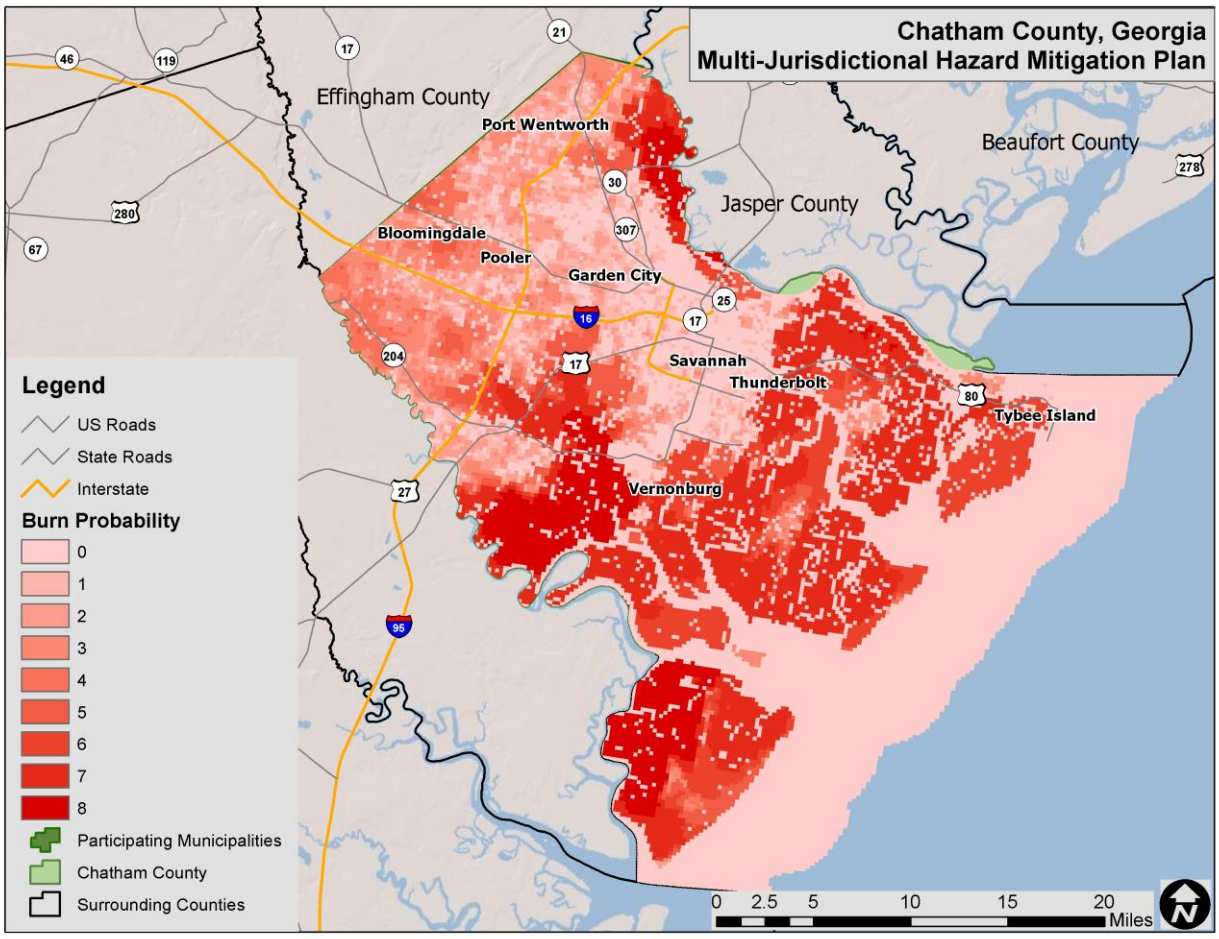
Based on data from the Georgia Forestry Commission found in the Chatham County Community Wildfire Protection Plan, over the past 56 years Chatham County experienced an average of 73 reported wildfires annually which burned a combined 475 acres, on average per year. However, using only more recent data, these numbers are significantly lower as there has only been an average of 38 fires burning 245 acres annually over the past 20 years. The data indicates that most of these fires are small, averaging 6.4 acres per fire.

It should also be noted that the annual peak for fires tends to occur early in the year as most of the fires take place in January, February, and March. Georgia Forestry Commission Wildfire Records show that in the past eight years, 313 homes (including barns, garages and other outbuildings) have been threatened by wildfire in Chatham County while estimated losses of almost $300,000 of residential property and equipment have been the result of wildfire.

4. Probability of Future Occurrences

Wildfire events will be an ongoing occurrence in Chatham County. **Figure 2.20** shows that there is some probability throughout the County that a wildfire will occur. However, the likelihood of wildfires increases during drought cycles and abnormally dry conditions. Fires are likely to stay small in size but could increase due local climate and ground conditions. Dry, windy conditions with an accumulation of forest floor fuel (potentially due to ice storms or lack of fire) could create conditions for a large fire that spreads quickly. It should also be noted that some areas do vary somewhat in risk. For example, highly developed areas are less susceptible unless they are located near the urban-wildland boundary. The risk will also vary due to assets. Areas in the urban-wildland interface will have much more property at risk, resulting in increased vulnerability and need to mitigate compared to rural, mainly forested areas. The probability assigned to Chatham County for future wildfire events is likely (10 to 100 percent annual probability).

**Figure 2.20: Burn Probability Chatham County**




*Source: Southern Wildfire Risk Assessment*

## T. Conclusions on Hazard Risk

The hazard profiles presented in this section were developed using best available data and result in what may be considered principally a qualitative assessment as recommended by FEMA in its "How-to" guidance document titled *Understanding Your Risks: Identifying Hazards and Estimating Losses* (FEMA Publication 386-2). It relies heavily on historical and anecdotal data, stakeholder input, and professional and experienced judgment regarding observed and/or anticipated hazard impacts. It also carefully considers the findings in other relevant plans, studies, and technical reports.

### 1. Hazard Extent

**Table 5.34** describes the extent of each natural hazard identified for Chatham County. The extent of a hazard is defined as its severity or magnitude, as it relates to the planning area.

**Table 2.34: Extent of Chatham County Hazards**

| **Atmospheric Hazards** | |
|---|---|
| Drought | According to the Georgia Automated Environmental Monitoring Network, the County has experienced precipitation deficit in several recent years, the greatest of which was a deficit of over 13 inches. Additionally, based on data collected from 1895-1995 on the Palmer Drought Severity Index, the County likely spends less than 5% of the time at a drought rating more severe than -3. |
| Extreme Heat | The extent of extreme heat can be defined by the maximum temperature reached. The highest temperature recorded in Chatham County is 104.4 degrees Fahrenheit. |
| Hailstorm | Hail extent can be defined by the size of the hail stone. The largest hail stone reported in Chatham County was 3.5 inches (reported on April 5, 1993). It should be noted that future events may exceed this. |
| Hurricane and Tropical Storm | Hurricane extent is defined by the Saffir-Simpson Scale which classifies hurricanes into Category 1 through Category 5 (Table 2.13). The greatest classification of hurricanes to traverse directly through Chatham County was unnamed storms in 1854, 1893, and 1896 which reached a maximum wind speed of 100 knots in the County. Although the County has not been impacted by an event of this size in many years, these past events indicate that a large storm could directly strike the County. |
| Lightning | According to the Vaisala flash density map (Figure 2.5), Chatham County is located in an area that experiences 6 to 8 lightning flashes per square kilometer per year. It should be noted that future lightning occurrences may exceed these figures. |
| Thunderstorm Wind / High Wind | Thunderstorm extent is defined by the number of thunder events and wind speeds reported. According to a 55-year history from the National Climatic Data Center, the strongest recorded wind event in Chatham County was reported on September 8, 1980 at 110 knots (approximately 126 mph). It should be noted that future events may exceed these historical occurrences. |
| Tornado | Tornado hazard extent is measured by tornado occurrences in the US provided by FEMA (Figure 2.6) as well as the Fujita/Enhanced Fujita Scale (Tables 2.18 and 2.19). The greatest magnitude reported was an F2 (last reported on May 23, 1980). It should be noted that an F5 tornado is possible. |

| | |
|---|---|
| Winter Storm and Freeze | The extent of winter storms can be measured by the amount of snowfall received (in inches). The greatest 24-hour snowfall reported in the County has been 4-6 inches. Due to unpredictable variations in snowfall throughout the County, extent totals will vary for each participating jurisdiction and reliable data on snowfall totals is not abundantly available. |
| **Geologic Hazards** | |
| Earthquake | Earthquake extent can be measured by the Richter Scale (Table 2.22) and the Modified Mercalli Intensity (MMI) scale (Table 2.23) and the distance of the epicenter from Chatham County. According to data provided by the National Geophysical Data Center, the greatest MMI to impact the County was VIII (severe) with a correlating Richter Scale measurement of approximately 7.2 (reported on September 1, 1886). The epicenter of this earthquake was located 137.0 km away. |
| **Hydrologic Hazards** | |
| Dam Failure | Dam failure extent is defined using the Georgia Safe Dams Program criteria. There are two dams located in Chatham County and both are classified as II-Significant. |
| Erosion | The extent of erosion can be defined by the measurable rate of erosion that occurs. There are some areas of Tybee Island where erosion rates have been measured at around 1-3 meters/year, however, there is also a great deal of accretion on the island in other areas. |
| Flood | Flood extent can be measured by the amount of land and property in the floodplain as well as flood height and velocity. The amount of land in the floodplain accounts for 71.7 percent of the total land area in Chatham County.<br><br>Flood depth and velocity are recorded via United States Geological Survey stream gages throughout the County. While a gage does not exist for each participating jurisdiction, there is one at or near many areas. The greatest peak discharge recorded for the County was reported in July 5, 1986. Water reached a discharge of 882 cubic feet per second. The greatest gage height in the County was recorded at 21.3 feet. Additional peak discharge readings and gage heights are in the table below. |

| Location/Jurisdiction | Date | Gage Height (ft) | Peak Discharge (cfs) |
|---|---|---|---|
| **Chatham County** | | | |
| BLACK CREEK AT GA 21, NEAR PORT WENTWORTH, GA | Oct. 08, 1929 | 16.70 | -- |
| ST. AUGUSTINE CREEK AT GA 21, NR PORT WENTWORTH,GA | Oct. 08, 1929 | 14.20 | -- |
| SAVANNAH RIVER AT GA 25, AT PORT WENTWORTH, GA | Oct. 08, 1929 | 12.30 | -- |
| PIPEMAKERS CANAL AT GA 21, AT SAVANNAH, GA | Oct. 08, 1929 | 15.10 | -- |
| PIPEMAKERS CANAL AT US 17, AT SAVANNAH, GA | Oct. 08, 1929 | 11.00 | -- |

| | | | |
|---|---|---|---|
| DUNDEE CANAL AT US 17, AT SAVANNAH, GA | Oct. 08, 1929 | 10.30 | -- |
| SPRINGFIELD CANAL AT BAY ST, AT SAVANNAH, GA | Oct. 15, 1947 | 7.80 | -- |
| KAYTON CANAL AT PRESIDENT ST, AT SAVANNAH, GA | Oct. 15, 1947 | 8.00 | -- |
| HARMON CANAL AT EDGEWATER RD, AT SAVANNAH, GA | Oct. 15, 1947 | 11.50 | -- |
| CASEY CANAL N AT VICTORY DR, AT SAVANNAH, GA | Jun. 23, 1963 | 9.00 | -- |
| CASEY CANAL S AT DELESSEPS AVE, AT SAVANNAH, GA | Jun. 23, 1963 | 9.00 | -- |
| CASEY CANAL S AT DERENNE AVE, AT SAVANNAH, GA | Jun. 23, 1963 | 7.50 | -- |
| CASEY CANAL S (MONTGOMERY CROSS RD) SAVANNAH, GA | Jun. 23, 1963 | 6.50 | -- |
| LOWER SPRINGFIELD CA TR C (GARRARD AVE) SAV, GA | Aug. 18, 1969 | 8.20 | -- |
| SPRINGFIELD CA TR A AT TREMONT AVE, SAVANNAH, GA | Nov. 01, 1969 | 7.10 | -- |
| WINDSOR FOREST CA #2 (WINDSOR RD) SAVANNAH, GA | Aug. 08, 1970 | 19.70 | -- |
| WILSHIRE CANAL AT MERCY BLVD, AT SAVANNAH, GA | Aug. 08, 1970 | 21.30 | -- |
| WILSHIRE CA TR A AT WOODLEY RD, AT SAVANNAH, GA | Aug. 08, 1970 | 18.60 | -- |
| WILSHIRE CA (WILSHIRE BLVD BL TR A) SAVANNAH, GA | Aug. 08, 1970 | 16.00 | -- |
| COLONIAL OAKS CA AT STILLWOOD DR, AT SAVANNAH, GA | Aug. 08, 1970 | 15.40 | -- |
| PLACENTIA CANAL AT US 80, AT SAVANNAH, GA | Aug. 18, 1971 | 7.25 | -- |
| GROVE RIVER TRIB AT GROVE PT RD NR SAVANNAH, GA | Aug. 12, 1981 | 7.19 | 109.0 |
| HARMON CANAL TRIB (EDGEWATER RD) AT SAVANNAH, GA | Sep. 01, 1983 | 7.03 | 78.0 |
| HARMON CANAL AT HUNTER AIR BASE AT SAVANNAH, GA | Sep. 01, 1983 | 6.60 | 273.0 |

| | | | | |
|---|---|---|---|---|
| | WILSHIRE CANAL AT TIBET AVE AT SAVANNAH, GA | Jul. 05, 1996 | 11.87 | 882.0 |
| | WILSHIRE CANAL TRIB AT WINDSOR RD AT SAVANNAH, GA | Jul. 05, 1996 | 6.41 | 127.0 |
| Storm Surge | Storm surge can be defined by the depth of inundation which is defined by the category of hurricane/tropical storm. Since Chatham County could be impacted by a Category 5 storm, depth of inundation could be 26.0 to 30.5 feet. | | | |
| Sea Level Rise | Sea level rise is defined by the areas impacted, but is more often associated with the amount of sea level rise that is expected to take place. Although it is difficult to predict an exact amount of rise, many projections call for somewhere in the range of 4-5 feet in the next 100 years. | | | |
| **Other Hazards** | | | | |
| Hazardous Materials Incident | According to USDOT PHMSA, the largest hazardous materials incident reported in the County was 10,000 LGA released on the railroad on May 16, 1981. It should be noted that larger events are possible. | | | |
| Terror Threat | There is no history of terror threats in Chatham County; however; it is possible that one of these events could occur. If this were to take place, the magnitude of the event could range on the scale of critical damage with many fatalities and injuries to the population. | | | |
| Wildfire | Wildfire data was provided by the Georgia Forestry Commission and the following information was reported in the Comprehensive Wildfire Protection Plan for the County:<br>• The average annual number of fires to occur in a year is 73.<br>• The average annual number of acres to burn is 475 acres.<br>Although this data lists the extent that has occurred, larger and more frequent wildfires are possible throughout the County. | | | |

2. Priority Risk Index

In order to draw some meaningful planning conclusions on hazard risk for Chatham County, the results of the hazard profiling process were used to generate countywide hazard classifications according to a "Priority Risk Index" (PRI). The purpose of the PRI is to categorize and prioritize all potential hazards for Chatham County as high, moderate, or low risk. Combined with the asset inventory and quantitative vulnerability assessment provided in the next section, the summary hazard classifications generated through the use of the PRI allows for the prioritization of those high hazard risks for mitigation planning purposes, and more specifically, the identification of hazard mitigation opportunities for the jurisdictions in Chatham County to consider as part of their proposed mitigation strategy.

The prioritization and categorization of identified hazards for Chatham County is based principally on the PRI, a tool used to measure the degree of risk for identified hazards in a particular planning area. The PRI is used to assist the Chatham County Hazard Mitigation Planning Team in gaining consensus on the determination of those hazards that pose the most significant threat to the Northern Piedmont counties based on a variety of factors. The PRI is not

scientifically based, but is rather meant to be utilized as an objective planning tool for classifying and prioritizing hazard risks in Chatham County based on standardized criteria.

The application of the PRI results in numerical values that allow identified hazards to be ranked against one another (the higher the PRI value, the greater the hazard risk). PRI values are obtained by assigning varying degrees of risk to five categories for each hazard (probability, impact, spatial extent, warning time, and duration). Each degree of risk has been assigned a value (1 to 4) and an agreed upon weighting factor[32], as summarized in **Table 2.35**. To calculate the PRI value for a given hazard, the assigned risk value for each category is multiplied by the weighting factor. The sum of all five categories equals the final PRI value, as demonstrated in the example equation below:

PRI VALUE = [(PROBABILITY x .30) + (IMPACT x .30) + (SPATIAL EXTENT x .20) + (WARNING TIME x .10) + (DURATION x .10)]

According to the weighting scheme and point system applied, the highest possible value for any hazard is 4.0. When the scheme is applied for Chatham County, the highest PRI value is 3.3 (flood). Prior to being finalized, PRI values for each identified hazard were reviewed and accepted by the members of the Hazard Mitigation Planning Team.

[32] The Hazard Mitigation Planning Committee, based upon any unique concerns or factors for the planning area, may adjust the PRI weighting scheme during future plan updates.

**Table 2.35: Priority Risk Index for Chatham County**

| PRI Category | Degree of Risk | | | Assigned Weighting Factor |
|---|---|---|---|---|
| | Level | Criteria | Index Value | |
| Probability | Unlikely | Less than 1% annual probability | 1 | 30% |
| | Possible | Between 1 and 10% annual probability | 2 | |
| | Likely | Between 10 and 100% annual probability | 3 | |
| | Highly Likely | 100% annual probability | 4 | |
| Impact | Minor | Very few injuries, if any. Only minor property damage and minimal disruption on quality of life. Temporary shutdown of critical facilities. | 1 | 30% |
| | Limited | Minor injuries only. More than 10% of property in affected area damaged or destroyed. Complete shutdown of critical facilities for more than one day. | 2 | |
| | Critical | Multiple deaths/injuries possible. More than 25% of property in affected area damaged or destroyed. Complete shutdown of critical facilities for more than one week. | 3 | |
| | Catastrophic | High number of deaths/injuries possible. More than 50% of property in affected area damaged or destroyed. Complete shutdown of critical facilities for 30 days or more. | 4 | |
| Spatial Extent | Negligible | Less than 1% of area affected | 1 | 20% |
| | Small | Between 1 and 10% of area affected | 2 | |
| | Moderate | Between 10 and 50% of area affected | 3 | |
| | Large | Between 50 and 100% of area affected | 4 | |
| Warning Time | More than 24 hours | Self explanatory | 1 | 10% |
| | 12 to 24 hours | Self explanatory | 2 | |
| | 6 to 12 hours | Self explanatory | 3 | |
| | Less than 6 hours | Self explanatory | 4 | |
| Duration | Less than 6 hours | Self explanatory | 1 | 10% |
| | Less than 24 hours | Self explanatory | 2 | |
| | Less than one week | Self explanatory | 3 | |
| | More than one week | Self explanatory | 4 | |

3. Priority Risk Index Results

**Table 2.36** summarizes the degree of risk assigned to each category for all initially identified hazards based on the application of the PRI. Assigned risk levels were based on the detailed hazard profiles developed for this section, as well as input from the Hazard Mitigation Planning Team. The results were then used in calculating PRI values and making final determinations for the risk assessment.

**Table 2.36: Summary of PRI Results for Chatham County**

| Hazard | Category/Degree of Risk | | | | | PRI Score |
|---|---|---|---|---|---|---|
| | Probability | Impact | Spatial Extent | Warning Time | Duration | |
| **Atmospheric Hazards** | | | | | | |
| Drought | Likely | Minor | Large | More than 24 hours | More than 1 week | **2.5** |
| Extreme Heat | Likely | Minor | Large | More than 24 hours | Less than 1 week | **2.4** |
| Hailstorm | Highly Likely | Limited | Small | Less than 6 hours | Less than 6 hours | **2.7** |
| Hurricane and Tropical Storm | Likely | Critical | Large | More than 24 hours | Less than 1 week | **3** |
| Lightning | Highly Likely | Limited | Small | Less than 6 hours | Less than 6 hours | **2.7** |
| Thunderstorm / High Wind | Highly Likely | Limited | Moderate | 6 to 12 hours | Less than 6 hours | **2.8** |
| Tornado | Likely | Critical | Moderate | Less than 6 hours | Less than 6 hours | **2.9** |
| Winter Storm and Freeze | Highly Likely | Minor | Large | More than 24 hours | Less than 24 hours | **2.6** |
| **Geologic Hazards** | | | | | | |
| Earthquake | Possible | Limited | Moderate | Less than 6 hours | Less than 6 hours | **2.3** |
| **Hydrologic Hazards** | | | | | | |
| Dam and Levee Failure | Unlikely | Limited | Small | Less than 6 hours | Less than 24 hours | **1.9** |
| Erosion | Likely | Limited | Small | More than 24 hours | More than 1 week | **2.4** |
| Flood | Highly Likely | Critical | Moderate | 6 to 12 hours | Less than 1 week | **3.3** |
| Storm Surge | Likely | Critical | Large | More than 24 hours | Less than 1 week | **3** |
| Sea Level Rise | Likely | Minor | Large | More than 24 hours | More than 1 week | **2.5** |
| **Other Hazards** | | | | | | |
| Wildfire | Likely | Limited | Small | Less than 6 hours | Less than 1 week | **2.6** |
| Hazardous Materials Incident | Highly Likely | Limited | Small | Less than 6 hours | Less than 24 hours | **2.8** |
| Terror Threat | Unlikely | Critical | Small | Less than 6 hours | Less than 24 hours | **2.2** |

## U. Final Determinations

The conclusions drawn from the hazard profiling process for Chatham County, including the PRI results and input from the Hazard Mitigation Planning Team, resulted in the classification of risk for each identified hazard according to three categories: High Risk, Moderate Risk, and Low Risk (**Table 2.37**). For purposes of these classifications, risk is expressed in relative terms

according to the estimated impact that a hazard will have on human life and property throughout all of Chatham County. A more quantitative analysis to estimate potential dollar losses for each hazard has been performed separately, and is described in *Chapter 3 – Local Hazard Vulnerability*. It should be noted that although some hazards are classified below as posing low risk, their occurrence of varying or unprecedented magnitudes is still possible in some cases and their assigned classification will continue to be evaluated during future plan updates.

**Table 2.37: Conclusions on Hazard Risk for Chatham County**

| | |
|---|---|
| **HIGH RISK** | Flood<br>Storm Surge<br>Hurricane/Tropical Storm<br>Severe Thunderstorm / High Wind<br>Tornado |
| **MODERATE RISK** | Hazardous Materials Incident<br>Lightning<br>Hailstorm<br>Wildfire<br>Winter Storm and Freeze<br>Drought<br>Sea Level Rise |
| **LOW RISK** | Erosion<br>Extreme Heat<br>Earthquake<br>Terrorism<br>Dam and Levee Failure |

# CHAPTER 3 – LOCAL HAZARD VULNERABILITY

This section identifies and quantifies the vulnerability of the jurisdictions within Chatham County to the significant hazards identified in the previous sections (*Hazard Identification and Profiles*). It consists of the following subsections:

I. Overview
II. Methodology
III. Explanation of Data Sources
IV. Asset Inventory
V. Vulnerability Assessment Results
VI. Conclusions on Hazard Vulnerability

**Table 3.1** provides a brief description of each section in this chapter and a summary of the changes that have been made. Chapter 3 of the 2015 plan combines the hazard vulnerability information previously presented in Chapters 2 and 3 of the 2010 plan, building off of the information provided in Chapter 2 of the 2015 plan.

**Table 3.1: Overview of updates to Chapter 3: Local Hazard Vulnerability**

| Chapter 3 Section | Updates to Section |
|---|---|
| I. Overview | This is a new section that summarizes the information provided in this chapter. |
| II. Methodology | This is a new section that describes the three distinct methodologies that were used to conduct the vulnerability assessment of the identified hazards. |
| III. Explanation of Data Sources | This is a new section that describes the data sources that were used to conduct the vulnerability assessment. |
| IV. Asset Inventory | This is a new section that identifies the assets within Chatham County and its jurisdictions in order to identify and characterize those properties potentially at risk to the identified hazards. |
| V. Vulnerability Assessment Results | This is a new section that presents the results for all of the identified hazards with a specific geographic boundary, modeling tool, or sufficient historical data to allow for further analysis. |
| VI. Conclusions on Hazard Vulnerability | This is a new section that presents a summary of annualized loss for each of the identified hazards. |

| 44 CFR Requirement |
| --- |
| 44 CFR Part 201.6(c)(2)(ii): The risk assessment shall include a description of the jurisdiction's vulnerability to the hazards described in paragraph (c)(2)(i) of this section. The description shall include an overall summary of each hazard and its impact on the community. The plan should describe vulnerability in terms of: (A) The types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard areas; (B) An estimate of the potential losses to vulnerable structures identified in paragraph (c)(2)(ii)(A) of this section and a description of the methodology used to prepare the estimate; (C) Providing a general description of land uses and development trends within the community so that mitigation options can be considered in future land use decisions. |

# I. Overview

This section builds upon the information provided in Chapter 2 by identifying and characterizing an inventory of assets in Chatham County. In addition, the potential impact and expected amount of damages caused to these assets by each identified hazard event is assessed. The primary objective of the vulnerability assessment is to quantify exposure and the potential loss estimates for each hazard. In doing so, Chatham County and the participating jurisdictions may better understand their unique risks to identified hazards and be better prepared to evaluate and prioritize specific hazard mitigation actions.

This section begins with an explanation of the methodology applied to complete the vulnerability assessment, followed by a summary description of the asset inventory as compiled for jurisdictions in Chatham County. The remainder of this section focuses on the results of the assessment conducted.

# II. Methodology

This vulnerability assessment was conducted using three distinct methodologies: (1) A stochastic risk assessment; (2) a geographic information system (GIS)-based analysis; and (3) a risk modeling software analysis. Each approach provides estimates for the potential impact of hazards by using a common, systematic framework for evaluation, including historical occurrence information provided in the *Hazard Identification* and *Hazard Profiles* sections. A brief description of the three different approaches is provided on the following pages.

## A. Stochastic Risk Assessment

The stochastic risk assessment methodology was applied to analyze hazards of concern that were outside the scope of hazard risk models and the GIS-based risk assessment. This involves the consideration of annualized loss estimates and impacts of current and future buildings and populations. Annualized loss is the estimated long-term weighted average value of losses to property in any single year in a specified geographic area (i.e., municipal jurisdiction or county). This methodology is applied primarily to hazards that do not have geographically-definable boundaries and are therefore excluded from spatial analysis through GIS. A stochastic risk methodology was used for the following hazards:

- Dam Failure

- Drought
- Erosion
- Extreme Heat
- Hailstorm
- Lightning
- Terror Threat
- Severe Thunderstorm/High Wind
- Tornado
- Winter Storm and Freeze

With the exception of Dam Failure, Erosion, Sea Level Rise, and Terror Threat, the hazards listed above are considered atmospheric and have the potential to affect all current and future buildings and all populations. **Table 3.1** provides information about all improved property in Chatham County that is vulnerable to these hazards. For all hazards, annualized loss estimates were determined using the best available data on historical losses from sources including NOAA's National Climatic Data Center records, county and municipal hazard mitigation plans, and local knowledge. Annualized loss estimates were generated by totaling the amount of property damage over the period of time for which records were available, and calculating the average annual loss. Given the standard weighting analysis, losses can be readily compared across hazards providing an objective approach for evaluating mitigation alternatives.

For the dam failure[33], erosion, and terror threat, no data with historical property damages was available. Therefore a detailed vulnerability assessment could not be completed for these hazards at this time.

The results for these hazards are found at the end of this section in **Table 3.16**.

## B. GIS-Based Analysis

Other hazards have specified geographic boundaries that permit additional analysis using Geographic Information Systems (GIS). These hazards include:

- Flood
- Hazardous Materials Incident (Fixed Site)
- Hazardous Materials Incident (Mobile)
- Sea Level Rise[34]
- Storm Surge

[33] As noted in *Chapter 2- Local Hazard Identification and Risk*, dam failure could be catastrophic to structures and populations in the inundation area. However, due to lack of data, no additional analysis was performed. Further, local USACE and Georgia Safe Dams Program also complete separate dam failure plans to identify risk and response measures.
[34] Information included for this hazard was mainly derived from analysis carried out by Climate Central and NOAA.

- Wildfire

The objective of the GIS-based analysis was to determine the estimated vulnerability of critical facilities and populations for the identified hazards in Chatham County using best available geospatial data. Digital data was collected from local, regional, state, and national sources for hazards and buildings. This included local tax assessor records for individual parcels and buildings and geo-referenced point locations for identified assets (critical facilities and infrastructure, special populations, etc.) when available. ESRI® ArcGIS™ 10.0 was used to assess hazard vulnerability utilizing digital hazard data, as well as local building data. Using these data layers, hazard vulnerability can be quantified by estimating the assessed building value for parcels and/or buildings determined to be located in identified hazard areas. The results of the analysis provided an estimate of the number of parcels, buildings, and critical facilities, as well as the estimated value of those buildings determined to be potentially at risk to the hazards with delineable geographic hazard boundaries.

## C. Risk Modeling Software Analysis

A risk modeling software was used for the following hazards:

- Earthquake
- Hurricane and Tropical Storm

There are several models that exist to model hazards. Hazus-MH was used in this vulnerability assessment to address the aforementioned hazards.

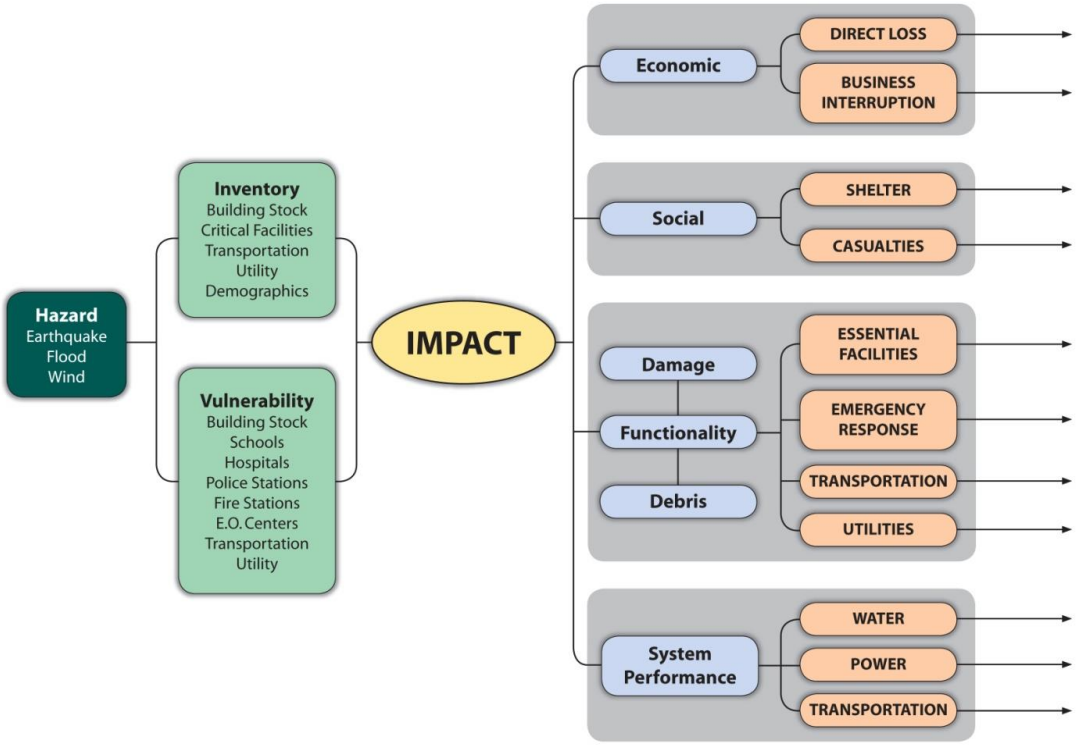

***Hazus-MH***

Hazus-MH ("Hazus") is a standardized loss estimation software program developed by FEMA. It is built upon an integrated GIS platform to conduct analysis at a regional level (i.e., not on a structure-by-structure basis). The Hazus risk assessment methodology is parametric, in that distinct hazard and inventory parameters (e.g., wind speed and building types) can be modeled using the software to determine the impact (i.e., damages and losses) on the built environment.

The Chatham County Risk Assessment utilized Hazus-MH to produce hazard damage loss estimations for hazards for the planning area. At the time this analysis was completed, Hazus-MH 2.1 was used to estimate potential damages from hurricane winds earthquake hazards using Hazus-MH methodology. Although the program can also model losses for flood and storm surge, it was not used in this Risk Assessment.

**Figure 3.1** illustrates the conceptual model of the Hazus-MH methodology.

**Figure 3.1: Conceptual Model of Hazus-MH Methodology**




Hazus-MH is capable of providing a variety of loss estimation results. In order to be consistent with other hazard assessments, annualized losses are presented when possible. Some additional results based on location-specific scenarios may also be presented to provide a complete picture of hazard vulnerability.

Loss estimates provided in this vulnerability assessment are based on best available data and methodologies. The results are an approximation of risk. These estimates should be used to understand relative risk from hazards and potential losses. Uncertainties are inherent in any loss estimation methodology, arising in part from incomplete scientific knowledge concerning natural hazards and their effects on the built environment. Uncertainties also result from approximations and simplifications that are necessary for a comprehensive analysis (e.g., incomplete inventories, non-specific locations, demographics, or economic parameters).

All conclusions are presented in "Conclusions on Hazard Vulnerability" at the end of this section.

## III. Explanation of Data Sources

***Earthquake***

Hazus-MH 2.1 (as described above) was used to assess earthquake vulnerability. A level 1, probabilistic scenario to estimate annualized loss was utilized. In this scenario, several return periods (events of varying intensities) are run to determine annualized loss. Default Hazus

earthquake damage functions and methodology were used to determine the probability of damage. Results are calculated at the 2000 U.S. Census tract level in Hazus and presented at the county level.

***Flood***

FEMA Digital Flood Insurance Rate Maps (DFIRMs) were used to determine flood vulnerability. DFIRM data can be used in ArcGIS for mapping purposes and they identify several features including floodplain boundaries and base flood elevations. Identified areas on the DFIRM represent some features of Flood Insurance Rate Maps including the 100-year flood areas (1.0-percent annual chance flood), and the 500-year flood areas (0.2-percent annual chance flood). For the vulnerability assessment, local parcel data, building footprints, and critical facilities were overlaid on the 100-year floodplain areas and 500-year floodplain areas. It should be noted that such an analysis does not account for building elevation.

***Hurricane and Tropical Storm Wind***

Hazus-MH 2.1 (as described above) was used to assess wind vulnerability. For the hurricane wind analysis, a probabilistic scenario was created to estimate the annualized loss damage and probable peak wind speeds in Chatham County. Default Hazus wind speed data, damage functions, and methodology were used in to determine the probability of damage for 50-, 100-, 500-, and 1,000-year frequency events (also known as return periods) in the scenario. Results are calculated in Hazus at the 2000 U.S. Census tract level and presented at the county and municipal level.

***Hazardous Materials Incident***

For the fixed hazardous materials incident analysis, Facility Registry Services (FRS) data was used. The Facility Registry Service is a publicly available database from the federal Environmental Protection Agency (EPA) that contains information on toxic chemical releases and other waste management activities reported annually by certain covered industry groups as well as federal facilities. This inventory was established under the Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA) and expanded by the Pollution Prevention Act of 1990. Each year, facilities that meet certain activity thresholds must report their releases and other waste management activities for listed toxic chemicals to EPA and to their state or tribal entity. These facilities fall under the purview of several major pieces of environmental legislation including the Clean Air Act, Clean Water Act, and Resource Conservation and Recovery Act. A facility must report if it falls under any of those statute. For instance if it meets any of the following three criteria, it would be classified as a Toxic Releases Inventory (TRI) site:

- The facility falls within one of the following industrial categories: manufacturing; metal mining; coal mining; electric generating facilities that combust coal and/or oil; chemical wholesale distributors; petroleum terminals and bulk storage facilities; RCRA Subtitle C treatment, storage, and disposal (TSD) facilities; and solvent recovery services;
- Has 10 or more full-time employee equivalents; and
- Manufactures or processes more than 25,000 pounds or otherwise uses more than 10,000 pounds of any listed chemical during the calendar year. Persistent, bioaccumulative, and

toxic (PBT) chemicals are subject to different thresholds of 10 pounds, 100 pounds, or 0.1 grams depending on the chemical.

For the mobile hazardous materials incident analysis, transportation data including major highways and railroads were obtained from the U.S. Department of Transportation's National Highway Planning Network (NHPN). This data is ArcGIS compatible, lending itself to buffer analysis to determine risk.

***Storm Surge***

The data used to analyze storm surge was created by the National Oceanic and Atmospheric Administration (NOAA) as part of the Comprehensive Hurricane Preparedness Study in conjunction with the Chatham County Emergency Management Agency. The Sea, Lake, and Overland Surges from Hurricanes (SLOSH) model was used to develop the data and show worst-case inundation areas for storms in Categories 1 through 5. To determine the worst-case inundation areas, Maximum of Maximums (MOMs) were utilized from the SLOSH model. For the vulnerability assessment, local parcel data and critical facilities were overlaid on the moderate and high incidence areas.

***Wildfire***

The data used to determine vulnerability to wildfire in Chatham County is based on GIS data called the Southern Wildfire Risk Assessment (SWRA). This data is available on the Southern Wildfire Risk Assessment website and can be downloaded and imported into ArcGIS. A specific layer, known as "Wildland Urban Interface Risk Index" (WUIRI) was used to determine vulnerability of people and property. The WUIRI is presented on a scale of 0 to -9. It combines data on housing density with the data on the impact and likelihood of a wildfire occurring in a specific area. The primary purpose of the data is to highlight areas of concern that may be conducive to mitigation actions. Due to the assumptions made, it is not a true probability. However, it does provide a comparison of risk throughout the region.

## IV. Asset Inventory

An inventory of geo-referenced assets within Chatham County and its jurisdictions was compiled in order to identify and characterize those properties potentially at risk to the identified hazards[35]. By understanding the type and number of assets that exist and where they are located in relation to known hazard areas, the relative risk and vulnerability for such assets can be assessed. Under this assessment, two categories of physical assets were created and then further assessed through GIS analysis. These are presented below in Section 3.4.1.

### A. Physical and Improved Assets

The two categories of physical assets consist of:

[35] While potentially not all-inclusive for the jurisdictions in Chatham County, "georeferenced" assets include those assets for which specific location data is readily available for connecting the asset to a specific geographic location for purposes of GIS analysis.

1. Improved Property: Includes all improved properties in Chatham County according to local parcel and building footprint data provided by the County. The information has been expressed in terms of the number of parcels and total building value of improvements (buildings) that may be exposed to the identified hazards. In addition, building footprint data was available for all jurisdictions and it was used to improve the overall assessment by providing an accurate assessment of how many buildings are located in hazard areas. However, it should be noted that building footprint data from all jurisdictions has not been updated since 2008, so it likely underestimates building counts.

2. Critical Facilities: Critical facilities vary by jurisdiction and the critical facilities provided by each jurisdiction are used in this section. It should be noted that this listing is not all-inclusive for assets located in the County, and it is anticipated that it may be expanded or adjusted during future plan updates as more geo-referenced data becomes available for use in GIS analysis.

The following tables provide a detailed listing of the geo-referenced assets that have been identified for inclusion in the vulnerability assessment Chatham County.

**Table 3.2** lists the number of parcels, total value of parcels, total number of parcels with improvements, and the total value of improvements for participating areas of Chatham County (study area of vulnerability assessment).[36]

**Table 3.2: Improved Property in Chatham County**

| Location | Number of Parcels | Total Assessed Value of Parcels | Estimated Number of Buildings | Total Estimated Value of Improvements |
|---|---|---|---|---|
| Bloomingdale | 1,370 | $63,538,405 | 2,862 | $96,290,658 |
| Garden City | 3,372 | $275,541,301 | 7,315 | $462,465,557 |
| Pooler | 8,284 | $907,650,216 | 8,946 | $1,610,983,555 |
| Port Wentworth | 4,292 | $252,949,078 | 3,958 | $437,546,258 |
| Savannah | 54,352 | $4,965,481,845 | 62,073 | $9,393,847,340 |
| Thunderbolt | 1,191 | $97,351,633 | 1,528 | $179,438,112 |
| Tybee Island | 3,860 | $537,529,670 | 2,855 | $675,239,671 |
| Unincorporated Area | 37,472 | $2,482,712,061 | 45,246 | $8,236,449,386 |
| **CHATHAM COUNTY[37] TOTAL** | **114,193** | **$9,582,754,209** | **134,783** | **$21,092,260,537** |

*Source: Chatham County GIS Department*

**Table 3.3** lists the fire stations, police stations, hospitals, schools, and other critical facilities located in Chatham County. These facilities were identified as primary critical facilities in that they are necessary to maintain government functions and protect the life, health, safety, and

[36] Total assessed values for improvements is based on tax assessor records as joined to digital parcel data. This data does not include dollar figures for tax-exempt improvements such as publicly-owned buildings and facilities. It should also be noted that, due to record keeping, some duplication is possible thus potentially resulting in an inflated value exposure for an area.
[37] Value of improvements for each jurisdiction is based on the dollar value of parcels with a building value greater than zero.

welfare of citizens. These facilities were geospatially mapped and used as the basis for further geographic analysis of the hazards that could potentially affect the facilities.

All critical facility information was provided by local governments and the Chatham County GIS department. In addition, **Figure 3.2** shows the locations of the primary critical facilities in Chatham County. Annex A includes a complete list of the critical facilities by name, as well as the hazards that affect each facility. As noted previously, this list is not all-inclusive and only includes information provided by local government.

**Table 3.3: Critical Facility Inventory in Chatham County**

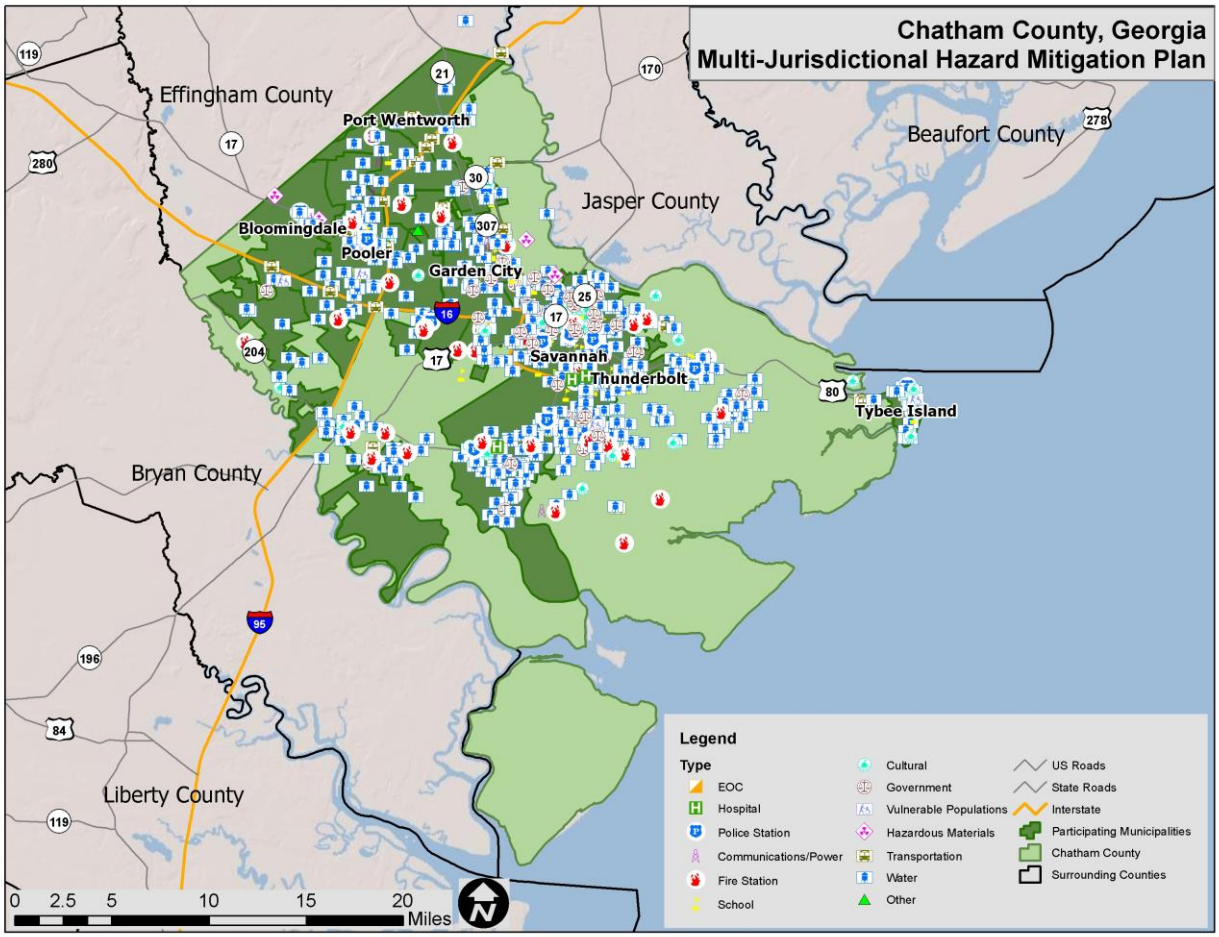
| Location | Fire Stations | Police Stations | EOC | Hospitals | Schools | Government | Comm/ Power |
|---|---|---|---|---|---|---|---|
| Bloomingdale | 1 | 1 | 0 | 0 | 1 | 2 | 2 |
| Garden City | 4 | 1 | 0 | 0 | 5 | 3 | 2 |
| Pooler | 4 | 1 | 0 | 0 | 4 | 2 | 2 |
| Port Wentworth | 2 | 1 | 0 | 0 | 1 | 5 | 0 |
| Savannah | 18 | 12 | 0 | 3 | 30 | 43 | 2 |
| Thunderbolt | 1 | 1 | 0 | 0 | 3 | 2 | 0 |
| Tybee Island | 1 | 1 | 0 | 0 | 1 | 2 | 2 |
| Unincorporated Area | 14 | 3 | 1 | 0 | 11 | 14 | 0 |
| **CHATHAM COUNTY TOTAL** | **45** | **21** | **1** | **3** | **56** | **73** | **10** |

*Source: Local Governments*

**Table 3.3: Critical Facility Inventory in Chatham County (cont.)**

| Location | Cultural | Vulnerable Populations | Hazardous Materials | Transportation | Water | Other |
|---|---|---|---|---|---|---|
| Bloomingdale | 0 | 2 | 2 | 1 | 5 | 0 |
| Garden City | 0 | 0 | 1 | 1 | 28 | 0 |
| Pooler | 0 | 3 | 0 | 6 | 45 | 1 |
| Port Wentworth | 1 | 1 | 0 | 5 | 14 | 0 |
| Savannah | 59 | 1 | 1 | 3 | 282 | 1 |
| Thunderbolt | 3 | 3 | 0 | 0 | 8 | 0 |
| Tybee Island | 5 | 1 | 0 | 3 | 20 | 0 |
| Unincorporated Area | 2 | 0 | 0 | 3 | 30 | 0 |
| **CHATHAM COUNTY TOTAL** | **70** | **11** | **4** | **22** | **432** | **2** |

**Figure 3.2: Critical Facility Locations in Chatham County**




*Source: Local Governments*

## B. Social Vulnerability

In addition to identifying those assets potentially at risk to identified hazards, it is important to identify and assess those particular segments of the resident population in Chatham County that are potentially at risk to these hazards.

**Table 3.4** lists the population by jurisdiction according to U.S. Census 2010 population estimates. The total population in Chatham County according to Census data is 265,128 persons. Additional population estimates are presented *in Chapter 1 – Introduction to the Planning Process, VIII. Community Data*.

**Table 3.4: Total Population in Chatham County**

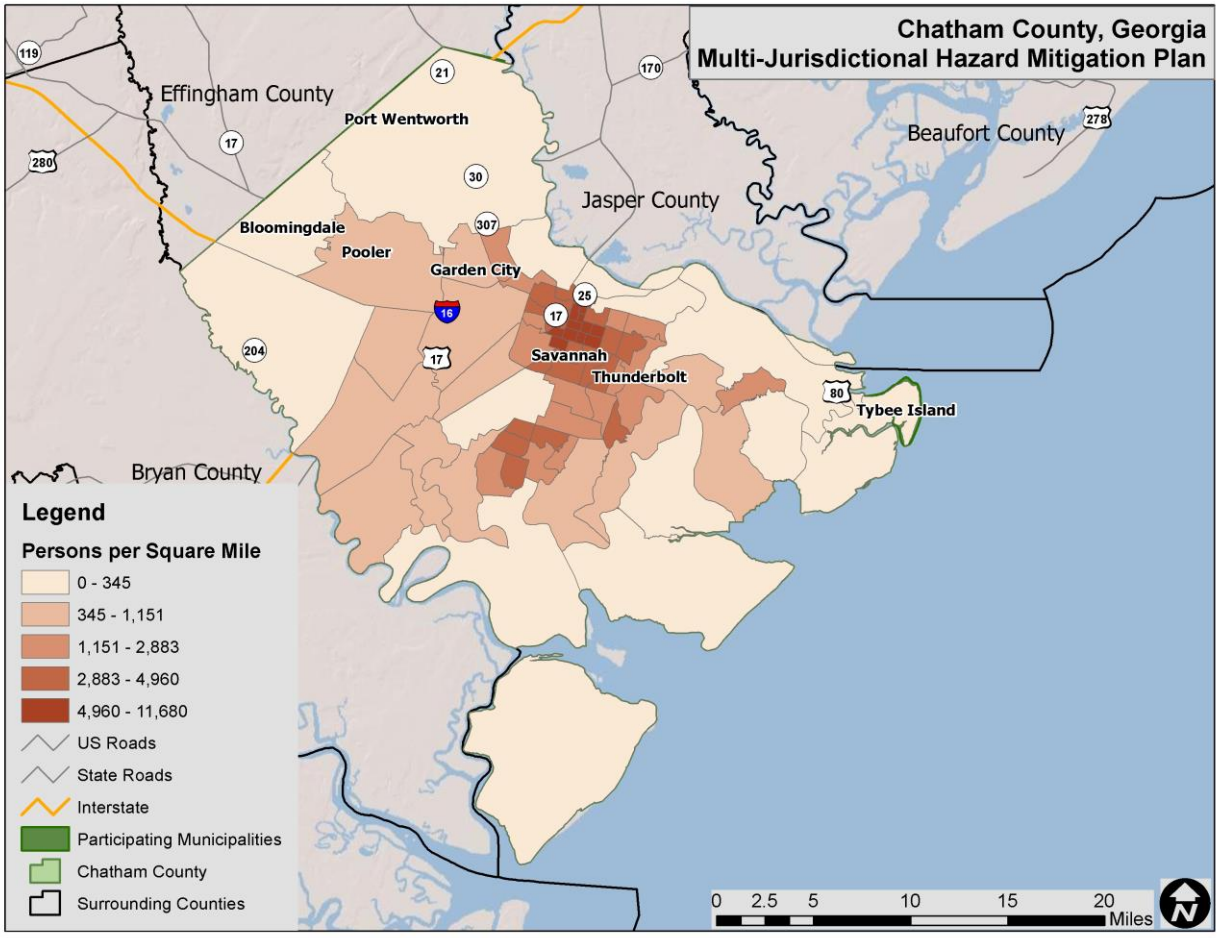
| Location | Total 2010 Population |
|---|---|
| Bloomingdale | 2,713 |
| Garden City | 8,778 |
| Pooler | 19,140 |

| Location | Total 2010 Population |
|---|---|
| Port Wentworth | 5,359 |
| Savannah | 136,286 |
| Thunderbolt | 2,668 |
| Tybee Island | 2,990 |
| Unincorporated Area | 87,194 |
| **CHATHAM COUNTY TOTAL** | **265,128** |

*Source: U.S. Census 2010*

In addition, **Figure 3.3** illustrates the population density by census tract as it was reported by the U.S. Census Bureau in 2010.

**Figure 3.3: Population Density in Chatham County**




*Source: U.S. Census Bureau, 2010*

## C. Development Trends and Changes in Vulnerability

Since the previous hazard mitigation plan was approved in 2010, Chatham County has experienced some growth and development. **Table 3.5** shows the number of building units constructed since 2010 according to the US Census American Community Survey.

**Table 3.5: Building Counts for Chatham County**

| Jurisdiction | Total Housing Units (2013) | Units Built 2010 or later | % Building Stock Built Post-2010 |
|---|---|---|---|
| Bloomingdale | 1,163 | 4 | 0.3% |
| Garden City | 4,022 | 0 | 0.0% |
| Pooler | 8,328 | 110 | 1.3% |
| Port Wentworth | 2,492 | 66 | 2.6% |
| Savannah | 62,122 | 734 | 1.2% |
| Thunderbolt | 1,234 | 0 | 0.0% |
| Tybee Island | 3,253 | 0 | 0.0% |
| Unincorporated Area | 37,532 | 407 | 1.1% |
| **CHATHAM COUNTY TOTAL** | **120,146** | **1,321** | **1.1%** |

*Source: US Census Bureau*

**Table 3.6** shows population growth estimates for the County and municipalities from 2010 to 2013 based on the US Census Annual Estimates of Resident Population.

**Table 3.6: Population Growth for Chatham County**

| Jurisdiction | Population Estimates (as of July 1) | | | | % Change 2010-2013 |
|---|---|---|---|---|---|
| | 2010 | 2011 | 2012 | 2013 | |
| Bloomingdale | 2,680 | 2,704 | 2,699 | 2,720 | 1.5% |
| Garden City | 8,969 | 8,929 | 8,868 | 8,888 | -0.9% |
| Pooler | 16,683 | 17,799 | 18,921 | 19,821 | 18.8% |
| Port Wentworth | 4,920 | 5,137 | 5,484 | 5,817 | 18.2% |
| Savannah | 134,348 | 135,780 | 137,690 | 139,620 | 3.9% |
| Thunderbolt | 2,643 | 2,659 | 2,595 | 2,583 | -2.3% |
| Tybee Island | 3,024 | 3,023 | 3,025 | 3,032 | 0.3% |
| Unincorporated Area | 83,161 | 85,291 | 87,062 | 88,621 | 6.6% |
| **CHATHAM COUNTY TOTAL** | **256,428** | **261,322** | **266,344** | **271,102** | **5.7%** |

Note: July 1 population estimates were used in this table to allow comparison of annual population counts (April 1 Census estimates were used for all other population counts throughout the plan which is why the counts may differ).
*Source: US Census Bureau*

Based on the data above, there has been a moderate rate of residential development in the County since 2010. Pooler, Port Wentworth, and Savannah experienced higher rates of development compared to the rest of the County, resulting in an increased number of structures that are vulnerable to the potential impacts of the identified hazards. Additionally, there has been some population growth in several of the other municipalities and the unincorporated area. Since the

population has increased in these municipalities, there are now greater numbers of people exposed to the identified hazards. Therefore, development and population growth have impacted the County's vulnerability since the previous local hazard mitigation plan was approved and there has been a moderate increase in the overall vulnerability.

It is also important to note that as development increases in the future, greater populations and more structures and infrastructure will be exposed to potential hazards if development occurs in high hazard areas like floodplains, high wildfire risk zones, or hazardous materials buffers.

## V. Vulnerability Assessment Results

As noted earlier, only hazards with a specific geographic boundary, modeling tool, or sufficient historical data allow for further analysis. Those results are presented here. All other hazards are assumed to impact the entire planning region (drought, extreme heat, hailstorm, lightning, thunderstorm/high wind, tornado, and winter storm and freeze) or, due to lack of data, analysis would not lead to credible results (erosion, dam and levee failure, terror threat). The total region exposure, and thus risk, was presented in **Table 3.1**.

The annualized loss estimate for all hazards is presented at the end of this section in **Table 3.16.**

The hazards presented in this subsection include: hurricane and tropical storm winds, earthquake, flood, hazardous materials incident, storm surge, wildfire, and sea level rise.

### A. Hurricane and Tropical Storm

Historical evidence indicates that Chatham County has significant risk to the hurricane and tropical storm hazard. There have been two disaster declarations due to hurricanes (Hurricane Floyd and Hurricane Katrina Evacuation) in the County. Many storm tracks have come near or traversed through Chatham County.

Hurricanes and tropical storms can cause damage through numerous additional hazards such as flooding, erosion, tornadoes and high winds, and precipitation, thus it is difficult to estimate total potential losses from these cumulative effects. The current Hazus-MH hurricane model only analyzes hurricane winds and is not capable of modeling and estimating cumulative losses from all hazards associated with hurricanes; therefore only hurricane winds are analyzed in this section. It can be assumed that all existing and future buildings and populations are at risk to the hurricane and tropical storm hazard. Hazus-MH 2.1 was used to determine annualized losses for the region as shown below in **Table 3.7.** In the comparative annualized loss analysis at the end of this section, only losses to buildings are reported in order to best match annualized losses reported for other hazards. Hazus-MH reports losses at the U.S. Census tract level, so determining participating jurisdiction losses was not possible.

**Table 3.7: Annualized Loss Estimations for Hurricane Wind Hazard**

| Location | Building Loss | Contents Loss | Inventory Loss | Total Annualized Loss |
|---|---|---|---|---|
| **Chatham County** | $26,299,000 | $12,054,000 | $194,000 | $38,547,000 |

*Source: Hazus-MH 2.1*

In addition, probable peak wind speeds were calculated in Hazus. These are shown below in **Table 3.8.**

**Table 3.8: Probable Peak Hurricane/Tropical Storm Wind Speeds (MPH)**

| Location | 50-year event | 100-year event | 500-year event | 1,000-year event |
|---|---|---|---|---|
| Bloomingdale | 88.8 | 103.2 | 132.3 | 142.2 |
| Garden City | 90.1 | 104.9 | 133.6 | 143.9 |
| Pooler | 89.9 | 104.4 | 133.6 | 143.3 |
| Port Wentworth | 88.8 | 103.1 | 132.0 | 142.2 |
| Savannah | 92.8 | 107.5 | 135.6 | 145.3 |
| Thunderbolt | 92.7 | 107.2 | 134.6 | 145.3 |
| Tybee Island | 94.7 | 108.9 | 136.6 | 145.8 |
| Unincorporated Area | 94.7 | 108.9 | 136.6 | 145.8 |
| **MAXIMUM WIND SPEED REPORTED** | **94.7** | **108.9** | **136.6** | **145.8** |

*Source: Hazus-MH 2.1*

***Social Vulnerability***

Given some equal susceptibility across Chatham County, it is assumed that the total population is at risk to the wind element of the hurricane and tropical storm hazard.

***Critical Facilities***

Given equal vulnerability across Chatham County, all critical facilities are considered to be at risk. Some buildings may perform better than others in the face of such an event due to construction and age, among other factors. Determining individual building response is beyond the scope of this plan. However, this plan will consider mitigation actions for vulnerable structures, including critical facilities, to reduce the impacts of the hurricane wind hazard. A list of specific critical facilities and their associated risk can be found in Annex A.

In conclusion, a hurricane event has the potential to impact many existing and future buildings, critical facilities, and populations in Chatham County. Hurricane events can cause substantial damage in their wake including fatalities, extensive debris clean-up, and extended power outages.

## B. Earthquake

For the earthquake hazard vulnerability assessment, a probabilistic scenario was created to estimate the annualized loss for the County. The results of the analysis reported at the U.S. Census tract level do not make it feasible to estimate losses at the jurisdiction level. Since the scenario is annualized, no building counts are provided. Losses reported included losses due to

building damage (structural and non-structural), contents, and inventory. However, like the analysis for hurricanes, the comparative annualized loss figures at the end of this chapter only utilize building losses in order to provide consistency with other hazards. **Table 3.9** summarizes the findings.

**Table 3.9: Annualized Loss Estimations for Earthquake Hazard**

| Location | Structural Building Loss | Non Structural Building Loss | Contents Loss | Inventory Loss | Total Annualized Loss |
|---|---|---|---|---|---|
| **Chatham County** | $160,000 | $467,000 | $161,000 | $7,000 | $795,000 |

*Source: Hazus-MH 2.1*

***Social Vulnerability***

It can be assumed that all existing and future populations are at risk to the earthquake hazard.

***Critical Facilities***

The Hazus probabilistic analysis indicated that no critical facilities would sustain measurable damage in an earthquake event. However, all critical facilities should be considered at-risk to minor damage, should an event occur. A list of individual critical facilities and their risk can be found in Annex A.

In conclusion, an earthquake has the potential to impact all existing and future buildings, facilities, and populations in Chatham County. Minor earthquakes may rattle dishes and cause minimal damage while stronger earthquakes will result in structural damage as indicated in the Hazus scenario above. Impacts of earthquakes include debris clean-up, service disruption and, in severe cases, fatalities due to building collapse. Specific vulnerabilities for assets will be greatly dependent on their individual design and the mitigation measures in place, where appropriate. Such site-specific vulnerability determinations are outside the scope of this assessment but will be considered during future plan updates if data becomes available. Furthermore, mitigation actions to address earthquake vulnerability will be considered.

## C. Storm Surge

In order to complete the vulnerability assessment for storm surge in Chatham County, GIS analysis was used. The potential dollar value of exposed land and property total was determined using the National Oceanic and Atmospheric Administration's (NOAA) Coastal Preparedness Study. County level tax parcel and building footprint data were intersected with storm surge inundation data using GIS to determine potential property at risk. **Table 3.10** presents the potential at-risk property where available. Almost the entire county is located in an area of some risk as determined by the NOAA data. However, there are some small areas that are considered to be of outside of the inundation zones. These areas are generally located further inland.

**Table 3.10: Total Potential At-Risk Parcels/Buildings for Storm Surge**

| Location | Number of Parcels At Risk | | Number of Improvements At Risk | | Total Value of Improvements At Risk ($) | |
|---|---|---|---|---|---|---|
| Incidence Level | Cat 1 | Cat 4 | Cat 1 | Cat 4 | Cat 1 | Cat 4 |
| Bloomingdale | 0 | 107 | 0 | 211 | $0 | $6,530,030 |
| Garden City | 114 | 2,488 | 16 | 4,766 | $12,021,710 | $345,207,588 |
| Pooler | 9 | 4,353 | 0 | 3,954 | $1,694,500 | $840,960,225 |
| Port Wentworth | 8 | 2,031 | 1 | 1,762 | $63,200 | $237,519,331 |
| Savannah | 1,261 | 33,926 | 381 | 38,498 | $954,690,614 | $5,539,707,434 |
| Thunderbolt | 115 | 1,191 | 91 | 1,527 | $42,476,033 | $179,438,112 |
| Tybee Island | 2,054 | 3,854 | 1,392 | 2,830 | $292,392,271 | $674,629,671 |
| Unincorporated Area | 8,122 | 36,625 | 6,338 | 42,865 | $2,543,562,795 | $7,892,628,187 |
| **CHATHAM COUNTY TOTAL** | **11,683** | **84,575** | **8,219** | **96,413** | **$3,846,901,123** | **$15,716,620,578** |

*Source: NOAA*

***Social Vulnerability***

Given high susceptibility across most of Chatham County, it is assumed that much of the total population is at risk to storm surge. However, people located along coastal areas are certainly at a much higher risk than those located further inland. For example, populations in Tybee Island are perhaps at the highest risk of impacts from storm surge.

***Critical Facilities***

There are 46 critical facilities located in the Category 1 storm surge zone and 490 facilities located in the Category 4 storm surge zone. In the Category 1 storm surge zone, the facilities include 5 cultural facilities, 1 hazardous materials site, 6 transportation assets, 1 facility for vulnerable populations, and 33 water facilities. A list of specific critical facilities and their associated risk can be found in Annex A.

In conclusion, storm surge has the potential to impact many existing and future buildings, facilities, and populations in Chatham County. Due to a variety of factors such as terrain and proximity to the ocean, the unincorporated county and Tybee Island bear the greatest burden when it comes to storm surge. Specific vulnerabilities for Chatham County assets may be dependent on their individual design and the mitigation measures in place. Such site-specific vulnerability determinations are outside the scope of this assessment but will be considered during future plan updates if data becomes available.

## D. Flood

Historical evidence indicates that Chatham County is susceptible to flood events. A total of 79 flood events have been reported by the National Climatic Data Center resulting in nearly $12 million dollars in damages.

In order to assess flood risk, a GIS-based analysis was used to estimate exposure to flood events using Digital Flood Insurance Rate Map (DFIRM) data in combination with local tax assessor

records for each of the Chatham County municipalities. The determination of assessed value at-risk (exposure) was calculated using GIS analysis by summing the building values for improved properties that were located within an identified floodplain. **Table 3.11** presents the potential at-risk properties. Both the number of parcels/buildings and the approximate value are presented.

**Table 3.11: Estimated Exposure of Parcels/Buildings to the Flood Hazard**

| Location | 1.0-percent ACF (A-zone) | | | 1.0-percent ACF (V-zone) | | |
|---|---|---|---|---|---|---|
| | Approx. Number of Parcels | Approx. Number Improved Buildings | Approx. Improved Value of Buildings[38] | Approx. Number of Parcels | Approx. Number Improved Buildings | Approx. Improved Value of Buildings[39] |
| Bloomingdale | 608 | 873 | $45,708,832 | 0 | 0 | $0 |
| Garden City | 843 | 1,478 | $140,254,344 | 0 | 0 | $0 |
| Pooler | 2,157 | 1,396 | $525,140,673 | 0 | 0 | $0 |
| Port Wentworth | 842 | 832 | $104,158,948 | 0 | 0 | $0 |
| Savannah | 8,844 | 6,440 | $2,192,302,232 | 205 | 109 | $28,168,418 |
| Thunderbolt | 408 | 531 | $105,866,001 | 0 | 0 | $0 |
| Tybee Island | 3,308 | 2,621 | $552,040,406 | 810 | 323 | $201,821,131 |
| Unincorporated Area | 17,193 | 17,371 | $4,697,276,991 | 805 | 703 | $158,568,929 |
| **CHATHAM COUNTY TOTAL** | **34,203** | **31,542** | **$8,362,748,427** | **1,820** | **1,135** | **$388,558,478** |

*Source: FEMA DFIRM*

**Table 3.11: Estimated Exposure of Parcels/Buildings to the Flood Hazard (cont.)**

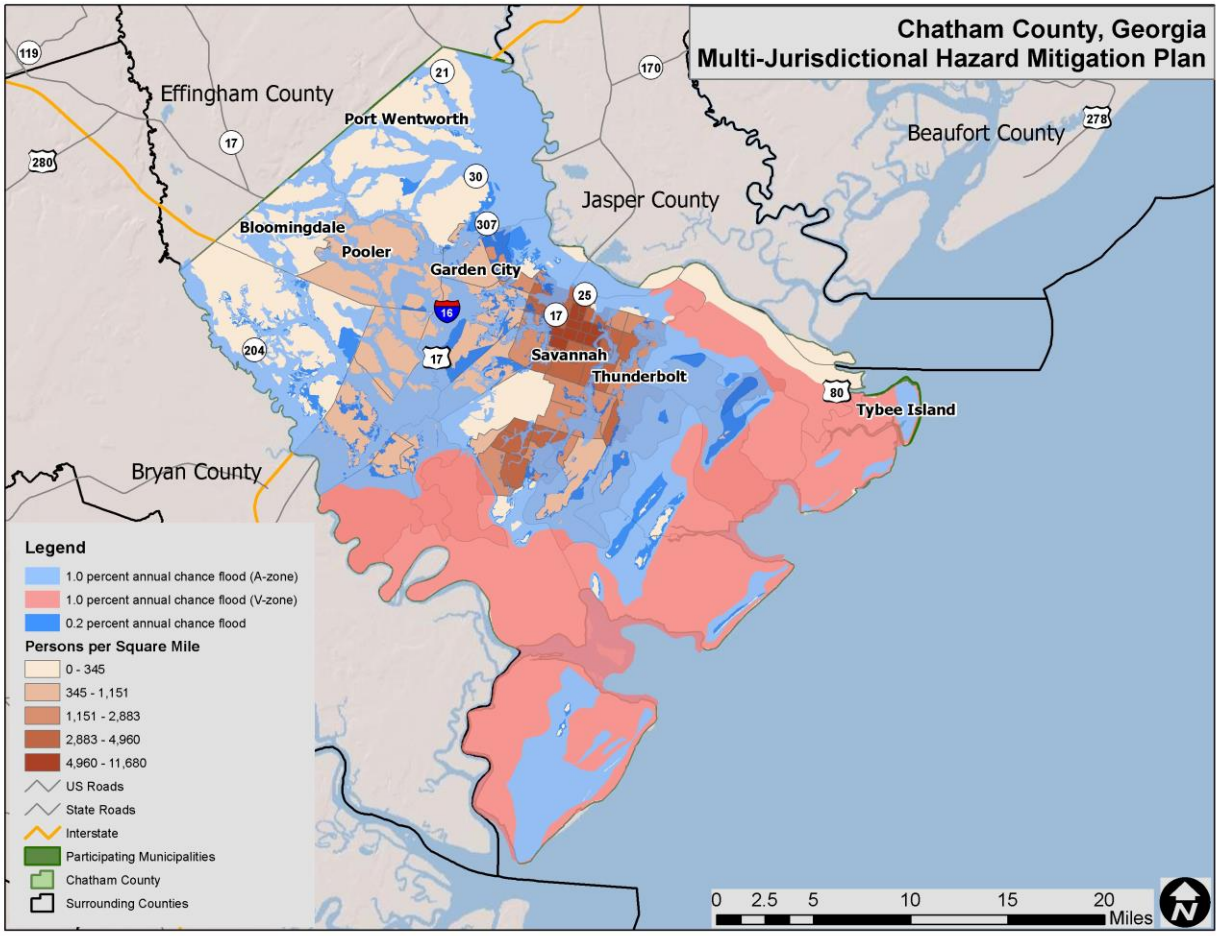
| Location | 0.2-percent ACF | | |
|---|---|---|---|
| | Approx. Number of Parcels | Approx. Number Improved Buildings | Approx. Improved Value of Buildings[40] |
| Bloomingdale | 26 | 3 | $2,141,900 |
| Garden City | 1,681 | 2,810 | $240,736,680 |
| Pooler | 190 | 219 | $41,555,590 |
| Port Wentworth | 775 | 948 | $93,147,814 |
| Savannah | 6,921 | 4,906 | $1,396,128,045 |
| Thunderbolt | 136 | 58 | $25,120,962 |
| Tybee Island | 0 | 0 | $0 |
| Unincorporated Area | 10,622 | 10,458 | $2,945,466,871 |
| **CHATHAM COUNTY TOTAL** | **20,351** | **19,402** | **$4,744,297,862** |

[38] Improved value of buildings is estimated based on the building value associated with parcels that have been identified as being located in the 1.0-percent annual chance floodplain, since building footprints were not associated with dollar value data.
[39] Improved value of buildings is estimated based on the building value associated with parcels that have been identified as being located in the 0.2-percent annual chance floodplain, since building footprints were not associated with dollar value data.
[40] Improved value of buildings is estimated based on the building value associated with parcels that have been identified as being located in the 1.0-percent annual chance floodplain, since building footprints were not associated with dollar value data.

***Social Vulnerability***

U.S. Census 2010 population at the tract level was used for analysis to determine where areas of high population concentration intersect with flood prone areas in the County. **Figure 3.4** is presented to gain a better understanding of at risk population.

**Figure 3.4: Population Density near Floodplains**




*Source: FEMA DFIRM, U.S. Census 2010*

***Critical Facilities***

The critical facility analysis revealed that there are 233 critical facilities located in the 1.0-percent annual chance floodplain A-zone and 8 facilities in the V-zone. There are also 81 critical facilities located in the 0.2-percent annual chance floodplain based on FEMA DFIRM boundaries and GIS analysis. (As previously noted, this analysis does not consider building elevation, which may negate risk.) A list of specific critical facilities and their associated risk can be found in Annex A.

In conclusion, a flood has the potential to impact many existing and future buildings, facilities, and populations in Chatham County, though some areas are at a higher risk than others. All types of structures in a floodplain are at-risk, though elevated structures will have a reduced risk.

As noted, the floodplains used in this analysis include the 100-year (A-zone), 100-year (V-zone), and 500-year FEMA regulated floodplain boundaries. It is certainly possible that more severe events could occur beyond these boundaries or urban (flash) flooding could impact additional structures. Such site-specific vulnerability determinations are outside the scope of this assessment but will be considered during future plan updates. Furthermore, areas subject to repetitive flooding should be analyzed for potential mitigation actions.

## E. Hazardous Materials Incident

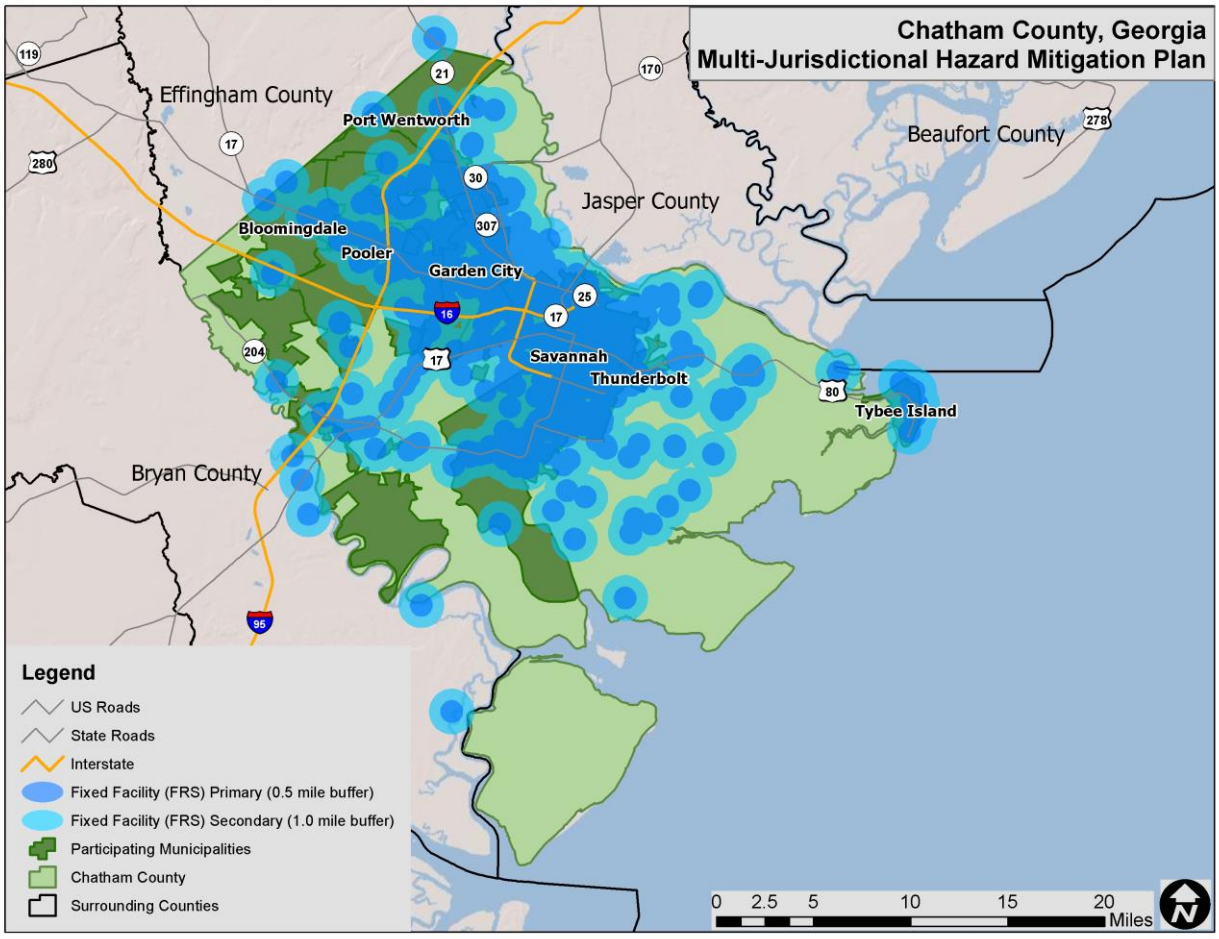
Historical evidence and existing Facility Registry Services sites indicate that Chatham County is susceptible to hazardous materials events, with several reports of damage via a number of different modes of transportation. However, it is difficult to calculate a reliable annualized loss figure based on these historical events. It is assumed that while one major event could result in significant losses, annualizing structural losses over a long period of time would most likely yield a negligible annualized loss estimate for Chatham County.

Although, most hazardous materials incidents that occur are contained and suppressed before destroying any property or threatening lives, they can have a significant negative impact. Such events can cause multiple deaths, completely shut down facilities for 30 days or more, and cause more than 50 percent of affected properties to be destroyed or suffer major damage. In a hazardous materials incident, solid, liquid, and/or gaseous contaminants may be released from fixed or mobile containers. Weather conditions will directly affect how the hazard develops. Certain chemicals may travel through the air or water, affecting a much larger area than the point of the incidence itself. Non-compliance with fire and building codes, as well as failure to maintain existing fire and containment features, can substantially increase the damage from a hazardous materials release. The duration of a hazardous materials incident can range from hours to days. Warning time is minimal to none.

In order to conduct the vulnerability assessment for this hazard, GIS intersection analysis was used for fixed and mobile areas and building footprints/parcels.[41] In both scenarios, two sizes of buffers—0.5-mile and 1.0-mile—were used. These areas are assumed to respect the different levels of effect: immediate (primary) and secondary. Primary and secondary impact sites were selected based on guidance from the PHMSA Emergency Response Guidebook. For the fixed site analysis, geo-referenced FRS listed sites in Chatham County, along with buffers, were used for analysis as shown in **Figure 3.5.** For the mobile analysis, the major roads (Interstate highway, U.S. highway, and State highway) and railroads, where hazardous materials are primarily transported that could adversely impact people and buildings, were used for the GIS buffer analysis. **Figure 3.6** and **Figure 3.7** show the areas used for mobile toxic release buffer analysis. The results indicate the approximate number of parcels/buildings and improved value, as shown in **Table 3.12** (fixed sites), **Table 3.13** (mobile road sites) and **Table 3.14** (mobile railroad sites).[42]

[41] This type of analysis will likely yield inflated results (generally higher than what is actually reported after an actual event).
[42] Note that parcels included in the 1mile analysis are also included in the 0.5-mile analysis.

## Figure 3.5: TRI Sites with Buffers in Chatham County




*Source: Facility Registry Service*

## Table 3.12: Exposure of Improved Property to Hazardous Materials (Fixed Sites)

| Location | 0.5-mile buffer | | | 1.0-mile buffer | | |
|---|---|---|---|---|---|---|
| | Approx. Number of Parcels | Approx. Number Improved | Approx. Improved Value[43] | Approx. Number of Parcels | Approx. Number Improved | Approx. Improved Value[44] |
| Bloomingdale | 766 | 1,519 | $59,337,970 | 1,278 | 2,517 | $89,488,158 |
| Garden City | 3,280 | 6,890 | $458,691,757 | 3,372 | 7,315 | $462,465,557 |
| Pooler | 3,545 | 5,402 | $777,606,547 | 6,292 | 7,723 | $1,248,840,480 |
| Port Wentworth | 1,476 | 2,493 | $200,274,409 | 2,602 | 3,371 | $309,688,889 |
| Savannah | 47,831 | 56,423 | $8,663,314,961 | 52,277 | 60,584 | $9,153,226,673 |
| Thunderbolt | 1,137 | 1,444 | $170,532,083 | 1,191 | 1,528 | $179,438,112 |
| Tybee Island | 3,709 | 2,727 | $653,567,571 | 3,823 | 2,838 | $674,984,771 |

[43] Improved value is estimated based on the building value associated with parcels that have been identified as being located in the 0.5-mile buffer, since building footprints were not associated with dollar value data.
[44] Improved value is estimated based on the building value associated with parcels that have been identified as being located in the 1.0-mile buffer, since building footprints were not associated with dollar value data.

| Location | 0.5-mile buffer | | | 1.0-mile buffer | | |
|---|---|---|---|---|---|---|
| | Approx. Number of Parcels | Approx. Number Improved | Approx. Improved Value[43] | Approx. Number of Parcels | Approx. Number Improved | Approx. Improved Value[44] |
| Unincorporated Area | 18,516 | 22,237 | $4,959,127,045 | 31,460 | 38,068 | $7,094,059,289 |
| **CHATHAM COUNTY TOTAL** | **80,260** | **99,135** | **$15,942,452,343** | **102,295** | **123,944** | **$19,212,191,929** |

**Figure 3.6: Mobile HAZMAT Buffers in Chatham County (Road)**

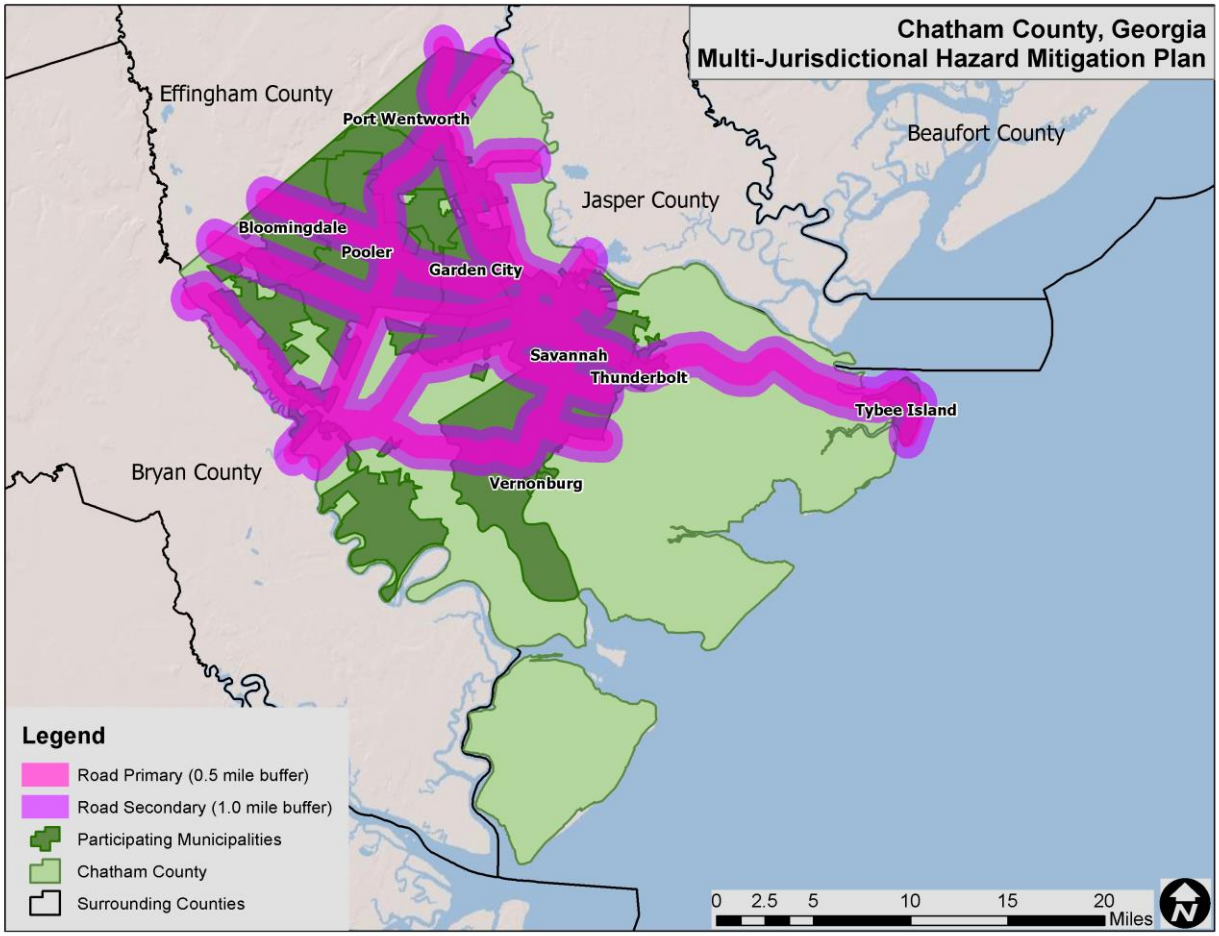


**Figure 3.7: Mobile HAZMAT Buffers in Chatham County (Rail)**

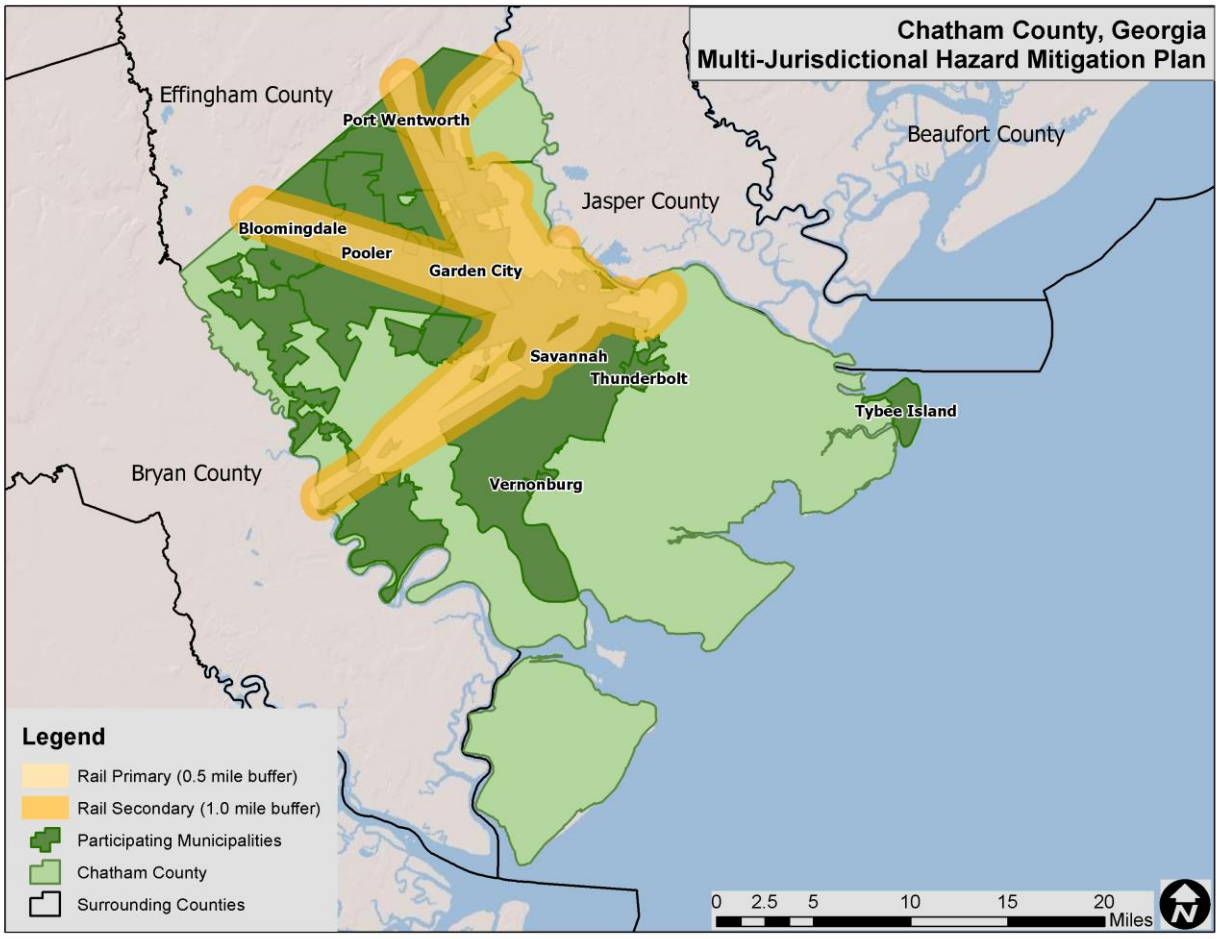



**Table 3.13: Exposure of Improved Property to Hazardous Materials Spill (Mobile Analysis - Road)**

| Location | 0.5-mile buffer | | | 1.0-mile buffer | | |
|---|---|---|---|---|---|---|
| | Approx. Number of Parcels | Approx. Number Improved | Approx. Improved Value[45] | Approx. Number of Parcels | Approx. Number Improved | Approx. Improved Value[46] |
| Bloomingdale | 884 | 1,807 | $66,859,654 | 1,299 | 2,617 | $92,790,958 |
| Garden City | 3,052 | 6,044 | $417,076,614 | 3,345 | 7,262 | $459,213,257 |
| Pooler | 3,238 | 3,953 | $689,940,809 | 5,740 | 7,126 | $1,186,037,062 |
| Port Wentworth | 2,658 | 3,088 | $300,395,096 | 3,406 | 3,534 | $368,286,839 |
| Savannah | 33,429 | 37,377 | $6,948,721,018 | 47,277 | 54,532 | $8,554,848,615 |
| Thunderbolt | 884 | 1,178 | $136,951,080 | 1,191 | 1,528 | $179,438,112 |
| Tybee Island | 3,780 | 2,795 | $659,490,171 | 3,860 | 2,855 | $675,239,671 |

[45] Improved value is estimated based on the building value associated with parcels that have been identified as being located in the 0.5-mile buffer, since building footprints were not associated with dollar value data.
[46] Improved value is estimated based on the building value associated with parcels that have been identified as being located in the 1.0-mile buffer, since building footprints were not associated with dollar value data.

| Location | 0.5-mile buffer | | | 1.0-mile buffer | | |
|---|---|---|---|---|---|---|
| | Approx. Number of Parcels | Approx. Number Improved | Approx. Improved Value[45] | Approx. Number of Parcels | Approx. Number Improved | Approx. Improved Value[46] |
| Unincorporated Area | 11,922 | 14,127 | $2,811,297,610 | 20,454 | 24,963 | $4,491,268,716 |
| **CHATHAM COUNTY TOTAL** | **59,847** | **70,369** | **$12,030,732,052** | **86,572** | **104,417** | **$16,007,123,230** |

**Table 3.14: Exposure of Improved Property to Hazardous Materials Spill (Mobile Analysis - Railroad)**

| Location | 0.5-mile buffer | | | 1.0-mile buffer | | |
|---|---|---|---|---|---|---|
| | Approx. Number of Parcels | Approx. Number Improved | Approx. Improved Value[47] | Approx. Number of Parcels | Approx. Number Improved | Approx. Improved Value[48] |
| Bloomingdale | 1,031 | 1,958 | $71,429,290 | 1,165 | 2,320 | $85,846,228 |
| Garden City | 2,884 | 5,351 | $412,608,132 | 2,999 | 5,861 | $424,762,847 |
| Pooler | 2,260 | 4,061 | $356,678,533 | 3,296 | 4,990 | $529,654,026 |
| Port Wentworth | 1,920 | 2,702 | $218,191,120 | 3,420 | 3,572 | $336,260,306 |
| Savannah | 20,140 | 20,206 | $4,196,147,111 | 28,477 | 31,147 | $5,163,571,214 |
| Thunderbolt | 0 | 0 | $0 | 0 | 0 | $0 |
| Tybee Island | 0 | 0 | $0 | 0 | 0 | $0 |
| Unincorporated Area | 3,881 | 5,634 | $1,783,421,277 | 6,629 | 9,389 | $2,349,327,715 |
| **CHATHAM COUNTY TOTAL** | **32,116** | **39,912** | **$7,038,475,463** | **45,986** | **57,279** | **$8,889,422,336** |

***Social Vulnerability***

Given high susceptibility across Chatham County, it is assumed that the total population is at risk to hazardous materials incidents. It should be noted that areas of population concentration, such as incorporated areas in the County, may be at an elevated risk due to a greater burden to evacuate population quickly.

***Critical Facilities***

*Fixed Site Analysis:*

The critical facility analysis for fixed TRI sites revealed that there are 695 facilities located in a HAZMAT risk zone. The primary impact zone includes nine facilities: 8 communications/power, 69 cultural, 37 fire stations, 1 EOC, 68 government, 4 hazardous materials, 3 hospitals, 20 police stations, 53 schools, 9 transportation, 9 vulnerable populations, 309 water, and 2 others. The remaining facilities are in the secondary, 1.0-mile zone. A list of specific critical facilities and their associated risk can be found in Annex A.

*Mobile Analysis:*

The critical facility analysis for road and railroad transportation corridors revealed that there are 600 critical facilities located in the primary and secondary mobile HAZMAT buffer areas for roads and 457 critical facilities located in the railroad HAZMAT buffer areas. The 1.0-mile road

[47] Improved value is estimated based on the building value associated with parcels that have been identified as being located in the 0.5-mile buffer, since building footprints were not associated with dollar value data.
[48] Improved value is estimated based on the building value associated with parcels that have been identified as being located in the 1.0-mile buffer, since building footprints were not associated with dollar value data.

buffer area (worst case scenario modeled) includes the following critical facilities: 6 communications/power, 54 cultural, 28 fire stations, 55 government, 2 hazardous materials, 2 hospitals, 17 police stations, 38 schools, 16 transportation, 8 vulnerable populations, 230 water, and 1 other. The railroad buffer areas include the following: 3 communications/power, 46 cultural, 16 fire stations, 51 government, 3 hazardous materials, 9 police stations, 24 schools, 11 transportation, 3 vulnerable populations, and 146 water. It should be noted that many of the facilities located in the buffer areas for railroad are also located in the buffer areas for road and/or the fixed site analysis. A list of specific critical facilities and their associated risk can be found in Annex A.

In conclusion, a hazardous material incident has the potential to impact many existing and future buildings, critical facilities, and populations in Chatham County. Those areas in a primary buffer are at the highest risk, though all areas carry some vulnerability due to variations in conditions that could alter the impact area such direction and speed of wind, volume of release, etc.

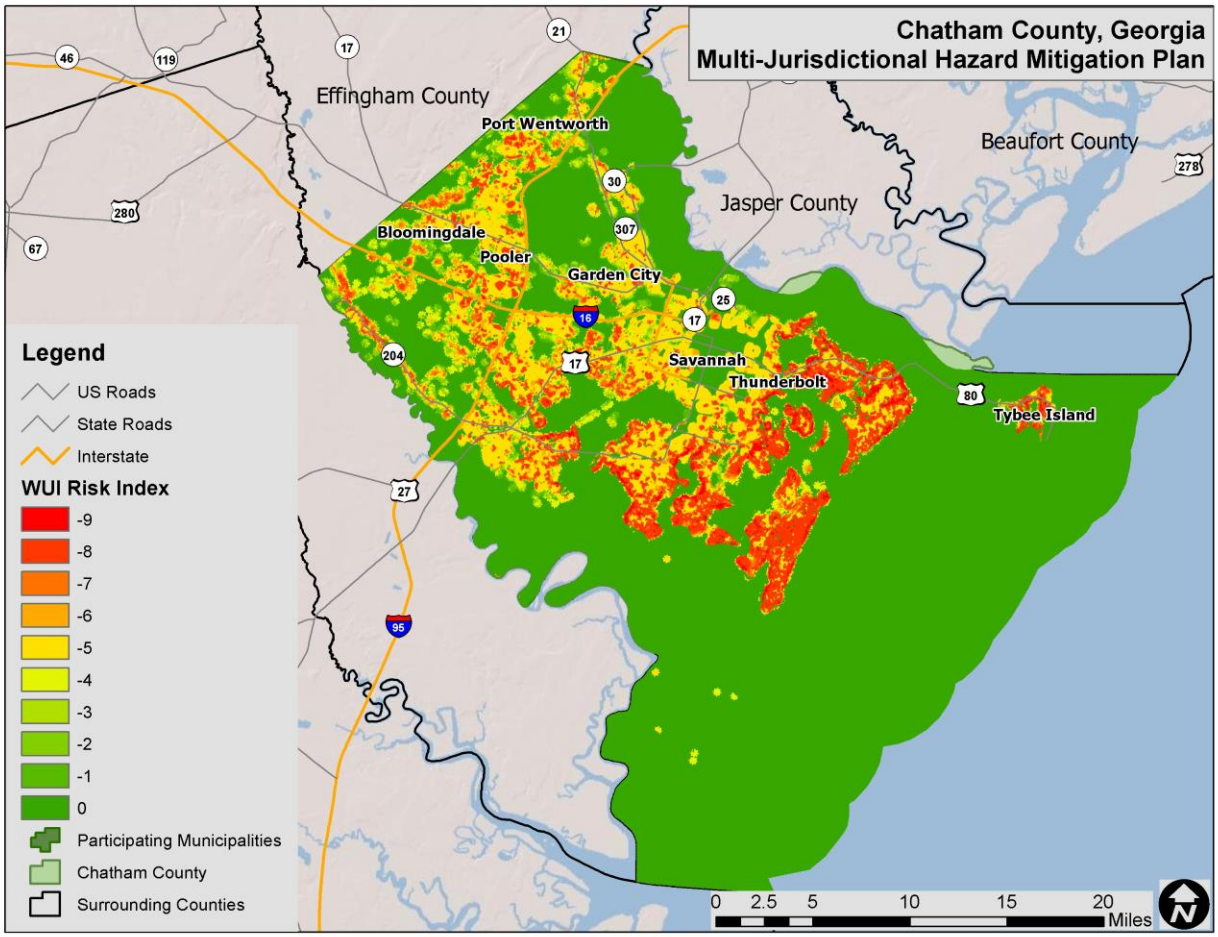
## F. Wildfire

Although historical evidence indicates that Chatham County has some risk to wildfire events, there are few reports of major damage from any one fire. Annualized loss is considered small, though it should be noted that a single event could result in significant damages throughout the County.

To estimate exposure to wildfire, the approximate number of building and parcels and their associated improved value was determined using GIS analysis. For the critical facility analysis, areas of concern were intersected with critical facility locations. **Figure 3.8** shows the Wildland Urban Interface Risk Index (WUIRI) data which is a data layer that shows a rating of the potential impact of a wildfire on people and their homes. The key input, WUI, reflects housing density (houses per acre) consistent with Federal Register National standards. The location of people living in the Wildland Urban Interface and rural areas is key information for defining potential wildfire impacts to people and homes. Initially provided as raster data, it was converted to a polygon to allow for analysis. The Wildland Urban Interface Risk Index data ranges from 0 to -9 with lower values being most severe (as noted previously, this is only a measure of relative risk). **Figure 3.9** shows the areas of analysis where any grid cell is less than -5. Areas with a value below -5 were chosen to be displayed as areas of risk because this showed the upper echelon of the scale and the areas at highest risk.

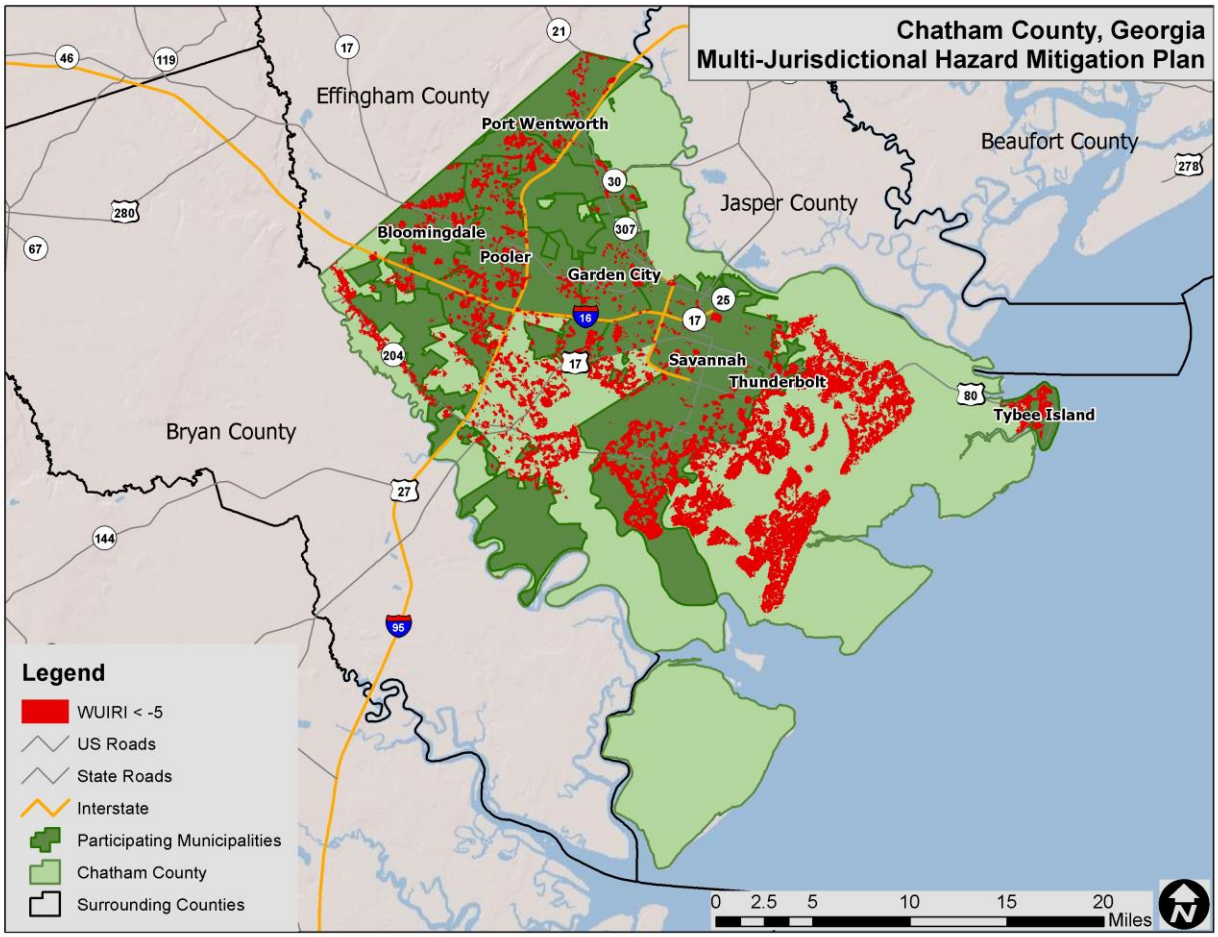
**Table 3.15** shows the results of the analysis.

**Figure 3.8: Wildfire Risk Areas in Chatham County**




*Source: Southern Wildfire Risk Assessment Data*

**Figure 3.9: Wildfire Risk Areas in Chatham County**




*Source: Southern Wildfire Risk Assessment Data*

**Table 3.15: Exposure of Improved Property to Wildfire Areas of Concern**

| | HIGH WILDFIRE RISK AREA | | |
|---|---|---|---|
| **Location** | **Approx. Number of Parcels** | **Approx. Number of Buildings** | **Approx. Improved Value** |
| Bloomingdale | 691 | 1,021 | $50,854,774 |
| Garden City | 1,010 | 1,838 | $169,710,210 |
| Pooler | 3,221 | 2,632 | $670,743,721 |
| Port Wentworth | 1,522 | 831 | $177,255,740 |
| Savannah | 10,848 | 9,654 | $2,380,501,826 |
| Thunderbolt | 558 | 549 | $91,823,290 |
| Tybee Island | 1,182 | 933 | $156,355,497 |
| Unincorporated Area | 25,257 | 25,359 | $5,660,952,300 |
| **CHATHAM COUNTY TOTAL** | **44,289** | **42,817** | **$9,358,197,358** |

***Social Vulnerability***

Although it is assumed that the total population is at some risk to the wildfire hazard, areas located near the Wildland Urban Interface are at elevated risk. Areas to the southeast of Savannah and near Tybee Island are at the highest risk of impact due to their location on the cusp of the urban-rural boundary.

***Critical Facilities***

The critical facility analysis revealed that there are 171 critical facilities located in the WUI Risk Index area for wildfire in Chatham County: 3 communications/power, 16 cultural, 15 fire stations, 4 government, 1 hazardous materials site, 7 police stations, 8 schools, 2 transportation assets, 1 facility for vulnerable populations, and 114 water facilities. A list of specific critical facilities and their associated risk can be found in Annex A.

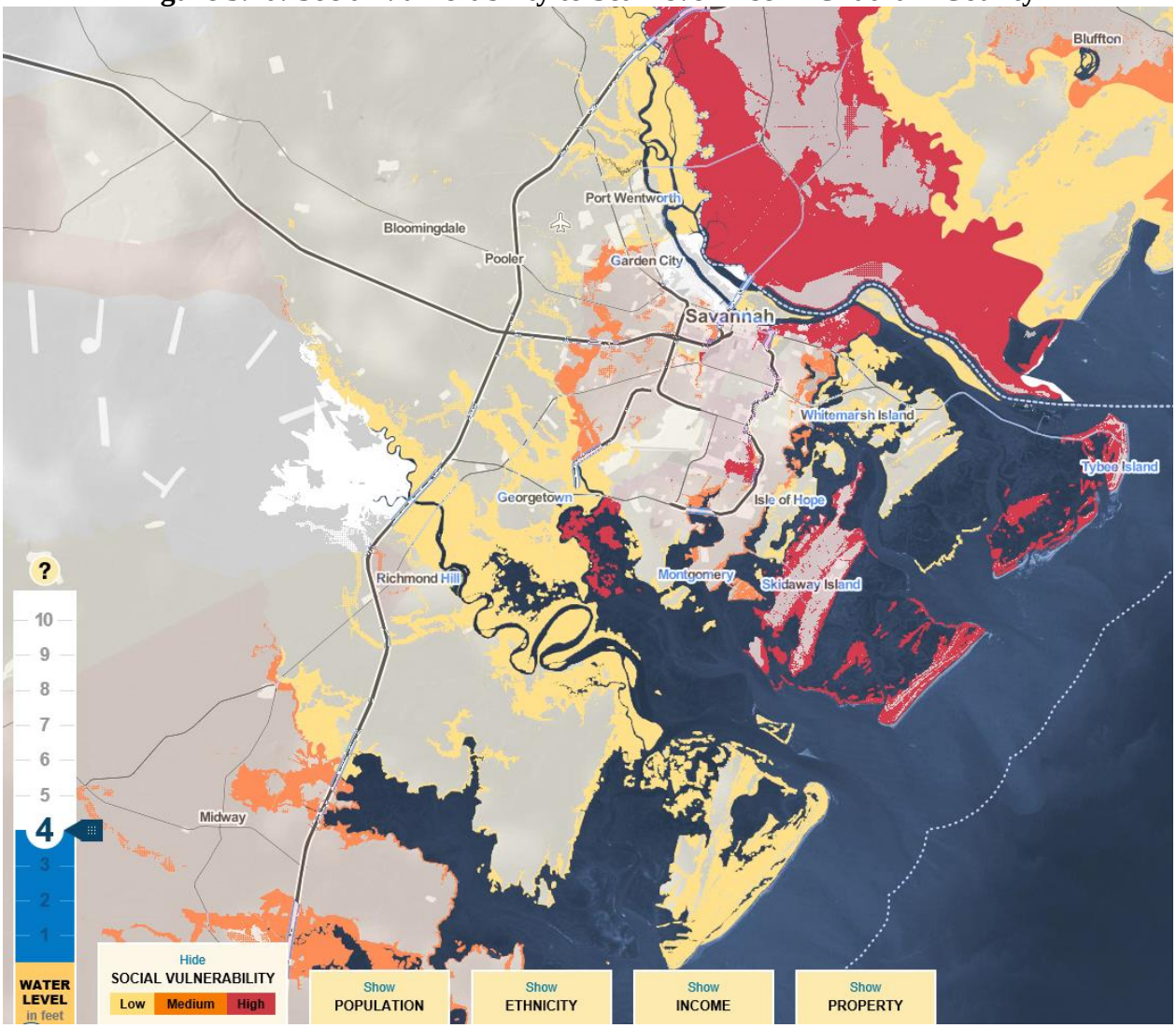
In conclusion, a wildfire event has the potential to impact a number of existing and future buildings, critical facilities, and populations in Chatham County.

## G. Sea Level Rise

Although there is no historical evidence on which to base future estimates of damage from sea level rise in Chatham County, it is clear that the County as has some significant risk to sea level rise as evidenced by the fact that the average rate of sea level rise has accelerated from just 1.7mm to 3.0mm per year since 1993 according to some estimates. In some areas of the County, loss estimates from future sea level rise are in the hundreds of millions of dollars.

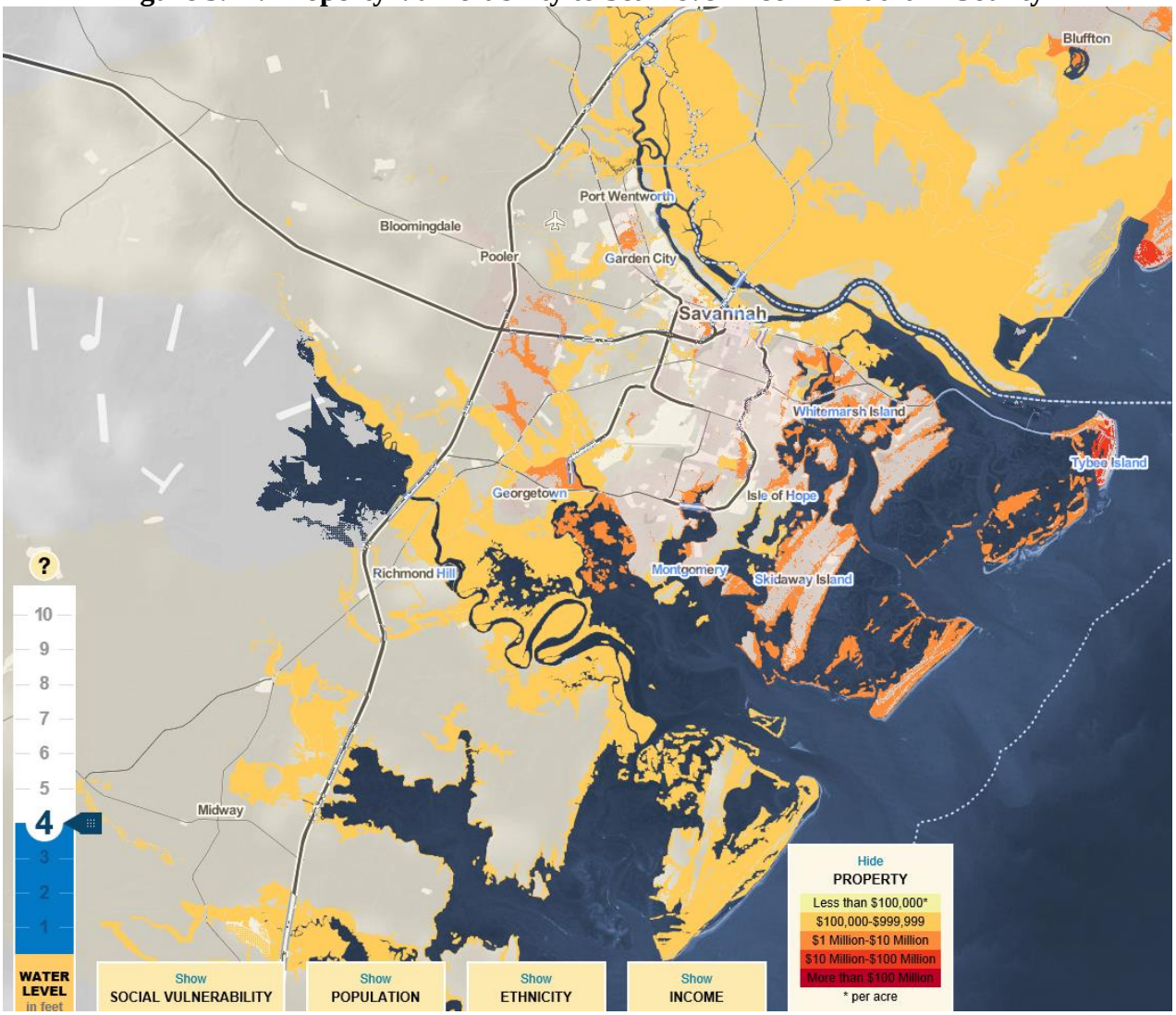
To estimate property that will potentially be exposed to sea level rise impacts, Climate Central's online forecast tool was utilized. This tool provides projections for different sea level rise scenarios and estimates exposure of population density, social vulnerability, and property values. For this plan, a sea level rise scenario that estimates 4 feet of rise in the Mean Higher High Water level was utilized as a relatively standard value that has been projected in many analyses. In this scenario, around $2.5 million worth of property would be exposed to sea level rise with over 17,000 people at risk. **Figure 3.10** and **Figure 3.11** show the Social Vulnerability Exposure and Property Value Exposure, respectively. This data indicates that a great deal of property is at risk to impacts from sea level rise and that significant action should be taken to reduce overall risk to this hazard.

**Figure 3.10: Social Vulnerability to Sea Level Rise in Chatham County**




*Source: Climate Central*

**Figure 3.11: Property Vulnerability to Sea Level Rise in Chatham County**




*Source: Climate Central*

***Social Vulnerability***

Although it is assumed that the total population would be impacted in some way by sea level rise, areas most directly impacted are likely to be along the coast in municipalities such as Tybee Island. According to an estimate by Climate Central, 4 feet of rise would result in more than 17,000 people exposed to the hazard and 7 feet in rise would result in more than 44,000 people exposed.

***Critical Facilities***

The critical facility analysis revealed that there are at least 200 critical facilities that would be impacted by sea level rise in Chatham County and it should be noted that many more could potentially be impacted based on the amount of sea level rise that takes place. It should also be noted that rising sea levels can have the effect of exacerbating the impacts caused by hazards

such as sea level rise and flooding, and these impacts are not accounted for in this analysis. A list of specific critical facilities and their associated risk can be found in Annex A.

In conclusion, sea level rise has the potential to impact a large number of existing and future buildings, critical facilities, and populations in Chatham County.

## VI. Conclusions on Hazard Vulnerability

The results of this vulnerability assessment are useful in at least three ways:

- Improving our understanding of the risk associated with the natural hazards in Chatham County through better understanding of the complexities and dynamics of risk, how levels of risk can be measured and compared, and the myriad of factors that influence risk. An understanding of these relationships is critical in making balanced and informed decisions on managing the risk.
- Providing a baseline for policy development and comparison of mitigation alternatives. The data used for this analysis presents a current picture of risk in Chatham County. Updating this risk "snapshot" with future data will enable comparison of the changes in risk with time. Baselines of this type can support the objective analysis of policy and program options for risk reduction in the region.
- Comparing the risk among the natural hazards addressed. The ability to quantify the risk to all these hazards relative to one another helps in a balanced, multi-hazard approach to risk management at each level of governing authority. This ranking provides a systematic framework to compare and prioritize the very disparate natural hazards that are present in Chatham County. This final step in the risk assessment provides the necessary information for local officials to craft a mitigation strategy to focus resources on only those hazards that pose the most threat to Chatham County and its municipalities.

Exposure to hazards can be an indicator of vulnerability. Economic exposure can be identified through locally assessed values for improvements (buildings), and social exposure can be identified by estimating the population exposed to each hazard. This information is especially important for decision-makers to use in planning for evacuation or other public safety related needs.

The types of assets included in these analyses include all building types in the participating jurisdictions. Specific information about the types of assets that are vulnerable to the identified hazards is included in each hazard subsection (for example all building types are considered at risk to the winter storm hazard and commercial, residential, and government owned facilities are at risk to repetitive flooding, etc.).

**Table 3.16** presents a summary of annualized loss for each hazard in Chatham County. Due to the reporting of hazard damages primarily at the county level, it was difficult to determine an accurate annualized loss estimate for each municipality. Therefore, an annualized loss was determined through the damage reported through historical occurrences at the county level.

These values should be used as an additional planning tool or measure risk for determining hazard mitigation strategies throughout the County.

**Table 3.16: Annualized Loss For Chatham County***

| Event | Chatham County |
|---|---|
| **Atmospheric Hazards** | |
| **Drought** | No Data |
| **Extreme Heat** | No Data |
| **Hailstorm** | $14,608 |
| **Hurricane & Tropical Storm** | $26,299,000 |
| **Lightning** | $148,225 |
| **Severe Thunderstorm / High Wind** | $111,860 |
| **Tornado** | $277,933 |
| **Winter Storm & Freeze** | $90,223 |
| **Geologic Hazards** | |
| **Earthquake** | $160,000 |
| **Hydrologic Hazards** | |
| **Dam Failure** | No Data |
| **Erosion** | No Data |
| **Flood** | $665,633 |
| **Storm Surge** | >$1,000,000 |
| **Sea Level Rise** | >$1,000,000 |
| **Other Hazards** | |
| **HAZMAT Incident (Fixed and Mobile)** | $898 |
| **Terror Threat** | No Data |
| **Wildfire** | $37,500 |

*In this table, the term "No Data" is used to indicate that no records for the particular hazard were recorded. This could be the case either because there were no events that caused dollar damage or because documentation of structural damage caused by that particular type of event is not well-kept.

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# CHAPTER 4 – OVERALL COMMUNITY MITIGATION GOALS AND MITIGATION ACTIONS

Chapter 4 addresses the most important portion of the Pre-Disaster Hazard Mitigation Plan which is the mitigation strategy for the County. This chapter contains natural and technological hazard mitigation goals and action items for Chatham County. The sections are as follows:

I. Mitigation Goals
II. Identification and Analysis of Mitigation Techniques
III. Mitigation Action Plan

**Table 4.1** provides a brief description of each section in this chapter and a summary of the changes that have been made from the 2010 Chatham County Hazard Mitigation Plan. Chapter 4 of the 2015 plan combines the previous Chapters 4 and 5 of the 2010 plan and was restructured so that it is no longer divided by hazard.

**Table 4.1: Overview of updates to Chapter 4: Overall Community Mitigation Goals and Mitigation Actions**

| Chapter 4 Section | Updates to Section |
|---|---|
| I. Mitigation Goals | This is a new section that presents the 4 overall goals that were developed for the 2015 plan to combine and streamline the previous 30 hazard-specific goals included in the 2010 plan. |
| II. Identification and Analysis of Mitigation Techniques | This is a new section that identifies the 6 broad categories of hazard mitigation techniques as well as specific examples of actions that were discussed and considered during plan development. |
| III. Mitigation Action Plan | This is a new section that presents the action plan for each jurisdiction that were designed to achieve the established mitigation goals. |

**Goals** are general guidelines that explain what the County wants to achieve. Goals are expressed as broad policy statements representing desired long-term results.

**Mitigation Actions** are the specific steps (projects, policies, and programs) that advance a given objective. They are highly focused, specific and measurable.

The intent of the Mitigation Strategy is to provide the communities in Chatham County with the goals that will serve as guiding principles for future mitigation policy and project administration, along with an analysis of mitigation techniques available to meet those goals and reduce the impact of identified hazards. It is designed to be comprehensive, strategic, and functional in nature:

- In being *comprehensive*, the development of the strategy includes a thorough review of all hazards and identifies extensive mitigation measures intended to not only reduce the future impacts of high risk hazards, but also to help the region achieve compatible economic, environmental, and social goals.
- In being *strategic*, the development of the strategy ensures that all policies and projects proposed for implementation are consistent with pre-identified, long-term planning goals.
- In being *functional*, each proposed mitigation action is linked to established priorities and assigned to specific departments or individuals responsible for their implementation with target completion deadlines. When necessary, funding sources are identified that can be used to assist in project implementation.

The first step in designing the Mitigation Strategy includes the identification of mitigation goals. Mitigation goals represent broad statements that are achieved through the implementation of more specific mitigation actions. These actions include both hazard mitigation policies (such as the regulation of land in known hazard areas through a local ordinance) and hazard mitigation projects that seek to address specifically targeted hazard risks (such as the acquisition and relocation of a repetitive loss structure).

The second step involves the identification, consideration, and analysis of available mitigation measures to help achieve the identified mitigation goals. This is a long-term, continuous process sustained through the development and maintenance of this Plan. Alternative mitigation measures will continue to be considered as future mitigation opportunities are identified, as data and technology improve, as mitigation funding becomes available, and as this Plan is maintained over time.

The third and last step in designing the Mitigation Strategy is the selection and prioritization of specific mitigation actions for the jurisdictions. When establishing high, medium and low priorities, STAPLEE criteria were applied during the discussions of individual steps regarding the perceived benefits and the expected costs of each action. The completed STAPLEE worksheets can be found in Annex E. Each mitigation action was ranked using a series of +, - and o designations, with points allotted for each designation.

The County and each participating jurisdiction have its own Mitigation Action Plan (MAP) that reflects the needs and concerns of that jurisdiction. The MAP represents an unambiguous and functional plan for action and is considered to be the most essential outcome of the mitigation planning process.

In preparing each Mitigation Action Plan for the Chatham County Pre-Disaster Hazard Mitigation Plan, officials considered the overall hazard risk and capability to mitigate the effects of hazards as recorded through the risk and capability assessment process, in addition to meeting the adopted mitigation goals and unique needs of the community.

The goals and objectives for this plan reflect Chatham County's logical desire to apply mitigation actions to reduce vulnerabilities and losses.

# I. Mitigation Goals

| 44 CFR Requirement |
| --- |
| ***44 CFR Part 201.6(c)(3)(i):*** The mitigation strategy shall include a description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards. |

The primary goal of all local governments is to promote the public health, safety, and welfare of its citizens. In keeping with this standard, Chatham County and the participating municipalities have developed four goal statements for local hazard mitigation planning in the County. In developing these goals, the previous 30 county hazard mitigation goals were reviewed and consolidated to address all of the hazards in four overall goals. In the previous plan, the goals were duplicated and addressed hazards individually and with this plan update the goals of the plan were formulated based on commonalities and condensed to be streamlined.

The proposed County goals were presented, reviewed, evaluated, and edited by the Hazard Mitigation Planning Team at their second meeting. This process of combining goals from the previous plans served to highlight the planning process that had occurred in the previous plan update. Each goal, purposefully broad in nature, serves to establish parameters that were used in developing more mitigation actions. The Chatham County Mitigation Goals are presented in **Table 4.2**. Consistent implementation of actions over time will ensure that community goals are achieved.

**Table 4.2: Chatham County Mitigation Goals**

| |
| --- |
| **Goal 1**: Protect people in Chatham County as well as existing and future structures and resources, particularly critical facilities, from coastal storm, tornadoes, rainwater flooding, storm surge, fire, hazardous materials incidents, terrorism, and transportation incidents' damages. |
| **Goal 2**: Improve education and outreach efforts regarding potential impacts from coastal storms, tornadoes, rainwater flooding, storm surge, fire, hazardous materials incidents, terrorism, and transportation incidents as well as specific mitigation measures that can be undertaken. |
| **Goal 3**: Improve capabilities and coordination to plan and implement hazard mitigation projects, programs and activities related to coastal storms, tornadoes, rainwater flooding, storm surge, fire, hazardous materials incidents, terrorism, and transportation incidents. |
| **Goal 4**: Improve data collection, dissemination, and redundancy use to reduce impacts from coastal storms, tornadoes, rainwater flooding, storm surge, fire, hazardous materials incidents, and transportation incidents. |

# II. Identification and Analysis of Mitigation Techniques

**44 CFR Requirement**

***44 CFR Part 201.6(c)(3)(ii):*** The mitigation strategy shall include a section that identifies and analyzes a comprehensive range of specific mitigation actions and projects being considered to reduce the effect of each hazard, with particular emphasis on new and existing buildings and infrastructure.

In formulating the Mitigation Strategy for Chatham County and the jurisdictions within it, a wide range of activities were considered in order to help achieve the established mitigation goals, in addition to addressing any specific hazard concerns. These activities were discussed during the Hazard Mitigation Planning Team meetings. In general, all activities considered by the HMP can be classified under one of the following six broad categories of mitigation techniques: Prevention, Property Protection, Natural Resource Protection, Structural Projects, Emergency Services, and Public Awareness and Education. These are discussed in detail below.

## A. Prevention

Preventative activities are intended to keep hazard problems from getting worse, and are typically administered through government programs or regulatory actions that influence the way land is developed and buildings are built. They are particularly effective in reducing a community's future vulnerability, especially in areas where development has not occurred or capital improvements have not been substantial. Examples of preventative activities include:

- Planning and zoning
- Building codes
- Open space preservation
- Floodplain regulations
- Stormwater management regulations
- Drainage system maintenance
- Capital improvements programming
- Riverine / fault zone setbacks

## B. Property Protection

Property protection measures involve the modification of existing buildings and structures to help them better withstand the forces of a hazard, or removal of the structures from hazardous locations. Examples include:

- Acquisition
- Relocation
- Building elevation
- Critical facilities protection

- Retrofitting (e.g., windproofing, floodproofing, seismic design techniques, etc.)
- Safe rooms, shutters, shatter-resistant glass
- Insurance

### C. Natural Resource Protection

Natural resource protection activities reduce the impact of natural hazards by preserving or restoring natural areas and their protective functions. Such areas include floodplains, wetlands, steep slopes, and sand dunes. Parks, recreation, or conservation agencies and organizations often implement these protective measures. Examples include:

- Floodplain protection
- Watershed management
- Riparian buffers
- Forest and vegetation management (e.g., fire resistant landscaping, fuel breaks, etc.)
- Erosion and sediment control
- Wetland preservation and restoration
- Habitat preservation
- Slope stabilization

### D. Structural Projects

Structural mitigation projects are intended to lessen the impact of a hazard by modifying the environmental natural progression of the hazard event through construction. They are usually designed by engineers and managed or maintained by public works staff. Examples include:

- Reservoirs
- Dams / levees / dikes / floodwalls
- Diversions / detention / retention
- Channel modification
- Storm sewers

### E. Emergency Services

Although not typically considered a "mitigation" technique, emergency service measures do minimize the impact of a hazard event on people and property. These commonly are actions taken immediately prior to, during, or in response to a hazard event. Examples include:

- Warning systems
- Evacuation planning and management

- Emergency response training and exercises
- Sandbagging for flood protection
- Installing temporary shutters for wind protection

### F. Public Education and Awareness

Public education and awareness activities are used to advise residents, elected officials, business owners, potential property buyers, and visitors about hazards, hazardous areas, and mitigation techniques they can use to protect themselves and their property. Examples of measures to educate and inform the public include:

- Outreach projects
- Speaker series / demonstration events
- Hazard map information
- Real estate disclosure
- Library materials
- School children educational programs
- Hazard expositions

## III. Mitigation Action Plan

The Mitigation Action Plan, or MAP, provides a functional plan of action for each jurisdiction. It is designed to achieve the mitigation goals established by the County and will be maintained on a regular basis according to the plan maintenance procedures described in this plan.

Each proposed mitigation action has been identified as an effective measure (policy or project) to reduce hazard risk for Chatham County and its municipalities. Each action is listed in the MAP in conjunction with background information such as hazard(s) addressed, relative priority, and estimated cost. Other information provided in the MAP includes potential funding sources to implement the action should funding be required (not all proposed actions are contingent upon funding). Most importantly, implementation mechanisms are provided for each action, including the designation of a lead agency or department responsible for carrying the action out as well as a timeframe for its completion. These implementation mechanisms ensure that the Chatham County Pre-Disaster Hazard Mitigation Plan remains a functional document that can be monitored for progress over time. The proposed actions are not listed in priority order, though each has been assigned a priority level of "high," "moderate," or "low" as described above.

The Mitigation Action Plan is organized by mitigation strategy category (Prevention, Property Protection, Natural Resource Protection, Structural Projects, Emergency Services, or Public Education and Awareness). The following are the key elements described in the Mitigation Action Plan:

- Hazard(s) Addressed—Hazard which the action addresses.
- Relative Priority—High, moderate, or low priority as assigned by the jurisdiction.
- Lead Agency/Department—Department responsible for undertaking the action.
- Potential Funding Sources—Local, State, or Federal sources of funds are noted here, where applicable.
- Implementation Schedule—Date by which the action the action should be completed. More information is provided when possible.
- Implementation Status (2014)—Indication of completion, progress, deferment, or no change since the previous plan. If the action is new, that will be noted here.

The mitigation actions proposed by each of the participating jurisdictions are listed in individual MAPs on the following pages. **Table 4.3** shows the number of mitigation actions proposed by each jurisdiction.

**Table 4.3 Current Mitigation Actions per Jurisdiction**

| Jurisdiction | Number of Mitigation Actions |
|---|---|
| Unincorporated Chatham County | 58 |
| City of Bloomingdale | 4 |
| City of Garden City | 8 |
| City of Pooler | 9 |
| City of Port Wentworth | 7 |
| City of Savannah | 61 |
| Town of Thunderbolt | 6 |
| City of Tybee Island | 7 |
| | |
| Total | 160 |

# Chatham County Mitigation Actions

| Action # | Description | Hazard(s) Addressed | Goal Addressed | Relative Priority | Lead Agency/ Department | Potential Funding Sources | Implementation Schedule | Implementation Status (2014) |
|---|---|---|---|---|---|---|---|---|
| **Prevention** | | | | | | | | |
| P-1 | Clear trees surrounding proposed storage shed at Chatham County Mosquito Control. | All | 1 & 3 | Moderate | County Mosquito Control | PDM; HMGP | 2015-2016 | Deferred-This action has been deferred due to lack of funding. |
| P-2 | Harden roof, windows, doors, and walls for new school construction designated as critical workforce shelters and post-disaster recovery locations. | All | 1 | Moderate | CEMA/County Facilities | PDM; HMGP | Deleted | Deleted-This type of hardening can be built into the construction specs when a facility is being built. |
| P-3 | Incorporate resilient design standards and construction methods, including high wind-load rating, in any future new emergency operations center (EOC) construction. | All | 1 | Moderate | CEMA/County Facilities | PDM; HMGP | Deleted | Deleted-This type of hardening can be built into the construction specs when a facility is being built. |
| P-4 | Harden roof, windows, doors and walls for new school construction designated as critical workforce shelters and post-disaster recovery locations. | All | 1 | Moderate | CEMA/County Facilities | PDM; HMGP | Deleted | Deleted-This type of hardening can be built into the construction specs when a facility is being built. |
| P-5 | Relocate fiber cable supporting the County Emergency Operations Center to below ground. | All | 1 | Moderate | CEMA/County Facilities | PDM; HMGP | 2018 | Deferred-This action was deferred due to lack of funding.<br>*The department will seek grant funding. |
| P-6 | Complete a County Engineering and Public Works drainage SOP that includes post-storm recovery information. | Hurricane | 1 | Moderate | County Engineering / Public Works | Local Staff Time | 2015-2016 | Deferred-This action was prioritized lower so it has been delayed but staff will focus on it in the next year.<br>*County Engineering is researching a model ordinance to utilize for SOP. |
| P-7 | Assist nursing homes and assisted living facilities with writing a County Emergency Management approved emergency plan that includes evacuation. | All | 1 | Moderate | CEMA | Local Staff Time | 2016 | Deferred-CEMA is continuing to work with the state on this effort and the state has moved it to a lower priority level. |

| Action # | Description | Hazard(s) Addressed | Goal Addressed | Relative Priority | Lead Agency/ Department | Potential Funding Sources | Implementation Schedule | Implementation Status (2014) |
|---|---|---|---|---|---|---|---|---|
| P-8 | Develop a local directory of cultural and historical critical facilities to include interior and exterior images of structures, grounds, and collections. This will be integrated with state efforts. | All | 1 & 3 | Moderate | CEMA / MPC | Local Funds; PDM | 2018 | Deferred-This action is partially complete and the facilities have been identified. *The next step is to begin obtaining the images of the locations. |
| P-9 | Work with facility managers to develop inventory lists, including cultural and historical facilities. | All | 1 & 4 | Low | CEMA | Local Funds | 2018 | Deferred-CEMA has been able to build inventory lists for some of the County facilities with the managers. *In the next 2 years, CEMA will continue this effort and complete the inventory lists. |
| P-10 | Develop comprehensive database. | All | 4 | Moderate | CEMA | Local Funds | Deleted | Deleted-It was determined this might not be the best use of time because other systems for capturing information are currently in place. |
| P-11 | Prioritize the critical facilities for the purpose of an engineering study. Undertake engineering study to evaluate critical facilities, including cultural and historical facilities, for safe room needs. | All | 1 & 3 | Low | CEMA | HMGP; PDM; Federal Grants | 2018 | Deferred-The engineering study is currently in progress, but additional time will be needed to complete the full evaluation. |
| P-12 | Conduct engineering evaluation of foundation for tech room/surveillance equipment shed at CNT building. | Flood | 1 & 3 | Low | County Facilities | Local Funds | 2015-2018 | Deleted-It was decided that the contents of the tech room would be removed prior to a hurricane to prevent damage rather than conducting a survey. |

| Action # | Description | Hazard(s) Addressed | Goal Addressed | Relative Priority | Lead Agency/ Department | Potential Funding Sources | Implementation Schedule | Implementation Status (2014) |
|---|---|---|---|---|---|---|---|---|
| P-13 | Conduct a study to identify fire vulnerabilities of buildings and their contents. Implement projects identified from the study. Include information in the County outreach mailer to citizens, businesses, industries, educational, historical, and cultural institutions concerning fire protection. | Fire | 1 & 3 | Low | CEMA | Local Funds; HMGP 5% | 2015-2018 | Deferred-Due to the lack of funding, a study has not been conducted. *This updated action is now a combination of 4 actions from the previous hazard mitigation plan. *CEMA will conduct the study when funds are available and identify the necessary projects for implementation along with the appropriate information for the brochures. |
| P-14 | Coordinate with state efforts to inventory or survey prioritized areas to determine if there is a need for additional study or data collection related to wildfire and/or urban-interface fires. Focus of inventory/study will be on identifying areas where there exist vulnerable populations or built environment and/or areas where fuel loads and other conditions suggest potential for wildfire risk. | Fire | 1 & 3 | Moderate | CEMA | Local Staff Time | Completed | Completed-The Georgia Forestry Commission In cooperation with CEMA and the fire departments completed the Community Wildfire Protection Plan in January 2015. |
| P-15 | Coordinate hazardous materials mitigation efforts with appropriate agencies through sharing of information, resources, and regular communications. | HAZMAT | 1 & 3 | High | CEMA | Local Funds; LEPC Grant Funds | 2015-2020 | Completed-This is a continuous effort with the LEPC meetings on a bi-monthly basis. |
| P-16 | Develop comprehensive database of hazmat facilities. | HAZMAT | 1 & 3 | Low | CEMA | Local Funds | Completed | Completed-There is an ESF 10-1 plan with a complete list of facilities with maps. |
| P-17 | Seek available funding to pursue projects at the local level. | All | 1, 2, 3 & 4 | Low | CEMA | Local Staff Time | 2015-2020 | Completed-This is a continuous effort annually. *CEMA is constantly researching additional funding opportunities. |

| Action # | Description | Hazard(s) Addressed | Goal Addressed | Relative Priority | Lead Agency/ Department | Potential Funding Sources | Implementation Schedule | Implementation Status (2014) |
|---|---|---|---|---|---|---|---|---|
| P-18 | Amend County Building Code to require wind protective measures be fully incorporated in all future critical facility constructions. | Hurricane, High Winds, Tornado, Thunderstorm | 1 | Moderate | County Building and Regulatory Safety | Local Staff Time | Completed | Completed-The state adopted a new building code that identified critical facilities and mandated higher resistant construction and operational requirements to survive disasters. *This action has been incorporated into the state mandated code. |
| P-19 | Review building codes for proper wind strength and safety regulations and for consistency with state and federal regulations. | Hurricane, High Winds, Tornado, Thunderstorm | 1 | Moderate | County Building and Regulatory Safety | Local Staff Time | Completed | Completed-The construction codes adopted by the Department of Community Affairs are reviewed and may be amended. The adopted codes become mandatory statewide. The codes are reviewed for consistency with statewide climatic and geographic differences and changes. The review also considers any federal regulations that the state may be obligated to enforce. Since the code adoption process at DCA includes coordination with all governmental agencies, this action is complete. |

| Action # | Description | Hazard(s) Addressed | Goal Addressed | Relative Priority | Lead Agency/ Department | Potential Funding Sources | Implementation Schedule | Implementation Status (2014) |
|---|---|---|---|---|---|---|---|---|
| P-20 | Amend County Building Code to require all mobile home parks to build and maintain tornado Community Safe Shelters capable of accommodating their residents. | Tornado | 1 | Moderate | County Building and Regulatory Safety / MPC | Local Staff Time | Completed | Completed- The building code provides regulations for tornado shelters and safe room's regulations for hurricanes, earthquakes and other climatic conditions for the construction of buildings. *The code addresses hurricane wind design criteria more than tornado wind design criteria due to the science of straight line verses cyclonic winds. The design criteria for hurricanes in this area would produce higher construction requirements than for tornados. Therefore, since buildings designed to meet the code requirements for hurricanes would be stronger that the tornado shelter or safe room, the listed action steps are complete. |

| Action # | Description | Hazard(s) Addressed | Goal Addressed | Relative Priority | Lead Agency/ Department | Potential Funding Sources | Implementation Schedule | Implementation Status (2014) |
|---|---|---|---|---|---|---|---|---|
| P-21 | Amend County Building Code to require all new private construction to include Tornado Safe Rooms capable of accommodating the structure's occupants. | Tornado | 1 | Low | County Building and Regulatory Safety / MPC | Local Staff Time | Completed | Completed- The building code provides regulations for tornado shelters and safe room's regulations for hurricanes, earthquakes and other climatic conditions for the construction of buildings. *The code addresses hurricane wind design criteria more than tornado wind design criteria due to the science of straight line verses cyclonic winds. The design criteria for hurricanes in this area would produce higher construction requirements than for tornados. Therefore, since buildings designed to meet the code requirements for hurricanes would be stronger that the tornado shelter or safe room, the listed action steps are complete. |

| Action # | Description | Hazard(s) Addressed | Goal Addressed | Relative Priority | Lead Agency/ Department | Potential Funding Sources | Implementation Schedule | Implementation Status (2014) |
|---|---|---|---|---|---|---|---|---|
| P-22 | Amend County Building Code to require all new public construction to include tornado Community Safe Shelter facilities capable of accommodating the structure's maximum occupancy; encourage the use of generators. | Tornado | 1 | Low | County Building and Regulatory Safety / MPC | Local Staff Time | Completed | Completed- The building code provides regulations for tornado shelters and safe room's regulations for hurricanes, earthquakes and other climatic conditions for the construction of buildings. *The code addresses hurricane wind design criteria more than tornado wind design criteria due to the science of straight line verses cyclonic winds. The design criteria for hurricanes in this area would produce higher construction requirements than for tornados. Therefore, since buildings designed to meet the code requirements for hurricanes would be stronger that the tornado shelter or safe room, the listed action steps are complete. |
| P-23 | Improve recurring funding for Public Works maintenance and flood management activities. | All | 1 | Moderate | CEMA; County Public Works | Local Staff Time | 2017 | Deferred-This action is not complete because it has only been partially funded. *CEMA is seeking additional funding to complete the flood management activities. |
| P-24 | Provide grants information, planning tools, training, and technical assistance to increase the number of public and private sector hazard mitigation projects. | All | 3 | Moderate | CEMA | HMGP 5%; Local Staff Time | 2016 | Deferred-This action is not complete because it has only been partially funded. *CEMA will continue to provide support and resources to the County on hazard mitigation projects. |

| Action # | Description | Hazard(s) Addressed | Goal Addressed | Relative Priority | Lead Agency/ Department | Potential Funding Sources | Implementation Schedule | Implementation Status (2014) |
|---|---|---|---|---|---|---|---|---|
| P-25 | Create survey/questionnaire for residential rainwater flooding events to lessen the impact. | Flood | 1 & 4 | Low | County Engineering; CEMA; MPC | Local Staff Time; HMGP 5% | 2016 | Deferred- This activity has been completed but requires continuous updating. *This activity is required by FEMA for CRS participation. |
| P-26 | Conduct a study to identify fire vulnerabilities of buildings and their contents. | Fire | 1 & 3 | Moderate | CEMA | Local Funds | 2017 | Deferred-This action has been deferred due to the lack of funding. |
| P-27 | Research alternate routes for hazardous materials transport and ways to prevent traffic disruption on Bay Street. | HAZMAT | 1 & 3 | Moderate | CEMA | Local Funds | 2016 | Completed-This action has been completed and routes are identified in the County Hazardous Materials Plan |
| **Property Protection** | | | | | | | | |
| PP-1 | Harden roof, windows, doors, and rooftop mechanical units at County critical facilities and critical workforce shelters. | All | 1 | Moderate | CEMA | PDM; HMGP | 2017 | Deferred-The County will continue to seek funding to support hardening efforts at the critical facilities and workforce shelters that have been identified. |
| PP-2 | Harden doors, windows, skylight, storage buildings and hangers at Chatham County Mosquito Control. | All | 1 | High | County Mosquito Control | PDM; HMGP | 2017 | Deferred-The doors and windows on the facility have been completed but the other components still need to be hardened and the department plans to apply for additional federal funding to do so. |
| PP-3 | Harden planned storage shed at Chatham County Mosquito Control Building. | All | 1 | High | County Mosquito Control | PDM; HMGP; Federal Grants | Deleted | Deleted-The facility has not been built and the hardening components can be built in the construction specs. |
| PP-4 | Anchor membrane roof with mechanical fastening system in order to compartmentalize roof at Chatham County Mosquito Control Building. | All | 1 | Low | County Mosquito Control | PDM; HMGP; Federal Grants | 2017 | Deferred-This is an alternate facility for department sites. The Department will continue to seek funding to provide this anchoring system. |

| Action # | Description | Hazard(s) Addressed | Goal Addressed | Relative Priority | Lead Agency/ Department | Potential Funding Sources | Implementation Schedule | Implementation Status (2014) |
|---|---|---|---|---|---|---|---|---|
| PP-5 | Anchor HVAC units on roof at Montgomery Street Courthouse. | All | 1 | Moderate | County Facilities | PDM; HMGP; Federal Grants; CIP | 2016-2017 | Deferred-Currently, the roof on the Courthouse needs to be replaced so the anchoring has been delayed until the funding is available for the roof replacement. |
| PP-6 | Replace windows and install hurricane shutters on the windows on Montgomery Street Courthouse. | All | 1 | Moderate | County Facilities/CEMA | PDM; HMGP; Federal Grants; Local Funds | 2017-2018 | Deferred-The facilities department is seeking funding to provide hardening updates to the only courthouse in the County. *The windows are slated to have window film on ¼ inch tempered glass. |
| PP-7 | Replace and/or harden the windows at the CNT building. | All | 1 | Moderate | County Facilities | PDM; HMGP; Federal Grants | Completed | Completed-Film has been placed on the windows during a renovation to withstand high impacts winds. |
| PP-8 | Brace or remove awning at the CNT building. | All | 1 | Moderate | County Facilities | PDM; HMGP; Federal Grants | Deleted | Deleted-The awning does not pose a safety threat and does not need to be removed. |
| PP-9 | Increase wind load of the roof on the CNT building. | All | 1 | Moderate | County Facilities | PDM; HMGP; Federal Grants | Completed | Completed-The roof was replaced 10 years ago with a wind retrofit. The wind load was rated for a Category 2 during construction. |
| PP-10 | Harden doors and strengthen load path in tech room/surveillance equipment shed, including replacing bay doors with hurricane resistant doors, at CNT building. | All | 1 | Moderate | County Facilities | PDM; HMGP; Federal Grants | Deleted | Deleted-No action is needed because the equipment and staff will be relocated prior to an event. |
| PP-11 | Provide window protection and replace doors at Citizens Service Center with hurricane rated doors. | All | 1 | Moderate | County Facilities | PDM; HMGP | Deleted | Deleted-The facility windows and doors have been rated for a Category 2 hurricane. |

| Action # | Description | Hazard(s) Addressed | Goal Addressed | Relative Priority | Lead Agency/ Department | Potential Funding Sources | Implementation Schedule | Implementation Status (2014) |
|---|---|---|---|---|---|---|---|---|
| PP-12 | Construct housing to provide wind and debris protection for fuel pumps at Chatham County Mosquito Control Building. | All | 1 & 3 | Moderate | County Facilities | PDM; HMGP | 2015-2016 | Deferred-The County is researching designs and funding options for this project |
| PP-13 | Cut back trees behind building at CNT facility. | All | 1 | Low | County Facilities | PDM; HMGP | 2015-2020 | Deferred-The County is unable to complete this task internally and will need to outsource this action and has been unable to do so because of funding and low priority. |
| PP-14 | Work with utility departments and companies to inspect and remove trees that, if damaged, would threaten utility infrastructure and critical facilities. | High Winds, Hurricane, Tornado, Thunderstorm | 1 | Low | County Engineering; Public Works; CEMA | Local Staff Time | 2015-2016 | Deferred-CEMA is continuing to build relationships in order to foster the management of potential threats from existing trees.<br>* A County-wide tree survey exist for the most part. It would require updating to include this component.<br>* County Arborists with assistance from local utility companies would make assessments. |
| PP-15 | Retrofit difficult to evacuate critical facilities, such as schools or nursing homes, to include Tornado Safe Shelter areas capable of accommodating the structures' occupants. | High Winds, Hurricane, Tornado, Thunderstorm | 1 | Moderate | CEMA | PDM; HMGP | Deleted | Deleted-Funding has been unavailable to complete this endeavor for so many facilities. |
| PP-16 | Harden/upgrade roof at prison to withstand higher wind speeds and protect backup generators. | High Winds, Hurricane, Tornado | 1 | Moderate | County Sheriff's Department | PDM; HMGP | 2017 | Deferred-The Sheriff's Department is currently in negotiations with the selected architects to perform this project. |
| PP-17 | Remove discontinued equipment on the ground at the Citizens Service Center. | All | 1 | Moderate | County Facilities | Local Staff Time | Completed | Completed-No equipment is no longer being utilized that needs to be removed. |

| Action # | Description | Hazard(s) Addressed | Goal Addressed | Relative Priority | Lead Agency/ Department | Potential Funding Sources | Implementation Schedule | Implementation Status (2014) |
|---|---|---|---|---|---|---|---|---|
| PP-18 | Conduct safe rooms for public usage. | Tornado | 1 | Moderate | CEMA | PDM; HMGP; Federal Grants | 2018 | Deferred-Due to the lack of funding, the County has been unable to accomplish this goal. *CEMA will seek federal funding to complete this action by 2018. |
| PP-19 | Construct safe rooms as recommended by the engineering study on critical facilities. | All | 1 | Moderate | CEMA | PDM; HMGP; Federal Grants | 2018-2020 | Deferred-The engineering study with the needed recommendations has not been completed. *The engineering study is slated to be completed in 2018 and the determinations will be made. |
| PP-20 | Elevate lift stations above the base flood elevation (BFE) including electrical components. | Flood | 1 & 3 | Moderate | Public Works; County Parks | HMP; PDM; FMA | 2018 | Deferred-Due to lack of funding this action has been deferred. *As funding becomes available, Public Works will begin the process of elevating each station. |
| PP-21 | Relocate critical facilities from flood areas. | Flood | 1 & 3 | Low | CEMA; County Engineering | HMP; PDM; FMA | Deleted | Deleted-Due to the regulations in the County Floodplain Ordinance it is not feasible for this to occur based on the geographic location and tax base of the County. |
| PP-22 | Eliminate door leak from gutter at Citizens Service Center. | Flood | 1 & 3 | Moderate | County Facilities | Local Funds | Completed | Completed-This issue has been repaired and the leak has been alleviated. |
| PP-23 | Protect elevator shafts in the Montgomery Street Courthouse from water intrusion. | Flood | 1 | Moderate | County Facilities | HMGP; PDM | Deleted | Deleted-This is not an issue for the elevators in the Courthouse and the action will be deleted. |

| Action # | Description | Hazard(s) Addressed | Goal Addressed | Relative Priority | Lead Agency/ Department | Potential Funding Sources | Implementation Schedule | Implementation Status (2014) |
|---|---|---|---|---|---|---|---|---|
| PP-24 | Utilize vehicle barriers at the judicial courthouse. | Terrorism | 1 | Low | County Facilities | DHS; Local Funds | 2017 | Deferred-This action was deferred due to the lack of funding. *As funding becomes available locally or through DHS, County Facilities will purchase the system. |
| PP-25 | Install hurricane shutters for the County Human Resources Building at 123 Abercorn Street. | Hurricane, High Winds, Thunderstorm, Tornado | 1 | Moderate | County Facilities / County HR | Local Funds | 2016 | New *This facility has been newly remodeled and this will prevent it from incurring any damages. |
| PP-26 | Reinforce cooling tower and roof on the Old County Courthouse located at 124 Bull Street. | Hurricane, High Winds, Thunderstorm, Tornado | 1 | Moderate | County Facilities | Local Funds | 2018 | New *Essential County services are located in this building. |
| PP-27 | Anchor and harden membrane roof with mechanical fastening system in order to compartmentalize roof at Chatham County Annex, eliminate the vent leak, as well as securing HVAC. | Hurricane, High Winds, Thunderstorm, Tornado | 1 | High | County Facilities | Local Funds / SPLOST | 2015 | Deferred-The County had not secured the funds to complete this action. *The roof will slated to be replaced and this action will addressed with the roof replacement. |
| PP-28 | Secure satellite dish on roof of the Chatham County Annex. | Hurricane, High Winds, Thunderstorm, Tornado | 1 | Moderate | County Facilities | PDM; HMGP | Completed | Completed-The satellite dish was removed from the roof. |
| PP-29 | Replace roll up doors with hurricane rated doors at Chatham County Annex. | Hurricane | 1 | Moderate | CEMA/County Facilities | PDM; HMGP | Completed | Completed-The doors have been rating for higher wind load. |
| PP-30 | Brace or remove awnings at Chatham County Annex. | Hurricane, High Winds, Thunderstorm, Tornado | 1 | Moderate | CEMA/County Facilities | PDM; HMGP | Completed | Completed-It was determined that the steel overhangs are part of structure and there are no removable awnings. |

| Action # | Description | Hazard(s) Addressed | Goal Addressed | Relative Priority | Lead Agency/ Department | Potential Funding Sources | Implementation Schedule | Implementation Status (2014) |
|---|---|---|---|---|---|---|---|---|
| PP-31 | Replace wooden power poles at Citizens Service Center with spun concrete poles. | All | 1 | Moderate | County Facilities | PDM; HMGP | Deleted | Deleted-This is not an action that Chatham County can accomplish. *This is in Georgia Power's authority only. |
| PP-32 | Conduct engineering inspection of roof on accordion building at Citizens Service Center. Increase wind load rating of the roof on the older portion of the Citizens Service Center. | Hurricane, High Winds, Thunderstorm, Tornado | 1 & 3 | Moderate | County Facilities | PDM; HMGP | Deleted | Deleted-There is no way to reinforce the roof without replacing it. *Roof was replaced 15 years ago. |
| PP-33 | Install accordion shutters to protect glass at tag building at Citizens Service Center. | Hurricane, High Winds, Thunderstorm, Tornado | 1 & 3 | Moderate | County Facilities | Local Funds | 2020 | Deferred-The County did not have available for funding for this action. *The County will include this action in future CIP budgets. |
| PP-34 | Protect generator at CNT Building through construction of housing and/or relocation. | All | 1 | Moderate | County Facilities | Local Funds; CIP | 2018-2020 | Deferred-The County has deferred this action due to a lack of funding. *The County intends to include this action in their CIP budget. |
| PP-35 | Replace/harden HVAC stands at the prison to withstand 150 mph winds. | Hurricane, High Winds, Thunderstorm, Tornado | 1 | Moderate | County Sheriff's Department | PDM; HMGP; Federal Grants | 2017 | Deferred-The Sheriff's Department has deferred this action due to lack of funding. |
| PP-36 | Bury fiber connection from courthouse to mosquito control building and install generator to main critical communication and data equipment. | All | 1 | Low | County Mosquito Control | PDM; HMGP; Federal Grants | 2017-2018 | Deferred-The County has deferred this action due to lack of funding. *The County will seek federal grant funds to complete this action. |
| PP-37 | Determine and/or construct safe room in the Administrative Building at the Chatham County Mosquito Control Building. | All | 1 | Low | County Mosquito Control | PDM; HMGP; Federal Grants | 2017-2018 | Deferred-The County has deferred this action due to lack of funding. *The County will seek federal grant funds to complete this action. |

| Action # | Description | Hazard(s) Addressed | Goal Addressed | Relative Priority | Lead Agency/ Department | Potential Funding Sources | Implementation Schedule | Implementation Status (2014) |
|---|---|---|---|---|---|---|---|---|
| PP-38 | Designate a safe room space at the Chatham County Annex. | All | 1 | High | CEMA; County Facilities | Local Staff Time | 2016 | Deferred-The County deferred this action because they were determining the best mechanism to complete this action. *This action will be completed within the year. |
| PP-39 | Address water intrusion issue at Sally Port at Montgomery Street Courthouse. | Flood | 1 | Moderate | County Facilities | FMA; HMGP | Completed | Completed-A pump was installed in 2009. |
| PP-40 | Add HVAC stands at CNT Building. | Flood | 1 | Low | County Facilities; CNT Department | Local Funds | 2017 | Deferred-The County deferred this action due to lack of funding. *It was determined that the CNT Dept. will allot funding for this action and complete it. |
| PP-41 | Apply fire retardant clear coat to all historic buildings. | Fire | 1 & 3 | Low | CEMA | HMGP | Deleted | Delete-This action is in direct conflict with the Secretary of the Interior's Standards for Rehabilitation and a specific design standard with the Historic District Ordinance Section 8-3030. |
| PP-42 | Add a vehicle barrier at the CNT Building. | All | 1 | Moderate | County Facilities | DHS; Local Funds | 2017 | Deferred-This action has been deferred due to lack of funding. |
| PP-43 | Plan to evaluate CNT grounds and facilities for any outstanding vulnerabilities. | All | 1 | Low | County Facilities | Local Staff Time | 2016 | Deferred-This action is done on a continuous basis. |
| PP-44 | Institute security measures for exposed pipelines. | All | 1 | Low | County Public Works | Local Funds and Staff Time | 2016 | Deferred-This action is done on a continuous basis. |

| Action # | Description | Hazard(s) Addressed | Goal Addressed | Relative Priority | Lead Agency/ Department | Potential Funding Sources | Implementation Schedule | Implementation Status (2014) |
|---|---|---|---|---|---|---|---|---|
| **Natural Resource Protection** | | | | | | | | |
| NRP-1 | Promote the acquisition by conservation organizations of flood areas for community green space. | Flood | 1 & 3 | Low | CEMA; MPC; County Engineering | Local Staff Time | 2018 | Deferred-The County is continuing to foster a relationship with multiple conservation organizations to encourage them to utilize their resources for this action. *No acquisition has occurred yet. |
| **Emergency Services** | | | | | | | | |
| ES-1 | Purchase generator for Citizens Service Center. | All | 1 & 3 | Low | County Facilities | Local Funds; CIP | 2015-2020 | Deferred-This action is not complete due to the lack of funding from any source other than the CIP. *May be able to relocate the generator from the old courthouse to the Citizens Service Center. |
| ES-2 | Conduct evacuation exercises with or for local EMA personnel and private citizens. | Hurricane; Terrorism | 1 & 3 | Moderate | CEMA | DHS; Local Funds | 2016 | Deferred-Due to lack of funding, this action has been deferred. CEMA will plan and conduct an evacuation exercise in the next year based on grant funding. |
| ES-3 | Install alternative communications in the form of WeatherWarn system for public safety. | All | 1 & 3 | Moderate | CEMA | HMGP 5% | Completed | Complete-Alternative means of communication were completed in 2013. *This system is controlled by the National Weather Service. |
| ES-4 | Require NOAA weather alert radios in daycare facilities. | All | 1 | Moderate | CEMA | Federal Grants | Deleted | Deleted-The County has no jurisdiction over daycare facilities and cannot mandate any requirements. |

| Action # | Description | Hazard(s) Addressed | Goal Addressed | Relative Priority | Lead Agency/ Department | Potential Funding Sources | Implementation Schedule | Implementation Status (2014) |
|---|---|---|---|---|---|---|---|---|
| ES-5 | Train fire respondents in appropriate salvage operations for collections. | Fire | 1 | High | CEMA | Local Funds | 2017 | Deleted-Fire operations are run through the municipalities and privatized. The County does not have jurisdiction of the fire training but can only support the efforts of the municipalities and private company. |
| ES-6 | Require new communications tower construction to include a provision for sirens. | All | 1 & 3 | Moderate | CEMA | HMGP 5% | 2015-2017 | Deferred-CEMA is currently trying to engage zoning administrators and officials to push this action forward and pursue funding. |
| ES-7 | Conduct regional training, response, and recovery exercises with appropriate agencies. | All | 1 & 3 | Low | CEMA | DHS; Local Funds | 2015-2020 | *Completed-This action occurs on a continual cycle. *CEMA has a very robust training program. |
| ES-8 | Install red light cameras at railroad crossings to deter motorists who try speeding through the crossing prior to the gate being lowered. | | 1 | Low | CEMA | Local Funds | Deleted | Deleted-This is not a CEMA issue. This is in the jurisdiction of the railroad or the company, CSX. |
| ES-9 | Conduct yearly workshops related to FEMA hazard mitigation grant programs, including FMA, HMGP, PDM, SRL, and RFC. | All | 1 & 2 | Moderate | CEMA | HMGP 5% | 2016 | Deferred-This is a continuous effort on an annual basis by CEMA. |
| ES-10 | Ensure generators are purchased for all prioritized critical facilities. | All | 1 | Moderate | CEMA | HMGP 5% | 2017 | Deferred-This action has been deferred due to lack of funding. *CEMA is working to apply for funding to support this action. |
| ES-11 | Ensure that agencies responding to HAZMAT transportation incidents have proper equipment and training. | HAZMAT | 1 | Low | CEMA | Local Funds; Federal and State Grants | 2016 | Deferred-This action is done on an annual basis. |
| ES-12 | Conduct hazardous material transportation accident training, response, and recovery exercises with appropriate agencies. | HAZMAT | 1 & 3 | Moderate | CEMA | Local Funds; Federal and State Grants | 2016 | Deferred-This action is done on an annual basis. |

| Action # | Description | Hazard(s) Addressed | Goal Addressed | Relative Priority | Lead Agency/ Department | Potential Funding Sources | Implementation Schedule | Implementation Status (2014) |
|---|---|---|---|---|---|---|---|---|
| **Public Education and Awareness** | | | | | | | | |
| PEA-1 | Conduct public forums to provide mitigation information and all hazards preparedness information. | All | 1, 2 & 3 | Low | CEMA | Local Funds; HMGP 5% | 2016 | Deferred-This is an ongoing endeavor and CEMA will continue to provide this type of opportunity to share information with citizens. |
| PEA-2 | Disseminate survey/questionnaire and collect information from business, industry, educational, historical, and cultural institutions regarding their questions and needs. Provide informational brochures for distribution explaining flooding safety and storm surge procedures and mitigation actions that can be undertaken by the institutions. | Flood; Storm Surge | 2 | Low | CEMA | Local Funds; HMGP 5% | 2018 | Deferred-CEMA is currently gathering information from the institutions to develop more updated brochures with all of the pertinent information for community institutions. |
| PEA-3 | Provide educational handouts to tourists and renters via the Savannah Visitors Center. | All | 2 | Low | CEMA | Local Funds; HMGP 5% | 2016 | Deferred-Update the current brochures and information to be suited for new information to be shared with visitors and tourists. |
| PEA-4 | Host/support a hazardous materials clean-up day to appropriately dispose of dangerous household chemicals. | HAZMAT | 1 , 2 & 3 | Moderate | CEMA | Local Funds | 2017 | Deferred-Due to lack of staff time, this item has been a lower priority. *CEMA intends to promote and conduct this effort in the next 2 years. |
| PEA-5 | Provide informational brochures for distribution explaining terrorism and tornado safety procedures and mitigation actions that can be undertaken by business, industry, educational, historical, and cultural institutions. | Terrorism; Tornado | 2 | Low | CEMA | Local Funds; HMGP 5% | 2017 | Deferred-Due to lack of staff time and funding dedicated directly to this effort, this action has been deferred. *CEMA intends to utilize grant funding to supplement the development of these materials. |
| PEA-6 | Include information in the County outreach mailer concerning transportation incident protection. | Transportation/HAZMAT | 1 & 2 | Low | CEMA | HMGP 5% | 2017 | Deferred-CEMA is currently developing all of the materials to be placed in the outreach mailer. |

| Action # | Description | Hazard(s) Addressed | Goal Addressed | Relative Priority | Lead Agency/ Department | Potential Funding Sources | Implementation Schedule | Implementation Status (2014) |
|---|---|---|---|---|---|---|---|---|
| PEA-7 | Encourage residents to purchase NOAA weather radios and explore opportunities to make weather radios available to low-income residents. | All | 1 & 2 | Moderate | CEMA; County Engineering | Local Staff Time | 2016 | Deferred-This action is deferred because it a continuous effort by CEMA to educate the public and provide opportunities for resources. * CEMA has cost of the units. Engineering could aid on determining number of low-income residents and with outreach and education. |
| PEA-8 | Provide public education regarding contra-flow system. | All | 1 & 2 | High | CEMA; County Engineering | Local Staff Time; HMGP 5%; SPLOST | 2016 | Deferred-The information is distributed on an annual cycle by CEMA. *CEMA will provide this information prior to hurricane season. *County Engineering will provide assistance with outreach. |
| PEA-9 | Include information in the Chatham County outreach mailer concerning wind protection programs and wind-blown missile measures. | Hurricane, High Winds, Thunderstorm, Tornado | 1 & 2 | Moderate | CEMA | HMGP 5%; Local Staff Time | 2016 | Deferred-This information is distributed on an annual cycle. *CEMA will provide this information prior to hurricane season. |
| PEA-10 | Provide outreach to the Hispanic members of the community regarding evacuation. | Hurricane | 1 & 2 | Moderate | CEMA | HMGP 5%; Local Staff Time | 2016 | Deferred-This information is distributed on an annual cycle. *CEMA will provide this information prior to hurricane season. |
| PEA-11 | Work with County Engineering to include information in Chatham County outreach mailers regarding permeable concrete paving and freshwater flooding preventative measures. | Flood | 1 & 2 | Moderate | County Engineering; MPC; CEMA | HMGP 5%; Local Staff Time; SPLOST | 2017 | Deferred-The action has been deferred due to lack of funding. *CEMA intends to work with County Engineering to develop the information that needs to be included. |

| Action # | Description | Hazard(s) Addressed | Goal Addressed | Relative Priority | Lead Agency/ Department | Potential Funding Sources | Implementation Schedule | Implementation Status (2014) |
|---|---|---|---|---|---|---|---|---|
| PEA-12 | Provide info brochures for distribution explaining flooding procedures and mitigation actions. | Flood | 1, 2 & 3 | High | County Engineering; MPC; City of Savannah | Local Funds; SPLOST | 2016 | Deferred-This is an ongoing effort.<br>* This is a FEMA outreach requirement for CRS participation.<br>*Current Engineering expenditures exceed $30,000 annually with assistance from the City of Savannah and The MPC. Should consider including CEMA info and assistance. |

# City of Bloomingdale Mitigation Actions

| Action # | Description | Hazard(s) Addressed | Goal Addressed | Relative Priority | Lead Agency/ Department | Potential Funding Sources | Implementation Schedule | Implementation Status (2015) |
|---|---|---|---|---|---|---|---|---|
| **Property Protection** | | | | | | | | |
| PP-1 | Elevate Police Department generator and flood proof structure. | Flood | 1 | Low | City Administration | PDM; HMGP | Completed | Completed |
| PP-2 | Provide for code enhancement and hardening of planned new fire station/emergency coordination facility. | All | 1 | Moderate | City Administration | PDM; HMGP | 2018 | *Deferred-Funding has not been available to complete this action but the Town intends to apply for grants to support this action in the next 3 years. |
| PP-3 | Link via conduit and cabling from City Hall to Police Department. | All | 1 & 3 | High | City Administration | Federal grants; local funds | 2018 | *New |
| PP-4 | Link via conduit and cabling from Fire Department to City Hall. | All | 1 & 3 | High | City Administration | Federal grants; local funds | 2018 | *New |
| **Structural Projects** | | | | | | | | |
| SP-1 | Replace/enlarge pipe under railroad tracks at the Governor Treutlen Canal. | All | 1 | Moderate | City of Bloomingdale; City of Pooler | HMGP; FMA | Deleted | *Deleted-This is not within the town's jurisdiction. |
| **Emergency Services** | | | | | | | | |
| ES-1 | Acquire portable generator for City Hall. | All | 1 | Low | City Administration | HMGP 5% | 2018 | *Deferred-The Town has not completed this action because no funding has been available. |
| ES-2 | Acquire portable generator for Public Works Maintenance Building. | All | 1 | Low | Public Works | HMGP 5% | Completed | Completed |

# City of Garden City Mitigation Actions

| Action # | Description | Hazard(s) Addressed | Goal Addressed | Relative Priority | Lead Agency/ Department | Potential Funding Sources | Implementation Schedule | Implementation Status (2015) |
|---|---|---|---|---|---|---|---|---|
| **Prevention** | | | | | | | | |
| P-1 | Evaluate major interstates in and around Garden City for potential terrorist targets. | Terrorism | 1 | Moderate | Administration | Local Funds | Deleted | Deleted; These are federal highways which the municipality has no authority over. |
| P-2 | Maintain GovCollect database to maintain and track properties that have been flooded. | Flood | 4 | High | Planning and Zoning Dept. | Local Funds | 2016 | New |
| P-3 | Revise flood damage prevention ordinance to higher regulatory standards. | Flood | 3 | High | Planning and Zoning Dept. | Local Staff Time | 2016 | New |
| P-4 | Adopt a revised Garden City Local Design Manual for higher regulatory standards. | All | 3 | High | Planning and Zoning Dept. | Local Staff Time | 2016 | New |
| P-5 | Trim and prune loop at Rommel and Smith Avenues and Highway 80 at Kessler to include conveyance ditches. | All | 1 | Moderate | Public Works | Local Staff Time | 2016 | New |
| **Property Protection** | | | | | | | | |
| PP-1 | Harden Garden City's City Hall. | All | 1 | Moderate | Administration | HMGP; PDM | Completed | *Completed-A brand new facility was constructed in 2014. It was designed to withstand 120mph winds. |
| PP-2 | Harden the Garden City Recreation Department Gymnasium. | All | 1 | Moderate | Administration | HMGP; PDM | 2016 | *Deferred-This building is believed to meet the requirements, and there need not be any change to the structure. However, if an action needs to take place the appropriation will be part of the next year's budget. City is determining the standards of the roof retro-fit. |

| Action # | Description | Hazard(s) Addressed | Goal Addressed | Relative Priority | Lead Agency/ Department | Potential Funding Sources | Implementation Schedule | Implementation Status (2015) |
|---|---|---|---|---|---|---|---|---|
| PP-3 | Add safe room to Groves High School. | All | 1 | Moderate | CEMA: City of Garden City; Board of Education | Federal grants | Deleted | Delete – This action must follow under the Board of Education. The jurisdiction has no authority to do construction or renovations on school facilities. |
| PP-4 | Relocate Fires Station 2 located at 2604 Highway 80 out of susceptible flooding area. | Flood | 1 & 3 | High | City Administration | Federal grants | 2017 | New |
| | **Structural Projects** | | | | | | | |
| SP-1 | Construct major drainage system between Highway 21 and Augusta Road to alleviate drainage issues. | Flood | 3 | Moderate | Public Works | General fund, grants | 2016 | New |
| **Public Education and Awareness** | | | | | | | | |
| PEA-1 | Increase public education and awareness in the City to include printed materials and K-12 classes. | All | 2 | High | Administration | Local Funds | 2016-2017 | New - The City plans to place printed newsletters in the libraries and public buildings to address all hazards. There will also be a flyer inserted with the water bills. Classes are slated to begin in the public schools in Garden City in the upcoming school year. |

# City of Pooler Mitigation Actions

| Action # | Description | Hazard(s) Addressed | Goal Addressed | Relative Priority | Lead Agency/ Department | Potential Funding Sources | Implementation Schedule | Implementation Status (2015) |
|---|---|---|---|---|---|---|---|---|
| **Prevention** | | | | | | | | |
| P-1 | Explore methods for adding redundancy to computer networking housed in fire station. | All | 1 | Moderate | Administration | Local Funding | Deleted | Deleted-Computer networking was completely removed from the fire station and will be housed in the City Hall that is under construction. |
| **Property Protection** | | | | | | | | |
| PP-1 | Provide window protection, such as shutters, for the windows at City Hall. | All | 1 | Low | City Administration | PDM; HMGP | Deleted | Deleted- The City is currently building a new City Hall that will be completed in 2017. |
| PP-2 | Increase wind load of new public works addition and new communications tower. | HU/TS | 1 | Moderate | City Administration | PDM; HMGP | Completed | Completed-This was completed in 2006. |
| PP-3 | Install tornado safe rooms in three school facilities. | TS | 1 | Moderate | CEMA; City of Pooler; Board of Education | PDM; HMGP | 2018 | New |
| PP-4 | Flood-proof lift stations in repetitive loss areas at Brighton Woods Drive and North Skinner Street. | Flood | 1 | Moderate | City Administration | FMA; HMGP | Completed | Completed-This action was completed in 2005. |
| PP-5 | Protect sewer infrastructure from infiltration from flood water and related debris. | FL/HU | 1 | Moderate | City Administration | FMA; HMGP | 2018 | New |
| PP-6 | Replace/enlarge pipe under railroad tracks at the Governor Treutlen Canal. | All | 1 & 3 | Moderate | City Administration; City of Bloomingdale | HMGP; FMA | Deleted | Delete- The railroad will not allow the municipalities to access the pipe. |
| PP-7 | Protect primary transportation route and maintain groundwater flow at Canal Bridge. | All | 1 | Moderate | City Administration | HMGP; FMA | 2017 | Deferred-The concrete bridge cause heavy bottle necks especially with school traffic. |
| PP-8 | Floodproof Pooler Police Department building. | Flood | 1 | Moderate | City Administration | FMA; HMGP | Deleted | Deleted; The old Police Department was torn down. |
| PP-9 | Elevate generator between City Hall and Police Department. | Flood | 1 | Moderate | City Administration | HMGP; PDM | Deleted | Deleted; This is not necessary because a new facility is being built to house both entities. |

| Action # | Description | Hazard(s) Addressed | Goal Addressed | Relative Priority | Lead Agency/ Department | Potential Funding Sources | Implementation Schedule | Implementation Status (2015) |
|---|---|---|---|---|---|---|---|---|
| PP-10 | Mitigation of repetitive loss structures in the Brighton Woods Repetitive Loss area. | Flood | 1 & 3 | Moderate | City Administration | HMGP; PDM; FMA; SRL; RFC | 2018 | Deferred-The County Floodplain Manager is assisting with correspondence with one homeowner. |
| PP-11 | Mitigation of repetitive loss structures along West Whatley Street. | Flood | 1 & 3 | Moderate | City Administration | HMGP; PDM; FMA; SRL; RFC | 2018 | Deferred- Determining a new strategy to increase homeowner participation. |
| PP-12 | Replace existing well house and raise the elevation level of the well house. | Flood | 1 & 3 | High | City Administration | PDM; HMGP | 2017 | New |
| PP-13 | Install safe room in critical facilities in the City's jurisdiction. | TO/HW | 1 | Moderate | City Administration | PDM | 2018 | New |
| **Emergency Services** | | | | | | | | |
| ES-1 | Install generators at all fire stations. | All | 1 & 3 | Moderate | City Administration | HMGP 5% | Completed | Completed-Generators were added to the fire stations in January 2015. |
| ES-2 | Install automatic switchovers for generators including lift stations. | All | 1 & 3 | Moderate | City Administration | HMGP; PDM; HMGP 5% | 2018 | Deferred-This action is continued to be included in the mitigation actions for the City. |
| ES-3 | Install generators at Rogers Street and Skinner Street water wells. | All | 1 & 3 | High | City Administration | HMGP 5% | 2016 | Deferred-Will be completed in December 2016. |

# City of Port Wentworth Mitigation Actions

| Action # | Description | Hazard(s) Addressed | Goal Addressed | Relative Priority | Lead Agency/ Department | Potential Funding Sources | Implementation Schedule | Implementation Status (2015) |
|---|---|---|---|---|---|---|---|---|
| **Prevention** | | | | | | | | |
| P-1 | Update City-wide Stormwater Master Plan. | Flood | 1 & 3 | Moderate | City Administration | SPLOST | 2017 | New |
| **Property Protection** | | | | | | | | |
| PP-1 | Harden boat launch/ramp at Houlihan Landing near Houlihan Bridge. | All | 1 & 3 | Moderate | City Administration | | Completed | Complete; One dock is new as of 2012 and the other one was retro-fitted in 2012 with all new materials that were screwed in. |
| PP-2 | Update City's Comprehensive Plan. | All | 1, 2 & 3 | High | City Administration | General Fund | 2016 | New-The City is currently working on updating the Comprehensive Plan City-wide. |
| PP-3 | Build detainment ponds for stormwater runoff. | Flood | 1 & 3 | Low | City Administration/ Public Works | SPLOST | 2018 | New |
| PP-4 | Renovate the sanitary sewage system on the south end of Port Wentworth. | Flood | 1 | Moderate | City Administration/ Public Works | SPLOST | 2017 | New |
| **Emergency Services** | | | | | | | | |
| ES-1 | Build a water tower for the City's water reserve. | All | 1 | Moderate | City Administration | Georgia Environmental Finance Authority | 2016 | New |
| ES-2 | Update the service delivery strategy City-wide. | All | 1 | Moderate | City Administration/ CEMA | General Funds | 2016 | New |
| **Public Education and Awareness** | | | | | | | | |
| PEA-1 | Increase public education and awareness within the City by including flyers in the water bills and providing documents in the public buildings. | All | 4 | Moderate | City Administration | Local Funds | 2016 | New |

# City of Savannah Mitigation Actions

| Action # | Description | Hazard(s) Addressed | Goal Addressed | Relative Priority | Lead Agency/ Department | Potential Funding Sources | Implementation Schedule | Implementation Status (2015) |
|---|---|---|---|---|---|---|---|---|
| **Prevention** | | | | | | | | |
| P-1 | Modify Flood Damage Prevention Ordinance (FDPO) to include LiMWA criteria. | Flood | 1 | Moderate | City Development Services | City Operating Budget | When new floodplain maps become effective | New-This is a new mitigation action included in the City's 2015 Flood Mitigation Plan. |
| P-2 | Complete a study to evaluate the effectiveness of a stormwater utility based on impervious area and its impact on the typical homeowner. | Flood | 1 | Moderate | City Stormwater Department, City Council | City Operating Budget | 2018 | New-This is a new mitigation action included in the City's 2015 Flood Mitigation Plan. |
| P-3 | The City of Savannah will adopt the CEMA Post-Disaster Mitigation Plan and Pre-Disaster Mitigation Plan. Continue to develop City of Savannah Pre and Post Mitigation as well as Long Term Recovery and Redevelopment Plans that are more focused on the needs of the City of Savannah in the future. | Flood | 3 | Moderate | CEMA, Savannah Fire Department (Emergency Management Director) | Chatham County (N/A to city of Savannah) | 2018 | New-This is a new mitigation action included in the City's 2015 Flood Mitigation Plan. |
| P-4 | Support the Chatham County-Savannah MPC Greenway Plan and coordinate with the MPC on the Plan as needed. | Flood | 1 | Low | City Parks and Recreation Department, MPC | Staff Time | 2019 | New-This is a new mitigation action included in the City's 2015 Flood Mitigation Plan. |
| P-5 | Create a Natural Floodplain Functions Plan and a Repetitive Loss Area Analysis. | Flood | 1 | High | City Development Services | Already obligated through contract with contractor | 2015 (within 6 months) | New-This is a new mitigation action included in the City's 2015 Flood Mitigation Plan. |
| P-6 | Work with GDOT and County Zoning Board to ensure that future development including road construction is regulated to the 100-year floodplain standard. | Flood | 1 | Moderate | CEMA, City Administration, MPC | N/A | 2016-2017 | Deferred-The City is working to implement this action. |
| P-7 | Study potential storm surge effects on cemeteries. | Storm Surge | 1 | Low | CEMA, City Administration | Local funds | 2017-2018 | Deferred-The City is working to implement this action. |
| P-8 | Remove records and documents from lower levels of buildings that may be flooded following a storm surge. | Storm Surge | 1 | Low | City Administration | N/A | 2017-2018 | Deferred-The City is working to implement this action. |

| Action # | Description | Hazard(s) Addressed | Goal Addressed | Relative Priority | Lead Agency/ Department | Potential Funding Sources | Implementation Schedule | Implementation Status (2015) |
|---|---|---|---|---|---|---|---|---|
| P-9 | Mapping of electrical wiring and comparison of current conditions to current code at Savannah-Chatham Metropolitan Police Department Barracks. | Fire | 1 | Low | City Administration | Local funds | 2016-2017 | Deferred-The City is working to implement this action. |
| P-10 | Research potential impacts from materials transported on tracks at I & D Water Plant. | Hazardous Materials Incident | 1 | Low | City Administration | Local funds | 2016-2017 | Deferred-The City is working to implement this action. |
| P-11 | Remove old/unused storage containers from the property at I & D Water Plant. | Hazardous Materials Incident | 1 | Moderate | City Administration | Local funds | Completed | Completed-This action has been successfully implemented. |
| P-12 | Enclose/replace structure housing chlorine tanks at I & D Water Plant to prevent ease of access to chemical by potential terrorists as noted in DHS CI/KR Courtesy Security Inspection. | Terrorism | 1 | High | City Administration | PDM, HMGP | January 2016 | Deferred-The City is working to implement this action. |
| P-13 | Conduct engineering study to determine airflow and shutter needs for vents at Kayton Pump Station. | Flood | 1 & 3 | Moderate | County Facilities | Local Funds | 2015-2017 | Deferred-Due to lack of funding, the study has not been performed but the City is building it into their current budget. |
| **Property Protection** | | | | | | | | |
| PP-1 | Chatham County Emergency Management (CEMA) will provide a prioritized list of critical facilities. | Flood | 1 | Moderate | Savannah Fire & Emergency Services Hazardous Materials Team, City Fire Department (Emergency Management Director), City Development Services | City Operating Budget | 2018 | New-This is a new mitigation action included in the City's 2015 Flood Mitigation Plan. |

| Action # | Description | Hazard(s) Addressed | Goal Addressed | Relative Priority | Lead Agency/ Department | Potential Funding Sources | Implementation Schedule | Implementation Status (2015) |
|---|---|---|---|---|---|---|---|---|
| PP-2 | Coordinate with the Chatham County Resource Protection Commission (RPC) to acquire lands vulnerable to flooding through SPLOST funds and other grant opportunities. | Flood | 1 | Moderate | City Parks and Recreation Department in cooperation with Chatham County-Savannah MPC and Savannah City Council | SPLOST Funding | 2018 | New-This is a new mitigation action included in the City's 2015 Flood Mitigation Plan. |
| PP-3 | Harden windows at the Savannah Civic Center. | Tornado, Thunderstorm, Hurricane, High Winds | 1 | High | City Administration | PDM, HMGP | June 2016 | Deferred-The City is working to implement this action. |
| PP-4 | Harden pump stations to increase wind resistance, including roof bracing and shuttering. | Tornado, Thunderstorm, Hurricane, High Winds | 1 | Moderate | City Administration | PDM, HMGP | January 2017 | Deferred-The City is working to implement this action. |
| PP-5 | Relocate the Southside radio site. | All | 1 | Moderate | City Administration | HMP, PDM, FMA | June 2017 | Deferred-The City is working to implement this action and has hardened the structure which has minimized urgency to relocate. |
| PP-6 | Harden roofs, windows, doors, and anchorage of all historical and cultural buildings. | Tornado, Thunderstorm, Hurricane, High Winds | 1 | Low | City Administration | PHM, HMGP | 2017-2018 | Deferred-The City is working to implement this action. |
| PP-7 | Provide window protection for the I & D Water Plant, such as shuttering or replacing windows with impact resistant glass. | Tornado, Thunderstorm, Hurricane, High Winds | 1 | Moderate | City Administration | PDM, HMGP | Completed | Completed-This action has been successfully implemented. |
| PP-8 | Improve attachment/anchoring of rooftop satellite at the I & D Water Plant. | Tornado, Thunderstorm, Hurricane, High Winds | 1 | Moderate | City Administration | PDM, HMGP | Completed | Completed-This action has been successfully implemented. |
| PP-9 | Replace walkway between chemical storage building and main building at I & D Water Plant with a hurricane resistant covered walkway. | Hurricane | 1 | Moderate | City Administration | PDM, HMGP | June 2016 | Deferred-The City is working to implement this action. |

| Action # | Description | Hazard(s) Addressed | Goal Addressed | Relative Priority | Lead Agency/ Department | Potential Funding Sources | Implementation Schedule | Implementation Status (2015) |
|---|---|---|---|---|---|---|---|---|
| PP-10 | Harden new storage building at I & D Water Plant through the use of additional cross members and fasteners. | Tornado, Thunderstorm, Hurricane, High Winds | 1 | High | City Administration | PDM, HMGP | June 2016 | Deferred-The City is working to implement this action. |
| PP-11 | Harden all metal buildings at I & D Water Plant through the use of additional crossmembers and fasteners. | Tornado, Thunderstorm, Hurricane, High Winds | 1 | Low | City Administration | PDM, HMGP | June 2016 | Deferred-The City is working to implement this action. |
| PP-12 | Replace doors and roll up doors with hurricane rated doors at all buildings at I & D Water Plant. | Hurricane | 1 | Low | City Administration | PDM, HMGP | June 2016 | Deferred-The City is working to implement this action. |
| PP-13 | Replace existing fuel building with a hurricane rated metal shed at I & D Water Plant that provides enough storage to fuel City Critical Response Vehicles for 72 hours without re-supply. | Hurricane | 1 | High | City Administration | PDM, HMGP | 2016-2017 | Deferred-The City is working to implement this action. |
| PP-14 | Replace roll up doors at centrifuge building at I & D Water Plant with hurricane rated doors. | Hurricane | 1 | High | City Administration | PDM, HMGP | June 2017 | Deferred-The City is working to implement this action. |
| PP-15 | Replace roll up door at generator building at I & D Water Plant with a hurricane rated door. | Hurricane | 1 | Moderate | City Administration | PDM, HMGP | June 2016 | Deferred-The City is working to implement this action. |
| PP-16 | Replace doors to electrical building at I & D Water Plant with hurricane rated doors. | Hurricane | 1 | Moderate | City Administration | PDM, HMGP | 2017-2018 | Deferred-The City is working to implement this action. |
| PP-17 | Harden building, including windows, doors, and shutter vents, at Kayton Pump Station. | Tornado, Thunderstorm, Hurricane, High Winds | 1 | High | City Administration | PDM, HMGP | June 2018 | Deferred-The City is working to implement this action. |
| PP-18 | Harden main doors and windows at Savannah Civic Center to compliment wind resistance upgrades to the fly loft structure on the North Side. | Tornado, Thunderstorm, Hurricane, High Winds | 1 | High | City Administration | PDM, HMGP | June 2016 | Deferred-The City is working to implement this action. |
| PP-19 | Incorporate impact resistant glass and hurricane rated doors into the planned replacement of the second flood windows and double doors at Savannah Civic Center. | Tornado, Thunderstorm, Hurricane, High Winds | 1 | High | City Administration | PDM, HMGP | June 2016 | Deleted-This action will be completed when action PP-18 is funded and implemented. |

| Action # | Description | Hazard(s) Addressed | Goal Addressed | Relative Priority | Lead Agency/ Department | Potential Funding Sources | Implementation Schedule | Implementation Status (2015) |
|---|---|---|---|---|---|---|---|---|
| PP-20 | Harden doors and access points to arena at Savannah Civic center. | Tornado, Thunderstorm, Hurricane, High Winds | 1 | Low | City Administration | PDM, HMGP | Deleted | Deleted-These improvements would be unnecessary with the construction of a new arena through SPLOST. |
| PP-21 | Replace back bay doors at Savannah Civic Center with hurricane rated doors. | Hurricane | 1 | Moderate | City Administration | PDM, HMGP | Deleted | Deleted-These improvements would be unnecessary with the construction of a new arena through SPLOST. |
| PP-22 | Install wind screen protection system at front door and all openings of Savannah-Chatham Metropolitan Police Department Barracks with a hurricane rated door. | Tornado, Thunderstorm, Hurricane, High Winds | 1 | Moderate | Savannah-Chatham Metropolitan Police | PDM, HMGP | June 2017 | Deferred-The City is working to implement this action. |
| PP-23 | Increase wind load of sloped roof at Savannah-Chatham Metropolitan Police Department Barracks. | Tornado, Thunderstorm, Hurricane, High Winds | 1 | Low | Savannah-Chatham Metropolitan Police | PDM, HMGP | Completed | Completed-The wind load of the sloped roof at the Savannah-Chatham Metropolitan Police Department Barracks has been increased. |
| PP-24 | Harden window units at Savannah Fire Department Headquarters. | Tornado, Thunderstorm, Hurricane, High Winds | 1 | Low | Savannah Fire Department | PDM, HMGP | Completed | Completed-Wind screens were ordered and installed. The entire system was test in June 2014. |
| PP-25 | Improve attachment of flat roof at I & D Water Plant through the use of mechanical fasteners. | Tornado, Thunderstorm, Hurricane, High Winds | 1 | Moderate | City Administration | PDM, HMGP | 2017-2018 | Deferred-The City is working to implement this action. |
| PP-26 | Provide weather safe access to the generator building at I & D Water Plant. | All | 1 | Low | City Administration | PDM, HMGP | 2017-2018 | Deferred-The City is working to implement this action. |
| PP-27 | Increase wind load of roof for chemical storage building at I & D Water Plant. | Tornado, Thunderstorm, Hurricane, High Winds | 1 | High | City Administration | PDM, HMGP | 2017-2018 | Deferred-The City is working to implement this action. |
| PP-28 | Improve anchoring of SCADA equipment on roof at I & D Water Plant. | Tornado, Thunderstorm, Hurricane, High Winds | 1 | High | City Administration | PDM, HMGP | Completed | Completed-SCADA was moved to hardened room inside Critical Workforce Shelter. |

| Action # | Description | Hazard(s) Addressed | Goal Addressed | Relative Priority | Lead Agency/ Department | Potential Funding Sources | Implementation Schedule | Implementation Status (2015) |
|---|---|---|---|---|---|---|---|---|
| PP-29 | Additional mechanical fastening for roof over ballroom section at Savannah Civic Center. | Tornado, Thunderstorm, Hurricane, High Winds | 1 | High | City Administration | PDM, HMGP | Completed | Completed-This was completed in July 2014 using Capital Improvement Funds. Roof is not rated to a CAT 3 Hurricane. |
| PP-30 | Increase wind load of arena roof at Savannah Civic Center. | Tornado, Thunderstorm, Hurricane, High Winds | 1 | Low | City Administration | PDM, HMGP | Completed | Completed-This was completed in July 2014 using Capital Improvement Funds. Roof is not rated to a CAT 3 Hurricane. |
| PP-31 | Housing for new generator at Savannah Civic Center. | Tornado, Thunderstorm, Hurricane, High Winds | 1 | Moderate | City Administration | PDM, HMGP | Completed | Completed-New housing was provided for the generator at Savannah Civic Center. |
| PP-32 | Harden rip/rap roof over pillars at Savannah Civic Center. | Tornado, Thunderstorm, Hurricane, High Winds | 1 | Moderate | City Administration | PDM, HMGP | Completed | Completed-Rip/rap roof over pillars at Savannah Civic Center was hardened. |
| PP-33 | Apply film on windows to harden and maintain historic character at Savannah Chatham Metropolitan Police Department Barracks. | Tornado, Thunderstorm, Hurricane, High Winds | 1 | Low | Savannah-Chatham Metropolitan Police | PDM, HMGP | Deleted | Deleted-This action will be unnecessary when action PP-22 is funded and implemented. |
| PP-34 | Secure window A/C units at Savannah-Chatham Metropolitan Police Department Barracks. | Tornado, Thunderstorm, Hurricane, High Winds | 1 | Low | Savannah-Chatham Metropolitan Police | PDM, HMGP | 2016-2017 | Deferred-The City is working to implement this action. |
| PP-35 | Increase wind load flat roof at Savannah-Chatham Metropolitan Police Department Barracks. | Tornado, Thunderstorm, Hurricane, High Winds | 1 | Moderate | Savannah-Chatham Metropolitan Police | PDM, HMGP | Completed | Completed-This was completed during emergency repairs for roof leaks at SCMPD HQs. |
| PP-36 | Bracing on garage doors at Savannah Fire Department. | Tornado, Thunderstorm, Hurricane, High Winds | 1 | Moderate | Savannah Fire Department | PDM, HMGP | June 2018 | Deferred-Wind Screens were ordered for Fire Headquarters / Station 3, however additional wind screens should be ordered for those stations outside of a CAT 3 Flooding. Stations 13, 14, 8,5,2. |

| Action # | Description | Hazard(s) Addressed | Goal Addressed | Relative Priority | Lead Agency/ Department | Potential Funding Sources | Implementation Schedule | Implementation Status (2015) |
|---|---|---|---|---|---|---|---|---|
| PP-37 | Water proof/windproof generator housing building at I & D Water Plant. | Tornado, Thunderstorm, Hurricane, High Winds | 1 | Moderate | City Administration | PDM, HMGP | Completed | Completed-This was completed as part of CWF construction. |
| PP-38 | Debris protection for clarifiers/filters at I & D Water Plant. | Tornado, Thunderstorm, Hurricane, High Winds | 1 | High | City Administration | PDM, HMGP | June 2016 | Deferred-The City is working to implement this action. |
| PP-39 | Upgrade seal on doors at Savannah Fire Department, or replace with hurricane rated doors. | Tornado, Thunderstorm, Hurricane, High Winds | 1 | Moderate | Savannah Fire Department | PDM, HMGP | Completed | Completed-This action has been successfully implemented. |
| PP-40 | Replace wood paneling closures at Savannah Fire Department. | Tornado, Thunderstorm, Hurricane, High Winds | 1 | Moderate | Savannah Fire Department | PDM, HMGP | Deleted | Deleted-This action is no longer necessary due to implementation of action PP-39 and PP-41. |
| PP-41 | Replace rotting door at Savannah Fire Department with a hurricane rated door. | Tornado, Thunderstorm, Hurricane, High Winds | 1 | Moderate | Savannah Fire Department | PDM, HMGP | Completed | Completed-This action has been successfully implemented. |
| PP-42 | Replace downtown Savannah power poles with spun concrete poles. | Tornado, Thunderstorm, Hurricane, High Winds | 1 | High | CEMA, City Administration | HMGP, PDM | 2017-2018 | Deferred-It is unlikely that this action will be approved by HRB. |
| PP-43 | Construct safe rooms in pump stations. | Tornado | 1 | Moderate | City Administration | PDM, HMGP | Completed | Completed-This was completed with Critical Workforce Shelter. |
| PP-44 | Funding for three fire stations to harden or replace temporary stations that are currently in use. | Tornado | 1 | Moderate | City Administration | CIP has been established for this project | July 2018 | Partially Completed-Stations 5 and 12 have been completed and the City is working to complete the one remaining station. |
| PP-45 | Remove motorcycle dome covering at Savannah-Chatham Metropolitan Police Department Barracks. | Tornado | 1 | Low | City Administration | N/A | 2017-2018 | Deferred-The City is working to implement this action. |
| PP-46 | Elevate external HVAC at ground level at I & D Water Plant. | Flood | 1 | Moderate | City Administration | PDM, HMGP | 2017-2018 | Deferred-The City is working to implement this action. |

| Action # | Description | Hazard(s) Addressed | Goal Addressed | Relative Priority | Lead Agency/ Department | Potential Funding Sources | Implementation Schedule | Implementation Status (2015) |
|---|---|---|---|---|---|---|---|---|
| PP-47 | HVAC stands at I & D Water Plant. | Flood | 1 | Moderate | City Administration | PDM, HMGP | 2016-2017 | Deferred-The City is working to implement this action. |
| PP-48 | HVAC stands on roof of chemical storage building at I & D Water Plant. | Flood | 1 | Moderate | City Administration | PDM, HMGP | June 2017 | Deferred-The City is working to implement this action. |
| PP-49 | Mechanism to prevent water from entering building via basement entrance at Savannah Civic Center. | Flood | 1 | High | City Administration | PDM, FMA | 2016-2017 | Deferred-The City is working to implement this action. |
| PP-50 | Place all mechanical equipment on pedestals at Savannah Civic Center. | Flood | 1 | High | City Administration | PDM, HMGP | June 2016 | Deferred-The City is working to implement this action. |
| PP-51 | Replace basement sump pumps at Savannah Civic Center. | Flood | 1 | High | City Administration | HMGP, PDM | June 2016 | Deferred-The City is working to implement this action. |
| PP-52 | Backflow protection for arena at Savannah Civic Center. | Flood | 1 | High | City Administration | HMGP, FMA | Deleted | Deleted-This be incorporated into new Arena design. |
| PP-53 | HVAC stands at Savannah-Chatham Metropolitan Police Department Barracks. | Flood | 1 | Low | Savannah-Chatham Metropolitan Police Department | HMGP, PDM | 2019 | Deferred-The City is working to implement this action. |
| PP-54 | Seal/replace basement windows to prevent rain entry at Savannah-Chatham Metropolitan Police Department Barracks. | Flood | 1 | Moderate | Savannah-Chatham Metropolitan Police Department | HMGP, PDM | January 2017 | Deferred-The City is working to implement this action. |
| PP-55 | Backflow protection at Savannah Fire Department. | Flood | 1 | Moderate | Savannah Fire Department | HMGP, FMA | Completed | Completed-This action has been successfully implemented. |
| PP-56 | Install signage in train trestle area at Anderson Street to indicate water depth. | Flood | 1 | Low | City Administration | HMGP 5% | 2015-2016 | Deferred-The City is working to implement this action. |
| PP-57 | Apply wet flood-proofing to pump stations. | Storm Surge | 1 | Moderate | City Administration | FMA | 2016-2017 | Deferred-The City is working to implement this action. |
| PP-58 | Improve generator housing at Savannah-Chatham Metropolitan Police Department Barracks. | Storm Surge | 1 | Moderate | City Administration | HMGP, PDM | 2016-2017 | Deferred-The City is working to implement this action. |
| PP-59 | Add signage regarding potential storm surge depths. | Storm Surge | 1 | Low | City Administration | FMA | 2016-2017 | Deferred-The City is working to implement this action. |
| PP-60 | Evaluate critical facilities and recommend appropriate storm surge retrofit protection measures. | Storm Surge | 1 | Low | City Administration | HMGP, PDM | 2017-2018 | Deferred-The City is working to implement this action. |

| Action # | Description | Hazard(s) Addressed | Goal Addressed | Relative Priority | Lead Agency/ Department | Potential Funding Sources | Implementation Schedule | Implementation Status (2015) |
|---|---|---|---|---|---|---|---|---|
| PP-61 | Research protection for wells around the city. | Storm Surge | 1 | Moderate | City Administration | N/A | 2015-2016 | Deferred-The City is working to implement this action. |
| PP-62 | Fire suppression system at Savannah-Chatham Metropolitan Police Department Barracks. | Fire | 1 | Low | City Administration | Local funds | 2018 | Deferred-The City is working to implement this action. |
| PP-63 | Replace Kayton Pump Station building with monolithic dome on a concrete ring foundation to house the motor and electrical components. | Flood | 1 | Moderate | City Administration | HMGP; PDM; Federal Grants | 2015-2017 | Deferred-The City is working to implement this action. |
| **Natural Resource Protection** | | | | | | | | |
| NRP-1 | Consider expanding riparian impervious surface setbacks including a 25' setback on coastal marshland and wetlands. | Flood | 1 | Low | City Water and Sewer Director, Chatham County-Savannah Metropolitan Planning Commission, City Council | City Operating Budget | 2020 | New-This is a new mitigation action included in the City's 2015 Flood Mitigation Plan. |
| **Structural Projects** | | | | | | | | |
| SP-1 | Prioritize CIP projects to address flooding in the following areas: Victory Drive, Skidaway & 41dt, 37th MLK, Montgomery & 52nd, Abercorn & 65th, Springfield Canal, Cloverdale, Detention Pond @ 52nd Derenne, Bilbo basin, and Placentia basin. | Flood | 1 | High | City Stormwater Department | City SPLOST funding | 2016 | New-This is a new mitigation action included in the City's 2015 Flood Mitigation Plan. |
| **Emergency Services** | | | | | | | | |
| ES-1 | Relocate Emergency Coordination Center, Backup 911 Center, City Server Room, Traffic Engineering and Law Enforcement / Fire / HAZMAT / SAR Special Operations to co-located hardened facility outside of storm surge zone that can maintain 24-hour operations in all-weather events. | All | 1 | High | City Administration | Local Funds | 2020 | New-Relocating to a hardened facility will ensure continuous operations during hazard events. |

| Action # | Description | Hazard(s) Addressed | Goal Addressed | Relative Priority | Lead Agency/ Department | Potential Funding Sources | Implementation Schedule | Implementation Status (2015) |
|---|---|---|---|---|---|---|---|---|
| **Public Education and Awareness** | | | | | | | | |
| PEA-1 | Remove building code/insurance disconnect through education of builders/realtors and modification of technical review checklist (cross-check NFIP/Insurance/Ordinance/IBC). | Flood | 2 | High | City Development Services | City Operating Budget | 2016 | New-This is a new mitigation action included in the City's 2015 Flood Mitigation Plan. |
| PEA-2 | Develop outreach strategy to educate building community on new flood maps. | Flood | 2 | Moderate | City Development Services | City Operating Budget | 2017 | New-This is a new mitigation action included in the City's 2015 Flood Mitigation Plan. |
| PEA-3 | Consider participation in FEMA's high water mark initiative. | Flood | 2 | Moderate | City Development Services | City Operating Budget | 2018 | New-This is a new mitigation action included in the City's 2015 Flood Mitigation Plan. |

# Town of Thunderbolt Mitigation Actions

| Action # | Description | Hazard(s) Addressed | Goal Addressed | Relative Priority | Lead Agency/ Department | Potential Funding Sources | Implementation Schedule | Implementation Status (2015) |
|---|---|---|---|---|---|---|---|---|
| **Prevention** | | | | | | | | |
| P-1 | Increase the area for debris following a storm with an MOU with the Board of Education to use the fields at Johnson High School as an additional area. | All | 1 & 3 | Moderate | Town of Thunderbolt Public Safety and Public Works | N/A | 2017 | New-Currently, the Town only has one location for debris at Cesaroni ball field and this would great expand their capacity. |
| P-2 | Conduct a full inspection of the Thunderbolt bridge to ensure that it will be open during any event or extreme threat. | All | 1 & 3 | High | Town of Thunderbolt Public Safety/GA DOT | PDM; HMGP | 2017 | New-If the drawbridge on President Street is unavailable, the Thunderbolt Bridge is the only means of access from the islands to the mainland including access to hospitals and critical care facilities. |
| P-3 | Assist and coordinate with Tara Nursing Home for evacuation of patients in the event of a threat. | All | 1 | Moderate | Town Administration/ CEMA | Local Staff Time | 2017 | New-The Nursing Home has a plan in place; however, the Town's involvement would be to ensure that the removal and transition of patients would be a smooth as possible. |
| **Property Protection** | | | | | | | | |
| PP-1 | Harden Town Hall and the fire station. | All | 1 | Moderate | Town Administration | PDM; HMGP | 2018 | Deferred-Due to the lack of funding, the Town was unable to update the facility but plans to do so once they apply for funding as needed. |
| PP-2 | Utilize flood controls to mitigate street flooding at Bonaventure and Downing and Gragg and Vernon Streets. | Flood | 1 & 3 | Low | Town Administration | PDM; HMGP | Deleted | Delete – It was determined that in regards to stormwater issues, this area is no longer a priority because it only isolated a few areas that needed attention and the priority became lower for the Town. |

| Action # | Description | Hazard(s) Addressed | Goal Addressed | Relative Priority | Lead Agency/ Department | Potential Funding Sources | Implementation Schedule | Implementation Status (2015) |
|---|---|---|---|---|---|---|---|---|
| **Emergency Services** | | | | | | | | |
| ES-1 | Acquire portable generator for water well. | All | 1 | Moderate | Town Administration | HMGP 5% | 2017 | Deferred-There has been a lack of funding for the project, but the Town intends to apply for funding in the future. |
| ES-2 | Acquire portable bypass pump for lift stations at Robertson, Mechanics, and Downing Avenues. | Flood | 1 & 3 | Moderate | Town of Thunderbolt Public Works | PDM; HMGP | 2017 | New-A bypass pump would help to address the sewage overflow that is occurring in these areas. |

# City of Tybee Island Mitigation Actions

| Action # | Description | Hazard(s) Addressed | Goal Addressed | Relative Priority | Lead Agency/ Department | Potential Funding Sources | Implementation Schedule | Implementation Status (2015) |
|---|---|---|---|---|---|---|---|---|
| **Prevention** | | | | | | | | |
| P-1 | Assist Tybee Island Nursing Home in applying for a hardening project. | All | 1 & 3 | Moderate | City Administration | PDM; HMGP | Deleted | Deleted- The City does not have any authority over nursing home facilities in the area. |
| P-2 | Conduct engineering studies to harden Tybee Island Lighthouse and Fort Screven. | All | 1 & 3 | Moderate | Tybee Island Lighthouse; Fort Screven | PDM; HMGP | Deleted | Deleted; This is not a City property. |
| P-3 | Research availability of temporary housing for island residents. | All | 1 | Low | City Administration | Local Staff Time | Completed | Completed-Research indicates that temporary housing on the island is not practical based on the potential scenarios. |
| P-4 | Put a plan in place for removal of records and documents from lower levels of buildings that may be flooded following a storm surge. | Flood/Storm Surge | 1 & 3 | Low | City Administration | Local Staff Time | Completed | Completed-A policy has been put in place to remove records from the lower levels of critical facilities based on evacuation plans. |
| **Property Protection** | | | | | | | | |
| PP-1 | Assist Tybee nursing home in applying to construct safe room(s). | All | 1 | Moderate | City Administration | Federal Funds | Completed | Deleted-This facility is not in the City's jurisdiction. |
| PP-2 | Evaluate critical facilities and recommend appropriate storm surge retrofit protection measures. | Storm Surge | 1 & 3 | Low | City Administration | HMGP; PDM | Completed | Completed-The study was completed and recommendations were made for specific facilities for elevation or equipment needs. |
| PP-3 | Study potential effects of hazards on cemeteries. | All | 1 | Low | City Administration | Local Staff Time | Deleted | Deleted-There are no cemeteries located within the City of Tybee Island. |
| PP-4 | Acquire of elevate repetitive loss properties. If properties are acquired they could be demolished and land preserved as open space. | Flood | 1 | Moderate | City Administration | HMGP; PDM; SRL; FMA | 2020 | New-There are 9 properties on the current repetitive loss list and these properties have had 2 or more floods in a 5-year period resulting in a dollar loss of $2,5000 or more. |

| Action # | Description | Hazard(s) Addressed | Goal Addressed | Relative Priority | Lead Agency/ Department | Potential Funding Sources | Implementation Schedule | Implementation Status (2015) |
|---|---|---|---|---|---|---|---|---|
| PP-5 | Elevate the 3 city potable water well pump houses (#78 Van Horn, #111 Butler Avenue, #105 14th Street). | Flood | 1 | Moderate | City Water and Sewer Department | Local Funds; FMA; HMGP; PDM | 2020 | New-Work will consist of the construction of an elevated building (Pump House) to house the motor, pump, pump control panel and generator with diesel fuel tank. The Chlorine Tank would still remain on ground lever under the new elevated building. |
| **Natural Resource Protection** | | | | | | | | |
| NRP-1 | Protect existing sand dunes. | Tornado, Thunderstorm, Storm Surge, Hurricane, High Winds | 1 & 3 | Moderate | City Administration | PDM; FMA; HMGP | 2017 | Deferred-This is a continuous effort in which the City seeks federal funding to protect its coast line. |
| NRP-2 | Build additional sand dunes. | Tornado, Thunderstorm, Storm Surge, Hurricane, High Winds | 1 & 3 | Moderate | City Administration | Local Funds | 2018 | Deferred-This is a continuous effort by the City to protect their coast line. |
| NRP-3 | Regulate dock construction to reduce damage to native marsh grass. | Tornado, Thunderstorm, Storm Surge, Hurricane, High Winds | 1 & 3 | Moderate | City Administration | State and Local Funds | Deleted | Deleted-This is regulated by State Law. |
| **Structural Projects** | | | | | | | | |
| SP-1 | Remove submerged hazards from North Beach (pieces of old jetties protrude at low tide but are covered at high tide creating a safety hazard for swimmers). | Storm Surge, Hurricane | 1 | Moderate | City Administration | Local Funds | 2017 | New-Warning signs have been posted and some light objects have been removed by the City of Tybee Island but more funding is needed for total removal of the hazards. Minor work to remove obstacles is ongoing. |

| Action # | Description | Hazard(s) Addressed | Goal Addressed | Relative Priority | Lead Agency/ Department | Potential Funding Sources | Implementation Schedule | Implementation Status (2015) |
|---|---|---|---|---|---|---|---|---|
| SP-2 | Install tide flex valve at 3rd Street, Venetian Drive, Chatham Avenue, and Alley #3. | Storm Surge, Flood | 1 | Moderate | City Public Works Department | Local Funds | Completed | Completed-The City's drainage is tidal influenced. These valves have been installed and keep the tide from filling up our pipes allowing us to retain more storm water. |
| **Emergency Services** | | | | | | | | |
| ES-1 | Install public announcement systems to be placed at each beach entrance on Tybee Island. | All | 1, 3 & 4 | Low | City Administration | HMGP 5% | Completed | Completed-4 PA alert systems were installed and equipped with audio and voice that can be heard throughout the island. |
| ES-2 | Upgrade generators at pump stations. | All | 1 | High | City Administration | HMGP 5% | Completed | Completed |
| ES-3 | Add redundancy to utility lines into Tybee Island. | All | 4 | Low | City Administration; GA Power | HMGP; PDM | 2019 | Deferred-The City is working with GA Power to continue this endeavor and anticipates completion in 2020. |
| ES-4 | Purchase portable generators for stationing at each of the three Tybee Island gas stations, and other uses as needed. | All | 1 & 3 | Moderate | City Administration | HMGP 5% | Completed | Completed-The generator is located at Police Station Gas Pump for fueling of all City vehicles. |
| ES-5 | Conduct additional hazard mitigation training for the fire department. | All | 1 | Low | City Administration/ Fire Department | Local Funds | Completed | Completed-Two City-wide hazard mitigation exercises have been conducted with personnel from each City department participating. |
| **Public Education and Awareness** | | | | | | | | |
| PEA-1 | Conduct workshops related to FEMA hazard mitigation grant programs as needed. | All | 4 | Moderate | City Administration | State Funds | 2016 | New-The City will work with the County to support public education on this endeavor. |

# CHAPTER 5 – EXECUTING THE PLAN

Chapter 5 describes the full execution of the plan. The following sections are included in this chapter:

I. Implementation Action Plan
II. Evaluation, Monitoring, Updating
III. Plan Update and Maintenance

**Table 5.1** provides a brief description of each section in this chapter and a summary of the changes that have been made.

**Table 5.1: Overview of updates to Chapter 5: Executing the Plan**

| Chapter 5 Section | Updates to Section |
|---|---|
| I. Implementation Action Plan | Some minor edits have been made. |
| II. Evaluation, Monitoring, Updating | Some additions have been made. |
| III. Plan update and maintenance | Some minor edits have been made. |

## I. Implementation Action Plan

### A. Administrative Actions

Once this plan update is approved, as with the 2010 plan, the County and seven municipalities affected by this plan will designate appropriate agencies within their jurisdictions to review this plan, evaluate the pre-assigned priorities, develop specific work plan proposals, and implement the plan.

Because of the multiple types of mitigation actions in this plan and the diverse funding sources that may be used, implementation methodologies will vary. Some mitigation actions may be initiated and supported by a local government in accordance with this plan. Others may involve multi-jurisdictional planning, cooperation and project proposal to FEMA or other funding agencies. Mitigation actions that can be accomplished through policy adoption by local governmental bodies and those likely to incur low local budgetary impacts can be selected as pilot actions to demonstrate feasibility.

County and municipal officials designated to implement this plan will include suitable reporting procedures (see next sections) to ensure effectiveness in their implementation instructions by providing project status reports that will address which implementation processes work well, challenges encountered, effectiveness of coordination efforts, and recommendations for revisions of strategies and implementation processes.

## B. Authority and Responsibility

The Georgia Emergency Management Act of 1981 authorizes local emergency management agencies such as CEMA to conduct emergency management activities for the County. CEMA was authorized to develop and implement a plan for mitigation actions by Local Government Resolution for Emergency Management executed by the Chatham County Commission and local municipalities on 25 April 2000.

Each of the local governments (Chatham County and the municipalities of Bloomingdale, Garden City, Pooler, Port Wentworth, Savannah, Thunderbolt, and Tybee Island) covered by this plan bear authority and responsibility for implementation of the plan within their respective jurisdictions, with coordination provided by CEMA. To maximize benefits, prior to funding, a formal cost-benefit analysis will be conducted to the satisfaction of the funding institution (e.g. county, municipality, or outside agency).

## C. Prioritization

Chapter 4 of this plan prioritizes the Mitigation Actions as being "high, moderate, or low" priority. High-priority designated tasks will be considered first for implementation by local officials followed by moderate and low priority actions. These priority designations were derived by the Hazard Mitigation Planning Team after consideration of social, technical, administrative, political, legal, economic and environmental (STAPLEE) criteria.

## D. Incorporation of Chatham County Pre-Disaster Hazard Mitigation Plan into Other Planning Activities

The County and municipal governments incorporate the goals, objectives and steps of this plan into other planning initiatives such as comprehensive plans, emergency operations plans, capital improvement plans, and other plans when appropriate. The 2010 Chatham County Pre-Disaster Hazard Mitigation Plan was used to guide revisions to the Chatham County Emergency Operations Plan (EOP); similarly, the priority selection of hazards addressed in this plan will be used to inform planning, disaster public education and resource management activities conducted by the County and by municipal governments and other entities within the County, including the County EOP, to which all seven municipalities are signatories. The 2010 plan was made available to county, municipal, and area planning organizations, including the Chatham County-Savannah Metropolitan Planning Commission (MPC), to serve as a foundation for planning and mitigation efforts. The MPC as well as the Savannah Area Geographic Information System (SAGIS) offices have significant research, planning, and mapping capabilities that consistently use the Chatham County Pre-Disaster Hazard Mitigation Plan as a reference in providing support to area jurisdictions.

This plan update will be presented to the agencies, writers, consultants and/or committees responsible for comprehensive plans, response plans and other such documents for their use in incorporating mitigation actions in support of their community preparedness, mitigation, and

long-term planning activities, including the MPC and the New Zoning Ordinance project. The project requirements from this plan will be incorporated into other planning mechanisms, as applicable, during the routine re-evaluation and update of these plans.

## II. Evaluation, Monitoring, Updating

### A. Method

CEMA will review this plan annually and reach out to the municipalities bi-annually to determine any changes in their activities noted in Annex L. CEMA will regularly review the status of implementation of action items in the plan. Monitoring activities will consist of:

- Soliciting and reviewing reports every other year no later than March 31 from participating municipalities and the County regarding status of implementation of action items from the plan.
- Tracking progress of sources of improved or revised data for use in subsequent plan updates no less frequently than biennially.
- Preparing a report of the status of implementation of action items from the plan and the availability of improved or revised data.

### B. Criteria

Mitigation activity status reports will indicate if projects have been:

- Scoped and/or documented for FEMA or other grant applications;
- Submitted for FEMA or other funding programs;
- Approved (or denied approval) for FEMA or other funding;
- Documented for funding by other means (e.g., municipal capital improvement plans);
- Funded (or not approved for funding) by other means;
- Under construction;
- Completed;
- For completed projects, whether hazard conditions have occurred such that avoided losses can be documented.

### C. Responsibility

CEMA has coordinating responsibility for mitigation planning efforts and for oversight of ongoing monitoring and evaluation of related mitigation actions. The responsible department for individual mitigation actions is expected to provide status and other reports as needed to document project progress and results. The meeting and update information is included in Annex L. In 2014, the municipalities were contacted regarding the update of the hazard mitigation plan in 2015.

### D. Timeframe

See outline in B. Criteria, above, regarding project status updates. CEMA maintains a schedule of monitoring, evaluating, and updating the mitigation plan throughout the five-year cycle. CEMA will review the plan and mitigation action implementation no later than March 31 each even-numbered year. In addition, when the provisions of this plan are impacted by an event of the hazard types provided for in it, updated data and lessons will be collected and collated within a reasonable period post-event for incorporation into the Hazard Mitigation Plan. A review and analysis shall then be conducted by CEMA, and appropriate findings made public and provided to participating organizations by the same methods used to develop this plan, with periods for public and those organizations' comments following.

## III. Plan Update and Maintenance

### A. Public Involvement

The public's and organizations' comments shall be considered by CEMA in the plan maintenance and update process, and appropriate data from the review, analysis and public comments will be used to modify the provisions of this plan. Modifications shall be promulgated by the same methods used to develop this plan.

The public will be notified of mitigation planning activity and opportunities for input via press releases and notices on the CEMA website.

### B. Timeframe

In addition to monitoring the progress of projects, the plan update is required to be evaluated and then revised or updated at least every five years from the date of FEMA approval. CEMA will establish a routine schedule of monitoring, evaluating, and updating the mitigation plan throughout the five-year cycle, including biennial review of the plan (by March 31 of each even-numbered year). If a disaster occurs or as action items are completed, the plan will be reviewed, revised, and updated as soon as practicable.

# CHAPTER 6 - CONCLUSION

This plan represents Chatham County's updated all-hazard mitigation strategy. It is based on the County's 2010 Pre-Disaster Hazard Mitigation Plan and was expanded and brought up to date using an inclusive planning process.

**Table 6.1** provides a brief description this chapter and a summary of the changes that have been made.

**Table 6.1: Conclusion**

| Chapter 6 Section | Updates to Section |
|---|---|
| Conclusion | Some minor edits have been made. |

For each hazard addressed in the plan, a qualitative damage/loss estimate was developed using low/moderate/high designations, based upon local knowledge of the community and municipal and county facilities. Committee members looked at potential risk to people (loss of life or injury), risk to facilities and critical facilities (primarily damage to the physical structure), and risk to infrastructure (utilities and roads primarily). While specific areas of concern or increased vulnerability are discussed in Chapters 2 and 3, the overall impact to the County was determined as follows:

**Table 6.1: Summary of Qualitative Risk Assessment**

| Hazard Type | Risk to People | Risk to Buildings | Risk to Infrastructure |
|---|---|---|---|
| **Atmospheric Hazards** | | | |
| Drought | Moderate | Low | Low |
| Extreme Heat | Moderate | Low | Low |
| Hailstorm | Low | High | Moderate |
| Hurricane and Tropical Storm | High | High | High |
| Lightning | Moderate | Moderate | Moderate |
| Thunderstorm / High Wind | Moderate | High | High |
| Tornado | High | High | Moderate |
| Winter Storm and Freeze | Moderate | Low | Moderate |
| **Geologic Hazards** | | | |
| Earthquake | Moderate | Moderate | Moderate |
| **Hydrologic Hazards** | | | |
| Dam and Levee Failure | Low | Low | Low |
| Erosion | Low | Moderate | Low |
| Flood | Moderate | High | Low |
| Storm Surge | High | High | High |
| Sea Level Rise | Low | Moderate | Moderate |

| Hazard Type | Risk to People | Risk to Buildings | Risk to Infrastructure |
|---|---|---|---|
| **Other Hazards** | | | |
| Wildfire | Moderate | Moderate | Moderate |
| Hazardous Materials Incident | High | High | High |
| Terror Threat | High | High | High |

Quantitative risk assessments were conducted based on the best data available at this time. These assessments are summarized in the following table. Information regarding the process used for these risk assessments can be found in Annex A along with a list of critical facilities and their specific hazard risks and a comprehensive list of historic occurrences of hazards.

**Table 6.2: Summary of Quantitative Risk Assessment**

| Hazard Type | Population at Risk | Critical Facilities at Risk | Buildings at Risk |
|---|---|---|---|
| **Atmospheric Hazards** | | | |
| Drought | 271,102 | 750 | 134,783 |
| Extreme Heat | 271,102 | 750 | 134,783 |
| Hailstorm | 271,102 | 750 | 134,783 |
| Hurricane and Tropical Storm | 271,102 | 750 | 134,783 |
| Lightning | 271,102 | 750 | 134,783 |
| Thunderstorm / High Wind | 271,102 | 750 | 134,783 |
| Tornado | 271,102 | 750 | 134,783 |
| Winter Storm and Freeze | 271,102 | 750 | 134,783 |
| **Geologic Hazards** | | | |
| Earthquake | 271,102 | 750 | 134,783 |
| **Hydrologic Hazards** | | | |
| Dam and Levee Failure | <2,600 | 3 | <1,000 |
| Erosion | <10,500 | 37 | <4,000 |
| Flood (All Flood Zones) | 135,405 | 213 | 52,079 |
| Storm Surge (Cat 4) | 250,673 | 490 | 96,413 |
| Sea Level Rise (4 feet) | >17,000 | 323 | >7,000 |
| **Other Hazards** | | | |
| Wildfire | 111,324 | 171 | 42,817 |
| Hazardous Materials Incident | 271,102 | 695 (Fixed)<br>648 (Mobile) | 123,944 (Fixed)<br>111,074 (Mobile) |
| Terror Threat | 271,102 | 750 | 134,783 |

*In cases where population could not be easily calculated because detailed data was not available, estimates for structures and population were made using a 2.6 multiplier of average number of persons per household in the United States in 2012 (U.S. Census).

Quantitative risk assessment can be improved for future plan updates by gathering more detailed data on critical facilities and their vulnerabilities. During this plan update, more detailed assessments at the individual facility level regarding the vulnerabilities to each hazard were carried out. Inventories of contents at risk would improve this methodology. This is addressed in several of the action items within Chapter 4.

References, planning documentation, and additional sources of information can be found in annexes.