2014

Hazard Mitigation Plan

❖ City of Chesapeake, Virginia

REPORT DOCUMENTATION

TITLE	REPORT DATE
City of Chesapeake, Virginia Hazard Mitigation Plan	May 27, 2014

ABSTRACT

The *City of Chesapeake Hazard Mitigation Plan* has been updated for 2014. The City is vulnerable to a wide range of hazards that threaten the safety of residents and have the potential to damage or destroy both public and private property and disrupt the local economy and overall quality of life. While the threat from hazards may never be fully eliminated, the *City of Chesapeake Hazard Mitigation Plan* recommends specific actions designed to protect residents, business owners and the built environment.

GRANT/SPONSORING AGENCY	ACKNOWLEDGEMENTS
This report was funded by the Federal Emergency Management Agency through the Virginia Department of Emergency Management, via grant Agreement number HMGP-4024-550-09 for $39,000.	The NEMAC would like to acknowledge the contributions of REMSA, Inc., Hampton, Virginia, throughout the planning process, as well as the contributions of the members of NEMAC and the extended subcommittee that made the planning process work.

INTRODUCTION

2014 UPDATE

Each section of this plan has been updated as part of the 2014 update process. At the beginning of each section, there is a brief description of the changes made to that section as part of the update. Also, the City of Chesapeake's Natural Event Mitigation Advisory Committee (NEMAC) concluded that the 2014 update would include formatting and other changes to align the plan with the *2011 Southside Hampton Roads Hazard Mitigation Plan* in anticipation of joining future Southside multi-jurisdictional planning processes.

Section 1 was updated to align the document with the *2011 Southside Hampton Roads Hazard Mitigation Plan*.

BACKGROUND

The City of Chesapeake is vulnerable to a wide range of natural hazards that threaten the safety of residents, and have the potential to damage or destroy both public and private property and disrupt the local economy and overall quality of life.

While the threat from hazards may never be fully eliminated, much can be done to lessen their potential impact. The concept and practice of reducing risks associated with known hazards is referred to as *hazard mitigation*.

FEMA Definition of Hazard Mitigation

"Any sustained action taken to reduce or eliminate the long-term risk to human life and property from hazards."

Hazard mitigation techniques include both structural measures, such as strengthening or protecting buildings and infrastructure, and non-structural measures, such as the adoption of sound land use or floodplain management policies and the creation of public awareness programs. Effective mitigation measures are often implemented at the county or municipal level, where decisions that regulate and control development are made. A comprehensive mitigation approach addresses hazard vulnerabilities that exist today and in the foreseeable future. Therefore, projected patterns of future development must be evaluated and considered in terms of how that growth will increase or decrease a community's hazard vulnerability over time.

As a community formulates a comprehensive approach to reduce the impacts of hazards, a key means to accomplish this task is through the development, adoption, and regular update of a local hazard mitigation plan. A hazard mitigation plan establishes the community vision, guiding principles, and the specific actions designed to reduce current and future hazard vulnerabilities.

The City of Chesapeake Hazard Mitigation Plan (hereinafter referred to as "Hazard Mitigation Plan" or "Plan") is a logical part of incorporating hazard mitigation principles and practices into routine government activities and functions. The Plan recommends specific actions designed to protect residents, business owners, and the developed environment from those hazards that pose the greatest risk. Mitigation actions should go beyond recommending structural solutions to reduce existing vulnerability, such as elevation, retrofitting, and acquisition projects. Local policies that guide community growth and development, incentives tied to natural resource protection, and public awareness and outreach activities should be considered to reduce the City's future vulnerability to identified hazards.

In keeping with federal requirements and to present a review of Chesapeake's risk and vulnerability, state and regional capabilities, and revised local capabilities, NEMAC prepared this updated Hazard Mitigation Plan in 2013 and 2014. The committee worked throughout 2013 to update mitigation goals, objectives, and recommended actions, as outlined in detail in Section 2. As part of the ongoing mitigation planning process, this Plan is the result of the 2013/2014 mitigation evaluation.

DISASTER MITIGATION ACT OF 2000

In an effort to reduce the Nation's mounting natural disaster losses, Congress passed the Disaster Mitigation Act of 2000 (DMA 2000). Section 322 of DMA 2000 requires that state and local governments develop a hazard mitigation plan in order to remain eligible for pre- and post-disaster mitigation funding. These funds include the Hazard Mitigation Grant Program (HMGP), Hazard Mitigation Assistance (HMA) and the Pre-Disaster Mitigation (PDM) program, which are administered by the Federal Emergency Management Agency (FEMA). Communities with an adopted and federally approved hazard mitigation plan are eligible for available mitigation funds before and after the next disaster strikes.

This Plan was prepared and updated in coordination with FEMA and the Virginia Department of Emergency Management (VDEM) to make certain it meets all applicable state and federal mitigation planning requirements. In addition, guidance from the March 2013 FEMA manual, *Local Mitigation Planning Handbook* was used by NEMAC as well as professional consultants to guide the plan update process. The *Local Mitigation Plan Review Tool*, found in Appendix A, provides a summary of FEMA's current minimum standards of acceptability, and notes the location within the Plan where each planning requirement is met.

PURPOSE

The general purposes of this Hazard Mitigation Plan are to:

- protect life and property by reducing the potential for future damages and economic losses that result from natural hazards;
- qualify for additional grant funding, in both the pre-disaster and post-disaster environment;
- speed recovery and redevelopment following future disasters;
- integrate existing flood mitigation documents;
- demonstrate a firm local commitment to hazard mitigation principles; and
- comply with state and federal legislative requirements tied to local hazard mitigation planning.

SCOPE

This Hazard Mitigation Plan shall be updated and maintained to continually address those natural hazards determined to be of high and moderate risk as defined by the results of the risk assessment (see "Conclusions on Hazard Risk" in Section 5: *Vulnerability Assessment*). This enables Chesapeake's NEMAC to prioritize mitigation actions based on those hazards which present the greatest risk to lives and property.

The planning area includes the incorporated, independent City of Chesapeake, Virginia.

AUTHORITY

This updated Hazard Mitigation Plan was adopted by the City of Chesapeake on May 27, 2014. A copy of the resolution adopting the Plan is included in Appendix B.

This Plan was developed and updated in accordance with current state and federal rules and regulations governing local hazard mitigation plans. The Plan shall be monitored and updated on a routine basis to maintain compliance with the following legislation:

- Section 322, Mitigation Planning, of the Robert T. Stafford Disaster Relief and Emergency Assistance Act, as enacted by Section 104 of the Disaster Mitigation Act of 2000 (P.L. 106-390); and
- Title 44 Code of Federal Regulations, Part 201, used as the basis for the October 1, 2011 update to FEMA's *Local Mitigation Plan Review Guide*.

PLANNING PROCESS

2014 UPDATE

Separate sections summarizing the meetings and procedures followed during the 2013/2014 update process were appended to each subsection. The original planning process was edited for brevity, but the overall plan history is maintained herein.

Section 2 was updated to align the document with the *2011 Southside Hampton Roads Hazard Mitigation Plan*.

INTRODUCTION

This section describes the original mitigation planning process undertaken by the City of Chesapeake in 2003, as well as the processes followed in the 2008 and 2014 updates. This section consists of the following five subsections:

- OVERVIEW OF HAZARD MITIGATION PLANNING
- PREPARING THE PLAN
- THE PLANNING TEAM
- COMMUNITY MEETINGS AND WORKSHOPS
- INVOLVING THE PUBLIC AND IDENTIFIED STAKEHOLDERS

OVERVIEW OF MITIGATION PLANNING

Local hazard mitigation planning involves the process of organizing community resources, identifying and assessing hazard risks, and determining how to minimize or manage those risks. This process results in a hazard mitigation plan that identifies specific actions designed to meet the goals established by those that participate in the planning process. To ensure the functionality of each mitigation action, responsibility is assigned to a specific individual, department or agency along with a schedule for its implementation. Plan maintenance procedures are established to help ensure that the plan is implemented, as well as evaluated and enhanced as necessary. Developing clear plan maintenance procedures helps ensure that the Hazard Mitigation Plan remains a current, dynamic, and effective planning document over time.

Participating in a hazard mitigation planning process can help local officials and citizens achieve the following results:

- save lives and property;
- save money;
- speed recovery following disasters;
- reduce future vulnerability through wise development and post-disaster recovery and reconstruction;
- enhance coordination within and across neighboring jurisdictions;

- expedite the receipt of pre-disaster and post-disaster grant funding; and
- demonstrate a firm commitment to improving community health and safety.

Mitigation planning is an important tool to produce long-term recurring benefits by breaking the repetitive cycle of disaster loss. A core assumption of hazard mitigation is that pre-disaster investments 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 reducing hazard vulnerability. Measures such as the acquisition or regulation of land in known hazard areas can help achieve multiple community goals, such as preserving open space, improving water quality, maintaining environmental health, and enhancing recreational opportunities. It is the intent of this document to help identify overlapping community objectives and facilitate the sharing of resources to achieve multiple aims.

PREPARING THE PLAN

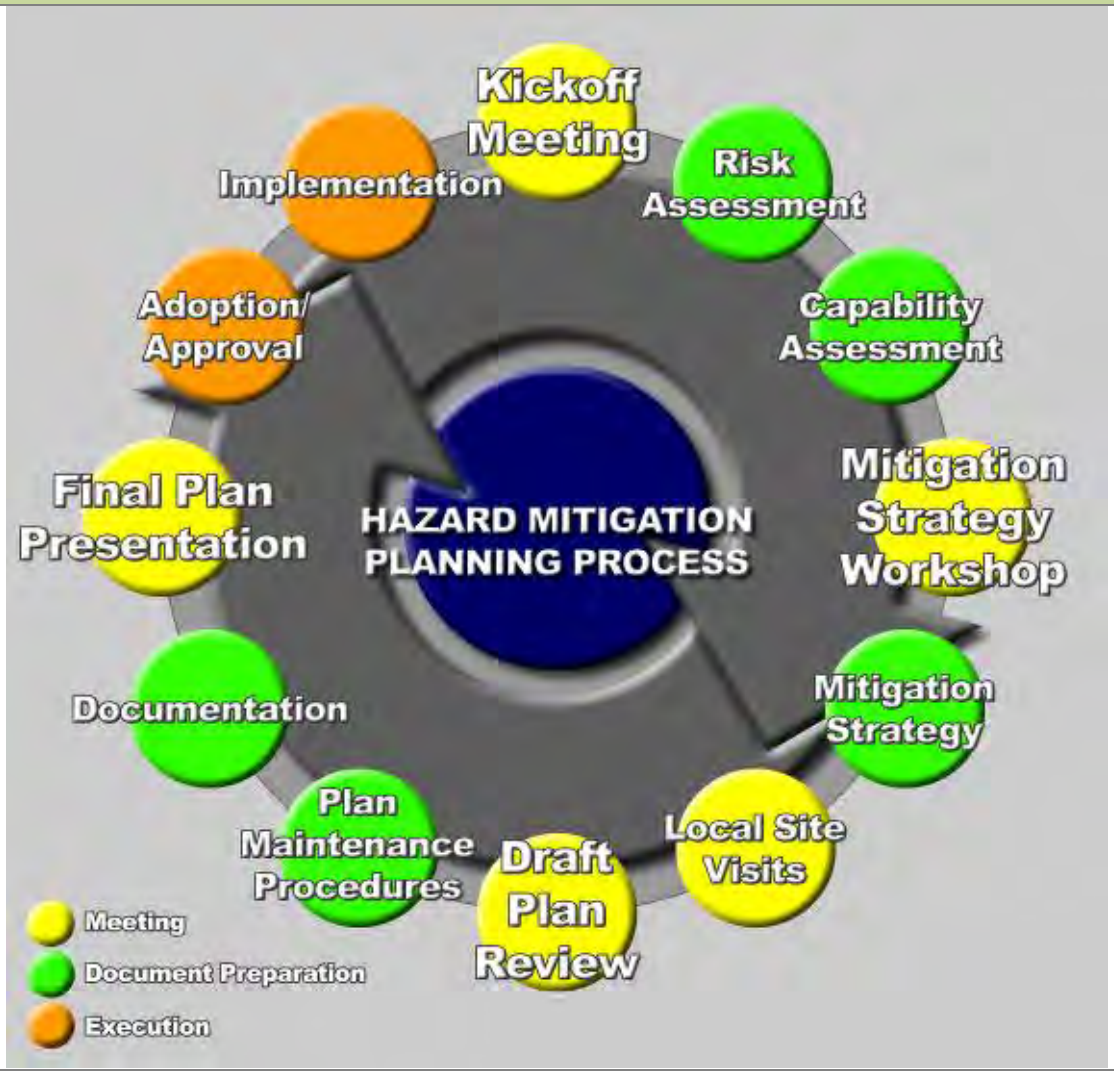
44 CFR Requirement

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.

Chesapeake's NEMAC used Federal Emergency Management Agency guidance (FEMA Publication Series 386) to develop and update this Hazard Mitigation Plan. A *Local Mitigation Plan Review Tool*, found in Appendix A, provides a detailed summary of FEMA's current minimum standards of acceptability for compliance with the Disaster Mitigation Act of 2000 and notes the location where each requirement is met within the Plan. These standards are based upon FEMA's Interim Final Rule as published in the Federal Register on February 26, 2002, and October 31, 2007, in Part 201 of the Code of Federal Regulations (CFR).

The planning process included nine major steps that were completed in 2003, and again during the update process beginning in May 2013. These steps are illustrated in **Figure 2.1**. Each of the planning steps illustrated in Figure 2.1 resulted in work products and outcomes that collectively make up the Hazard Mitigation Plan.

FIGURE 2.1: CITY OF CHESAPEAKE HAZARD MITIGATION PLANNING PROCESS



THE PLANNING COMMITTEE

A community-based planning team made up of NEMAC members, additional local government officials, and key stakeholders, including citizens, helped guide the development of the Plan. The committee organized local meetings and planning workshops to discuss and complete tasks associated with preparing the Plan, including reviewing plan drafts and providing timely comments. Additional participation and input from residents and other identified stakeholders was sought through the distribution of survey questionnaires and public meetings that described the planning process, the findings of the risk assessment, and the proposed mitigation actions. The committee reconvened in 2013 and used a similar process for the update.

CHESAPEAKE MITIGATION PLANNING COMMITTEE

The participants listed in **Table 2.1** are the members of the 2008 and 2014 Chesapeake Hazard Mitigation Planning Committees who participated in the planning process. Specifically, the tasks assigned to the committee members included:

- participate in mitigation planning meetings and workshops;
- provide best available data as required for the risk assessment portion of the Plan;
- provide copies of any mitigation or hazard-related documents for review and incorporation into the Plan;
- support the development of the Mitigation Strategy, including the design and adoption of community goals and objectives;
- help design and propose appropriate mitigation actions for incorporation into the Mitigation Action Plan;
- review and provide timely comments on all study findings and draft components of the plan; and
- support the adoption of the Hazard Mitigation Plan by community leaders.

Additional participation and input from other identified stakeholders and the general public was sought by the Committee during the planning process through e-mails, advertisements and public notices aimed at informing people about the status of the Plan. Public and stakeholder involvement is discussed in more detail later in this section.

TABLE 2.1: HAZARD MITIGATION PLANNING COMMITTEE MEMBERS

NAME	YEAR(S) OF PARTICIPATION IN PROCESS	DEPARTMENT	APPOINTED NEMAC MEMBER?
Kendall Calvert	2008	Citizen	Yes
Rick Randall	2008	Citizen	Yes
Joey Rothgery	2008	American Red Cross	Yes
Shelley Jaye	2008	Citizen	Yes
Scott Whitehurst	2008	Citizen	Yes
Cherie Walton	2008	Citizen	Yes
William Jones	2008	Citizen	Yes
Jeff Parrish	2008	Citizen	Yes
Sara Ruch	2008	Citizen	Yes
Jim Scruggs	2008	Citizen	Yes
Heath Covey	2008	Public Communications	Yes
Eric Martin	2008	Public Works	Yes
Tom Elder	2008	Economic Development	Yes
Scott Meyer	2008	Planning	Yes
Michelle Oblinsky	2008	Fire Department/OEM	Yes
John Knowles	2008	Public Utilities	Yes
Robert Smalley	2008	Neighborhood Services	Yes
Tim Winslow	2008	Facilities	Yes
Sheri Arnold	2008	Neighborhood Services	Yes
Jennifer White	2008	Planning	Yes
Steven Wright	2008	Economic Development	Yes

TABLE 2.1: HAZARD MITIGATION PLANNING COMMITTEE MEMBERS			
NAME	YEAR(S) OF PARTICIPATION IN PROCESS	DEPARTMENT	APPOINTED NEMAC MEMBER?
Bruno, Doug	2014	Citizen	Yes
Johnson, Becky	2014	Citizen	Yes
Poulin, Tom	2014	Citizen	Yes
Spatz, Stu	2014	Citizen	Yes
Wakefield, Pam	2014	Non-Profit	Yes
Walton, Cherie	2014	Businessperson	Yes
Webb, Steven	2014	Businessperson	Yes
Yacus, George	2014	Citizen	Yes
Ackiss, Carl	2014	Fire	No
Burkard, Richard	2014	Development & Permits	No
Covey, Heath	2014	Public Information	No
Gilbreath, Von	2014	Economic Development	No
Braidwood, Robb	2014	Emergency Management	No
Knowles, John	2014	Public Utilities	No
Sawan, Sam	2014	Public Works	No
Sweats, Brian	2014	Planning	No
Winslow, Tim	2014	Public Works	No
Bradshaw, Alan	2014	Dominion Power	No
Calderon, Val	2014	Cox Communication Risk Mgmt Specialist	No
Carter, Jeff	2014	Chesapeake Police	No
Fisher, Josh	2014	Chesapeake Parks & Recreation	No
Foley, Kirby	2014	Mosquito Control	No
Kirkby, Mark	2014	Chesapeake Sherriff's Office	No
Lackey, Kelly	2014	City Attorney	No
Lawrence, Watson	2014	Virginia Agricultural Extension	No
Lewis, Pat	2014	Chesapeake General Hospital, Security Office	No
Miller, Pam	2014	Virginia Health Dept., Emergency Planner	No
Sammler, Bill	2014	National Weather Service	No
Sommer, Pete	2014	Tidewater Community College	No

2003 COMMUNITY MEETINGS AND WORKSHOPS

In late 1999, FEMA and VDEM selected the City of Chesapeake to be a participating community in the Project Impact Program. The program was a nationwide initiative dedicated to help make communities become disaster-resistant through a local partnership of government officials, citizens, private sector companies, professional and civic associations, learning institutions, volunteer and community organizations, and the media. Representatives from each of these community stakeholder groups formed a Project Impact Steering Committee to develop disaster prevention and preparedness programs to reduce the impact of natural and manmade disasters.

From 2000 to 2002, the Steering Committee held regular meetings and continually worked on the City's Hazard Vulnerability Assessment (HVA). The Steering Committee coordinated and consulted with other entities and stakeholders to identify and delineate natural and manmade hazards within the City and to assess the risks and vulnerability of public and private buildings, facilities, utilities, communications, transportation systems, and other vulnerable infrastructure.

In February 2003, the City hired a consulting planner to build upon their completed HVA and Project Impact efforts and work with the community to develop the original Natural Hazards Mitigation Plan. A Mitigation Advisory Committee (MAC) that included public representatives, private citizens, businesses, and organizations was brought together to work with the consultants and provide input at key stages of the process. Efforts to involve City departments and community organizations that might have a role in the implementation of the mitigation actions or policies included: invitations to attend meetings and serve on the MAC, e-mails of minutes and updates, strategy development workshops, and teleconferences, and opportunities for input and comment on all draft deliverables.

The original Natural Hazards Mitigation Plan was completed in 2003 and was approved by FEMA in April 2004. NEMAC was created by City Council as one of the plan's mitigation strategies; the ordinance is included in Appendix C. NEMAC is a seventeen member committee comprising eight Chesapeake citizens and nine City employees from various departments, each having responsibilities in mitigation and recovery for the City. NEMAC is a purposefully diverse group of City employees, citizens and community organizations. It is this diversity within the committee that provides strength in unique and varied viewpoints regarding different issues.

2008 COMMUNITY MEETINGS AND WORKSHOPS

As the Office of Emergency Management moved forward with the Mitigation Plan Update needed for 2008, it was decided that NEMAC should be instrumental in providing guidance and contributing to the Plan. Rather than hire a consultant for the first update, a grant was applied for to allow the City to hire a planner to assist in the process. Much of the work was done as a concerted effort between the Office of Emergency Management and NEMAC. NEMAC decided to keep to the same format and a similar planning process that was successful in the original plan development.

Each NEMAC meeting in 2007 was dedicated to the Mitigation Plan Update. A subcommittee was formed in January. The subcommittee, made up of a majority of citizen committee members along with several City employee members, met in February and April 2007 to review and provide input on the Plan, particularly in Section 8. NEMAC meeting minutes further detail the agenda items and order of discussions from each session.

2013/2014 COMMUNITY MEETINGS AND WORKSHOPS

Below is a summary of the key meetings and community workshops during the 2014 update process. Routine discussions and additional meetings were held by local officials to accomplish planning tasks specific to their department or agency. A consultant (REMSA, Inc., of Hampton, Virginia) was hired with grant funds to update the hazard identification and vulnerability analysis, to guide the committee through the planning process based on the revised information, and to begin the process of moving the plan toward incorporation with the Southside Hampton Roads Hazard Mitigation Plan in future updates.

MAY 2, 2013: PROJECT KICKOFF MEETING

Participants in the Kickoff Meeting discussed the overall approach to updating the Hazard Mitigation Plan, with emphasis placed on priorities for outreach and public participation, as well as the steps necessary to meet the requirements of the Disaster Mitigation Act of 2000, and the Community Rating System (CRS) of the National Flood Insurance Program. The consultant initiated data collection efforts at the meeting and reviewed the existing list of hazards with the representatives present.

Community representatives requested that sea level rise/land subsidence, severe thunderstorms, extreme heat, and mosquito borne disease be included in the plan update. Manmade hazards included in the 2008 plan were discussed and determined to be outside the committee's scope. The mitigation actions suggested in the 2008 plan for manmade hazards have been (or were previously) included in other community plans, such as the Emergency Operations Plan. The group reviewed CRS requirements and discussed potential stakeholders and how they would be asked to participate, including tasks such as: reviewing drafts, participating on the committee, and/or attending public meetings.

SEPTEMBER 19, 2013: FIRST PLANNING COMMITTEE MEETING

The consultant provided an overview of the proposed update approach to committee members. Committee members discussed the hazards of most critical concern to the region, and concurred to adjust the names of several hazards, and added several hazards as well. The hazard rankings using a Probability Risk Index were discussed and tabled for additional discussion at the next meeting. The Committee reviewed the Hazard Identification and Vulnerability Assessment information updated by the consultant prior to this meeting.

OCTOBER 23, 2013: SECOND PLANNING COMMITTEE MEETING

The second Planning Committee meeting was the beginning of the "Mitigation Strategy Workshop." The meeting began with a detailed presentation on the findings of the capability assessment and additional discussion to refine those findings. The assessment included local capabilities, as well as updated information regarding completed mitigation actions.

Members of the Hazard Mitigation Committee discuss goal statements for the 2013 update.

In addition to the hazard identification and vulnerability data provided in Sections 4 and 5, the consultant helped the Committee members review several documents in preparation for the goal setting exercise which was the focus of the meeting. This background helped Committee members maintain continuity between various local, regional, and state planning efforts.

Data, documents, plans and procedures reviewed as part of the planning process included:

- Chesapeake's Comprehensive Plan goal statements;
- *2013 Commonwealth of Virginia Hazard Mitigation Plan* goals and objectives;
- Virginia *Governor's Commission on Climate Change Final Report*, December 2008; and,
- *2011 Southside Hampton Roads Hazard Mitigation Plan* Goals and Objectives
- the City's:
    - floodplain management regulations,
    - site plan review process, and
    - permitting procedures.

The group was provided a list of potential, broad community goal key words in order to encourage brainstorming about revising the goal statements. The members also reviewed existing goal statements from the current plan and other plans pertinent to the region. Subgroups chose their top key phrases, and they were presented to the larger group. The entire committee then carefully reviewed the existing mitigation plan goal statements and was encouraged to critique each word in light of the goal key words identified earlier. The facilitator reworked, grouped together, and presented the revised goals and objectives so that the group could arrive at a consensus on the broader mitigation goals and objectives associated with the updated mitigation plan.

Before the next meeting, the consultant organized and rewrote the goals based on committee member input and the voting results.

NOVEMBER 21, 2013: THIRD MITIGATION PLANNING COMMITTEE MEETING

The Committee reviewed the revised goals and objectives and approved the revisions with minor wording changes. The consultant shared additional review notes on floodplain management regulations, applications for Site Plan Review and Building Permit Applications, and suggested opportunities for mitigation actions based on capability gaps and other observations. The group again reviewed a general list of potential mitigation actions categorized by type.

Committee members worked carefully through a review of the list of existing mitigation actions from the 2008 plan, deciding which actions to modify or delete based on their progress toward completion. The group then selected and discussed priorities for several new proposed actions. The consultant discussed a variety of mitigation categories for considering and evaluating possible mitigation action alternatives appropriate to Chesapeake.

JANUARY 16, 2014: FOURTH MITIGATION PLANNING COMMITTEE MEETING

Following the November committee meeting, the consultant completed descriptions of each new or revised mitigation action item, including potential costs and benefits and priorities. The Committee received a completed list of proposed mitigation action items at the fourth planning meeting and was asked to provide comments.

INVOLVING THE PUBLIC

44 CFR Requirement

Part 201.6(b)(1): The planning process shall include an opportunity for the public to comment on the plan during the drafting stage and prior to plan approval.

Individual citizen involvement provides the planning committee with a greater understanding of local concerns and increases mitigation success by developing community "buy-in" from those directly affected by public policy and planning decisions. As citizens become more involved in decisions that affect their

life and safety, they are more likely to gain appreciation of the natural hazards present in their community and take personal steps to reduce hazard impacts. Public awareness is a key component of an overall mitigation strategy aimed at making a home, neighborhood, school, business or city safer from the effects of natural hazards.

Public input was sought using three methods: (1) open public meetings; (2) the FEMA Town Hall Meeting associated with the City's revised preliminary Flood Insurance Rate Maps; and (3) the posting of the draft Hazard Mitigation Plan on Internet Web sites and at government offices. Public meetings were held at two stages of the planning process; early in the process to introduce the revised Hazard Identification and Vulnerability Assessment, and after the planning committee workshops, but well prior to adoption by City Council.

2008 Public Meetings

There was continued public involvement in every step of the update process. Draft copies of the plan were on public display for review at all seven public libraries, the Office of Emergency Management, the Planning Department and the City's website beginning on October 8, 2007. Several opportunities were provided to the public for input and participation throughout the planning process. One open public meeting was held on November 15, 2007, to allow the general public an opportunity to meet with NEMAC members, ask questions, and provide comments and input on the draft mitigation plan.

2013/2014 Public Meetings

Three open public meetings were held to present the findings of the risk and capability assessments and to review mitigation actions to be included in the Hazard Mitigation Plan.

The first public meeting was held on September 19, 2013. The meeting was advertised in *The Virginian-Pilot*. This publication has local and regional circulation which ensured local officials, residents, businesses, and other public and private interests in the region, including neighboring communities, were notified on how to be involved in the local mitigation planning process.

Upon completion of a final draft Plan, the Committee held an open public meeting on the final Hazard Mitigation Plan on January 16, 2014. The meeting was advertised in the same manner, and provided further opportunities for the public and identified stakeholders to review and comment on all sections of the Plan prior to local approval and adoption. Advertisements and general notifications on the posting and availability of the draft Plan for public review were disseminated by the City through the web site: http://www.cityofchesapeake.net/. The meeting and subsequent 2-week review period provided citizens with a final opportunity to review the content of each of the Plan's sections, to ask questions and suggest possible revisions.

Participants in the January 16, 2014 Public Meeting comment on the Mitigation Actions for Chesapeake. (City Photo)

Additionally, the plan was reviewed and presented to City Council at a public hearing on May 27, 2014. Though the plan was in its final format, this did provide additional opportunity to answer questions and present findings to the public and elected officials.

2013 Town Hall Meeting

On October 30, 2013, FEMA and the City of Chesapeake jointly hosted a Town Hall Meeting at the Chesapeake Conference Center to introduce the preliminary Flood Insurance Rate Maps to the public. NEMAC was invited to set up a table to discuss the hazard mitigation planning process with interested persons. Many attendees provided feedback on the general location of repetitive flood loss areas and asked questions about the planning process. The program lasted from 2pm to 7pm, and more than 250 people attended.

2014 Public Participation Survey

A Public Participation Survey was designed to capture data and information from residents and business owners that might not be able to attend public meetings or participate through other means in the mitigation planning process.

There were 241 responses to the Public Participation Survey provided input for NEMAC. A summary of the survey findings is provided in Appendix D along with a copy of the survey instrument.

INVOLVING STAKEHOLDERS

44 CFR Requirement

Part 201.6(b)(2): The planning process shall include an opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have authority to regulate development, as well as businesses, academia and other private and non-profit interests to be involved in the planning process.

A range of stakeholders, including neighboring communities, agencies, businesses, academia, nonprofits, hospitals, and other interested parties were invited and encouraged to participate in the development of the Hazard Mitigation Plan. Stakeholder involvement was encouraged through notifications and invitations to agencies or individuals to participate in Planning Committee meetings and the Mitigation Strategy Workshop.

In addition to the Planning Committee meetings, the committee encouraged open and widespread participation in the mitigation planning process through the design and publication of newspaper advertisements that promoted the open public meetings. These media advertisements and survey instruments provided opportunities for local officials, residents, and businesses to be involved and offer input throughout the local mitigation planning process.

During the 2014 update process, additional stakeholders were invited to participate in one of three ways: 1) attend and participate in Committee meetings; 2) attend and participate in the Public Meetings; and/or 3) review draft documents and provide comments and critique. The additional stakeholders invited included:

- State agency representatives;
- the Hampton Roads Planning District Commission;
- Neighboring jurisdictions;
- Representatives from colleges and universities in the region;
- the National Weather Service;
- Representatives from utilities servicing the region; and,
- Representatives from the medical community.

COMMUNITY PROFILE

2014 UPDATE

Section 3 was updated to align the document with the *2011 Southside Hampton Roads Hazard Mitigation Plan*. Tables and figures were updated to incorporate data from the 2010 U.S. Census, the Hampton Roads Planning District Commission (HRPDC) and other sources.

INTRODUCTION

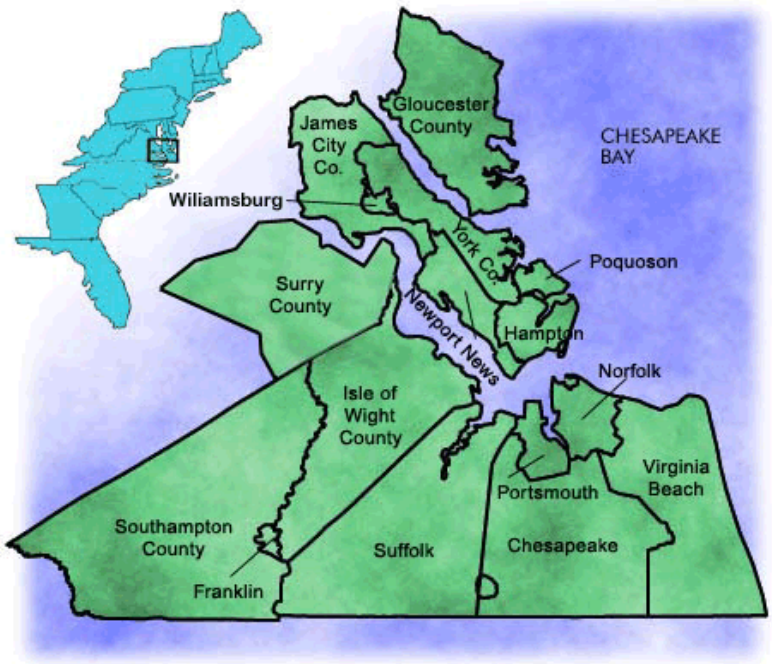
This community profile provides a general overview of the geography, environment, and economic characteristics of the City of Chesapeake. This section consists of the following five subsections:

- GEOGRAPHY AND THE ENVIRONMENT
- POPULATION AND DEMOGRAPHICS
- HOUSING, INFRASTRUCTURE, AND LAND USE
- EMPLOYMENT AND INDUSTRY
- DEVELOPMENT TRENDS

GEOGRAPHY AND THE ENVIRONMENT

Located in the southeastern quadrant of Virginia, the City of Chesapeake is bordered to the north by the Cities of Portsmouth and Norfolk, to the south by Currituck and Camden Counties in North Carolina, to the east by the City of Virginia Beach, and to the west by the City of Suffolk **(Figure 3.1)**. Averaging 353 square miles of land area within its jurisdictional boundaries, Chesapeake is the second largest city in land area in Virginia, and the 13th largest city in the United States. According to the City's Economic Development Department, Chesapeake lies within a 750-mile radius of 2/3 of the nation's population and industrial activity.

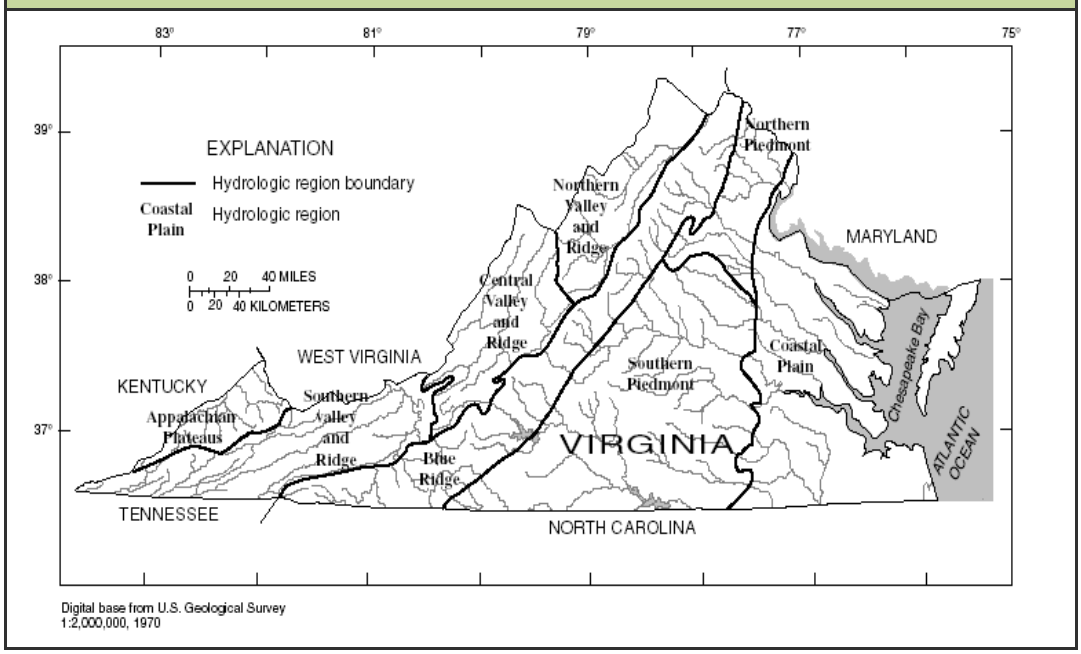
FIGURE 3.1: CITY OF CHESAPEAKE WITHIN THE HAMPTON ROADS REGION OF VIRGINIA



The City of Chesapeake is part of the Hampton Roads region, which includes the Cities of Virginia Beach, Hampton, Newport News, Williamsburg, Poquoson, Norfolk, Portsmouth, and Suffolk, and the Counties of York, Matthews, James City, Isle of Wight, and Gloucester in Virginia, and Currituck County in North Carolina. Hampton Roads is located within the Atlantic Coastal Plains Province, which is characterized by its low, flat relief **(Figure 3.2)**. The City's elevation is nearly level, with the highest elevation point being 25 feet above sea level. The overall elevation for the City of Chesapeake averages about 12.2 feet above sea level. Excluding the Great Dismal Swamp, approximately one-third of the City of Chesapeake's land area consists of wetlands.

The Atlantic Coastal Plain is the easternmost of Virginia's physiographic zones. The zone extends from New Jersey to Florida, and includes all of Virginia east of the Fall Line, which is the point at which east-flowing rivers cross from the hard, igneous, and metamorphic rocks of the Southern Piedmont to the relatively soft, unconsolidated strata of the Coastal Plain (USGS 2001).

FIGURE 3.2: HYDROLOGIC REGIONS OF VIRGINIA



The City of Chesapeake contains portions of two significant watersheds: the James River Watershed and the Albemarle Sound Coastal Watershed. The James River Watershed encompasses approximately 10,432 square miles, and its headwaters are located in Bath and Highland Counties. The James River, which is a part of the Chesapeake Bay Basin, empties into the Chesapeake Bay at Hampton Roads. The Albemarle Sound Coastal Watershed is a part of the Pasquotank River Basin and encompasses about 3,900 square miles. In Virginia, the watershed comprises four distinct sub-watersheds — the Great Dismal Swamp, North Landing River, Northwest River, and Back Bay. These waters flow into the Albemarle and Pamlico Sounds in southeastern North Carolina.

The Eastern Branch, Western Branch, and Southern Branch of the Elizabeth River are located within the City of Chesapeake. The Eastern Branch is located in the northeast portion of the City, while the Western Branch is located in the northwest. The Southern Branch is the main stem of the Elizabeth River, and is located towards the southwest and southeastern portions of the City. Indian River, a major drainageway for the City, is a tributary of the Eastern Branch. The Southern Branch is part of the Intracoastal Waterway system, connected by its Deep Creek tributary, which runs southwest to the Dismal Swamp Canal, and at the North Landing River via the Chesapeake and Albemarle Canal. The North Landing River is also a part of the Intracoastal Waterway, and serves as the easternmost boundary for the City. Other significant bodies of water within the City's jurisdictional boundaries include the Northwest River and Lake Drummond.

The summer, fall, spring, and winter temperatures are typically mild, averaging 76.5°, 61.9°, 57.2°, and 41.3°, respectively. Average rainfall is approximately 45 inches per year, and the region usually receives small amounts of snowfall annually. Additional discussion of weather extremes, including winter storms and extreme heat, are included in Section 4.

POPULATION AND DEMOGRAPHICS

Table 3.1 provides a summary of the population, housing, and land area present within Chesapeake and the Southside Hampton Roads region, as well population and housing densities per square mile. Chesapeake is the third largest city in what is often termed the "Southside" of Hampton Roads. However, the population density is far lower than the cities of Virginia Beach, Norfolk, and Portsmouth.

TABLE 3.1: SUMMARY OF REGIONAL POPULATION, HOUSING, LAND AREA AND DENSITY

JURISDICTION	POPULATION	HOUSING UNITS	AREA IN SQUARE MILES			DENSITY PER SQUARE MILE OF LAND AREA	
			TOTAL AREA	WATER AREA	LAND AREA	POPULATION	HOUSING UNITS
Virginia Beach	437,994	177,879	497	249	248	1,766	717
Norfolk	242,803	95,018	96	43	54	4,496	1,760
Chesapeake	222,209	83,196	351	10	341	652	244
Portsmouth	95,535	40,806	47	13	33	2,895	1,237
Suffolk	84,585	33,035	429	29	400	211	83
Isle of Wight County	35,270	14,633	363	47	316	112	46
Smithfield	8,089	3,323	10	1	10	809	332
Windsor	2,626	1,059	1	0	1	2,626	1,059
REGION TOTAL	**906,902**	**365,753**	**1,443**	**382**	**1,061**	**855**	**345**

Source: U.S. Census Bureau, 2010

According to the 2010 Census, the City of Chesapeake has a population of 222,209 people. **Table 3.2** shows total population breakdowns, including percent of children under the age of 18, percent of elderly population (age 65 and over), and percent of population living below the poverty level. Data in Table 3.2 are based on 2010 Census data and the most recent American Community Survey.

TABLE 3.2: DEMOGRAPHIC CHARACTERISTICS, CITY OF CHESAPEAKE

TOTAL POPULATION	UNDER 18 YEARS OLD (%)	65 YEARS AND OVER (%)	MEDIAN AGE	BELOW POVERTY LEVEL (%)
222,209	57,521 (25.9%)	23,146 (10.4%)	37 years	16,443 (7.4%)

Source: 2010 U.S. Census Bureau and 2007-2011 American Community Survey 5-Year Estimates

Table 3.3 lists the population change experienced by Chesapeake between 1970 and 2010, as well as the HRPDC population projection through 2040. While the cities of Portsmouth and Norfolk have experienced a decrease in overall population, all other jurisdictions have experienced a steady increase since 1970. Much of this trend may be attributed to suburbanization as residents move outward from the

denser city centers into suburban areas such as Chesapeake. The population projection for 2040 in Chesapeake, if realized, would represent a 58% population growth between 2000 and 2040.

TABLE 3.3: REGIONAL POPULATION CHANGE AND PROJECTED CHANGE, 1970 - 2040

JURISDICTION	1970	1980	1990	2000	2010	2040
Chesapeake	89,580	114,486	151,982	199,184	222,209	314,600
Isle of Wight County	18,285	21,603	25,053	29,728	35,270	62,800
Norfolk	307,951	266,979	261,250	234,403	242,803	253,200
Portsmouth	110,963	104,577	103,910	100,565	95,535	98,200
Suffolk	45,024	47,621	52,143	63,677	84,585	182,700
Virginia Beach	172,106	262,199	393,089	425,257	437,994	497,500
REGION TOTAL	**743,909**	**817,465**	**987,427**	**1,052,814**	**1,118,396**	**1,409,000**

Source: Hampton Roads Planning District Commission Population Estimates, U.S. Census Bureau

HOUSING, INFRASTRUCTURE AND LAND USE

According to the 2010 Census, there are 83,196 housing units in Chesapeake with more than 95% of the units classified as occupied. The majority of structures were built between 1980 and 1999 (46%), and almost 75% of all housing units are owner-occupied. Slightly more than 80% of the housing units are mortgaged. **Table 3.4** summarizes data on housing characteristics for Chesapeake. More specific information is provided in Section 5.

TABLE 3.4: HOUSING CHARACTERISTICS, CITY OF CHESAPEAKE

TOTAL HOUSING UNITS	AVERAGE HOUSEHOLD SIZE	MEDIAN VALUE	OCCUPIED UNITS (%)	STRUCTURES BUILT BEFORE 1970 (%)
82,763	2.75 persons	$271,700	78,893 (95.3%)	19,976 (24%)

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

The City has eight major highways and roads within its jurisdictional boundaries, including: I-64, I-264, I-464, I-664, US Route 58, US Route 17, Route 168, and Route 168 Bypass. Route 168 is a four-lane highway that links I-64 to North Carolina and the Outer Banks region, a major tourist destination throughout the year. US Route 58 links Hampton Roads with I-95 and I-85, which are the primary north-south interstate highways in Virginia, and US Route 13 connects the City to Virginia's Eastern Shore via the Chesapeake Bay Bridge Tunnel.

Water-related infrastructure is prevalent throughout the City's waterways for commercial, industrial, and recreational uses. Located approximately 20 miles inland from the Atlantic Ocean, the City has over 120 miles of commercial waterfront land, including over 12 miles of deep draft channels. According to the City of Chesapeake 2003 Legislative Program Document, the City has more miles of deep-water canals than

any other city in the country. The City is currently responsible for the maintenance, repair, and replacement of 56 fixed bridges, four drawbridges, and 10 overpasses. The City has four marinas: the Top Rack Marina, Chesapeake Marina, Centerville Waterway Marina, and Virginia Yacht Brokers. The park at Great Bridge also has a boat landing. There is also a boating facility at the Elizabeth River Boat Landing and Park. Also intersecting the City is a portion of the Atlantic Intracoastal Waterway, a series of federally maintained inland navigation channels that extends from Norfolk, Virginia to Miami, Florida. The Intracoastal Waterway was authorized by the Rivers and Harbors Act of 1938, and was developed and is still maintained by the U.S. Army Corps of Engineers.

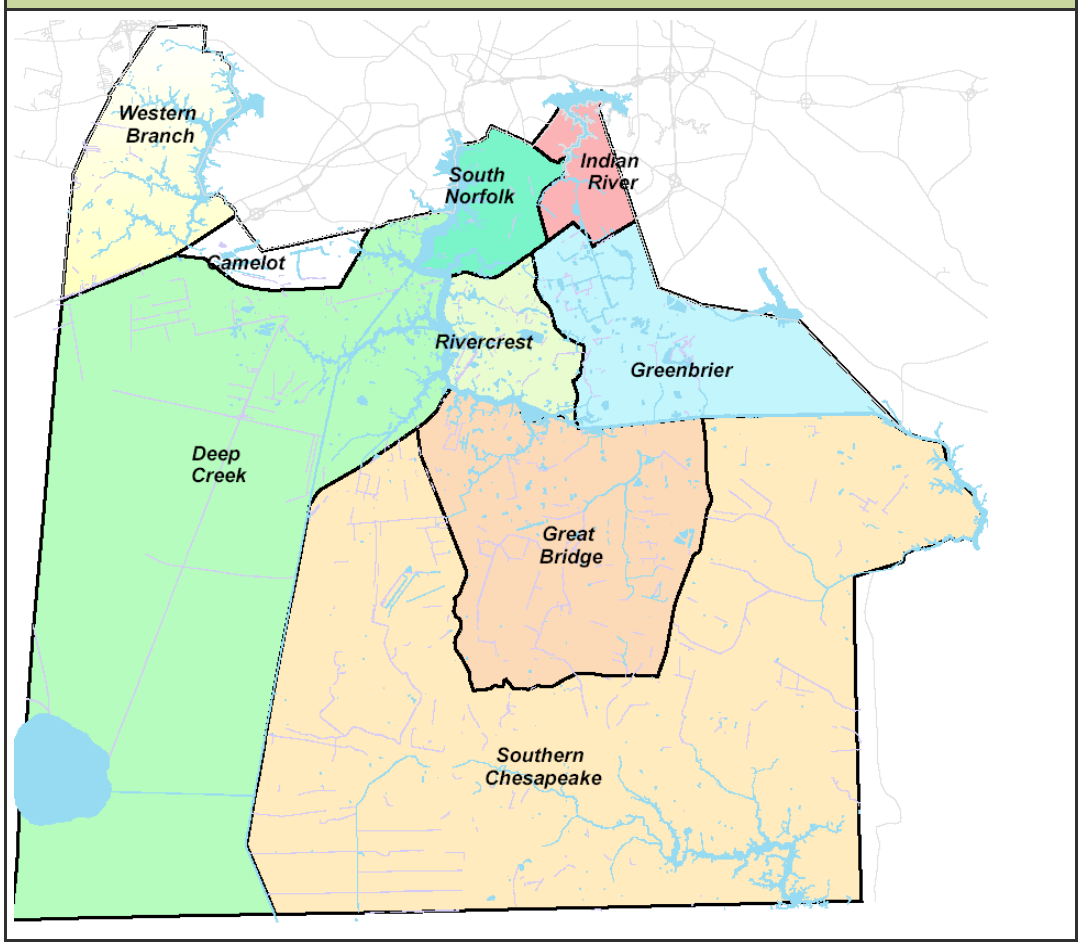
The Hampton Roads region's primary airport is the Norfolk International Airport located in the City of Norfolk. Chesapeake has two smaller airports, the Chesapeake Regional Airport and the Hampton Roads Airport, and a Federal landing field, Fentress Naval Auxiliary Landing Field. Rail operations have long been a part of Chesapeake's history, both for public and private uses. Rail lines within the City include CSX Railway Western Branch, Norfolk Southern, Commonwealth Railroad, the Chesapeake and Albemarle Railroad, and the Norfolk/ Portsmouth Beltline.

Electrical service is supplied throughout the region by Dominion Virginia Power, and natural gas is provided by Columbia Gas and Virginia Natural Gas. Verizon, Verizon Wireless, FIOS and Cox Communications are primary service providers for cable television, phone, and internet service.

With an enrollment of over 39,000 students, Chesapeake Public Schools is the seventh largest school system in the Commonwealth. Chesapeake has 28 primary and elementary schools, 10 middle schools, seven high schools, and over 1,600 acres of school campus. The schools operate the largest transportation system in the City with more than 400 buses; in 2006 the school bus fleet traveled over four million miles, transporting more than 28,000 students to and from school each day. The school system is also the City's largest employer with more than 6,000 employees. Additionally, Chesapeake has five special program centers; an alternative school, a center for science and technology, a gifted and talented school, a special education center, and an adult education center. Tidewater Community College operates a campus within Chesapeake with an annual enrollment of 34,000 students.

Of the City's estimated 225,920 total acres of land, less than one quarter (55,000 acres) of the land is zoned for residential uses. Of that amount, approximately 4,000 acres of undeveloped property remains available throughout the City for residential development. The City is divided into nine planning areas that are illustrated in **Figure 3.3**, including: Camelot, Deep Creek, Great Bridge, Greenbrier, Indian River, Rivercrest, Southern Chesapeake, South Norfolk, and Western Branch.

FIGURE 3.3: CITY OF CHESAPEAKE PLANNING AREAS



Development within the northern planning areas of South Norfolk, Indian River, Camelot, and the northeast corner of Deep Creek is urban in nature and the areas are more densely populated. Western Branch, Rivercrest, Greenbrier, and the northernmost parts of Great Bridge are suburban in nature. **Table 3.5** summarizes land use by planning area in Chesapeake.

TABLE 3.5: LAND USE BY PLANNING AREA

PLANNING AREA	RESIDENTIAL	COMMERCIAL	INDUSTRIAL	AGRICULTURAL	OTHER
Camelot	47.48%	5%	47.51%	-	-
Deep Creek	10.35%	0.93%	4.88%	13.53%	70.31%
Great Bridge	41.71%	4.16%	2.33%	45.4%	6.4%
Greenbrier	27.37%	7.35%	3.43%	43.09%	18.76%
Indian River	74.62%	7.31%	2.18%	2.96%	12.93%
Rivercrest	46.72%	11.38%	24.63%	1.39%	15.88%
South Norfolk	45.88%	8.6%	43.99%	-	1.53%
S. Chesapeake	3.73%	0.13%	0.36%	90.76%	5.02%
Western Branch	57.86%	10.1%	3.25%	26.86%	1.93%

Source: City of Chesapeake Planning Department

Table 3.6 summarizes population distributions by planning area in Chesapeake. The Western Branch and Great Bridge planning areas contain the City's highest populations, with 14.43% and 21.73% of the total population, respectively. Most new residential development is occurring within the Great Bridge, Greenbrier, and Rivercrest areas.

TABLE 3.6: POPULATION BY PLANNING AREA

PLANNING AREA	PERCENT OF POPULATION
Camelot	3.44%
Deep Creek	12.72%
Great Bridge	21.73%
Greenbrier	12.12%
Indian River	9.18%
Rivercrest	9.32%
South Norfolk	10.93%
S. Chesapeake	6.12%
Western Branch	14.43%

Source: City of Chesapeake GIS

EMPLOYMENT AND INDUSTRY

Nearly two million people live in or within an hour's drive of the Southside Hampton Roads region, and because of the presence of several naval bases, a large proportion of the total population is employed in military and service related industries. The military bases not only contribute billions of dollars annually to the regional economy, but also supply a skilled labor force. Over 15,000 trained and disciplined personnel leave the military installations each year, and many of these persons decide to stay in the area and look for local private sector employment. In addition, there are approximately 40,000 military spouses available to work. The region's tourism industry creates over 10,000 seasonal jobs during summer months. This group provides an additional source of workers to companies with personnel needs that peak at other times of the year. Lastly, over 86,000 students attend eight universities and four community colleges in the area. Most of these students are permanent residents available for part-time or full-time employment while in school and upon graduation.

Table 3.7 shows labor force data, unemployment rates and income and poverty information for the City of Chesapeake, the region and the state.

TABLE 3.7: REGIONAL EMPLOYMENT

JURISDICTION	CIVILIAN LABOR FORCE (2012)	UNEMPLOYMENT RATE (%) (Spring 2013)
Chesapeake	117,375	5.7
Extended Labor Market	642,601	6.4
VIRGINIA	**4,209,532**	**5.2**

Source: U.S. Census Bureau, Virginia Economic Development Partnership, Bureau of Labor Statistics

The City of Chesapeake was created in 1963 with the merger of Norfolk County and the City of South Norfolk. Still a relatively young city, Chesapeake has a significant stake in fostering economic expansion throughout the community. In 2006, 34 new businesses opened facilities in Chesapeake and 54 existing businesses expanded their operations. The City's Economic Development Department estimates that these 88 firms were responsible for over $193 million in new capital investment, and added an additional 1307 new employees to their payrolls (Department of Economic Development, 2006).

The City of Chesapeake's emphasis on sustainable development has placed increased focus on creating effective strategies to accommodate redevelopment and infill development opportunities. Accordingly, this emphasis on redevelopment has targeted four specific initiatives within the City:

- South Norfolk (SoNo) District
- Greenbrier Business District
- Great Bridge Village District
- South Military Highway Corridor

The City's abundant land, proximity to major transportation routes, and central, mid-Atlantic location, has created an attractive environment for both foreign and domestic firms. Over 80 manufacturers employing approximately 90,000 people are located in Chesapeake. Several major businesses include:

- American GFM Corporation
- Chesapeake Hardwood Products, Inc.
- Exxon Mobile Corporation
- Flow Serve, Inc.
- Mitsubishi Chemical America, Inc.
- Plasser American Corp.
- Sumitomo Machinery Corp. of America
- Usui International Corporation
- Yupo Corporation America
- Dollar Tree, Inc.

Major service and support centers include:

- Canon Information Technology Systems
- Capital Group Companies
- Chubb and Son Insurance Group
- Cox Communications
- Dendrite International
- EDS
- First Data Resources
- Harris Publishing
- HSBC
- Panasonic Customer Call Service
- Pitney Bowes
- QVC of Chesapeake
- Sentara Healthcare Materials Management Division
- U.S. Coast Guard Finance Center
- Verizon Communications

Approximately 1,000 acres of industrial property and two business parks are included within part of the City's district known as Foreign Trade Zone Number 20. These zones are outside U.S. customs territory, which means firms can legally import merchandise into these districts without paying tariffs. The zone

has been very successful in attracting new foreign businesses, and the City now has more than 80 foreign-owned companies from 20 different countries.

The City's waterfront properties and proximity to major military facilities have attracted other industries such as the maritime and shipbuilding-related industries, and oil and petroleum industries. The City of Chesapeake borders the Norfolk Naval Base, the largest naval facility in the world. The greater Hampton Roads Region includes other major military facilities such as Joint Base Langley-Eustis, Joint Expeditionary Base Little Creek-Fort Story, Camp Pendleton, NAS Oceana, and a myriad of other small bases. Fentress Landing Field, a Naval Auxiliary Field located in Chesapeake, is used as a training facility for naval aviators.

Chesapeake is also home to Naval Support Activity Northwest, a high-security intelligence base that monitors radio and other communications traffic from around the world. Major units include the Fleet Surveillance Support Command, the Naval Satellite Communications Facility, the Coast Guard Communications Master Station Atlantic, the Marine Corps Security Force Training Company, the Electronic Warfare Operational Programming Facility, and the NATO Satellite Communications Facility.

The City has two regional malls, 50 strip shopping centers, and numerous smaller retail centers. Additionally, the City is considered one of the most active commercial real estate markets in the United States having numerous industrial and commercial parks, including:

- Cavalier Business Center
- Crossways at Greenbrier
- Greenbrier Business Park
- Greenbrier Commerce Park
- Greenbrier Industrial Park
- Gateway Commerce Park
- Battlefield Corporate Center
- Dominion Commerce Park
- Liberty Executive Park

Municipally-controlled parks include:

- Cavalier Industrial Park
- Chesapeake Air Commerce Park
- Oakbrooke Business & Technology Center

The City has close to 300 farms, on 60,000 acres, that produce annual sales totaling $36 million. The largest source of their sales is in the nursery and greenhouse businesses, and the City is Virginia's second largest producer. Chesapeake also ranks among Virginia's top ten communities in terms of production of agronomic crops such as soybeans, corn, and wheat. Other agricultural products include alfalfa, hay, corn silage, vegetables, honey, beef and dairy cattle. The City has over 1,800 horses on private farms and boarding facilities which contribute to an estimated $12,688,000 in animal and facility investment.

DEVELOPMENT TRENDS

Urban areas of the City, generally with the Urban Overlay District, continue to be designated for infill development at higher densities. Higher concentrations are targeted for the areas adjacent to future mass transit corridors which generally follow the existing north-south corridors of the City. The Suburban Overlay District has been extended southward in the vicinity of the Edinburgh development to connect the suburban "island". Rural development patterns in southern Chesapeake are expected to continue. Additional economic development opportunities are encouraged in Western Branch, Edinburgh and Greenbrier through the creation of a new "Multi-Use District" land use classification. With regard to transportation, no major new roadways are proposed. Alternative modes of transportation such as mass transit and trails continue to be included as components of the City's Master Transportation Plan, along with provisions for future high-speed rail.

HAZARD IDENTIFICATION AND ANALYSIS

2014 UPDATE

Section 4 was updated to align the document with the 2011 Southside Hampton Roads Hazard Mitigation Plan.

Each of the hazards described in the 2008 Chesapeake Hazard Mitigation Plan was reviewed and updated with current hazard history information from several sources, including the National Climatic Data Center (NCDC), National Oceanic and Atmospheric Administration (NOAA) Hurricane Tracks, National Weather Service (NWS), and the Commonwealth of Virginia, Hazard Mitigation Plan 2010. Discussion of Mosquito Borne Diseases observed in the region, including a table of historical incidents and habitat mapping, was included as directed by NEMAC. An analysis of Sea Level Rise/Land Subsidence, Extreme Heat, and Severe Thunderstorms has also been appended.

The committee discussed and approved changing the name of the "Flood" hazard to "Coastal Floods, Nor'easters and Storm Surge." "Winter Weather", which previously had a separate section, was included with Nor'easters under Wind Events.

The committee reviewed and discussed manmade hazard planning as it was incorporated into the 2008 update of the plan. NEMAC agreed to remove this portion of the plan and focus ongoing mitigation efforts on natural hazards for two primary reasons:

1. The manmade hazard identification and vulnerability analyses contain a great deal of protected data. The public, and even some NEMAC members, cannot view this data and therefore cannot participate in the planning process for updating the manmade hazard annex.
2. The 2008 mitigation action items were either excerpted from or later incorporated into other types of community plans already in existence. The manmade hazard annex was truly outside the scope of NEMAC.

As part of the update process, the committee was asked to review the existing plan's hazard identification section and provide input to the Consultant regarding any changes. Committee members were briefed on the updated section immediately upon completion and requested to review the updated information in detail.

INTRODUCTION

This section of the Plan describes the natural hazards that threaten the City of Chesapeake and provides general background information, local data (e.g., the location and spatial extent), and historical occurences[1] for each hazard. This section also presents best available data regarding notable historical damages[2] within the City. The natural hazards discussed in this section are as follows:

- FLOODING
- SEA LEVEL RISE AND LAND SUBSIDENCE

[1] Significant historical events are based on information made available through NOAA unless otherwise cited. In most cases, NOAA information is obtained directly from NOAA's NCDC, the world's largest archive of weather data.
[2] Historical damage information is based on best available data and should only be considered approximate for general analysis and planning purposes. More information on the calculation of estimated property damages is provided in Section 5: *Vulnerability Assessment*.

- WIND EVENTS
  - HURRICANES
  - TORNADOES
  - WINTER STORMS AND NOR'EASTERS
  - SEVERE THUNDERSTORMS
- DROUGHT
- WILDFIRES
- EXTREME HEAT
- MOSQUITO BORNE DISEASES
- PANDEMIC FLU OR WIDESPREAD DISEASE OUTBREAK

44 CFR Requirement

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.

Some of these hazards are interrelated (e.g., hurricane events can cause flooding and tornado activity, and nor'easters can cause flooding, coastal erosion and winter storm conditions); thus, hazard discussions overlap where necessary throughout the risk assessment.

To a large extent, historical records are used to identify the level of risk within the planning area—with the assumption that the data sources cited are reliable and accurate. Maps are provided to illustrate the location and spatial extent for those hazards within the region that have a recognizable geographic boundary (i.e., hazards that are known to occur in particular areas of the region such as the 100-year floodplain). For those hazards with potential risk not confined to a particular geographic area (such as winter storms, thunderstorms and tornadoes), historical event locations and/or general information on the applicable intensity of these events across the entire planning area is provided.

For most hazards analyzed in this section, some level of property damage was associated with any or all of the hazard events cataloged. However, for some historic events reports of property damage were not available. Therefore, totals of past property damages derived from historical records are best estimates and should not be used as a stand-alone indicator of hazard risk.

The *Vulnerability Assessment*, Section 5 of this plan, expands upon the foundation provided here and assesses the vulnerability of the City to these natural hazards.

SUMMARY OF PRESIDENTIAL DISASTER DECLARATIONS

A presidential disaster declaration is issued when a disaster event is determined to be beyond the response capabilities of state and local governments. Since 1953, the first year presidential disaster declarations were issued in the United States, the City has been named in eight such declarations (**Table 4.1**). Under a presidential disaster declaration, the state and affected local governments are eligible to apply for federal funding to pay 75% of the approved costs for debris removal, emergency services related to the storm, and the repair or replacement of damaged public facilities. The types of natural hazards that led to these disaster declarations in Chesapeake include ice storms, winter storms, hurricanes, and the Hurricane Katrina evacuation in 2005. The most recent declarations were for Tropical Depression Ida in 2009 and Hurricane Irene in 2011.

TABLE 4.1: PRESIDENTIAL DISASTER DECLARATIONS ISSUED FOR THE CITY OF CHESAPEAKE

YEAR	DATE	DISASTER NUMBER	DISASTER TYPE
1972	September 8	339	Tropical Storm Agnes
1996	February 16	1086	Blizzard of 1996
1998	October 9	1242	Hurricane Bonnie
1999	September 24	1293	Hurricane Floyd
2003	September 18	1491	Hurricane Isabel
2005	September 12	3240	Hurricane Katrina Evacuation
2009	December 9	1862	Tropical Depression Ida
2011	August 26	4024	Hurricane Irene

Source: FEMA, 2013

NATIONAL CLIMATIC DATA CENTER STORM EVENT DATABASE

Much of the data in the remaining tables in this section were taken from the NOAA NCDC database. NCDC receives storm data from the NWS which, in turn, receives their information from a variety of sources, including: county, state, and federal emergency management officials, local law enforcement officials, skywarn spotters, NWS damage surveys, newspaper clippings, the insurance industry, and the general public. Information on hazard events not recorded in this database is provided in narrative format for each hazard subsection. NCDC data are marginally useful because they are most accurate beginning in the early to mid 1990's. If available, local or anecdotal data were used to supplement the NCDC data and to provide a more accurate depiction of historic hazard events in the City.

FLOODING

BACKGROUND

Photo courtesy of the City of Chesapeake.

Approximately 90% of presidentially declared disasters are associated with floods. However, the majority of damages across the United States are due to more frequent, localized flooding events that do not receive federal disaster declarations.

The primary types of flooding include riverine, coastal, and urban flooding. Riverine flooding is a function of excessive precipitation levels and water runoff volumes within a stream or river. Coastal flooding is typically a result of storm surge, wind-driven waves, and heavy rainfall produced by hurricanes, tropical storms, nor'easters, and other large coastal storms. Urban flooding occurs when manmade development obstructs the natural flow of water or when impervious surfaces significantly decrease the ability of natural groundcover to absorb and retain surface water runoff. Chesapeake is subject to a variety of flood sources. The two major sources are: coastal flooding and storm surge associated with large amounts of tidally-influenced water being pushed inland from Hampton Roads, and nontidal, riverine flooding as a result of excess precipitation in the watershed.

Similar to hurricanes, nor'easters are ocean storms capable of causing substantial damage to coastal areas in the Eastern United States due to their 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. There are two main components to a nor'easter: (1) a Gulf Stream low-pressure system (counter-clockwise winds) generated off the southeastern U.S. coast, gathering warm air and moisture from the Atlantic, and pulled up the East Coast by strong northeasterly winds at the leading edge of the storm; and (2) an Arctic high-pressure system (clockwise winds) which meets the low-pressure system with cold, arctic air blowing down from Canada. When the two systems collide, the moisture and cold air produce a mix of precipitation and have the potential for creating dangerously high winds and heavy seas. As the low-pressure system deepens, the intensity of the winds and waves increase and can cause serious damage to coastal areas as the storm moves northeast.

The periodic inundation of floodplains adjacent to rivers, streams, and shorelines is a natural and inevitable occurrence that can be expected to take place based upon established recurrence intervals. FEMA has studied and mapped both the 100-year floodplain (with a 1% chance of being equaled or exceeded in any given year), and the 500-year floodplain (with a 0.2% chance of being equaled or exceeded in any given year) for the study area.

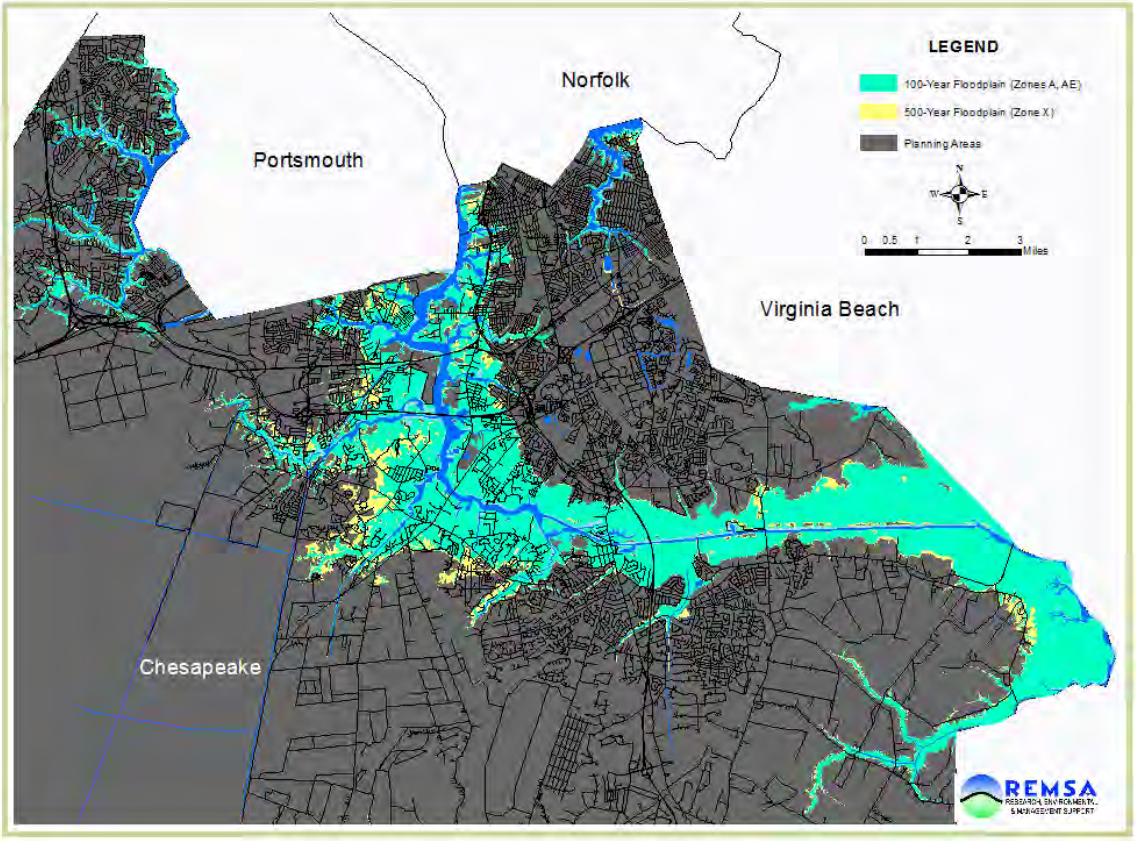
LOCATION AND SPATIAL EXTENT

Flooding can occur along all waterways in the City of Chesapeake including the branches of the Elizabeth River, the Indian River, the Northwest River, and the North Landing River. Localized riverine flooding can occur in areas of the City not adjacent to a major body of water. Large sections of the City are low and subject to tidal flooding during hurricanes and severe nor'easters. Flood duration is typically shorter for hurricanes and tropical storms than for nor'easters. The main impacts from severe floods or floods that might exceed the 500-year frequency event are expected to be:

- Inundation of low-lying residential neighborhoods;
- Impassable road crossings and consequential risk for people and cars attempting to traverse flooded crossings;
- Damage to public and private infrastructure, possibly including but not limited to water and sewer lines, bridge embankments, and both small and large drainageways;
- Wave action responsible for shoreline damage, and damage to boats and facilities; and
- Inundation of critical facilities, possibly including some fire stations, police facilities, public shelters, and several City buildings. Public shelter availability is limited by the expected severity of flooding.

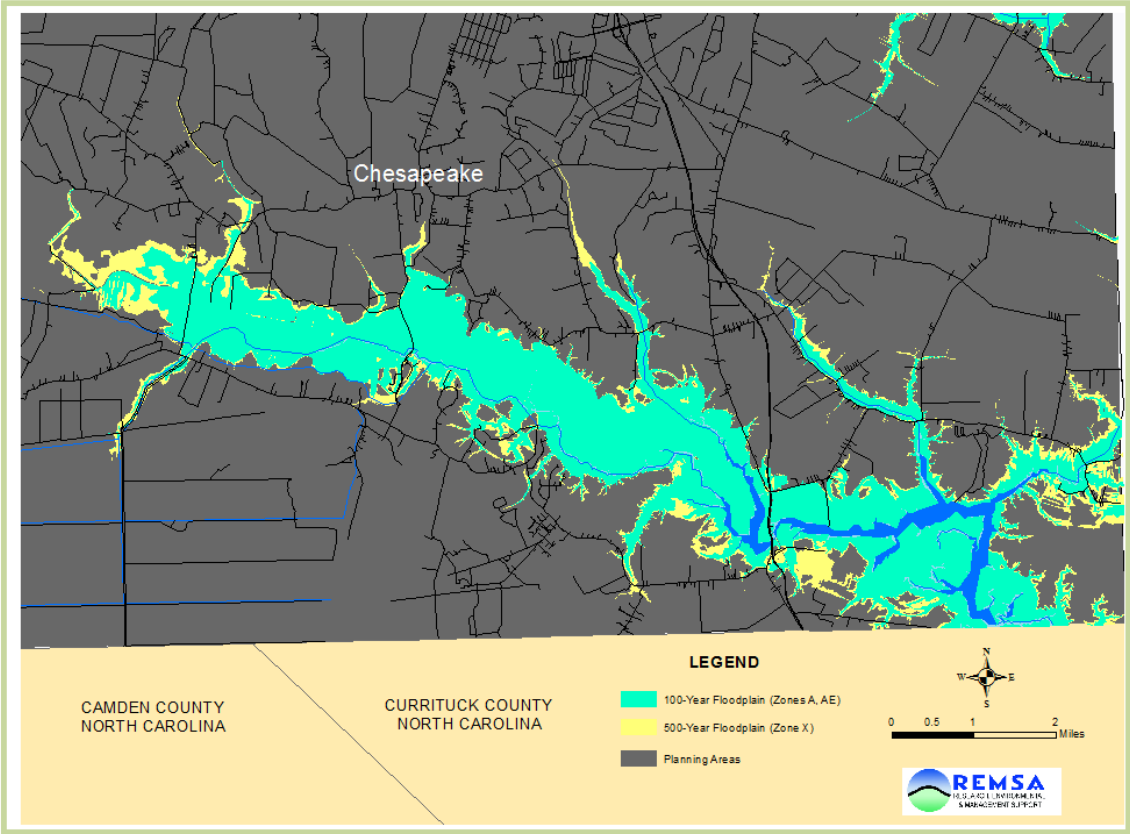
Areas identified as vulnerable to flooding are depicted on FEMA's Flood Insurance Rate Maps (FIRMs), which were developed through the National Flood Insurance Program (NFIP), show the existing potential flood hazard areas throughout the City based on the estimated 100-year floodplain (**Figures 4.1 and 4.2).** The 100-year floodplain represents the areas susceptible to the 1% annual flood. The maps also show the 0.2% annual flood, or 500-year flood. The 100-year flood, or base flood, has at least a 26% chance of occurring over the life of a typical 30-year mortgage.

FIGURE 4.1: FEMA-IDENTIFIED 100-YEAR FLOOD HAZARD AREAS, NORTH CHESAPEAKE



Source: Federal Emergency Management Agency, 1999

FIGURE 4.2: FEMA-IDENTIFIED 100-YEAR FLOOD HAZARD AREAS, SOUTH CHESAPEAKE

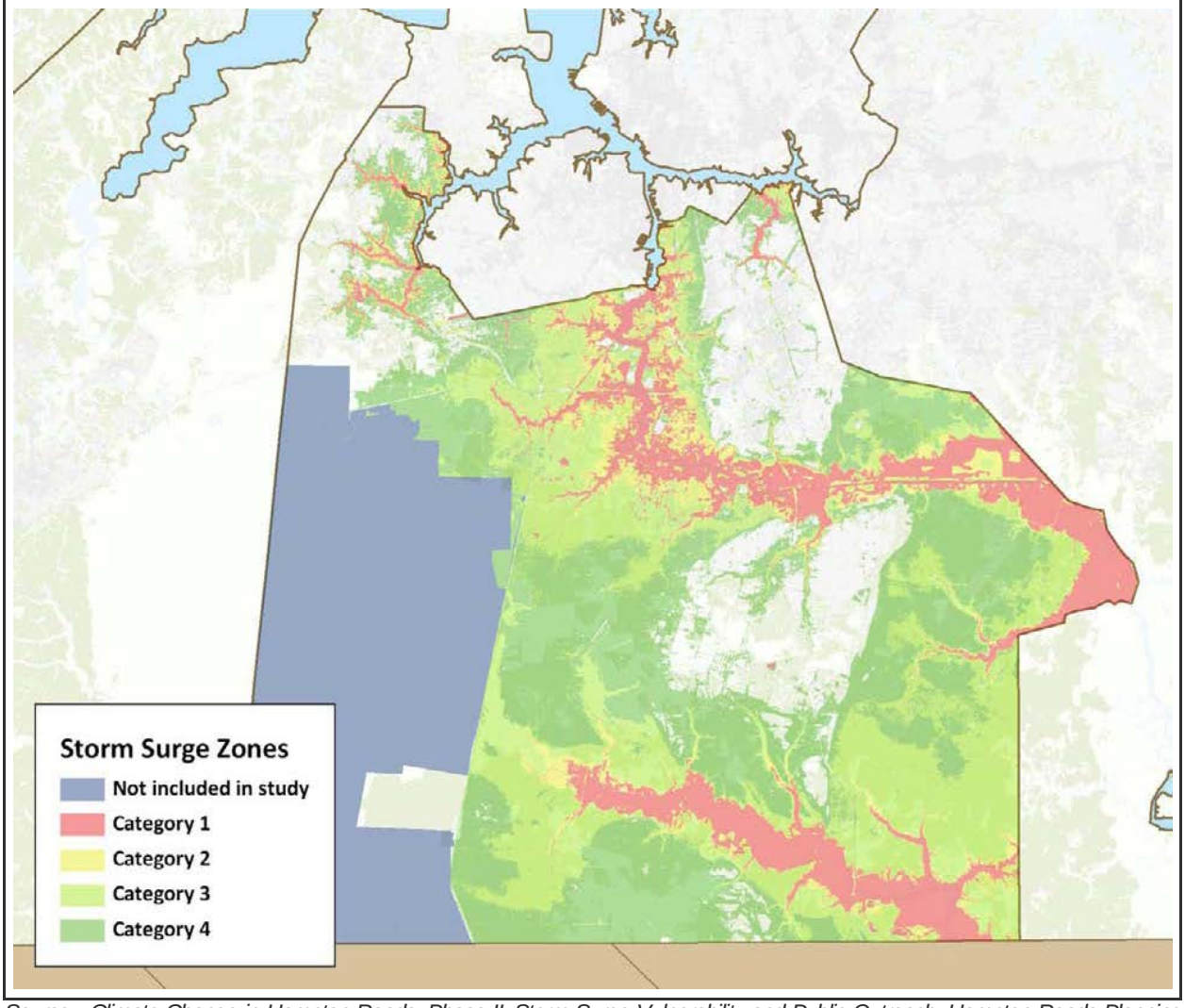


Source: Federal Emergency Management Agency, 1999

During the planning period for the 2014 update to this plan, the City had entered into the appeals process and was reviewing new preliminary FIRM data from FEMA. Those maps were still in draft format and not at a stage of completion that allowed analysis and mapping using the new data during the development of this section.

Figure 4.3 shows the most recent storm surge hazard areas that can be expected as the result of Category 1, 2, 3, and 4 hurricanes, based on the Sea, Lake and Overland Surge from Hurricanes (SLOSH) model. SLOSH is a computerized model run by the NWS to estimate storm surge heights resulting from hypothetical hurricanes by taking into account the maximum of various category hurricanes as determined by pressure, size, forward speed, and sustained winds. The regional analysis represents the composite maximum water inundation levels for a series of parallel tracks making landfall at various points along the coast. The SLOSH model, therefore, is best used for defining the “worst case scenario” of potential maximum surge for particular locations as opposed to the regional impact of one singular storm surge event.

FIGURE 4.3: STORM SURGE ZONES, CITY OF CHESAPEAKE



Source: Climate Change in Hampton Roads, Phase II: Storm Surge Vulnerability and Public Outreach, Hampton Roads Planning District Commission, June 2011

More specific local areas in Chesapeake subject to flooding include areas along the Southern Branch of the Elizabeth River, including Deep Creek, Camelot, and South Norfolk, according to City officials. The locations of these areas within the City of Chesapeake are identified in **Figure 4.4**. **Table 4.2** provides a more detailed description of each of the local areas of flooding.

FIGURE 4.4: LOCALLY IDENTIFIED FLOOD-PRONE AREAS

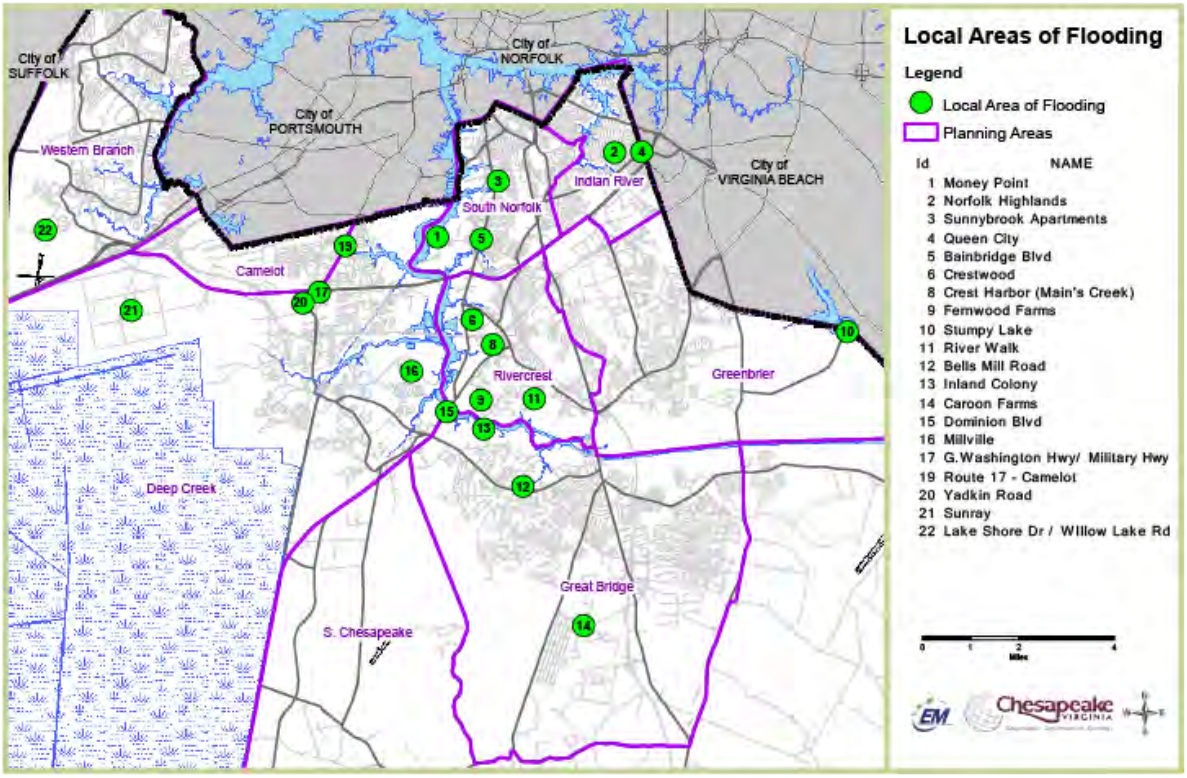


TABLE 4.2: LOCALLY-IDENTIFIED AREAS OF FLOODING

PLANNING AREA	NAME	DESCRIPTION	SOURCE	MITIGATION ACTIVITIES
South Norfolk & Indian River	Money Point	Industrial area which receives frequent tidal flooding	Tidal/Storm water	Storm Water Improvements In progress (CDBG funding)
	Norfolk Highlands	Older area that was developed in the 1940's and 1950's where historic flooding has occurred.	Storm Water	
	Sunny Brook Apartments	Apartment complex off Bainbridge Boulevard has experience historic flooding.	Storm Water	
	Queen City	Public Housing Complex in this area has received historic flooding.	Storm Water	
	Bainbridge Blvd.	Industrial Area that frequently is cut off by flooding. Fire Station in the area also experiences flooding.	Tidal/Storm Water	

TABLE 4.2: LOCALLY-IDENTIFIED AREAS OF FLOODING

PLANNING AREA	NAME	DESCRIPTION	SOURCE	MITIGATION ACTIVITIES
Greenbrier & Rivercrest	Crestwood	Area has received historic flooding. Ongoing outfall project in this area should reduce flooding.	Tidal	
	Campostella Walk	Historic flooding has occurred in this area. An outfall project has been identified to address flooding in this area.	Storm Water	In Progress
	Crest Harbor (Mains Creek)	Homes built in the 1950s and 1960s where historic flooding has occurred	Tidal	
	Fernwood Farms Road	This area has experienced historic flooding of roadways and garages. Very few structures in the area are at a low elevation, although this is a frequently impacted area.	Tidal	FY 2008 RFC funds to buy two homes
	Stumpy Lake	Outfall crosses over road causing flooding.	Storm Water	
	River Walk	Residential Area affected by flooding	Tidal	
Great Bridge & Southern Chesapeake	Bells Mill Road	Residential neighborhood is cut off by flooding. May have a high concentration of special needs populations.	Tidal	
	Inland Colony	Historic flooding has occurred to elevations of 4' or 5' receive most frequent flooding	Tidal	Home Elevations to 4 properties using HMGP grant funding
	Caroon Farms	Caroon Farms has experienced historic flooding. Maintenance has been identified as a potential problem.	Storm Water	
	Dominion Blvd	Area on west end of steel bridge low - subject to be overtopped	Tidal	
Deep Creek & Camelot	Millville	Residential area where historic flooding has occurred	Tidal	
	George Washington Highway/S Military Highway	Areas surrounding this intersection have received flooding in the past	Storm Water	
	Elmsmore Road	Residential has experienced historic flooding	Storm Water	
	Route 17 Camelot	Areas of Route 17 have experienced historic flooding. An elderly housing complex in the area may have experienced flooding including water in the facility basement.	Storm Water	Storm Water Improvements In Progress

TABLE 4.2: LOCALLY-IDENTIFIED AREAS OF FLOODING

PLANNING AREA	NAME	DESCRIPTION	SOURCE	MITIGATION ACTIVITIES
Deep Creek & Camelot (continued)	Yadkin Road	Container Storage area that has received damage due to flooding in the past.	Storm Water	Storm Water Improvements In Progress
	Sunray area	Sparsely settled Rural area that has received flooding in the past.	Storm Water	Storm Water Improvements In Progress
Western Branch	Only small isolated flooding areas in the Western Branch area	Lake Shore Dr. and Willow Lake Rd.	Storm Water	Storm Water Improvements In Progress

Additional areas that have been identified as having a flood risk include Route 17 along the boundary of the Great Dismal Swamp. The recently completed "new" Route 17 is higher than the old roadway and is not subject to high frequency of flooding like the old route, which is now a trailway. The areas adjacent to the Intracoastal Waterway are also subject to flooding. If flooding were to occur in this area, Route 17 (a major transportation route in the City) could be undermined or blocked with floodwater or debris. The areas adjacent to the Intracoastal Waterway are also subject to significant flooding, with the potential for local roadways to be blocked and structures inundated with floodwater.

In addition to these flood prone areas, the City of Chesapeake's 2002 Hazard Vulnerability Assessment also listed flood prone roadways. **Table 4.3** contains a list of these roadways taken from the previous assessment and organized by planning sector. Specific flood characteristics may subject other roadways to flooding as well.

TABLE 4.3: ROADWAYS SUBJECT TO FLOODING BY SECTOR

SECTOR	ROADWAY
Deep Creek	Route 17 along the Dismal Swamp
	Route 17 near Deep Creek Locks, points south
	Mill Creek and Cooks Mill Road
	Shipyard Road area of Millville Road
	Rockwood Road and Burson Road
	SunRay Road and Homestead Road
Great Bridge	Cedar and Sawyer Mill
	Bells Mill and Cedar Road
	Bells Mill and Deep Water Drive
	Bells Mill and Seabrook Lane
	100 Block of Battlefield Boulevard North
	I-64 at the Highrise Bridge - either side of the bridge
	Bells Mill and Seabrook Point
Southern Chesapeake	Route 68 at the waterway near Northwest River
	Ditch Road in Southern Chesapeake
	Route 17 and Douglas Road
	Route 17 and Cornland Road

TABLE 4.3: ROADWAYS SUBJECT TO FLOODING BY SECTOR, CONT.	
SECTOR	**ROADWAY**
Southern Chesapeake (continued)	South Battlefield Boulevard Water Treatment Plant
	Route 17 and Ballahack Road area
	Route 17 and #10 Lane
	St. Julian Creek area
	Bunch Walnuts Road - 3200 Block
	Lake Drummond Causeway to Ballahack Road
Rivercrest	Route 168 Bypass at Oak Grove/North Battlefield Exit
	Dominion North (revised Route 17) to Steel Bridge
	Bainbridge Boulevard from Military Highway to Dominion Boulevard
South Norfolk	Bethel Road from Berkley to Border
	Cayce Drive from Bethel to Amick
	Pringle Drive from Bethel to Amick
	Liberty Street from Fitchett to Nelson
	Nelson Street from Portland to Liberty
	Liberty Street at Commerce
	Poindexter at 1200 Block
	Poindexter at Bainbridge
	Chesapeake Avenue at Stuben Avenue
	Chesapeake Drive at 2100 Block
	Rodgers Street at Stuben
	Haywood Avenue at Stuben
	Ardmore Avenue at 2100 Block
	Rowland Avenue in South Norfolk
	Freeman Avenue and Bainbridge Boulevard in South Norfolk
	Freeman Avenue East of I-464
	Great Bridge Boulevard in South Norfolk
	Bainbridge and Military
	North Battlefield by Swing Bridge
	I-464 between Freeman Avenue Exit and Poindexter Street Exit
Indian River	Tatemstown from Haring to Wingfield
Western Branch	Lake Shore Road and Charlton Road
	Route 58 at I-264, I-664, I-64 Interchange
	I-664 at I-264, I-664, I-64, and Route 58 up to Portsmouth Boulevard Exit
	I-264 at I-264, I-664, I-64 and Route 58 Interchange

SIGNIFICANT HISTORICAL EVENTS[3]

Many flood events that have occurred in the City have been the result of coastal storms, tropical storms or hurricanes. Other localized flooding occurs when heavy rains fall during high tide causing waters that would normally drain quickly to back up because of the tides. Based on historical and anecdotal evidence, it is clear that there is a relatively high frequency of flooding in the City. Some of the notable flood events to impact Chesapeake are discussed below.

The Storm of 1749 is one of the most notable storms to occur in this region. It was responsible for the formation of Willoughby Spit, a formation of land approximately two miles long and a quarter mile wide. This storm created a 15 foot storm surge that flooded much of the region.

The Chesapeake-Potomac hurricane struck the region on **August 23, 1933** and created a high tide in Norfolk of 9.69 feet above Mean Lower Low Water (MLLW), a record for the area. Eighteen people were killed by this storm that also flooded downtown Norfolk and destroyed homes at Ocean View. Winds were recorded at 70 MPH in Norfolk, 82 MPH at Cape Henry, and 88 MPH at the Naval Air Station in Norfolk.

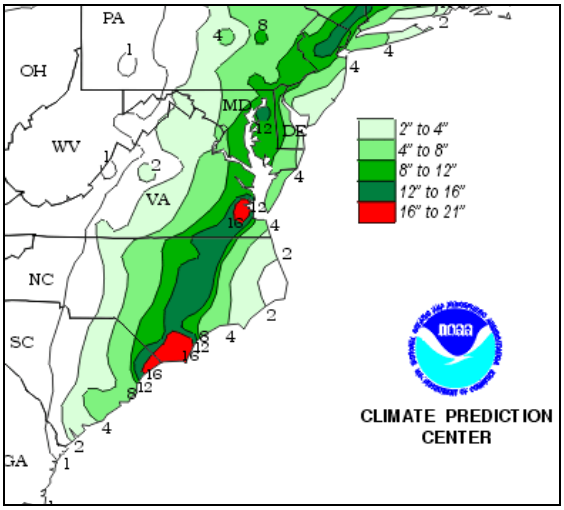
The Ash Wednesday storm of 1962 produced very severe flooding throughout the Southside Hampton Roads region partly because it occurred during "Spring Tide" (sun and moon phase to produce a higher than normal tide). The storm moved north off the coast past Virginia Beach and then reversed its course moving again to the south and bringing with it higher tides and waves which battered the coast for several days. The storm's center was 500 miles off the Virginia Capes when water reached nine feet at Norfolk and seven feet on the coast. Huge waves toppled houses into the ocean and broke through Virginia Beach's concrete boardwalk and sea wall. Houses on the bay side also saw extensive tidal flooding and wave damage. The beaches and shorefront had severe erosion. Locals indicated that the damage from this storm was worse in Virginia Beach than that caused by the 1933 Hurricane. The islands of Chincoteague and Assateague on the Eastern Shore were completely submerged. Receding water exposed hundreds of thousands of dead chickens drowned by the flooding. The Virginia Department of Health indicated that it was an extreme health hazard and asked all women, children, and elderly to evacuate. A million dollars in damage was done to NASA's Wallops Island launch facility and an estimated $4 million in wind and flood damages occurred in the City of Hampton. Winds were recorded at speeds up to 70 MPH causing 40-foot waves at sea. This storm also produced Virginia's greatest 24-hour snowfall with 33 inches and the greatest single storm snowfall with 42 inches (these were recorded in the mountainous western region of the Commonwealth).

In September of 1999, **Hurricane Floyd** was responsible for wind and flood damage in the Southside Hampton Roads region. Several trees were uprooted as wind speeds were recorded between 50 and 80 MPH across the region. This event brought over 10 inches of rain to Chesapeake, occurring just two weeks after Tropical Storm Dennis had saturated the area with 6.2 inches of rain. Hurricane Floyd caused the Great Dismal Swamp to overflow its banks creating flooding along the Northwest River.

In September of 2003, **Hurricane Isabel** caused widespread flooding, comparable to that caused by the 1933 hurricane and the Ash Wednesday Storm of 1962. Hurricane Isabel proved to be the costliest disaster in Virginia's history. The storm produced a high storm surge (four to five feet in Southside Hampton Roads) which inundated the tidal portions of the region's creeks and rivers. Damage from flooding was extensive to structures and infrastructure in the planning area. The NFIP processed more than 24,000 Isabel claims in six states and the District of Columbia, totaling nearly $405 million. As a result of polluted runoff, Virginia Department of Health forbade gathering shellfish in the Virginia portion of the Chesapeake Bay, and rivers flowing into the bay. On September 18, 2003, Hurricane Isabel made landfall off the coast of northeast North Carolina. The hurricane, which had originally been a Category 5 storm, reached Chesapeake as a weak Category 1 storm. According to the National Hurricane Center,

[3] Many of the flood events that have occurred in the Southside Hampton Roads Region have been caused by hurricanes, tropical storms or nor'easters that have impacted the region. Therefore, there will be some duplication of discussions about the significant historical events across the different hazards.

the City started to receive hurricane force wind gusts at 3pm on September 18, 2003. The magnitude of Hurricane Isabel's impact on the City was historic. Rain, storm surge, and wind severely affected all areas of the City. Rainfall from Hurricane Isabel averaged four to seven inches over large portions of eastern North Carolina, east-central Virginia, and Maryland.



Rainfall totals from Hurricane Floyd.
Source: NOAA Climate Prediction Center

The November **2009 Mid-Atlantic nor'easter** (or "Nor'Ida") was a powerful storm that caused widespread flooding throughout the region. Persistent onshore flows brought elevated water levels for four days. At Sewells Point, a max storm tide of 7.74 feet MLLW was recorded on November 13th, the third highest recorded tide of all time at that location. Widespread coastal damage and major flooding occurred as a result of seven inches of rainfall and large wind-driven waves impacting beaches. Damage in Virginia exceeded $38.8 million, of which 64% was in Norfolk alone. According to the NWS, 7.4 inches of rain fell in Norfolk between November 11 and 13. Hurricane-force winds also affected the region, with a peak gust of 75 mph recorded at Oceana.

In August 2011, **Hurricane Irene** moved northward over the Outer Banks of North Carolina and just off the Virginia coast, producing heavy rains which caused widespread flooding across most of south central and southeast Virginia Saturday morning, August 27th into early Sunday morning, August 28th. Storm total rainfall generally ranged from six to as much as 12 inches. Heavy rains associated with Hurricane Irene produced widespread lowland flooding across much of Chesapeake, including roadways which were washed out or closed. Great Bridge reported 10.75 inches of rain. Deep Creek reported 9.72 inches of rain.

At the end of October 2012, **Tropical Cyclone Sandy** moved northward well off the Mid Atlantic Coast producing heavy rain which caused flooding across much of eastern and southeast Virginia. Storm total rainfall ranged from four inches to as much as 10 inches across the area. Numerous roads were closed due to flooding. Storm total rainfall ranged from three to six inches across Chesapeake. Although the storm did not cause the destruction locally that it did in the northeast, it remains a significant rain and coastal flood event for the City.

Table 4.4 provides information on significant flood events documented by the NCDC between 1994 and January, 2013 in the City of Chesapeake and the Southside Hampton Roads region, representing the most recent data available. These events resulted in no known deaths or injuries, and only $7.75 million in property damages reported to the NCDC. Additional unreported property damages are likely. Additional data on repetitive flood losses is provided in Chapter 5.

TABLE 4.4: SIGNIFICANT FLOOD EVENTS (1993 - 2013)

LOCATION	DATE OF OCCURRENCE	TYPE OF EVENT	DEATHS/ INJURIES	PROPERTY DAMAGE	DETAILS
Hampton Roads	11/17/1994	Coastal Flooding	0/ 0	$605,000	Easterly flow between Hurricane Gordon and a strong anticyclone over New England caused coastal flooding damage in Virginia Beach. On the 18th, tides were up to 4 feet above normal. At 14th St, 100 feet of fishing pier washed away. Several homes suffered minor damage. A 1000-foot stretch of road and several protective steel bulkheads were damaged. The above-normal tides caused other minor flooding in Tidewater. Nansemond River overflowed its banks in Suffolk and caused minor flooding.
Hampton Roads	12/23/1994	Coastal Flooding	0/ 0	$65,000	A double-structured storm system produced minor coastal flooding in the Tidewater region. The effects were much less than expected as the main storm moved well east of the mid-Atlantic before curling northwest into Long Island. In the Sandbridge section of Virginia Beach, a beachfront home collapsed into the sea. The combination of pounding surf and wind from Hurricane Gordon in late November and this event finished off the home. In addition, a few more bulkheads were flattened. Several roads in Tidewater area suffered minor flooding.
Chesapeake	7/18/1996	Flash Flood	0/ 0	$0	Two to four inches of rain within 6 hours resulted in 2 to 3 feet of water along Bainbridge Boulevard and Freeman Avenue. High water reported at Interstate 64/264 split.
Chesapeake	7/24/1999	Flash Flood	0/ 0	$0	Parts of Interstate 264 were covered with more than 3 feet of water. Some other roads including Ballahack Road were also flooded. In addition, there was 14 feet of water reported on Military Highway at the Triple Decker Bridge. Fire Station 2 in Chesapeake near Norfolk was evacuated and the cars were under water.
Chesapeake	8/14/1999	Flash Flood	0/ 0	$0	Numerous roads flooded, including Route 13.
Chesapeake	9/7/1999	Flash Flood	0/ 0	$0	No description available.
Hampton Roads	9/15/1999	Flood	0/ 0	$0	Very heavy rain from Hurricane Floyd produced widespread flooding and flash flooding across much of central and eastern Virginia, and northeast North Carolina. Rainfall amounts generally ranged from 12 to 18 inches. Numerous roads were washed out due to flooding. Many areas normally prone only to flooding of poor drainage and low lying areas experienced significant flash flooding. Also, there were enormous agricultural/crop losses due to the flooding.
Chesapeake	10/17/99	Flash Flood	0/ 0	$0	Very heavy rainfall, locally up to 7 to 12 inches, associated with Hurricane Irene, resulted in numerous flooded roads and roads closed due to high water.
Wallaceton	7/4/2004	Flash Flood	0/ 0	$0	A section of Route 17 north of Ballahack Road, in the Great Dismal Swamp Area, was washed out as a result of torrential rain.
Cornland	7/13/2005	Flash Flood	0/ 0	$0	One half mile of Murray Drive near Fentress in the Green Haven sub-division under water.
Chesapeake	8/9/2005	Flash Flood	0/ 0	$0	Parts of Taylor Road flooded.
Chesapeake	10/8/2005	Flash Flood	0/ 0	$0	Bruce Road closed near Tyre Neck Road in Western Branch part of Chesapeake.

TABLE 4.4: SIGNIFICANT FLOOD EVENTS (1993 - 2013)

LOCATION	DATE OF OCCURRENCE	TYPE OF EVENT	DEATHS/ INJURIES	PROPERTY DAMAGE	DETAILS
Deep Creek	6/14/2006	Flash Flood	0/ 0	$0	Heavy rain associated with the remnants of Tropical Storm Alberto caused flash flooding and the closure of Bainbridge Boulevard near the Triple Decker Bridge.
Chesapeake	9/1/2006	Flash Flood	0/ 0	$0	Numerous streets flooded with feet of water.
Chesapeake	8/12/2009	Flash Flood	0/ 0	$0	Scattered thunderstorms along a frontal boundary produced heavy rain which caused flash flooding across portions of southeast Virginia. Gracie Road and Hwy 407 flooded. Numerous vehicles floating in flood waters.
Cornland	9/30/2010	Flash Flood	0/ 0	$0	Showers and thunderstorms in advance of low pressure and associated cold front produced flash flooding across portions of southeast Virginia. Numerous streets flooded city-wide.
Chesapeake		Flash Flood	0/ 0	$0	No description available.
Chesapeake	11/12/2009	Coastal Flood	0/0	$200,000	An intense Nor'easter produced moderate to severe coastal flooding across much of eastern and southeast Virginia and the Virginia Eastern Shore. The peak tide height at Money Point was 8.59 feet above MLLW, which was 6.17 feet above the astronomical tide. That tide height was 0.3 feet higher than the previous record storm tide measured at this location during Hurricane Isabel in September 2003. Several streets, homes and businesses were flooded in low lying areas.
Chesapeake	12/19/2009	Coastal Flood	0/0	$10,000	A strong coastal low pressure area produced moderate to severe coastal flooding across much of eastern and southeast Virginia and the Virginia Eastern Shore. The peak tide height at Money Point was 6.77 feet above MLLW. Several streets, homes and businesses were flooded in low lying areas.
Great Bridge	8/27/2011	Flood, Tropical Event	0/0	$0	Hurricane Irene moving northward over the outer banks of North Carolina and just off the Virginia coast produced heavy rains which caused widespread flooding across most of south central and southeast Virginia Saturday morning, August 27th into early Sunday morning, August 28th. Storm total rainfall generally ranged from four to as much as twelve inches. Heavy rains associated with Hurricane Irene produced widespread low-land flooding across much of the county, including roadways which were washed out or closed. Storm total rainfall generally ranged from six to twelve inches. Great Bridge reported 10.75 inches of rain. Deep Creek reported 9.72 inches of rain.
Chesapeake	10/29/2012	Coastal Flood	0/0	$275,000	Tropical Cyclone Sandy moving northward well off the Mid Atlantic Coast then northwest into extreme southern New Jersey produced very strong northeast winds followed by very strong west or northwest winds. The very strong winds caused moderate to severe coastal flooding across portions of eastern and southeast Virginia. Storm total rainfall ranged from 4 inches to as much as 10 inches across the area. Numerous roads were closed due to flooding. Storm total rainfall ranged from three to six inches across Chesapeake.
TOTAL			**0/0**	**$1,150,000**	

Source: NCDC (1993 to January, 2013 data)

PROBABILITY OF FUTURE OCCURRENCES

Flooding remains a highly likely occurrence throughout the identified flood hazard and storm surge areas of the City. Smaller floods caused by heavy rains and inadequate drainage capacity will be frequent, but not as costly as the large-scale floods which may occur at less frequent intervals, including extended torrential rainfall and storm surge events associated with hurricanes, tropical storms, and nor'easters.

SEA LEVEL RISE AND LAND SUBSIDENCE

BACKGROUND

Global sea level is determined by the volume and mass of water in the world's oceans. Sea level rise occurs when the oceans warm or ice melts, bringing more water into the oceans. Sea level rise caused by warming water or thermal expansion is referred to as steric sea level rise, while sea level rise caused by melting snow and ice is called eustatic sea level rise. The combination of steric and eustatic sea level rise is referred to as absolute sea level rise. Absolute sea level rise does not include local land movements. Additionally, while it is often represented as a global average, absolute sea level rise varies from place to place as a result of differences in wind patterns, ocean currents, and gravitational forces.

The primary consequences of continuing sea level rise are interrelated and include:

Increased Coastal Erosion – Sea level rise influences the on-going processes that drive erosion, in turn making coastal areas ever more vulnerable to both chronic erosion and episodic storm events (Maryland Commission on Climate Change, 2008). Secondary effects of increased erosion include increased water depths and increased sediment loads which can drown seagrass and reduce habitat and food sources for fish and crabs.

Inundation of Normally Dry Lands – The loss of coastal upland and tidal wetlands through gradual submergence or inundation is likely over time. Wetlands can provide protection from erosion, subdue storm surges, and provide a nursery and spawning habitat for fish and crabs. Without impediments, such as hardened shorelines, and with a slow enough rate of sea level rise, wetlands can normally migrate upland. However, if barriers are present and sea level rise outpaces upland migration, wetlands can drown in place. (VA Governor's Commission on Climate Change, 2008) Many communities in the region have noted an influx of requests in recent years for bulkhead repair as a result of more frequent inundation behind failing bulkheads. Tidal wetlands are slowly migrating landward. The loss of wetlands means increased coastal and shoreline erosion, reduced storm surge protection, and reduction in nursery and spawning habitat for fish and crabs. This reduced habitat can be detrimental to the watermen of the lower Chesapeake Bay, including all of Hampton Roads.

Coastal Flooding – An increase in duration, quantity, and severity of coastal storms results in increased flood damages to infrastructure. Increased sea level and/or land subsidence increases the base storm tide, which is the storm surge plus astronomical tide (Boon, Wang, and Shen, undated). Ultimately, sea level rise increases the destructive power of every storm surge. Minor storms that may not have caused damage in the past will begin to affect infrastructure in the future (Boon, et al, undated). Higher wave energy from higher storm tides will translate each storm's destructive forces landward. The damage caused by major storms is expected to be increasingly costly. Sea level rise will threaten the longevity and effectiveness of stormwater drainage systems, especially during significant rain events that occur during high tides such as that which may be caused by a nor'easter.

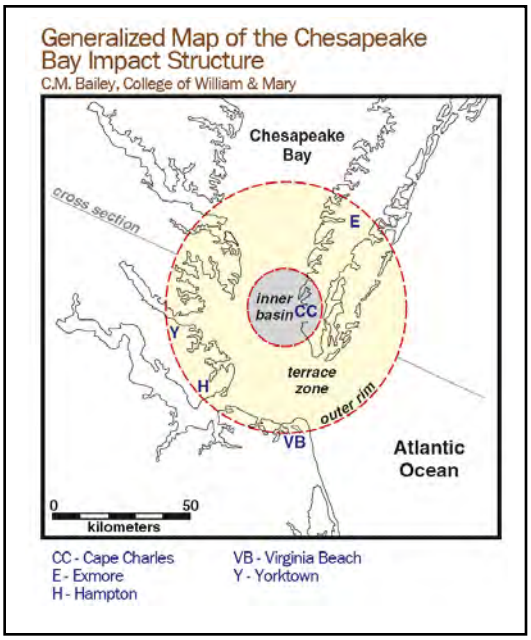
Saltwater Intrusion – As sea level rises, the groundwater table may also rise, and saltwater may intrude into freshwater aquifers. This impact may have secondary impacts related to drinking water and agriculture, even for home gardeners.

LOCATION AND SPATIAL EXTENT

Several factors are influencing the rates of sea level rise relative to land in Chesapeake and the Hampton Roads region, including an increased volume of water in the oceans from melting ice. Some scientists believe that thermal expansion of a gradually warming ocean increases ocean volume. The rate of sea

level rise is relative to the land adjacent to the sea; land subsidence is the downward movement of the earth's crust. The Southside Hampton Roads region is experiencing both regional subsidence (along the east coast of the United States) and local subsidence, exacerbating the effects of storms.

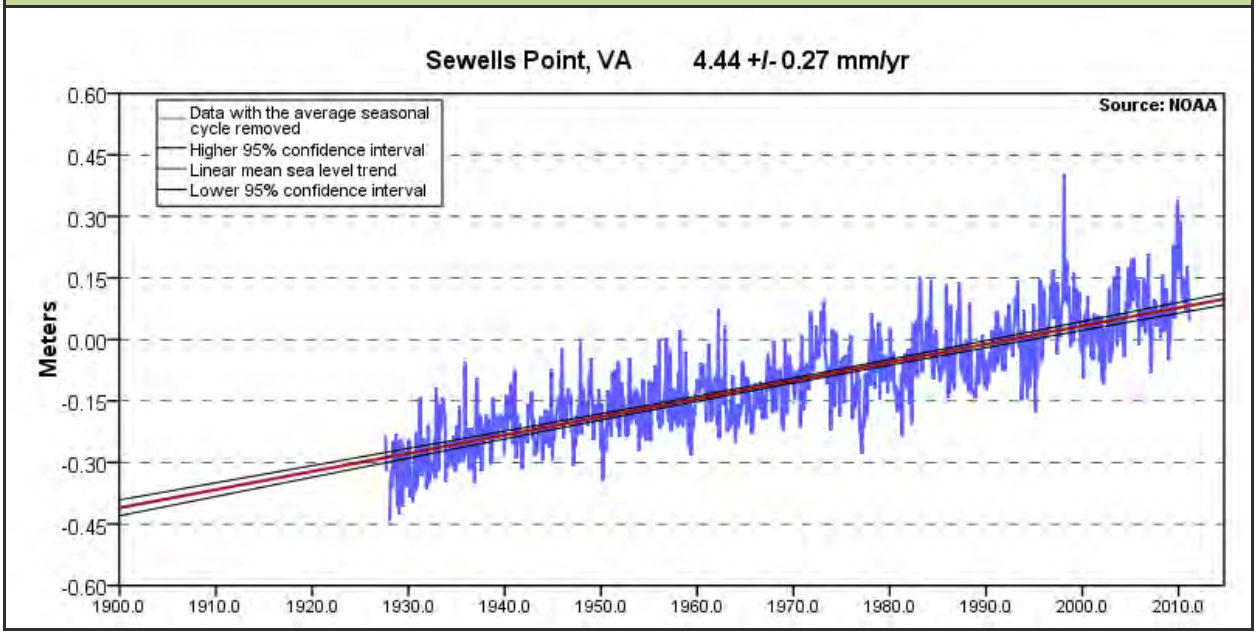
Local subsidence is believed to be the result of settlement or compaction of subsurface layers into the Chesapeake Bay Impact Crater (CBIC). A relatively recent discovery, the CBIC formed approximately 35 million years ago as the result of a comet or meteor strike (Boon, Wang, and Shen, *Planning for Sea Level Rise and Coastal Flooding,* October, 2008).



NOAA has compiled data from regional tide gauges to document the rates of sea level rise. There are three local stations with data pertinent to the City of Chesapeake, and the rates of sea level rise range from 1.23 feet to 1.98 feet per 100 years.

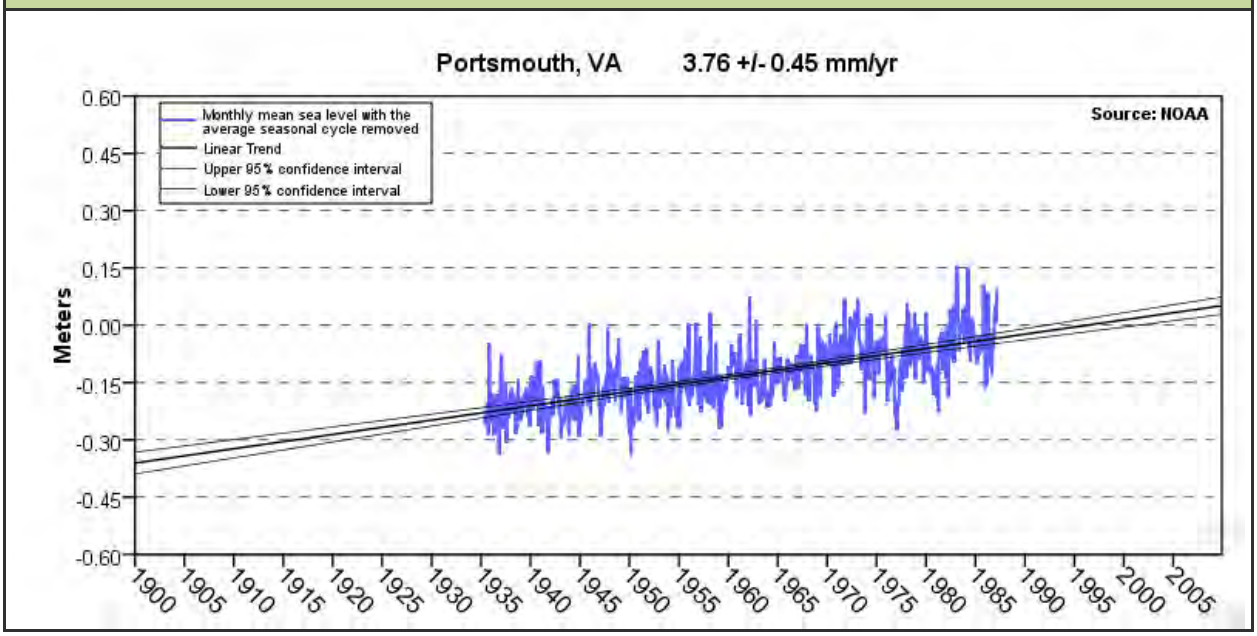
At Sewell's Point, Naval Station Norfolk, the local NOAA tide station with the longest period of record, the mean sea level trend is 4.44 millimeters/year with a 95% confidence interval of +/- 0.27 mm per year, based on monthly mean sea level data from 1927 to 2006 (**Figure 4.5**). This rate is equivalent to a change of 1.46 feet in 100 years. The plot shows the monthly mean sea level without the regular seasonal fluctuations due to coastal ocean temperatures, salinities, winds, atmospheric pressures, and ocean currents. The long-term linear trend is also shown, including its 95 percent confidence interval.

FIGURE 4.5: MEAN SEA LEVEL TREND, SEWELLS POINT, VIRGINIA



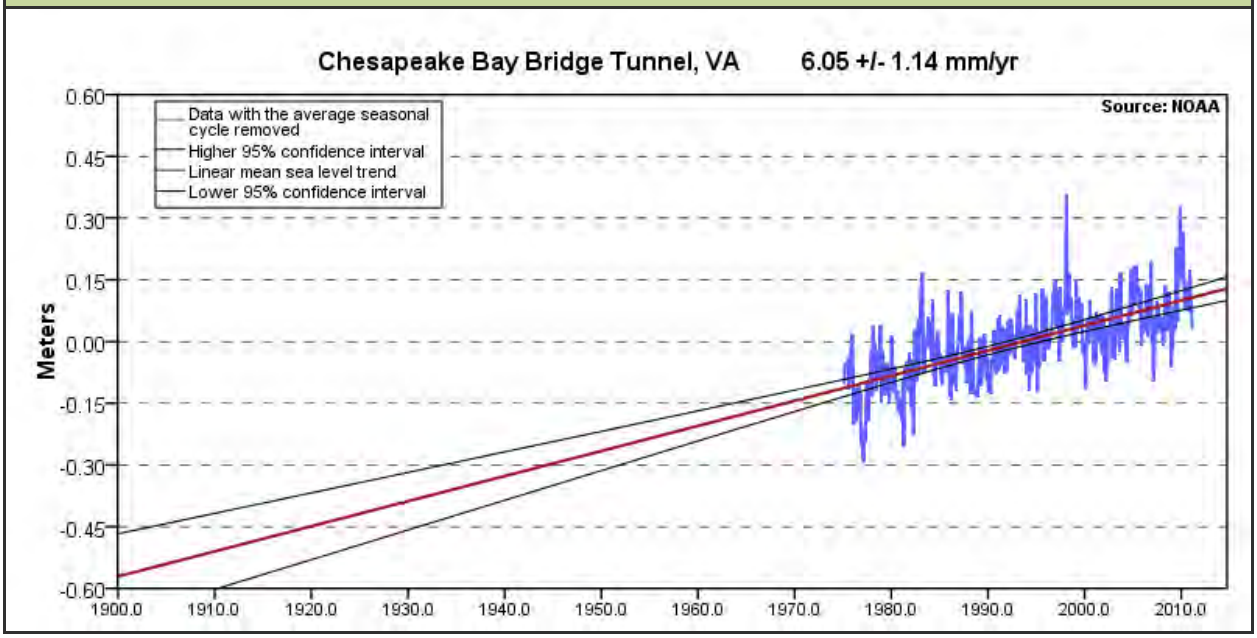
At Downtown Portsmouth, the mean sea level trend is 3.76 millimeters/year with a 95% confidence interval of +/- 0.45 mm/year based on monthly mean sea level data from 1935 to 1987 (**Figure 4.6**). This rate is equivalent to a change of 1.23 feet in 100 years.

FIGURE 4.6: MEAN SEA LEVEL TREND, PORTSMOUTH, VIRGINIA



At the First Island, Chesapeake Bay Bridge Tunnel, the mean sea level trend is 6.05 millimeters/year with a 95% confidence interval of +/- 1.14 mm per year based on monthly mean sea level data from 1975 to 2006, which is equivalent to a change of 1.98 feet in 100 years (**Figure 4.7**).

FIGURE 4.7: MEAN SEA LEVEL TREND, CHESAPEAKE BAY BRIDGE TUNNEL, VIRGINIA

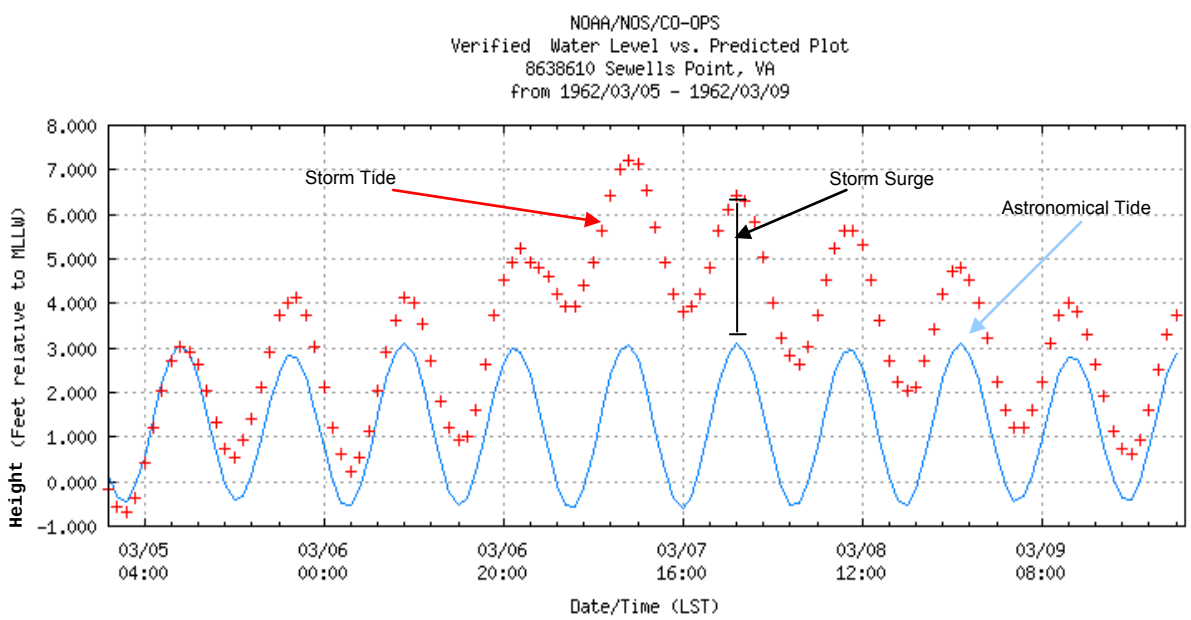


SIGNIFICANT HISTORICAL EVENTS

Unlike wildfires, earthquakes or coastal storms, the impacts of sea level rise are not felt or recorded in a matter of hours or days, but instead are slowly observed, recorded, and experienced over decades and centuries. However, scientists at the Virginia Institute of Marine Science (VIMS) have gathered data from several historical storms and made careful comparisons in an effort to highlight the historical impact of sea level rise locally.

The Ash Wednesday Storm of 1962 produced a peak storm tide of approximately 7.2 feet MLLW at Sewell's Point (see **Figure 4.8**). If that same storm were to occur at mean high tide in 2030, using the sea level rise rates calculated above for Sewell's Point, the astronomical tide would be approximately one foot higher. Since the storm tide is obtained by adding the storm surge to the astronomical tide, the same storm could then produce a storm tide of over eight feet MLLW. By comparison, Hurricane Isabel in 2003 produced a storm tide of 7.887 feet MLLW and caused an immense amount of damage.

FIGURE 4.8: ASTRONOMICAL AND STORM TIDES FOR 1962 STORM (NOAA, 2008)



Similarly, Boon (undated) concluded that sea level rise contributed to the similarity of two storms, the August 1933 hurricane and Hurricane Isabel in 2003. The storms had comparable peak storm tides of 8.018 feet MLLW (1933) and 7.887 feet MLLW (2003), and both peaks occurred very shortly before or after astronomical high tide, yet the 1933 storm occurred during spring tides and Isabel during neap tides. As a result, the storm surge in the 1933 storm was much higher and, all things being equal, the data would not have shown the storm surge that it did for Isabel had it not been for the constant adjustment of MLLW to account for as much as 1.35 feet of sea level rise between August, 1933 and September, 2003 (**Table 4.5**).

TABLE 4.5: AUGUST 1933 HURRICANE AND HURRICANE ISABEL (BOON, UNDATED)

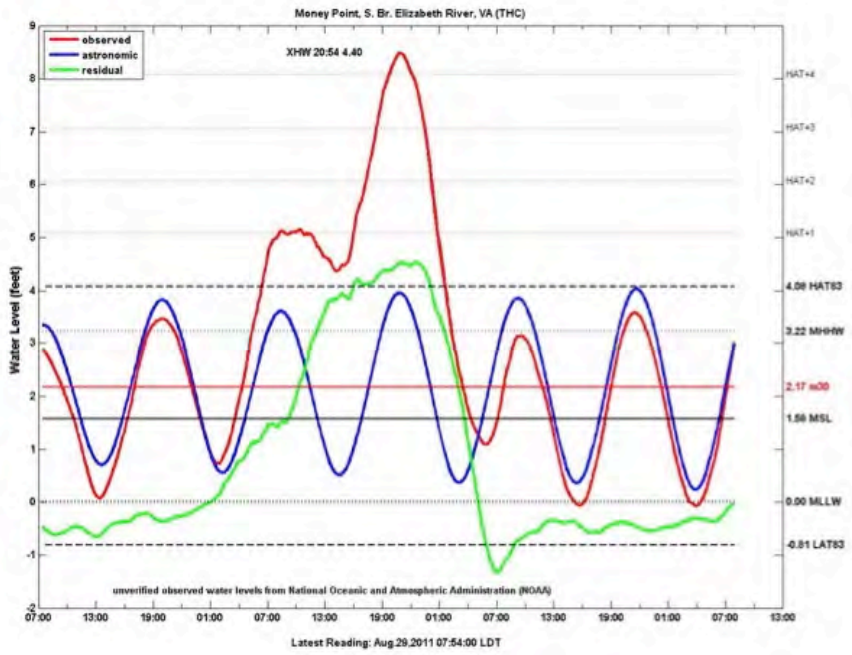
STORM	STORM TIDE (HEIGHT IN FEET ABOVE MLLW)	STORM SURGE (HEIGHT IN FEET ABOVE NORMAL)	MEAN WATER LEVEL (HEIGHT IN FEET ABOVE MLLW)
August 1933	8.018	5.84	0.95
Isabel – September 2003	7.887	4.76	2.30
1933 -2003	0.131	1.08	-1.35

A mere tropical depression, Ernesto struck Hampton Roads on September 1, 2006. At Sewells Point, the storm surge reached a peak of about four feet above monthly mean sea level for the lunar month, but occurred at low tide. Boon (*Ernesto: Anatomy of a Storm Tide,* undated) concludes that if the peak storm surge had occurred at high tide, the storm tide peak would have reached seven feet MLLW, or just 0.9 feet below Isabel's peak storm tide.

More recently, several scientist-authors have highlighted data at Money Point, Virginia, on the southern branch of the Elizabeth River near Portsmouth. The Money Point gage is probably the most useful gage for predicting real-time storm surge flooding in the City of Chesapeake. (NOAA has not compiled sea level rise trend data for the Money Point gage as shown in **Figures 4.5** through **4.7** for other gages in the region.)

In *Sea Level Rise and Coastal Infrastructure: Prediction, Risks and Solutions*, Bilal M. Ayyub and Michael S. Kearney observe that during the extratropical storm event which occurred in mid-November 2009, the maximum extratidal storm tide height of 4.69 feet at Money Point exceeded the extratidal height of 4.43 feet observed there during Hurricane Isabel. Again, during Hurricane Irene in 2011, the VIMS Tidewatch tool showed Money Point experienced the highest water levels in the area, at 4.4 feet above highest astronomical tide. **Figure 4.9** shows observed water levels (red), predicted astronomic tide (blue), and the storm surge (green).

FIGURE 4.9: HURRICANE IRENE, TIDEWATCH DATA FOR MONEY POINT, VA



Source: VIMS

PROBABILITY OF FUTURE OCCURRENCES

According to VIMS in a report to the U.S. Army Corps of Engineers, Norfolk District, "Land subsidence in Chesapeake Bay is likely to continue at or near present rates." Future absolute sea level rise, measured relative to the center of the earth rather than fixed points on land, "remains uncertain owing to diverse and possibly changing trends world-wide" (Boon, John D., Brubaker, Forrest, *Chesapeake Bay Land Subsidence and Sea Level Change: An Evaluation of Past and Present Trends and Future Outlook*, November 2010). Therefore, for planning purposes, the rates experienced in the past and documented through tide gauge measurement are expected to continue, and this hazard is considered to have a highly likely probability of occurrence.

WIND EVENTS: HURRICANES AND TROPICAL STORMS

BACKGROUND

Hurricane Isabel approaches North Carolina and Virginia in September of 2003. (Photo courtesy of NASA)

Hurricanes and tropical storms are characterized by closed circulation developing around a low-pressure center in which the winds rotate counter-clockwise in the Northern Hemisphere and with a diameter averaging 10 to 30 miles across. A tropical cyclone refers to any such circulation that develops over tropical waters. Tropical cyclones act as a mechanism to transport built-up heat from the tropics toward the poles. In this way, they are critical to the earth's atmospheric heat and moisture balance. The primary damaging forces associated with these storms are high-level sustained winds, heavy precipitation, and tornadoes. Coastal areas are particularly vulnerable to storm surge, wind-driven waves, and tidal flooding which can prove more destructive than cyclone wind[4].

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 September 10th. The Atlantic Ocean averages about 10 storms annually, of which six reach hurricane status. (NASA Earth Observatory online at: http://earthobservatory.nasa.gov)

As a 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 (MPH), the system is designated a tropical storm, given a name, and is monitored by the National Hurricane Center in Miami, Florida. When sustained winds reach or exceed 74 MPH the storm is deemed a hurricane. Hurricane intensity is further classified by the Saffir-Simpson Hurricane Wind Scale which rates hurricane intensity on a scale of one to five, with five being the most intense. The wind scale, recently revised to remove storm surge ranges, flooding impact and central pressure statements, is shown in **Table 4.6**.

[4] For purposes of this risk assessment, coastal flood hazards associated with hurricanes and tropical storm events are included separately under the "flood" hazard.

TABLE 4.6: SAFFIR-SIMPSON HURRICANE WIND SCALE		
CATEGORY	MAXIMUM SUSTAINED WIND SPEED (MPH)	DAMAGE SUMMARY
1	74–95	Very dangerous winds will produce some damage.
2	96–110	Extremely dangerous winds will cause extensive damage.
3	111–130	Devastating damage will occur
4	131–155	Catastrophic damage will occur.
5	155 +	Catastrophic damage will occur.

Source: National Hurricane Center

Categories 3, 4, and 5 are classified as "major" hurricanes, and while hurricanes within this range comprise only 20% of total tropical cyclones making landfall, they account for over 70 percent of the damage in the United States. **Table 4.7** describes the damage that could be expected for each hurricane category.

TABLE 4.7: HURRICANE DAMAGE CLASSIFICATIONS		
STORM CATEGORY	DAMAGE LEVEL	DESCRIPTION OF DAMAGES
1	MINIMAL	People, livestock, and pets struck by flying or falling debris could be injured or killed. Older (mainly pre-1994 construction) mobile homes could be destroyed, especially if they are not anchored properly as they tend to shift or roll off their foundations. Newer mobile homes that are anchored properly can sustain damage involving the removal of shingle or metal roof coverings, and loss of vinyl siding, as well as damage to carports, sunrooms, or lanais. Some poorly constructed frame homes can experience major damage, involving loss of the roof covering and damage to gable ends as well as the removal of porch coverings and awnings. Unprotected windows may break if struck by flying debris. Masonry chimneys can be toppled. Well-constructed frame homes could have damage to roof shingles, vinyl siding, soffit panels, and gutters. Failure of aluminum, screened-in, swimming pool enclosures can occur. Some apartment building and shopping center roof coverings could be partially removed. Industrial buildings can lose roofing and siding especially from windward corners, rakes, and eaves. Failures to overhead doors and unprotected windows will be common. Windows in high-rise buildings can be broken by flying debris. Falling and broken glass will pose a significant danger even after the storm. There will be occasional damage to commercial signage, fences, and canopies. Large branches of trees will snap and shallow rooted trees can be toppled. Extensive damage to power lines and poles will likely result in power outages that could last a few to several days.
2	MODERATE	There is a substantial risk of injury or death to people, livestock, and pets due to flying and falling debris. Older (mainly pre-1994 construction) mobile homes have a very high chance of being destroyed and the flying debris generated can shred nearby mobile homes. Newer mobile homes can also be destroyed. Poorly constructed frame homes have a high chance of having their roof structures removed especially if they are not anchored properly. Unprotected windows will have a high probability of being broken by flying debris. Well-constructed frame homes could sustain major roof and siding damage. Failure of aluminum, screened-in, swimming pool enclosures will be common. There will be a substantial percentage of roof and siding damage to apartment buildings and industrial buildings. Unreinforced masonry walls can collapse. Windows in high-rise buildings can be broken by flying debris. Falling and broken glass will pose a significant danger even after the storm. Commercial signage, fences, and canopies will be damaged and often destroyed. Many shallowly rooted trees will be snapped or uprooted and block numerous roads. Near-total power loss is expected with outages that could last from several days to weeks. Potable water could become scarce as filtration systems begin to fail.

TABLE 4.7: HURRICANE DAMAGE CLASSIFICATIONS		
STORM CATEGORY	DAMAGE LEVEL	DESCRIPTION OF DAMAGES
3	EXTENSIVE	There is a high risk of injury or death to people, livestock, and pets due to flying and falling debris. Nearly all older (pre-1994) mobile homes will be destroyed. Most newer mobile homes will sustain severe damage with potential for complete roof failure and wall collapse. Poorly constructed frame homes can be destroyed by the removal of the roof and exterior walls. Unprotected windows will be broken by flying debris. Well-built frame homes can experience major damage involving the removal of roof decking and gable ends. There will be a high percentage of roof covering and siding damage to apartment buildings and industrial buildings. Isolated structural damage to wood or steel framing can occur. Complete failure of older metal buildings is possible, and older unreinforced masonry buildings can collapse. Numerous windows will be blown out of high-rise buildings resulting in falling glass, which will pose a threat for days to weeks after the storm. Most commercial signage, fences, and canopies will be destroyed. Many trees will be snapped or uprooted, blocking numerous roads. Electricity and water will be unavailable for several days to a few weeks after the storm passes.
4	EXTREME	There is a very high risk of injury or death to people, livestock, and pets due to flying and falling debris. Nearly all older (pre-1994) mobile homes will be destroyed. A high percentage of newer mobile homes also will be destroyed. Poorly constructed homes can sustain complete collapse of all walls as well as the loss of the roof structure. Well-built homes also can sustain severe damage with loss of most of the roof structure and/or some exterior walls. Extensive damage to roof coverings, windows, and doors will occur. Large amounts of windborne debris will be lofted into the air. Windborne debris damage will break most unprotected windows and penetrate some protected windows. There will be a high percentage of structural damage to the top floors of apartment buildings. Steel frames in older industrial buildings can collapse. There will be a high percentage of collapse to older unreinforced masonry buildings. Most windows will be blown out of high-rise buildings resulting in falling glass, which will pose a threat for days to weeks after the storm. Nearly all commercial signage, fences, and canopies will be destroyed. Most trees will be snapped or uprooted and power poles downed. Fallen trees and power poles will isolate residential areas. Power outages will last for weeks to possibly months. Long-term water shortages will increase human suffering. Most of the area will be uninhabitable for weeks or months.
5	CATASTROPHIC	People, livestock, and pets are at very high risk of injury or death from flying or falling debris, even if indoors in mobile homes or framed homes. Almost complete destruction of all mobile homes will occur, regardless of age or construction. A high percentage of frame homes will be destroyed, with total roof failure and wall collapse. Extensive damage to roof covers, windows, and doors will occur. Large amounts of windborne debris will be lofted into the air. Windborne debris damage will occur to nearly all unprotected windows and many protected windows. Significant damage to wood roof commercial buildings will occur due to loss of roof sheathing. Complete collapse of many older metal buildings can occur. Most unreinforced masonry walls will fail which can lead to the collapse of the buildings. A high percentage of industrial buildings and low-rise apartment buildings will be destroyed. Nearly all windows will be blown out of high-rise buildings resulting in falling glass, which will pose a threat for days to weeks after the storm. Nearly all commercial signage, fences, and canopies will be destroyed. Nearly all trees will be snapped or uprooted and power poles downed. Fallen trees and power poles will isolate residential areas. Power outages will last for weeks to possibly months. Long-term water shortages will increase human suffering. Most of the area will be uninhabitable for weeks or months.

Source: National Hurricane Center

Storm surge is a large dome of water often 50 to 100 miles wide and rising anywhere from four to twenty feet. The storm surge arrives ahead of the storm's actual landfall and the more intense the hurricane 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. A storm surge is a wave that has outrun its generating source and become a long period swell. The surge is always highest in the right-front quadrant of the direction in which the hurricane is moving. As the storm approaches shore, the greatest storm surge will be to the

north of the 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.

Storm surge heights and associated waves are dependent upon the shape of the 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. Damage during hurricanes may also result from spawned tornadoes and inland flooding associated with heavy rainfall that usually accompanies these storms.

LOCATION AND SPATIAL EXTENT

Chesapeake is in an area that can expect to experience hurricane damage in any given year. Since the mid-1800s, numerous tropical cyclones have affected Virginia, causing the deaths of an estimated 228 people and costing the Commonwealth more than a billion dollars in damages.

In fact, 77 storms have passed within 75 miles of Chesapeake since 1851 (**Figures 4.10 and 4.11**). Two Category 3 hurricanes passed within 75 miles of the region (both unnamed storms in 1879 and 1899), eight were Category 2 hurricanes, 16 were Category 1 hurricanes and 51 were tropical storms.

Hurricane winds impact the study area uniformly. All building stock, infrastructure and critical facilities are equally vulnerable to these hazards. Vulnerability maps showing infrastructure and critical facilities that are at risk to these hazards are found in **Appendix E**.

SIGNIFICANT HISTORICAL EVENTS[5]

The NWS began keeping weather records on January 1, 1871. Prior to that, information on past hurricanes and tropical storms to impact the Chesapeake and the Southside Hampton Roads region were taken from ships logs, accounts from local citizens, newspapers, and other sources. There are several historical references to major storms that affected coastal Virginia in the 1600's and 1700's[6]. Some of these storms were strong enough to alter land masses, including the widening of the Lynnhaven River (September 6, 1667) and formation of Willoughby Spit (October 19, 1749). These reports also indicate severe flooding caused by these storms (12-15 feet of flooding in some cases).

Better records have been kept since 1871. One of the first storms to be well documented was a hurricane in October 1878 that resulted in Cobb and Smith Islands on the Eastern Shore being completely submerged.

One of the worst storms to impact the region occurred in August 1933 when a hurricane known as the Chesapeake-Potomac Hurricane of 1933 passed just west of the Hampton Roads area. The storm made landfall in northeastern North Carolina and moved northwest. This hurricane produced the record high tide for the area which exists today, at a level of 9.69 feet above MLLW. The highest sustained wind was 88 MPH at the Naval Air Station (NAS). Less than a month later, another hurricane struck the area with winds again clocked at 88 MPH at NAS, but tides only rose to 8.3 feet above MLLW.

Another unnamed storm occurred in September of 1944 creating the fastest one-minute wind speed to ever be recorded in the area of 134 MPH at Cape Henry. Gusts were estimated to be 150 MPH. The local NWS office recorded 72 MPH winds with gusts to 90 MPH.

[5] As previously mentioned, many of the significant hurricane, coastal storm and tropical storm events were also significant flooding events. As such, many of the significant historical events for hurricanes may also be discussed in the description of the flood hazard.

[6] The first historical reference to a major hurricane that could have affected the Virginia coast was in August 24, 1635.

Although the center of circulation for Hurricane Hazel did not pass within 75 miles of the region, wind speeds of 78 MPH were recorded at Norfolk Airport with gusts up to 100 MPH and an unofficial reading of 130 MPH was also reported in Hampton.

In 1960 Hurricane Donna passed through the region with a fastest one-minute wind speed of 73 MPH at Norfolk Airport, 80 MPH at CapeHenry and estimated 138 MPH at Chesapeake Light Ship. Lowest pressure of 28.65 inches holds the area record for a tropical storm. Three deaths were documented in association with this hurricane.

On August 27, 1998, Hurricane Bonnie tracked over the region after passing over the northern Outer Banks. Winds speeds were sustained at 46 MPH with gusts to 64 MPH at Norfolk International Airport. Four to seven inches of rain combined with near hurricane force winds knocked out power to 320,000 customers across Virginia. Highest tide was recorded at 6.0 feet above MLLW. This was the most significant storm to impact the region since Hurricane Donna in 1960.

On September 6, 1999, downgraded Hurricane Floyd passed directly over Virginia Beach on a track similar to Hurricane Donna in 1960. Wind speeds were recorded at 31 MPH with gusts to 46 MPH. Rainfall amounts of 12-18 inches were recorded in portions of eastern Virginia, causing extensive flooding in the Southside Hampton Roads region.

In the 1990s, several storms had a less direct path over Hampton Roads, but nonetheless impacted the weather severely. In 1996, Hurricanes Bertha and Fran impacted the region, followed by Hurricane Danny in 1997, Hurricane Bonnie in 1998, and Hurricanes Dennis, Floyd, and Irene in 1999. Although each of these storms was downgraded by the time they reached Hampton Roads, they each created problems for the region when they passed through, and two resulted in Federal Disaster declarations (Bonnie and Floyd) for the region. Tropical storms Helene in 2000 and Kyle occurred in 2002, and of course, Hurricane Isabel caused $1.6 billion damage in the region in 2003, and claimed 33 lives (*The Virginian Pilot,* 9/4/06). During Isabel, wind speeds of 54 MPH with gusts to 75 MPH in Norfolk and significant beach erosion were reported.

Of the five storms that have passed through the region since the original Hazard Mitigation Plan was developed (Alberta, Ernesto, Barry, Gabrielle, Hanna and Irene), Hanna initially appeared to forecasters to have the worst characteristics. Tropical Storm Hanna tracked up the Mid-Atlantic coast on September 6, 2008, with maximum sustained winds around 50 MPH. Hanna originally made landfall near the border of North and South Carolina around 3:20 am on the 6th. The storm tracked across eastern North Carolina during the early afternoon hours before turning northeast across southeastern Virginia later in the afternoon. Hanna eventually tracked across the Chesapeake Bay and into Delaware during the evening hours. With the track of Hanna being to the east, the strongest winds were also confined to the east of Hampton Roads. The highest sustained wind of 55 MPH with a peak gust of 68 MPH was recorded at the 3rd Island Bay Bridge Tunnel. Minimum pressure of 991 MB was recorded at the 3rd Island Bay Bridge Tunnel. Coastal storm tides of two feet or less above astronomical tide levels were common, with only minor beach erosion reported. Near the coast, as well as inland, tropical storm winds knocked down numerous trees and power lines, as well as caused minor structural damage. No fatalities or injuries were attributed to the winds.

Contrary to expectations and forecasts, however, Ernesto in early September 2006 proved very damaging because of coastal flooding. State officials blamed Ernesto for six deaths across Virginia and an estimated $33 million in statewide damage (*The Virginian Pilot,* 9/4/06). Additional discussion of the regional flood-related impacts from Ernesto is shown in **Table 4.4**.

In late August 2011, Hurricane Irene devastated the Caribbean and eastern seaboard of the United States. Storm surge ranged between 3.3 to 4.5 feet along the coasts of Maryland, Delaware and New Jersey. Although the impacts were expected to be severe in coastal Virginia, the resulting damage was noteworthy, but hardly catastrophic as it was in parts of North Carolina and areas north of Chesapeake Bay. On August 28, a storm tide of 6.6 feet was recorded at Money Point, Virginia. Irene's second landfall near Cape Lookout, North Carolina, brought sustained hurricane force winds to the Outer Banks

and tropical storm force winds inland to Chesapeake. There were power outages, heavy rain and flooding. The City opened shelters at Oscar Smith High School, Western Branch High School, Hickory Middle School, and Thurgood Marshall Elementary School. Residents in low-lying areas and mobile homes were urged to evacuate using the Emergency Alert System, which notifies registered residents via voice and/or text messages.

Hurricane Sandy in October 2012 was again expected to bring extreme hurricane conditions to southeastern Virginia. Fortunately, the storm track veered away from the Virginia coast and spared the region much of the devastation wrought in the northeast. Some areas of Virginia were included in the Presidentially-Declared Disaster for the storm, but Chesapeake and Hampton Roads saw little more than flooding in low-lying areas and limited wind damage, and therefore were not among declared communities.

Flooding at the "Triple Decker Bridge" resulting from Hurricane Sandy.

Photo credit: City of Chesapeake

Table 4.8 shows the historical storm tracks within 75 miles of Chesapeake since 1851 that are the basis for **Figures 4.10 and 4.11**.

TABLE 4.8: HISTORICAL STORM TRACKS WITHIN 75 MILES OF CHESAPEAKE (SINCE 1851)

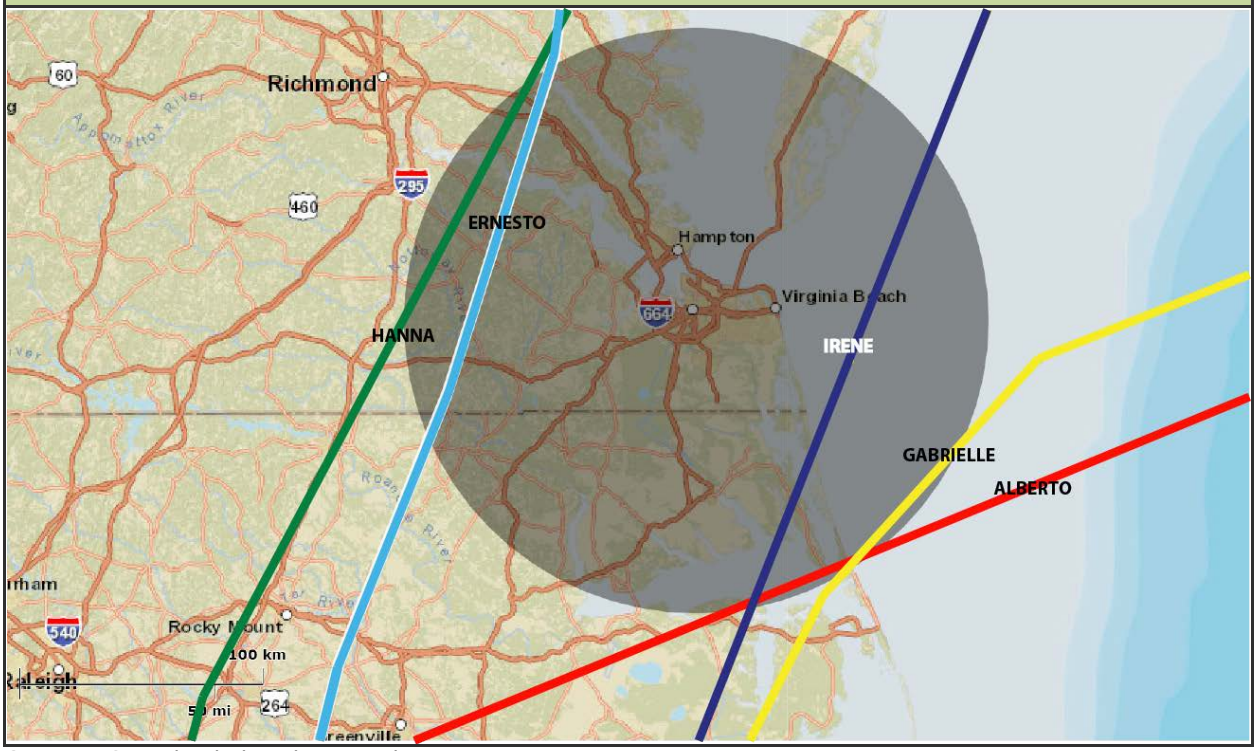
DATE OF OCCURRENCE	STORM NAME	WIND SPEED (MPH)	STORM CATEGORY AT LANDFALL
8/25/1851	UNNAMED	45	TROPICAL STORM
9/10/1854	UNNAMED	45	TROPICAL STORM
8/20/1856	UNNAMED	60	TROPICAL STORM
9/17/1859	UNNAMED	60	TROPICAL STORM
9/27/1861	UNNAMED	70	TROPICAL STORM
11/2/1861	UNNAMED	80	CATEGORY 1 HURRICANE
9/18/1863	UNNAMED	70	TROPICAL STORM
10/26/1872	UNNAMED	45	TROPICAL STORM
9/29/1874	UNNAMED	70	TROPICAL STORM
9/17/1876	UNNAMED	90	CATEGORY 1 HURRICANE
10/23/1878	UNNAMED	105	CATEGORY 2 HURRICANE
8/18/1879	UNNAMED	115	CATEGORY 3 HURRICANE
9/9/1880	UNNAMED	80	CATEGORY 1 HURRICANE
9/10/1881	UNNAMED	70	TROPICAL STORM
9/11/1882	UNNAMED	45	TROPICAL STORM
9/23/1882	UNNAMED	45	TROPICAL STORM
9/12/1883	UNNAMED	45	TROPICAL STORM
8/26/1885	UNNAMED	80	CATEGORY 1 HURRICANE
7/2/1886	UNNAMED	40	TROPICAL STORM
9/11/1888	UNNAMED	40	TROPICAL STORM
10/12/1888	UNNAMED	60	TROPICAL STORM
9/25/1889	UNNAMED	45	TROPICAL STORM
6/17/1893	UNNAMED	65	TROPICAL STORM
10/23/1893	UNNAMED	50	TROPICAL STORM
9/29/1894	UNNAMED	85	CATEGORY 1 HURRICANE
10/10/1894	UNNAMED	75	CATEGORY 1 HURRICANE
9/23/1897	UNNAMED	70	TROPICAL STORM
10/26/1897	UNNAMED	60	TROPICAL STORM
8/18/1899	UNNAMED	120	CATEGORY 3 HURRICANE
10/31/1899	UNNAMED	65	TROPICAL STORM

TABLE 4.8: HISTORICAL STORM TRACKS WITHIN 75 MILES OF CHESAPEAKE (SINCE 1851)

DATE OF OCCURRENCE	STORM NAME	WIND SPEED (MPH)	STORM CATEGORY AT LANDFALL
7/11/1901	UNNAMED	80	CATEGORY 1 HURRICANE
6/16/1902	UNNAMED	40	TROPICAL STORM
9/15/1904	UNNAMED	65	TROPICAL STORM
9/1/1908	UNNAMED	50	TROPICAL STORM
8/25/1918	UNNAMED	40	TROPICAL STORM
12/3/1925	UNNAMED	45	TROPICAL STORM
9/19/1928	UNNAMED	45	TROPICAL STORM
8/23/1933	UNNAMED	80	CATEGORY 1 HURRICANE
9/16/1933	UNNAMED	90	CATEGORY 1 HURRICANE
9/6/1935	UNNAMED	75	CATEGORY 1 HURRICANE
9/18/1936	UNNAMED	100	CATEGORY 2 HURRICANE
8/2/1944	UNNAMED	50	TROPICAL STORM
9/14/1944	UNNAMED	105	CATEGORY 2 HURRICANE
10/20/1944	UNNAMED	40	TROPICAL STORM
6/26/1945	UNNAMED	50	TROPICAL STORM
7/7/1946	UNNAMED	65	TROPICAL STORM
8/14/1953	BARBARA	105	CATEGORY 2 HURRICANE
8/31/1954	CAROL	100	CATEGORY 2 HURRICANE
8/12/1955	CONNIE	80	CATEGORY 1 HURRICANE
9/20/1955	IONE	70	TROPICAL STORM
7/10/1959	CINDY	40	TROPICAL STORM
7/30/1960	BRENDA	50	TROPICAL STORM
9/12/1960	DONNA	105	CATEGORY 2 HURRICANE
9/14/1961	UNNAMED	40	TROPICAL STORM
9/1/1964	CLEO	45	TROPICAL STORM
9/17/1967	DORIA	40	TROPICAL STORM
8/28/1971	DORIA	65	TROPICAL STORM
6/22/1972	AGNES	50	TROPICAL STORM
7/1/1981	BRET	60	TROPICAL STORM
9/30/1983	DEAN	65	TROPICAL STORM
9/14/1984	DIANA	60	TROPICAL STORM
9/27/1985	GLORIA	105	CATEGORY 2 HURRICANE
8/18/1986	CHARLEY	80	CATEGORY 1 HURRICANE
9/25/1992	DANIELLE	65	TROPICAL STORM
7/13/1996	BERTHA	75	CATEGORY 1 HURRICANE
7/24/1997	DANNY	45	TROPICAL STORM
8/28/1998	BONNIE	85	CATEGORY 1 HURRICANE
9/16/1999	FLOYD	80	CATEGORY 1 HURRICANE
9/24/2000	HELENE	45	TROPICAL STORM
10/12/2002	KYLE	45	TROPICAL STORM
9/18/2003	ISABEL	100	CATEGORY 2 HURRICANE
8/14/2004	CHARLEY	40	TROPICAL STORM
6/16/2006	ALBERTO	60	EXTRATROPICAL STORM
9/2/2006	ERNESTO	45	EXTRATROPICAL STORM
9/10/2007	GABRIELLE	40	TROPICAL STORM
9/06/2008	HANNA	70	TROPICAL STORM
8/28/2011	IRENE	75	CATEGORY 1 HURRICANE

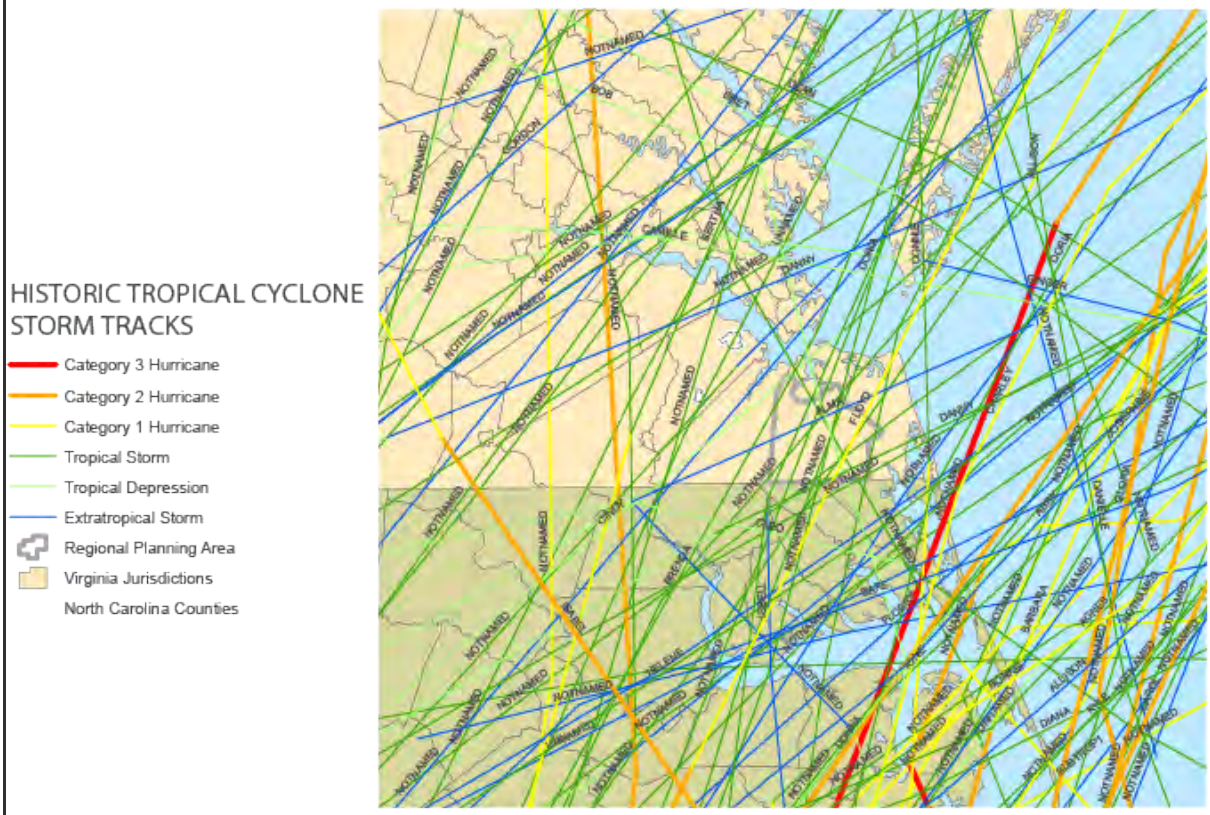
Source: National Hurricane Center, 2013

FIGURE 4.10: HISTORICAL STORM TRACKS WITHIN 75 MILES OF CHESAPEAKE SINCE 2005



Source: NOAA Historical Hurricane Tracks.

FIGURE 4.11: HISTORICAL STORM TRACKS WITHIN 75 MILES OF CHESAPEAKE, 1851-2005



Source: NOAA Historical Hurricane Tracks

PROBABILITY OF FUTURE OCCURRENCES

It is likely that the City will be impacted by hurricanes and tropical storms in the future. The City is less likely to experience the effects of a major (Category 3 or stronger) hurricane; however, it remains a possibility. The effects of smaller hurricanes (Categories 1 and 2 with wind speeds from 74-110 MPH) and tropical storms (sustained wind speeds of at least 39 MPH and torrential rains) will be more frequent, as storms making landfall along the North Carolina and Virginia coastlines could impact the region in any given year.

WIND EVENTS: TORNADOES

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 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 NWS, tornado wind speeds normally range from 40 to more than 300 MPH. The most violent tornadoes have rotating winds of 250 MPH or more and are capable of causing extreme destruction and turning normally harmless objects into deadly missiles.

Each year, an average of over 1,200 tornadoes is reported nationwide, resulting in an average of 80 deaths and 1,500 injuries (NOAA, 2002 and 2014). They are more likely to occur during the spring and early summer months of March through June and can occur at any time of day, but are 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.

Waterspouts are weak tornadoes that form over warm water and are most common along the Gulf Coast and southeastern states. Waterspouts occasionally move inland, becoming tornadoes that cause damage and injury. However, most waterspouts dissipate over the open water causing threats only to marine and boating interests. Typically a waterspout is weak and short-lived, and because they are so common, most go unreported unless they cause damage.

The destruction caused by tornadoes ranges from light to devastating depending upon the intensity, size, and duration of the storm. Typically, tornadoes cause the greatest damages to structures of light or wood-framed construction such as residential homes (particularly mobile homes), and tend to remain localized in impact. The traditional Fujita Scale for tornadoes, introduced in 1971, was developed to measure tornado strength and associated damages. Starting in February of 2007, an “enhanced” Fujita (EF) Scale was implemented, with somewhat lower wind speeds at the higher F-numbers, and more thoroughly-refined structural damage indicator definitions. **Table 4.9** provides a summary of the EF Scale. Assigning an EF Scale rating to a tornado involves the following steps:

- Conduct an aerial and ground survey over the entire length of the damage path;
- Locate and identify damage indicators in the damage path;
- Consider the wind speeds of all damage indicators and assign an EF Scale category for the highest wind speed consistent with wind speeds from the other damage indicators;
- Record the basis for assigning an EF scale rating to a tornado event; and
- Record other pertinent data related to the tornado event.

TABLE 4.9: ENHANCED FUJITA (EF) SCALE FOR TORNADOES	
EF-SCALE NUMBER	3 SECOND GUSTS (MPH)
F0	65-85
F1	86-110
F2	11-135
F3	136-165
F4	166-200
F5	over 200

Source: NWS Storm Prediction Center

In Virginia, tornadoes primarily occur from April through September, although tornadoes have been observed in every month. Low-intensity tornadoes occur most frequently; tornadoes rated F2 or higher are very rare in Virginia, although F2, F3, and a few F4 storms have been observed. According to the *Commonwealth of Virginia, Mitigation Plan 2013*, Virginia ranks 28th in terms of the number of tornado touchdowns reported between 1950 and 2006.

LOCATION AND SPATIAL EXTENT

Tornadoes typically impact a relatively small area; however, it is impossible to predict where in the planning area a tornado may strike. Therefore, it is assumed that Chesapeake is uniformly exposed to this hazard.

Tornadoes associated with tropical cyclones are somewhat more predictable. These tornadoes occur frequently in September and October when the incidence of tropical storm systems is greatest. They usually form around the perimeter of the storm, and most often to the right and ahead of the storm path or the storm center as it comes ashore. These tornadoes commonly occur as part of large outbreaks and generally move in an easterly direction.

Figure 4.12 illustrates the approximate location where confirmed tornadoes have touched down in the region.

SIGNIFICANT HISTORICAL EVENTS

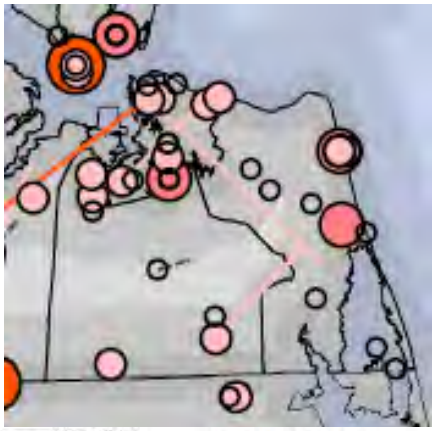
The City of Chesapeake has experienced 13 tornadoes since 1960, seven of those occurring since (and including) 1990. The tornadoes occurring since 1990 had strengths of F0, F1, and F2. Damage estimates for these tornadoes exceed $1.8 million. **Table 4.10** lists historical tornadoes that touched down in the City of Chesapeake (NCDC Website).

TABLE 4.10: TORNADOES IN THE CITY OF CHESAPEAKE

DATE	DESCRIPTION
11/26/1926	A waterspout came ashore from the Elizabeth River and collapsed two 700 feet long warehouses.
4/8/1962	An F2 tornado tracked approximately 9 miles across the southeast portion of Norfolk County near St. Brides, Hickory and Fentress. Many roofs were blown off and some outbuildings were leveled.
6/18/1969	An F1 tornado touched down at 11:01 PM.
8/27/1971	An F1 tornado touched down at 1:30 PM causing an estimated $250,000 in damage.
11/3/1971	An F2 tornado touched down at 10:30 AM.
4/4/1976	An F1 tornado touched down at 3:00 PM causing an estimated $2,500 in damage.
5/8/1984	A cluster of thunderstorms caused damage in Chesapeake. Numerous tornadoes were spotted around the state.
2/9/1990	An F0 tornado touched down causing an estimated $25,000 in damage.
8/6/1993	An F2 tornado hit Etheridge Manor, Etheridge Woods, Windlesham Plantation, Hanbury corridor, and the Hampton Roads Airport causing an estimated $1,651,500 in damage.
7/24/1997	An F1 tornado touched down near Gorier Avenue and Poindexter Street in Norfolk, traveling north along the railroad tracks. One home damaged in Chesapeake; damage was estimated at $60,000.
4/9/1998	An F0 tornado uprooted several trees and sheared the tops off many others in a 4 to 5 mile path along the northern portions of the City. The tornado appeared to remain just above the ground, with all structural damage resulting from falling limbs/trees. There were no deaths or injuries associated with the event that caused an estimated $25,000 in damage.
8/27/1998	An F0 tornado associated with the remnants of Hurricane Bonnie initially affected the Riverwalk section of the City, then tracked east-northeast through the Greenbrier section. Damage estimated to be $25,000.
8/14/2004	An F0 tornado associated with remnants of Hurricane Charley affected an area of Southern Chesapeake causing approximately $5000 in property damage. A fence was damaged and several trees downed.
5/4/2009	Scattered severe thunderstorms along a frontal boundary produced large hail, damaging winds and one tornado in Chesapeake. An EF0 tornado touched down in the Great Bridge section south of Cedar Road between Shillelagh Road and Battlefield Boulevard. Several trees were downed and numerous branches were torn off other trees. Also, a few shingles were ripped off some homes. There was approximately $10,000 property damage.

Source: NCDC

FIGURE 4.12: HISTORIC TORNADO TOUCHDOWNS AND TRACKS: 1950-2011



VIRGINIA DEPARTMENT OF EMERGENCY MANAGEMENT

DATA SOURCES:
SVRGIS
VGIN Jurisdictional Boundaries
ESRI State Boundaries

LEGEND:
Tornado F-Scale
0
1
2
3
4
5

PROJECTION: *VA Lambert Conformal Conic North American Datum 1983*

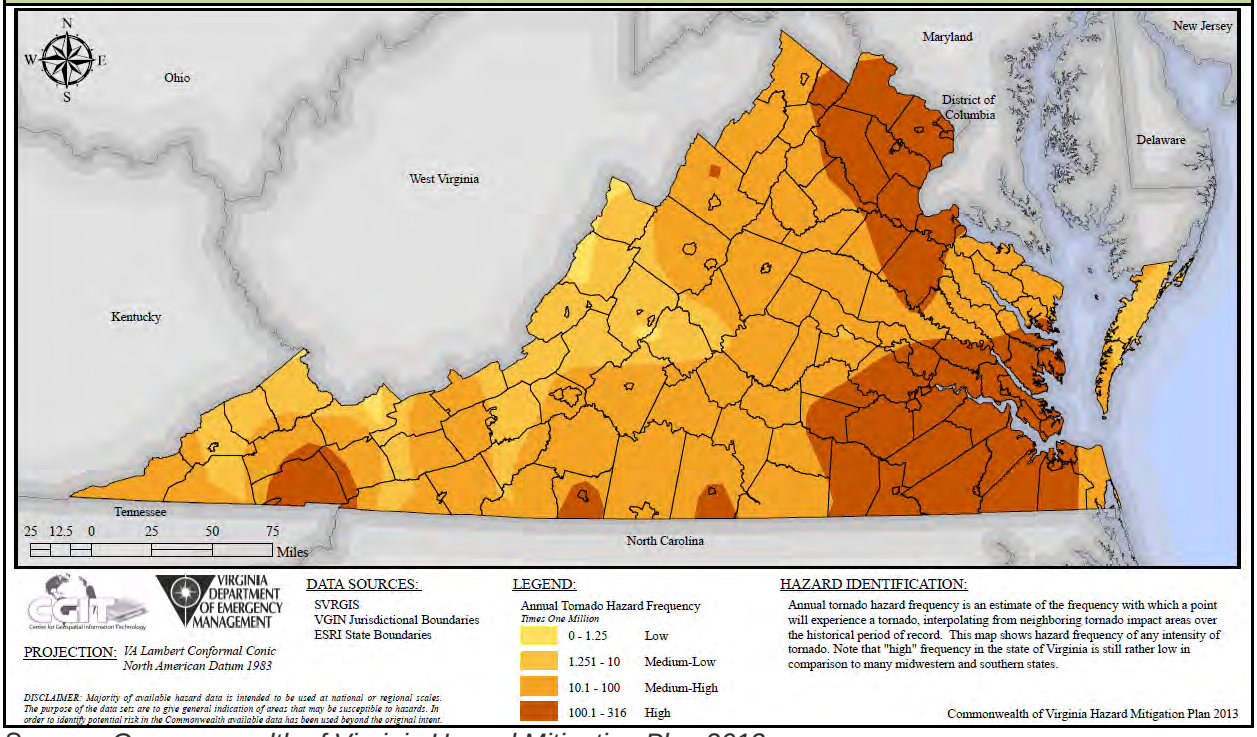
DISCLAIMER: Majority of available hazard data is intended to be used at national or regional scales. The purpose of the data sets are to give general indication of areas that may be susceptible to hazards. In order to identify potential risk in the Commonwealth available data has been used beyond the original intent.

Source: *Commonwealth of Virginia Hazard Mitigation Plan 2013*

PROBABILITY OF FUTURE OCCURRENCES

For updates to the *Commonwealth of Virginia Mitigation Plan 2010*, the Virginia Department of Emergency Management documented statewide annual tornado frequency and annual significant tornado hazard frequency. The City of Chesapeake, as shown in **Figure 4.13**, is located in an area of medium to high risk for tornado strikes of magnitude F2 or larger. Please note that this map is Virginia-specific and "high frequency" in the Commonwealth is still relatively low frequency in parts of the Midwest and southern United States. The probability of future occurrence is considered likely.

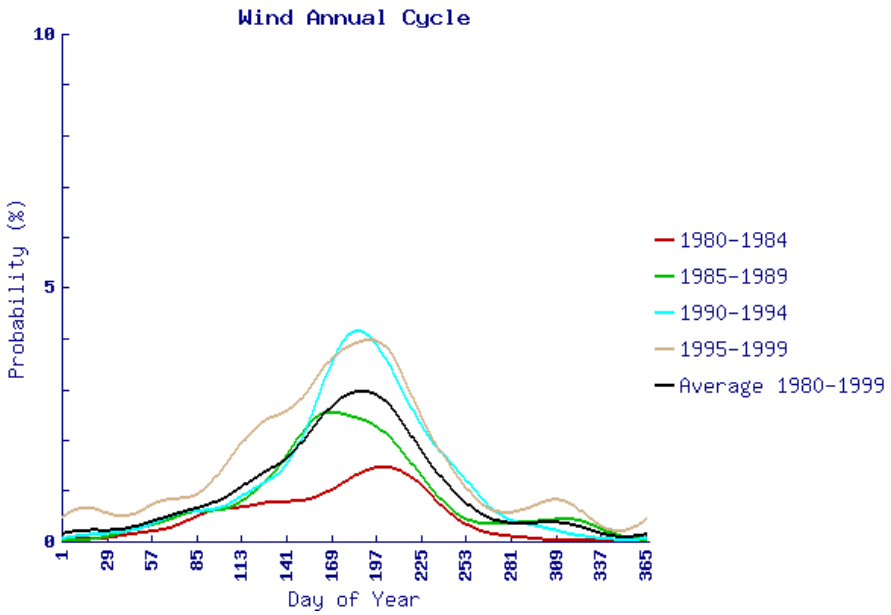
FIGURE 4.13: HISTORICAL TORNADO HAZARD FREQUENCY



Source: *Commonwealth of Virginia Hazard Mitigation Plan 2013*

A tornado wind event could occur in Chesapeake at any time of the year, but is most likely to occur from April to August, with peak probability in June, as can be seen in the Wind Annual Cycle for Chesapeake (**Figure 4.14**) below.

FIGURE 4.14: ANNUAL WIND CYCLE, CITY OF CHESAPEAKE



Source: National Severe Storm Labs

WIND EVENTS: WINTER STORMS AND NOR'EASTERS

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. Some winter storms may be large enough to affect several states, while others may affect only a single community. Many winter storms are accompanied by low temperatures and heavy and/or blowing snow, which can severely impair visibility.

Winter storms may include snow, sleet, freezing rain, or a mix of these wintry forms of precipitation. Sleet—raindrops that freeze into ice pellets before reaching the ground—usually bounce when hitting a surface and do not stick to objects; however, sleet can accumulate like snow and cause a hazard to motorists. Freezing rain is rain that falls onto a surface with a temperature below freezing, forming a glaze of ice. Even small accumulations of ice can cause a significant hazard, especially on roads, power lines and trees. An ice storm occurs when freezing rain falls and freezes immediately upon impact. Communications and power can be disrupted for days, and even small accumulations of ice may cause extreme hazards to motorists and pedestrians.

A VDOT snowplow plows I-64 East. (Photo by Tom Saunders, VDOT)

A freeze is weather marked by low temperatures, especially when below the freezing point (zero degrees Celsius or thirty-two degrees Fahrenheit). Agricultural production is seriously affected when temperatures remain below the freezing point.

The Northeast Snowfall Impact Scale (NESIS) developed by the NWS characterizes and ranks high-impact Northeast snowstorms. These storms have large areas of 10 inch snowfall accumulations and greater. NESIS has five categories: Extreme, Crippling, Major, Significant, and Notable. The index differs from other meteorological indices in that it uses population information in addition to meteorological measurements. Thus NESIS gives an indication of a storm's societal impacts. This scale was developed because of the impact Northeast snowstorms can have on the rest of the country in terms of transportation and economic impact.

NESIS scores are a function of the area affected by the snowstorm, the amount of snow, and the number of people living in the path of the storm. The aerial distribution of snowfall and population information are combined in an equation that calculates a NESIS score which varies from around one for smaller storms to over 10 for extreme storms. The raw score is then converted into one of the five NESIS categories, with the largest NESIS values result from storms producing heavy snowfall over large areas that include major metropolitan centers (**Table 4.11**).

TABLE 4.11: NORTHEAST SNOWFALL IMPACT SCALE (NESIS)		
CATEGORY	NESIS VALUE	DESCRIPTION
1	1 - 2.499	Notable
2	2.5 – 3.99	Significant
3	4 – 5.99	Major
4	6 – 9.99	Crippling
5	10.0+	Extreme

Nor'easters are extra-tropical events that produce strong winds and precipitation in the form of heavy rain, ice or snow. They can cause increases in tidal elevations (storm surge), wind speed, and erosion. These cyclonic storms, called nor'easters because of the direction of the storm winds, can last for several days and can impact very large areas.

The presence of the Gulf Stream off the eastern seaboard in the winter season acts to dramatically enhance the surface horizontal temperature gradients within the coastal zone. This is particularly true off the Virginia coastline where, on average, the Gulf Stream is closest to land north of 32 degrees latitude. During winter offshore cold periods, these horizontal temperature gradients can result in rapid and intense destabilization of the atmosphere directly above and shoreward of the Gulf Stream. This air mass modification or conditioning period often precedes wintertime coastal extra-tropical cyclone development. The temperature structure of the continental air mass and the position of the temperature gradient along the Gulf Stream drive this cyclone development. As a low pressure deepens, winds and waves can increase and cause serious damage to coastal areas as the storm generally moves to the northeast.

The coastal communities of Virginia are most vulnerable to the impacts of nor'easters. Since the storms often occur at night, and typically make landfall with less warning than hurricanes (due to their rapid formation along the coast), residents may be caught at home unprepared. On the other hand, nor'easters typically occur during the tourist off-season when fewer non-residents are visiting the coast. As with hurricanes, structural vulnerability to nor'easters is proportional to the strength of the structure, with mobile homes being particularly vulnerable.

The Dolan-Davis Scale, **Table 4.12**, was developed by scientists at the University of Virginia to identify and classify the damages that may occur during nor'easters. Although rarely referenced by the NWS or other media in describing nor'easters, the scale provides a descriptive tool for the types and levels of damage associated with a nor'easter. Heavy precipitation in the form of rain or snow, beach and dune erosion from wave action, sand/water overwash associated with storm surge, and resultant coastal property damage are all commonly associated with strong nor'easters.

TABLE 4.12: DOLAN-DAVIS NOR'EASTER INTENSITY SCALE				
STORM CLASS	BEACH EROSION	DUNE EROSION	OVERWASH	PROPERTY DAMAGE
1 (Weak)	Minor changes	None	No	No
2 (Moderate)	Modest; mostly to lower beach	Minor	No	Modest
3 (Significant)	Erosion extends across beach	Can be significant	No	Loss of many structures at local level
4 (Severe)	Severe beach erosion and recession	Severe dune erosion or destruction	On low beaches	Loss of structures at community- scale
5 (Extreme)	Extreme beach erosion	Dunes destroyed over extensive areas	Massive in sheets and channels	Extensive at regional-scale; millions of dollars

LOCATION AND SPATIAL EXTENT

Winter storms impact the study area uniformly. All building stock, infrastructure and critical facilities are equally vulnerable to these hazards. Vulnerability maps showing infrastructure and critical facilities that are at risk to these hazards are found in **Appendix E**.

SIGNIFICANT HISTORICAL EVENTS

According to the NCDC, the City of Chesapeake has experienced 30 significant winter storm or nor'easter events including snow and ice storms, extreme cold, and freezing rain since 1993 (**Table 4.13**). These events account for $20,120,000 in property damages for the affected areas. The region received presidential disaster declarations from major winter storms in 1996 (the Blizzard of '96) and 2000. Some of the more significant winter storms to impact the region in the twentieth century are discussed below.

On March 1-3, 1927 a nor'easter hit the region with high winds gusting to 62 MPH at Cape Henry and 52 MPH at Norfolk. Heavy snow fell across North Carolina into Virginia and travel was delayed for two to three days. In Virginia Beach, high tide and heavy surf on March 2 inflicted considerable damage. The beaches in some places were washed back 50 feet and denuded of the overlying sand, exposing the clay beneath.

On April 11, 1956, a severe nor'easter gave gale winds (greater than 40 MPH) and unusually high tides to the tidewater Virginia area. At Norfolk, the strongest gust was 70 MPH. The strong northeast winds blew for almost 30 hours and pushed up the tide, which reached 4.6 feet above normal in Hampton Roads. Thousands of homes were flooded by the wind-driven high water and damages were large. Two ships were driven aground. Waterfront fires were fanned by the high winds. The flooded streets made access to firefighters very difficult, which added to the losses.

On January 30-31, 1966, a blizzard struck Virginia and the Northeast U.S. It was the second snowstorm to hit Virginia in a week. The first storm dumped nine inches in Norfolk. With fresh snow on the ground, arctic air settled in and temperatures dropped into the teens. The second storm dumped one to two feet of snow over a large part of the state. Intense winds and drifting snow continued and kept roads closed for several days after the storm. Temperatures dropped into the single digits with some falling below zero. Wind chill temperatures were dangerously low.

The winter of 1976-1977 was the coldest winter on the East Coast of the past century. Storms across the state dropped a few more inches every few days to keep a fresh coating on the streets that were just clearing from the previous storms. The average temperature for the month of January in Norfolk was 29.2°F which was 12° below normal. The prolonged cold wave caused oil and natural gas shortages and President Carter asked people to turn thermostats down to conserve energy. The major elements of this winter were the cold temperatures. There was little snowfall associated with this winter in the region.

The "Presidents Day Storm" of February 1979 dropped seven inches on snow on Norfolk on February 18-19 and 13 inches of snow were recorded for the entire month. The following winter, 20 inches fell in Virginia Beach and a foot of snow fell in Norfolk in a storm that hit the region in February. On March 1, another foot of snow fell in Norfolk and the total snowfall amount of 41.9 inches for Norfolk was the snowiest winter ever recorded in eastern Virginia.

The "Superstorm of March '93," was also known as "The Storm of the Century" for the eastern United States, due to its large area of impact, all the way from Florida and Alabama through New England. Impacts in the Southside Hampton Roads region were not as severe, but this storm still caused major disruption across a large portion of the country.

The "1996 Blizzard" from January 6 to January 13, 1996 affected much of the eastern seaboard. In Virginia, the winter storm left up to 36 inches of snow in portions of the state. In the Southside Hampton Roads region, most of the communities saw at least a foot of snow between January 6 and January 12.

A major ice storm at the end of December 1998 resulted in approximately 400,000 customers being without power during the maximum outage period. Some customers were without power for about ten days during the holidays. Many accidents occurred due to slippery road conditions, especially bridges and overpasses and holiday travel. Many secondary roads were impassable due to fallen tree limbs or whole trees.

The winter of 2010 was a memorable one for residents of Hampton Roads. The NWS compiled preliminary winter climate data for 2010-2011 at Norfolk, which indicate an average temperature of 38.9 degrees, or 3.2 degrees lower than the normal of 42.1 degrees. Total snowfall was 21.8 inches, which is remarkable when compared to the normal of 7.1 inches for an average winter. December 2010 was the 2nd-snowiest on record, at 17.8 inches, because most snow fell before January 1. There was 13.4 inches of snow for December 26, which is the fourth-biggest daily snowfall on record. (Source: *The Daily Press,* 3/11/2011, and NWS) The December 26 winter storm created havoc on the roadways. Between midnight and 10 pm December 26, State Police recorded 421 traffic crashes, 296 disabled vehicles and 1,159 total calls for service in Hampton Roads, Eastern Shore, Williamsburg, Franklin and Emporia. The NESIS ranking for the December, 2010 winter storm was a Category 3.

Many other descriptions of historical occurrences of winter storms and nor'easters can be found online at http://www.vaemergency.com/newsroom/history/winter.cfm

TABLE 4.13: WINTER STORM AND NOR'EASTER ACTIVITY (1993 - 2013)			
DATE OF OCCURRENCE	TYPE OF EVENT	PROPERTY DAMAGE	DETAILS
12/28/1993	Winter Weather	$0	No description available.
1/6/1996	Winter Storm	$50,000	No description available. NESIS Category 5
2/2/1996	Winter Storm	$0	A winter storm tracked northeast from the gulf coast states to off the Virginia coast. It spread a mixture of snow, sleet and some freezing rain from the lower Chesapeake Bay southwest into south central Virginia.
2/16/1996	Winter Storm	$0	A storm tracked northeast from western South Carolina Thursday night to off the North Carolina coast Friday morning. Then it moved off north and spread heavy snow across Virginia.
3/7/1996	Winter Storm	$0	A low pressure area developed over the Carolinas and then tracked off Virginia coast. It spread light snow across central and eastern Virginia.
12/23/1998	Ice Storm	$20,000,000	A major ice storm affected central and eastern Virginia from Wednesday into Friday. A prolonged period of freezing rain and some sleet resulted in ice accumulations of one half inch to one inch in many locations. The heavy ice accumulations on trees and power lines caused widespread power outages across the region. Approximately 400,000 customers were without power during the maximum outage period. Some customers were without power for about ten days. Many accidents occurred due to slippery road conditions, especially bridges and overpasses. Many secondary roads were impassable due to fallen tree limbs or whole trees.
1/19/2000	Winter Storm	$0	Two to three inches of snow fell overnight as an area of low pressure passed south of the region. The highest amounts were measured along a line from Caroline county in the north, through the City of Richmond, then along the southern shore of the James River.
1/25/2000	Winter Storm	$20,000	A significant winter storm dropped 8 to 12 inches of snow across portions of eastern Virginia. There was blowing and drifting of snow from winds which gusted over 40 MPH at times. The snow mixed with sleet and freezing rain occasionally during the late morning hours. In Isle of Wight County, strong winds pushed the Pagan River onto South Church Street. Isle of Wight County snowfall totaled 7 to 8 inches. NESIS Category 2
12/3/2000	Winter Storm	$50,000	A winter storm struck parts of extreme southern and southeastern Virginia. The storm affected a relatively small area, but the areas that had snow received some hefty totals. Windsor reported 4 inches of snowfall. Local law enforcement agencies reported scores of accidents, several of which involved injuries. Schools were closed the following day.
2/22/2001	Winter Storm	$0	A winter storm produced 1 to 4 inches of snow across south central and eastern Virginia. Local law enforcement agencies reported numerous accidents, some of which involved injuries. Many schools were dismissed early on the day of the storm, and several schools in the area were either closed or had a delayed opening the following day due to slippery road conditions.

TABLE 4.13 (CONT): WINTER STORM AND NOR'EASTER ACTIVITY (1993 - 2013)			
DATE OF OCCURRENCE	TYPE OF EVENT	PROPERTY DAMAGE	DETAILS
1/2/2002	Winter Storm	$0	A winter storm produced 8 to as much as 12 inches of snow across south central and southeast Virginia. Local law enforcement agencies reported numerous accidents. Most schools in the area were closed Thursday and Friday due to very slippery road conditions.
12/4/2002	Winter Storm	$0	A winter storm produced 1 to 4 inches of snow along with 1/4 to 1/2 inch of ice from south central Virginia northeast through the middle peninsula and Virginia northern neck. Numerous trees and power lines were reported down due to ice accumulations, resulting in scattered power outages. Local law enforcement agencies also reported numerous accidents. Most schools in the area were closed Thursday and Friday due to power outages and very slippery road conditions.
1/6/2003	Winter Weather/ mix	$0	A weak winter storm produced only a dusting to 1 inch of snow across portions of central and eastern Virginia. Accumulations from this storm were mostly on cars and grassy areas, with roadways remaining generally wet although some slush was reported.
1/16/2003	Winter Storm	0	A winter storm produced 4 to 8 inches of snow across portions of central and eastern Virginia. Local law enforcement agencies reported numerous accidents. Most schools in the area were closed Friday due to very slippery road conditions.
1/23/2003	Winter Weather/ mix	$0	A winter storm produced around one inch of snow across portions of south central and southeast Virginia. Local law enforcement agencies reported several accidents.
2/15/2003	Winter Storm	$0	A winter storm produced 1 to 3 inches of snow, along with sleet and 1/4 to 1/2 inch of ice accumulation, across central and eastern Virginia. Local law enforcement agencies reported numerous accidents. Most schools in the area were closed Monday due to very slippery road conditions. NESIS Category 4
1/9/2004	Winter Storm	$0	Two to as much as five inches of snow fell across portions of central, south central, and southeast Virginia. The snow produced very slippery roadways, which resulted in several accidents.
1/25/2004	Winter Storm	$0	Two to as much as four inches of snow and sleet fell across portions of eastern and southeast Virginia. The snow and sleet produced very slippery roadways, which resulted in numerous accidents and school closings for a few days.
2/15/2004	Winter Storm	$0	One to three inches of snow fell across portions of south central and southeast Virginia. The snow produced very slippery roadways, which resulted in several accidents and school closings for a few days.
12/19/2004	Winter Weather/ mix	$0	One half inch to as much as three inches of snow fell across central and eastern Virginia. The snow produced slippery roadways, which resulted in several accidents.
12/26/2004	Winter Storm	$0	A winter storm produced a narrow band of six to as much as fourteen inches of snow across the Virginia Eastern Shore, Hampton Roads, and interior southeast Virginia. The snow caused very hazardous driving conditions, which resulted in numerous accidents. Smithfield in Isle of Wight county reported 12 inches and Isle of Wight reported 11 inches.
1/19/2005	Winter Weather/ mix	$0	One half inch to as much as two inches of snow fell across central and eastern Virginia. The snow produced slippery roadways, which resulted in several accidents.

TABLE 4.13 (CONT): WINTER STORM AND NOR'EASTER ACTIVITY (1993 - 2013)			
DATE OF OCCURRENCE	TYPE OF EVENT	PROPERTY DAMAGE	DETAILS
1/20/2005	Winter Weather/ mix	$0	One half inch to as much as three inches of snow fell across much of central and eastern Virginia. The snow produced slippery roadways, which resulted in several accidents. NESIS Category 4
2/3/2005	Winter Weather/ mix	$0	One half inch to two inches of snow fell across much of central and eastern Virginia. A few isolated areas reported close to four inches. The snow produced slippery roadways, which resulted in several accidents. Smithfield in Isle of Wight county reported 2.3 inches of snow.
3/1/2009	Winter Weather	$0	Snowfall amounts were generally between one and three inches across the county. Painter reported 2.5 inches of snow. Coastal low pressure produced between one half inch and three inches of snow across portions of south central and southeast Virginia from late Sunday afternoon, March 1st, into Monday morning March 2nd. NESIS Category 1
1/30/10	Winter Storm	$0	Low pressure moving off the coastal Carolinas produced between five and fifteen inches of snow across central and eastern Virginia from Friday night, January 29th, into Saturday night January 30th. Snowfall amounts were generally between five and eight inches across the City. Chesapeake reported 7.5 inches of snow.
2/5/2010	Winter Weather	$0	Snowfall amounts were generally between one and two inches across the county. Chesapeake (Western Branch) reported 1.3 inches of snow. Low pressure moving off the coastal Carolinas produced between one and five inches of snow across portions of south central and southeast Virginia from Friday afternoon, February 5th, through Saturday afternoon February 6th. NESIS Category 3
2/13/2010	Winter Weather	$0	Snowfall amounts were generally around one inch across the county. Low pressure moving off the coastal Carolinas produced between one and two inches of snow across portions of south central and southeast Virginia from Friday night, February 12th, through midday Saturday February 13th.
3/2/2010	Winter Weather	$0	Snowfall amounts were generally between one and two inches across the county. Chesapeake reported 1.0 inch of snow. Low pressure moving off the coastal Carolinas produced between one and three inches of snow across portions of south central and southeast Virginia from Tuesday night, March 2nd, through Wednesday morning March 3rd.
12/25/10	Winter Storm	$0	Low pressure moving north just off the Mid Atlantic Coast produced between five and sixteen inches of snow across central and eastern Virginia from Saturday afternoon, December 25th, into Sunday evening December 26th. Snowfall amounts were generally between nine and fourteen inches across the county. Chesapeake reported 13.0 inches of snow. Great Bridge reported 12.3 inches of snow.
30 Events		**$20,120,000**	

Source: NCDC

PROBABILITY OF FUTURE OCCURRENCES

Winter storms remain a likely occurrence for the region. While storms will be more likely to produce small amounts of snow, sleet or freezing rain, larger storms, though less frequent in occurrence, could also impact the region.

Historical evidence indicates that Chesapeake has been impacted by varying degrees of snow storms and ice storms over the last century. In terms of receiving measurable snowfall, the NCDC estimates that there is between 83.3 and 89.8 percent probability that the Southside Hampton Roads region will receive measurable snowfall in any given year, **Table 4.14**. Data are not available for Chesapeake specifically, but the regional information is pertinent to this analysis.

TABLE 4.14: PROBABILITY OF RECEIVING A MEASURABLE SNOWFALL

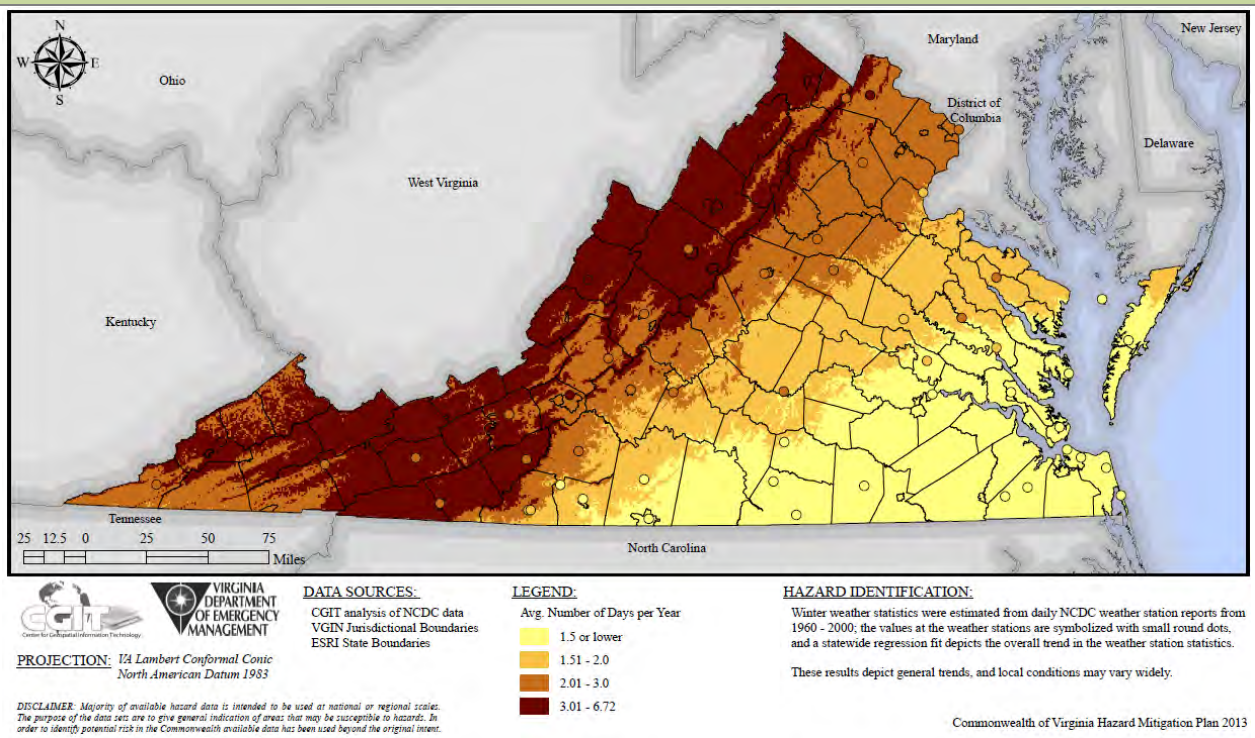
JURISDICTION	ANNUAL PROBABILITY	WINTER PROBABILITY	SPRING PROBABILITY	FALL PROBABILITY
Chesapeake	No data	No data	No data	No data
Isle of Wight	83.3%	94.1%	25.0%	4.0%
Norfolk	89.8%	88.7%	36.4%	5.5%
Portsmouth	No data	No data	No data	No data
Suffolk	No data	90.0%	63.6%	29.1%
Virginia Beach	84.0%	85.7%	23.5%	2.7%

Source: NOAA, NCDC, Snow Climatology Page, 2011

Figure 4.15 indicates the average number of days the region will experience three or more days with at least three inches of snow. Data produced for the *Commonwealth of Virginia Hazard Mitigation Plan 2013* indicate the following frequency characteristics about winter storm characteristics for Chesapeake:

- 1.5 or fewer days per year with at least three inches of snow;
- 0.5 or fewer days per year with at least six inches of snow; and,
- three or fewer days per year entirely at or below 32°F.

FIGURE 4.15: AVERAGE NUMBER OF DAYS WITH AT LEAST THREE INCHES OF SNOW



Source: Commonwealth of Virginia Hazard Mitigation Plan 2013

WIND EVENTS: SEVERE THUNDERSTORMS

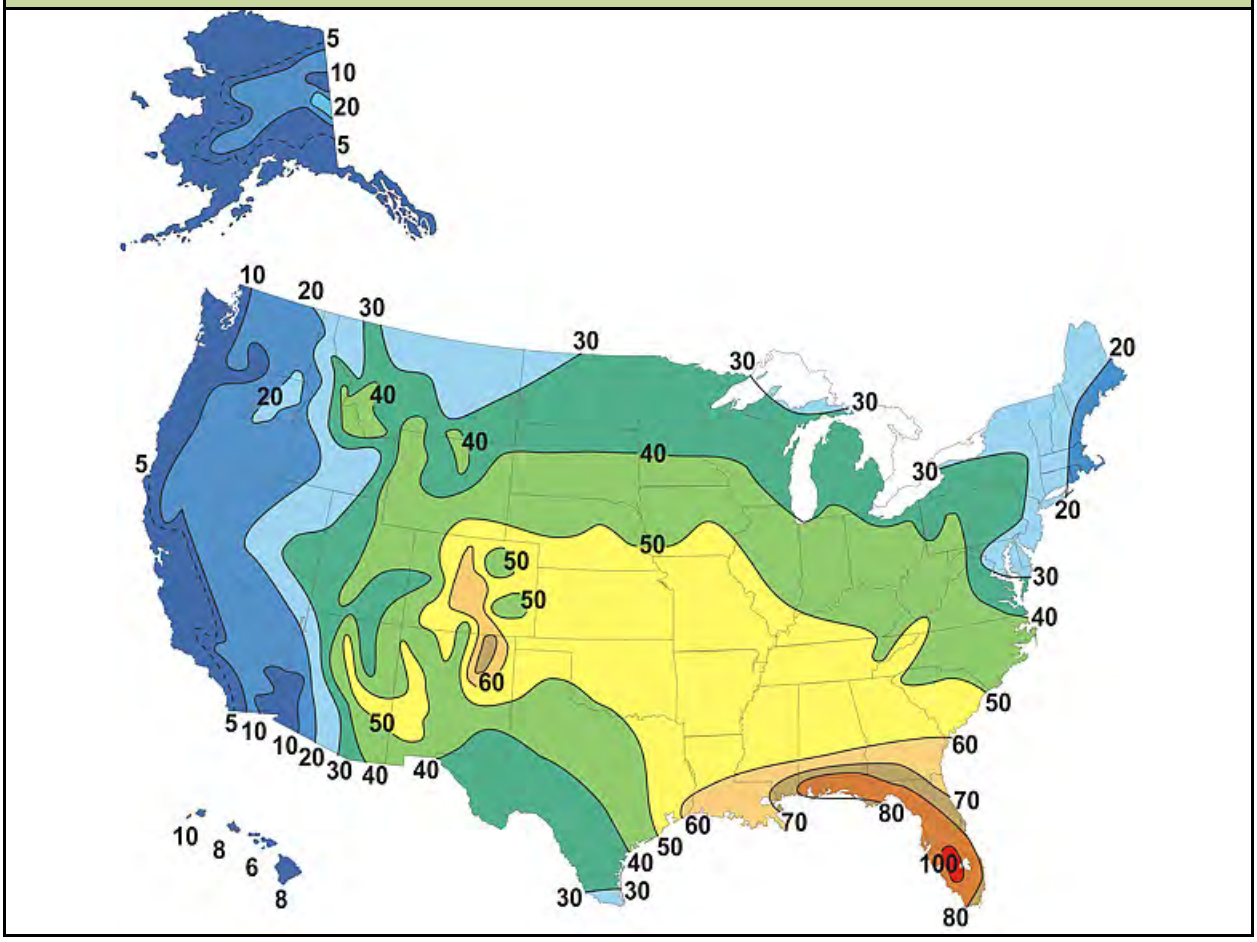
BACKGROUND

According to the NWS, more than 100,000 thunderstorms occur each year, though only 10% of these are classified as "severe." Although thunderstorms generally affect a small area when they occur, they are extremely dangerous because of their ability to generate tornadoes, large hail, strong winds, flash flooding, and damaging lightning. While thunderstorms can occur in all regions of the United States, they are most common in the central and southern states because atmospheric conditions in those regions are most ideal for generating these powerful storms.

Thunderstorms are caused when air masses of varying temperatures meet. Rapidly rising warm moist air serves as the "engine" for thunderstorms. These storms can occur singularly, in lines, or in clusters. They can move through an area very quickly or linger for several hours.

The National Weather Service has generated a map showing the annual number of thunderstorm days each year, nationwide. **Figure 4.16** illustrates thunderstorm hazard severity based on the annual number of thunderstorm days and indicates approximately 40 such days for Chesapeake.

FIGURE 4.16: ANNUAL NUMBER OF THUNDERSTORM DAYS EACH YEAR

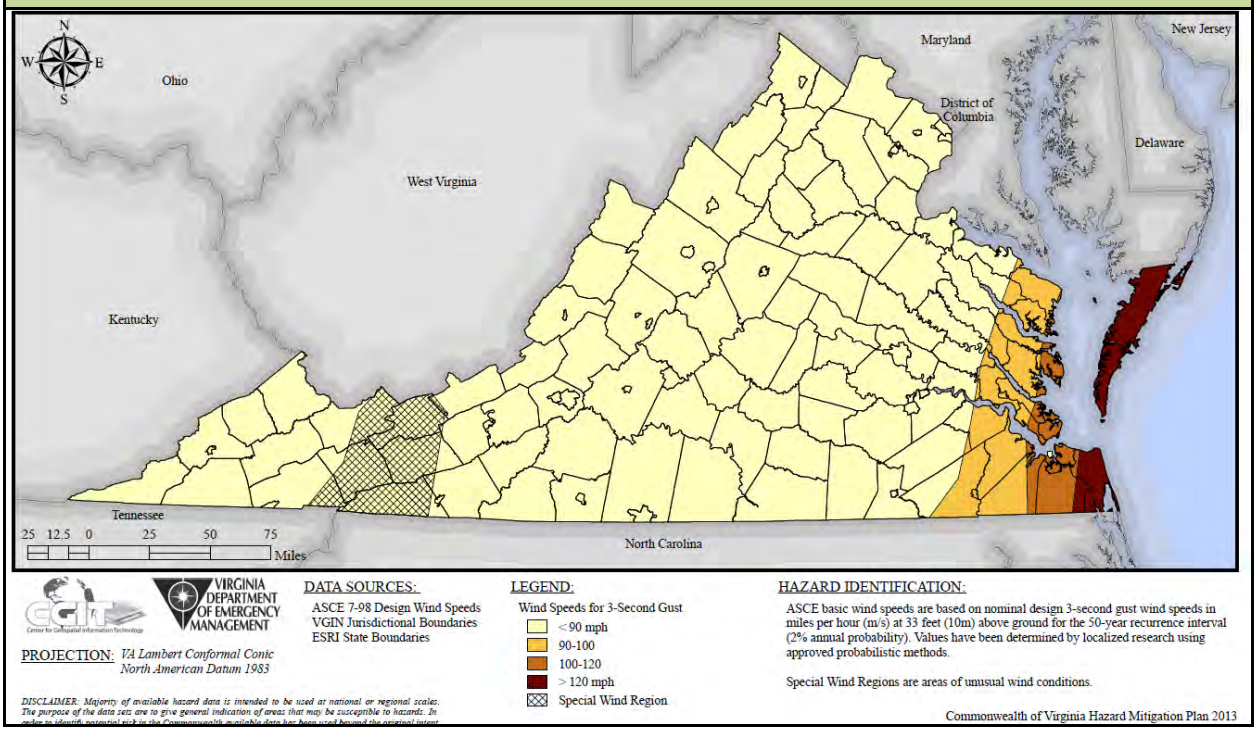


Source: National Weather Service

Straight-line winds, which in extreme cases have the potential to cause wind gusts that exceed 100 MPH, are responsible for most thunderstorm wind damage. One type of straight-line wind, the downburst, can cause damage equivalent to a strong tornado and can be extremely dangerous to aviation. Chesapeake is also vulnerable to *derechos*, widespread, long-lived, straight-line wind storms that are associated with a land-based, fast-moving band of severe thunderstorms. Associated squall lines will form in an area of wind divergence in upper levels of the troposphere, within a region of low-level warm air advection and rich low-level moisture. They travel quickly in the direction of movement of their associated storms, similar to a gust front, except that the wind is sustained and increases in strength behind the front, generally exceeding hurricane-force. Usually a warm-weather phenomenon, derechos occur mostly in summer, especially during June and July in the Northern Hemisphere, within areas of moderately strong instability and moderately strong vertical wind shear. They may, however, occur at any time of the year and occur as frequently at night as during the daylight hours.

Figure 4.17 shows the basic design wind speed for the 50-year recurrence interval used for design and construction in Virginia, as defined by the American Society of Civil Engineers (ASCE). Much of Chesapeake is in an area with estimated wind speed between 100 and 120 MPH for a 3-second gust, with a 50-year recurrence interval.

FIGURE 4.17: ASCE DESIGN WIND SPEEDS



Source: Commonwealth of Virginia Hazard Mitigation Plan, 2013

LOCATION AND SPATIAL EXTENT

Thunderstorms are common throughout the Commonwealth of Virginia, and have been known to occur during all months of the year. In addition to the high winds associated with these events, thunderstorms can also bring dangerous lightning that causes fires, property damage, and may cause death or serious injury. Thunderstorms can also produce hail, which can cause varying degrees of property and crop damage. According to the NCDC, the City has experienced a recorded 57 *severe* thunderstorm events since 1996 resulting in 0 deaths or injuries and approximately $112,000 in property damage.

Severe thunderstorms impact the study area uniformly. All building stock, infrastructure and critical facilities are equally vulnerable to these hazards. Vulnerability maps showing infrastructure and critical facilities that are at risk to these hazards are found in **Appendix E**.

SIGNIFICANT HISTORICAL EVENTS

Table 4.15 provides details of historical severe thunderstorm activity in the City as recorded by the NCDC. The most significant report of damage was from a storm on June 3, 1998, when several structures were damaged, resulting in reported damages of $10,000. On June 29, 2012, a derecho produced a widespread path of damaging winds across much of central and eastern Virginia. Reported damage in Chesapeake was limited to downed trees. On May 24, 2011, and again on June 30, 2012, significant thunderstorm winds caused damage to structures, resulting in higher than usual property damages.

TABLE 4.15: SIGNIFICANT THUNDERSTORM EVENTS (1996 - 2013)

LOCATION	DATE OF OCCURRENCE	ESTIMATED WIND GUST (KNOTS)	DEATHS/ INJURIES	PROPERTY DAMAGE	DETAILS
City Wide	1/19/1996	49	0/0	$0	Several trees and large limbs down by high winds in scattered locations throughout the City.
Chesapeake	5/3/1997		0/0	$1,000	Tree down 3 miles west of Battlefield Boulevard.
Northwest	6/3/1998		0/0	$10,000	Several trees were either snapped off at the top or blown over. Also, the wall of a barn was blown down and the roof collapsed. Some roof damage was observed to other farm structures as well as a tree blown across the roof of a residence.
Deep Creek	6/16/1998		0/0	$2,000	Few trees and power lines down.
Chesapeake	4/9/1999		0/0	$2,000	Telephone pole down and wires down.
Greenbrier	5/24/1999		0/0	$1,000	Power lines down near Plantation Lakes and Kempsville Road.
Deep Creek	7/24/1999		0/0	$1,000	Large tree down and blocking road.
Greenbrier	8/11/1999		0/0	$1,000	Tree fell on a car in the Greenbrier section of Chesapeake.
Chesapeake	5/2/2002		0/0	$2,000	Trees down.
Deep Creek	5/2/2002		0/0	$2,000	Trees down on Route 17.
Chesapeake	5/13/2002	52	0/0	$0	Wind gust of 60 mph.
Chesapeake	11/11/2002		0/0	$2,000	Trees down in south end of City. Large tree (100 feet) down at the intersection of Benefit and Lake Drummond Causeway.
Deep Creek	2/22/2003	50	0/0	$2,000	Large branches down at Interstate 64 and Dominion Boulevard.
Deep Creek	8/17/2003	50	0/0	$1,000	Large limbs and branches down on intersection of Old Mill and Martin Johnson Roads.
Chesapeake	3/7/2004	50	0/0	$2,000	Trees down.
Chesapeake	5/26/2004	50	0/0	$2,000	Trees down.
Chesapeake	6/25/2004	50	0/0	$2,000	Trees down on Lake Drummond Causeway.
Chesapeake	6/25/2004	50	0/0	$2,000	Trees down.
Great Bridge	7/2/2004	50	0/0	$2,000	Trees down.
Deep Creek	7/7/2004	50	0/0	$2,000	Power lines down.
Cornland	4/23/2005	50	0/0	$2,000	Trees down.
Chesapeake	5/23/2005	50	0/0	$2,000	Two 12 inch diameter trees down.

TABLE 4.15 (CONT): SIGNIFICANT THUNDERSTORM EVENTS (1996 - 2013)					
LOCATION	DATE OF OCCURRENCE	ESTIMATED WIND GUST (KNOTS)	DEATHS/ INJURIES	PROPERTY DAMAGE	DETAILS
Deep Creek	7/27/2005	50	0/0	$2,000	Tree down across small house of Cedar Road by Union Mission Summer Camp.
Cornland	7/27/2005	50	0/0	$2,000	Trees down along Virginia/North Carolina border on Dismal Swamp side on US Route 17.
Great Bridge	6/23/2006	50	0/0	$5,000	Trees down on car at Crosswinds Drive.
Cornland	8/4/2006	50	0/0	$2,000	Trees blown down on West Road in front of Chesapeake Regional Airport.
Bowers Hill	7/27/2007	50	0/0	$1,000	The combination of a hot and humid air mass and a lee side trough helped to produce scattered severe thunderstorms across southeast Virginia. Trees were downed at the intersection of I-664 and U.S. 58.
Hickory	8/10/2007	50	0/0	$1,000	Scattered severe thunderstorms produced wind damage across portions of central and southeast Virginia. Tree was reported knocked down on Indian Creek Rd.
Deep Creek	8/21/2007	50	0/0	$1,000	Scattered severe thunderstorms produced wind damage across portions of central and southeast Virginia. Trees were downed on Route 17.
Chesapeake	3/5/2008	50	0/0	$1,000	Scattered severe thunderstorms produced damaging winds and some large hail across portions of central and eastern Virginia. Several trees were snapped off.
Cornland	5/20/2008	50	0/0	$2,000	Scattered severe thunderstorms, associated with low pressure and a cold front, produced damaging winds and large hail across portions of south central and southeast Virginia. Numerous large trees were downed near Greenbrier and Volvo Parkway.
Bowers Hill	6/27/2008	50	0/0	$2,000	Scattered severe thunderstorms produced damaging winds and large hail across portions of central and eastern Virginia. Numerous trees were downed blocking Highway 58/460 near Hampton Roads Executive Airport.
Deep Creek	7/8/2008	50	0/0	$2,000	Scattered severe thunderstorms produced damaging winds and large hail across portions of central and eastern Virginia. Several trees were downed in the Deep Creek area.
Hickory	7/8/2008	50	0/0	$2,000	Scattered severe thunderstorms produced damaging winds and large hail across portions of central and eastern Virginia. Trees were downed on Highway 168 near the Toll Plaza.
Boone	1/7/2009	50	0/0	$1,000	Scattered severe thunderstorms in advance of a cold front produced damaging winds across portions of southeast Virginia. Tree was uprooted. Large ten inch branches were downed on a road near the Chesapeake Square Mall.

TABLE 4.15 (CONT): SIGNIFICANT THUNDERSTORM EVENTS (1996 - 2013)					
LOCATION	DATE OF OCCURRENCE	ESTIMATED WIND GUST (KNOTS)	DEATHS/ INJURIES	PROPERTY DAMAGE	DETAILS
Great Bridge	1/28/2009	50	0/0	$1,000	Scattered severe thunderstorms in advance of a cold front produced damaging winds across portions of southeast Virginia. Large pine tree was knocked down after snapping a power line.
Deep Creek	5/4/2009	52	0/0	$1,000	Scattered severe thunderstorms along a frontal boundary produced large hail, damaging winds and one tornado across portions of southeast Virginia. Trees were downed.
Cornland	5/7/2009	50	0/0	$2,000	Scattered severe thunderstorms in advance of a cold front produced damaging winds across portions of southeast Virginia. Several trees were downed.
Great Bridge	5/7/2009	50	0/0	$2,000	Scattered severe thunderstorms in advance of a cold front produced damaging winds across portions of southeast Virginia. Several trees were downed.
Hickory	5/7/2009	50	0/0	$2,000	Scattered severe thunderstorms in advance of a cold front produced damaging winds across portions of southeast Virginia. Two large trees were downed.
Fentress	5/7/2009	50	0/0	$2,000	Scattered severe thunderstorms in advance of a cold front produced damaging winds across portions of southeast Virginia. Several trees were downed.
Bowers Hill	6/9/2009	50	0/0	$1,000	Scattered severe thunderstorms in advance of a frontal boundary produced damaging winds and large hail across portions of central and southeast Virginia. Large tree limbs were downed near Churchland.
Boone	6/9/2009	50	0/0	$2,000	Scattered severe thunderstorms in advance of a frontal boundary produced damaging winds and large hail across portions of central and southeast Virginia. Numerous large trees were downed in the vicinity of Chesapeake Square Mall.
Boone	6/9/2009	50	0/0	$1,000	Scattered severe thunderstorms in advance of a frontal boundary produced damaging winds and large hail across portions of central and southeast Virginia. Six inch tree branches were downed.
Butts	7/29/2009	50	0/0	$2,000	Scattered severe thunderstorms produced damaging winds and large hail across portions of southeast Virginia. One tree was uprooted and landed on a house. Several large branches were snapped.
Great Bridge	8/5/2009	50	0/0	$2,000	Scattered severe thunderstorms in advance of a cold front produced damaging winds and a lightning strike across portions of southeast Virginia. Numerous trees were downed in the Great Bridge area.

TABLE 4.15 (CONT): SIGNIFICANT THUNDERSTORM EVENTS (1996 - 2013)					
LOCATION	DATE OF OCCURRENCE	ESTIMATED WIND GUST (KNOTS)	DEATHS/ INJURIES	PROPERTY DAMAGE	DETAILS
Deep Creek	7/29/2010	50	0/0	$1,000	Scattered severe thunderstorms in advance of a cold front produced damaging winds and large hail across portions of central and eastern Virginia. Large tree was downed on Old Mill Road.
Fentress	8/5/2010	50	0/0	$2,000	Scattered severe thunderstorms well in advance of a cold front produced damaging winds and large hail across portions of central and eastern Virginia. Trees were downed onto power lines on Fairfield Drive.
Bowers Hill	9/30/2010	50	0/0	$1,000	Scattered thunderstorms in advance of low pressure and an associated cold front produced damaging winds across portions of southeast Virginia. Tree was downed on Route 58.
Cornland	4/5/2011	50	0/0	$2,000	Scattered severe thunderstorms in advance of a cold front produced damaging winds across portions of central and eastern Virginia. Trees were downed on Fentress Airfield Road and Waters Road.
Crestwood	5/24/2011	60 (measured)	0/0	$2,000	Scattered severe thunderstorms well in advance of a cold front produced damaging winds and large hail across portions of south central and southeast Virginia.
Oak Grove	5/24/2011	50	0/0	$5,000	Scattered severe thunderstorms well in advance of a cold front produced damaging winds and large hail across portions of south central and southeast Virginia. Homes in a subdivision sustained shingle and roof damage.
Crestwood	5/24/2011	64 (measured)	0/0	$2,000	Scattered severe thunderstorms well in advance of a cold front produced damaging winds and large hail across portions of south central and southeast Virginia. Wind gust of 64 knots (74 mph) was measured at the Virginia Department of Transportation site VA007 at High Rise Bridge.
Crestwood	6/29/2012	50	0/0	$2,000	A derecho produced a widespread path of damaging winds across much of central and eastern Virginia. Multiple trees were downed.
Great Bridge	6/30/2012	50	0/0	$5,000	Scattered severe thunderstorms well in advance of a cold front produced damaging winds, large hail and one tornado across portions of central and eastern Virginia. Large tree was downed onto a home in Hickory Subdivision in Great Bridge.
Chesapeake	8/2/2012	50	0/0	$2,000	Scattered severe thunderstorms along a trough of low pressure produced damaging winds and large hail across portions of central and southeast Virginia. Several trees were downed and some were blocking roads.
Chesapeake	1/31/2013	50	0/0	$3,000	Scattered severe thunderstorms in advance of a cold front produced damaging winds across portions of central and eastern Virginia. Trees were downed across the City blocking numerous roads.
TOTAL			**0/0**	**$112,000**	

Source: NCDC

PROBABILITY OF FUTURE OCCURRENCES

Severe thunderstorms will remain a highly likely occurrence for region.

DROUGHT

BACKGROUND

Drought is a natural climatic condition caused by an extended period of limited rainfall beyond that which occurs naturally in a broad geographic area. High temperatures, high winds and low humidity can worsen drought conditions, and make areas more susceptible to wildfire. Human demands and actions can also hasten drought-related impacts.

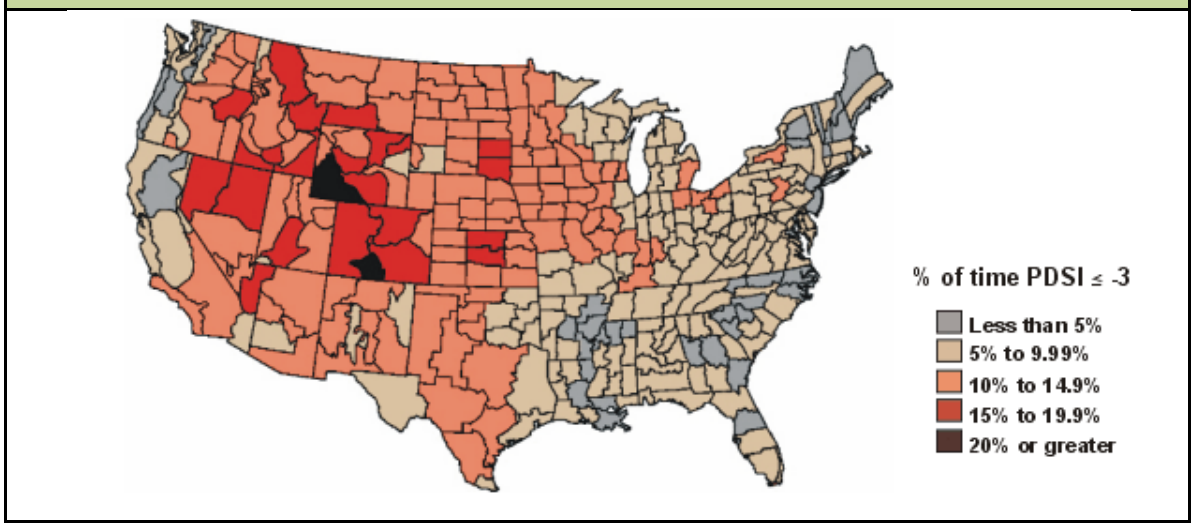
A USGS streamflow gaging station at the Ogeechee River near Eden, Georgia in July 2000 illustrates the drought conditions that can severely affect water supplies, agriculture, stream water quality, recreation, navigation and forest resources. (Photo courtesy of the United States Geological Survey)

Economic losses to a community from drought include agricultural production, livestock production, fisheries, water transportation, recreation, tourism, and water consumption. Additionally, Chesapeake's waterways are used as a means of transportation by commercial vessels. Under severe drought conditions, the water levels can fall to levels that may not permit commercial vessels to pass, affecting the region's commerce.

Environmental drought impacts include both human and animal habitats, and hydrologic units. During periods of drought, the amount of available water decreases in lakes, streams, aquifers, soil, wetlands, springs, and other surface and subsurface water sources. This decrease in water availability can affect water quality such as salinity, bacteria, turbidity, as well as temperature increase and pH changes. Low water flow can result in decreased sewage flows and subsequent increases in contaminants in the water supply.

Droughts are frequently classified as one of the following four types: meteorological, agricultural, hydrological or socio-economic. Meteorological droughts are typically defined by the level of "dryness" when compared to an average or normal amount of precipitation over a given period of time. Agricultural droughts relate common characteristics of drought to their specific agricultural-related impacts. Emphasis tends to be placed on factors such as soil water deficits, water needs based on differing stages of crop development, and water reservoir levels. Hydrological drought is directly related to the effect of precipitation shortfalls on surface and groundwater supplies. Human factors, particularly changes in land use, can alter the hydrologic characteristics of a basin. Socio-economic drought is the result of water shortages that limit the ability to supply water-dependent products in the marketplace. **Figure 4.18** shows the Palmer Drought Severity Index (PDSI) summary map for the United States from 1895 to 1995. PDSI drought classifications are based on observed drought conditions and range from -0.5 (incipient dry spell) to -4.0 (extreme drought). As can be seen in the figure, the Eastern United States has not historically seen as many significant long-term droughts as the Central and Western regions of the country.

FIGURE 4.18: PALMER DROUGHT SEVERITY INDEX, 1895-1995 PERCENT OF TIME IN SEVERE AND EXTREME DROUGHT



Source: National Drought Mitigation Center

LOCATION AND SPATIAL EXTENT

Drought typically impacts a large area that cannot be confined to geographic boundaries; however, some regions of the United States are more susceptible to drought conditions than others. According to **Figure 4.18**, Virginia is in a zone representing 5% to 9.99% of the time with PDSI less than or equal to -3 (-3 indicating severe drought conditions), meaning that drought conditions are a relatively low to moderate risk for Chesapeake. The region would be uniformly exposed to this hazard and the spatial extent of that impact could potentially be large. However, drought conditions typically do not cause significant damage to the built environment.

SIGNIFICANT HISTORICAL EVENTS

The drought of record for Virginia occurred in 1931 when the statewide average rainfall amount was 7.64 inches compared to an average mean rainfall amount of 17.89. This was during this period that also saw the Great Dust Bowl that helped lead to the Great Depression.

Since 1993, the NCDC has recorded only two instances of drought to impact Chesapeake and the Southside Hampton Roads region (**Table 4.16**). Though instances are recorded on a monthly basis by the NCDC, events are usually part of ongoing drought conditions that last several months or years.

TABLE 4.16: OCCURRENCES OF DROUGHT (1993 - 2013)

DATE OF OCCURRENCE	DETAILS
10/31/1993	Unusually dry weather during the summer and early fall led to many communities in southeastern Virginia to place water conservation measures into effect in October 1993.
9/1/1997	A very dry period from May through September resulted in drought-like conditions across much of central and eastern Virginia. Monthly rainfall departures from normal for Norfolk included: -2.21 inches in May, -2.73 inches in June, -3.05 inches in August, and -1.93 inches in September. This caused significant crop damage throughout much of the area which was estimated to be around $63.8 million.

Source: NCDC

In addition to this official drought record, periods of drought-like conditions are also known to have impacted the region in 1997, 2002, 2003, 2005, 2007, 2008, and 2010. Water restrictions have been put into place as far back as 1997 and shallow wells have lost water in the region. Additional historical accounts were available for the most recent droughts in 2002, 2007, 2008 and 2010.

During the summer of 2002, Virginia experienced significant drought impacts due to precipitation deficits that dated to 1999 in most areas of the Commonwealth. While this drought did not reach the level of severity of the drought of record (1930-1932), increases in water demands when compared to the 1930's resulted in significant impacts to all sectors of Virginia's economy and society. The intensity of these drought impacts peaked in late August 2002. Wildfire indices were at levels previously unrecorded in Virginia, the vast majority of Virginia agricultural counties had applied for Federal drought disaster designation, stream flows reached periods of record lows, and thousands of individual private wells failed. During the third week of August several public water supply systems across the Commonwealth were on the brink of failure. Several large municipal systems, such as Charlottesville and Portsmouth, had less than 60 days of water supply capacity remaining in reservoirs. Several smaller rural systems that rely primarily on withdrawals from free-flowing streams, such as the towns of Farmville and Orange, had at most a few days of water supply available and were forced to severely curtail usage.

According to Commonwealth of Virginia records, a declaration of a State of Emergency Due to Extreme Drought Conditions was executed by the Governor of Virginia on August 30, 2002. The Executive Order was to be effective from August 30, 2002 through June 30, 2003. The 2002 drought resulted in several changes to the way Virginia predicts and responds to drought.

As a result of the mandatory water restrictions imposed on citizens by the Chesapeake City Council in 2002, members of the community could not water their lawns, fill their pools, wash streets or driveways, or operate ornamental fountains. In addition, limitations were placed on the manner in which outdoor shrubs and plants could be watered and cars could be washed. Restaurants were not allowed to serve water to patrons unless specifically requested, and fire hydrants could be used only for public health and safety.

Citizens and businesses were encouraged to make long-term changes to reduce their demand on water. Many suggestions centered on landscaping issues. The community was encouraged to replace fescue with hot-weather grasses like Bermuda or wire grass (Beizer, 2002). They were also asked to consider planting bushes and flowers native to the Chesapeake region that can adapt to hot, dry weather conditions.

Farmers suffered economic losses from yield reductions as well as harvestable acreage constriction. Farmers in nearby Suffolk lost 50% of their soybeans and corn crops and 30% of peanuts and cotton (Stone and McNatt, 2002). Some 135 Chesapeake farmers were also adversely affected in late 2002 and 2003 when a period of wet weather saturated and, in some cases, flooded their fields, killing and washing away crops. Chesapeake City Council requested and received a Presidential Disaster Declaration from the adverse flooding of Fall 2002. The declaration cited 100% loss of 25 acres of peanuts, 30% loss of harvestable forage crops, and 90% loss of intended winter wheat acreage. The wet weather also damaged soybean crops and made harvesting difficult (Beizer, 2002).

A statewide drought in late summer, early fall 2007 came very close to setting a 130-year statewide low precipitation record. Late October rainfall was helpful, but impacts to livestock, peanuts, hay and cotton were experienced and many crop insurance claims were made in southeast Virginia.

The year started out in a normal manner for the Hampton Roads area. However, many states in the southeast were already experiencing drought conditions. By the spring, southwestern Virginia was also experiencing drought conditions. As spring led into summer, drought spread eastward across Virginia. Dry soil conditions were compounded by an unusual late season freeze Easter weekend, affecting many crops in southeastern United States.

In Chesapeake, spring crops were moderately affected by the Easter freeze. There was some replanting of early spring crops, but most of the major agronomic crop acreage had yet to be planted or escaped serious damage. Perennial nursery crops did experience some freeze damage, enough to slow growth and delay maturity, but not to kill plants.

The early effects of the drought began in May 2007 with winter wheat (8,000 acres plus) which was maturing in the fields. A good crop was harvested overall, but a good crop would have been an exceptional crop with more rain that month. Only 1.9 inches fell in May. The City's Agriculture Department Director estimates a farmer's loss as 10 bushels per acre from the yield potential that was there resulting in about $320,000 less income.

Spring and summer saw very sporadic showers in southern Chesapeake communities where most of the agriculture is concentrated (Hickory, Saint Brides, and Fentress). The spring and summer was somewhat unusual in that there were no wide scattered rain events. The showers that did occur were mostly isolated showers that were much localized. The area that received the least amount of rain was in the Fentress community, east of Centerville Turnpike up to the Virginia Beach line along the North Landing River. Overall precipitation measured in the extreme southern portion of Chesapeake was 22.7 inches for the January through September period; normal rainfall is 30 to 35 inches of rain by September. This is the most important period of precipitation for crops as many of our crops are mature or harvested by the end of September.

Because there was a good ground reserve of moisture at the beginning of the growing season, the onset of drought did not severely affect wheat, corn, silage or early vegetables. However, later crops such as soybeans, alfalfa, fall vegetables, hay and forage crops were significantly affected. The Chesapeake Food & Agriculture Council, which consists of federal and state agencies (Natural Resource Conservation Service, Farm Service Agency, Virginia Cooperative Extension), met in August to prepare a brief report for submittal to the Governor's Office on the local status of agriculture. In that brief report, the Council detained an expected loss of 35 to 40% of soybean and hay crops due to drought conditions. Similar reports across Virginia prompted the Governor to request drought disaster declaration from U. S. Department of Agriculture (USDA) for the entire state. That drought declaration from USDA was announced October 15th.

Low stream flow in summer 2008 resulted in severe hydrologic drought. In early 2008, Chesapeake was still suffering from drought. Non-irrigated fall vegetables did not survive or yield well. Hay and forage crops continued to suffer, creating shortages and high feed prices for livestock owners. Chesapeake's nursery and greenhouse industry is the second largest in the state with annual sales of approximately $20 million, and was impacted from drought both in production and sales. Landscape developers in many parts of the state were not purchasing landscape plants because of the lack of water for irrigation. Local irrigation ponds used for nursery production were also experiencing low levels. Many nurseries were starting to ration water from irrigation ponds to keep plants alive. This limited water was holding back plant growth, delaying grade and maturity for harvest. Several shallow wells were experiencing lower output of gallons, an indication of a receding aquifer.

Some nurseries began purchasing City water to compensate for shortage in irrigation ponds and shallow wells. Agronomic crop acreage may shift to later planted crops such as soybeans to give more time for rain to recharge ground supplies. Many farmers make contingency plans for planting and irrigation options should droughts persist. For the majority of acreage however, irrigation is not an option because of limited fresh water supply and prohibitive cost.

Below average rainfall across much of the state resulted in 67 localities requesting the Governor's assistance in obtaining a Federal disaster designation due to drought in summer, 2010. Crop yields were well below average with particular emphasis on corn and soybeans.

HISTORICAL REGIONAL WATER SUPPLY PROBLEMS

Water supply and drought became a political issue between Virginia and North Carolina in the 1970s. Congress had ordered the U.S. Army Corps of Engineers to study water supply issues for the rapidly growing Tidewater region. The Corps had determined, with North Carolina's permission, to use water from Lake Gaston. During the 1978 gubernatorial race, North Carolina reversed its position on Lake Gaston. Chesapeake and other Tidewater cities undertook studying water supply alternatives on their own. In 1980, Chesapeake began the Northwest River project, but in 1985, the Northwest River project encountered supply problems. In 1987, the Lake Gaston project was resolved in the courts in favor of Virginia and was revived; Chesapeake entered into a partnership agreement with Virginia Beach and Sussex County to share the Lake Gaston project. The project remained in the courts for Virginia and North Carolina throughout the property acquisition and construction phases of the project until construction on the project was completed in 1998 (Goddard Space Flight Center, 2001).

In recent years, the City signed a 40-year rainwater contract with Norfolk to provide seven to 10 million gallons of water per day. This water will be treated at the Lake Gaston Water Treatment Plant in the Western Branch area, and should provide the City with enough water to meet water demand until 2040.

PROBABILITY OF FUTURE OCCURRENCES

Based on current and seasonal outlook drought maps available through the National Drought Mitigation Center as of June 2013, Chesapeake is in not currently in an area of abnormally dry conditions. However, based on past events, Chesapeake is likely to experience recurring drought conditions when precipitation falls below normal for extended periods of time.

WILDFIRES

BACKGROUND

A wildfire is any fire occurring in a wildland area (i.e., grassland, forest, brush land) except for fire under prescription.[7] Wildfires are part of the natural management of the Earth's ecosystems, but may also be caused by natural or human factors. Over 80% 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.

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. Wildland fires are usually signaled by dense smoke that fills the area for miles around.

Fire 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 disasters (such as hurricanes or tornadoes) increase the probability of wildfires by producing fuel in both urban and rural settings. Forest damage from hurricanes and tornadoes may block interior access roads and fire breaks, pull down overhead power lines, or damage pavement and underground utilities.

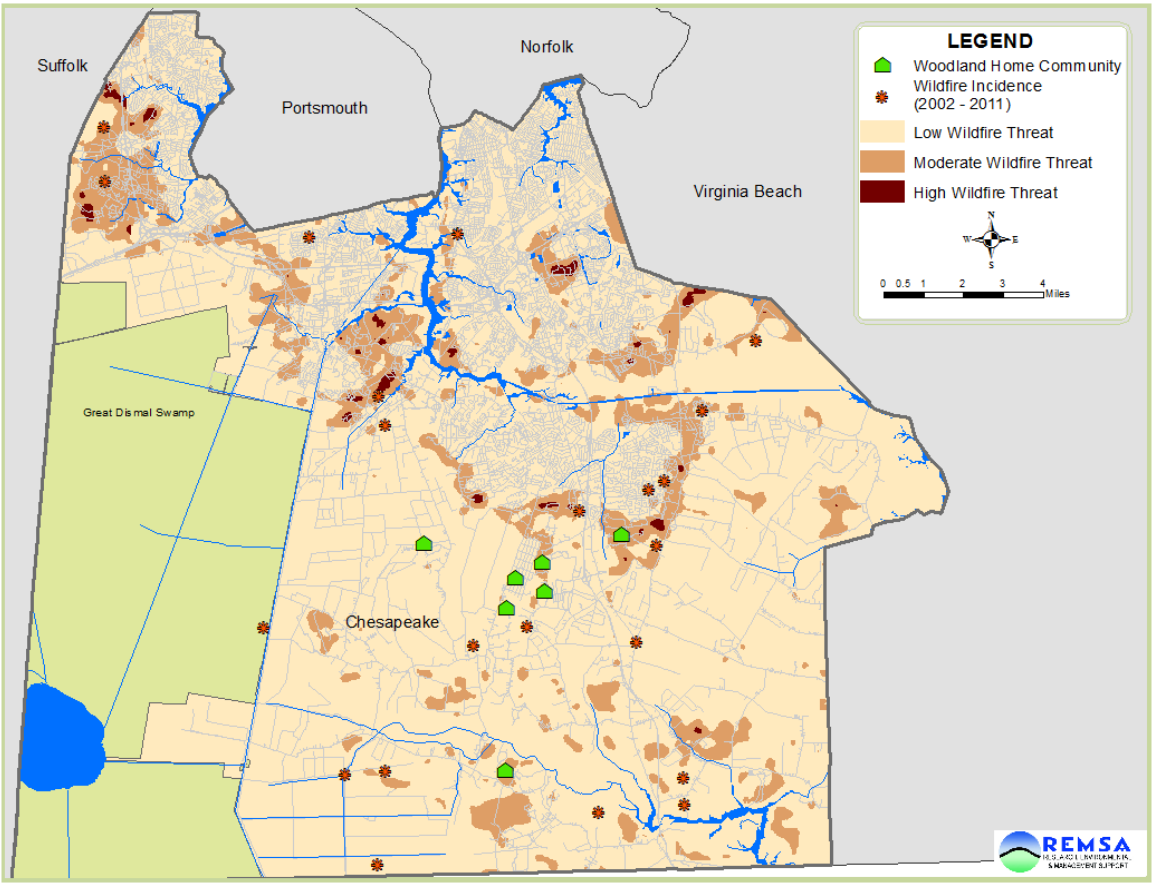
A 2008 fire sparked by logging equipment in the Great Dismal Swamp National Wildlife Refuge lasted 121 days and cost more than $10 million. It was the longest and most expensive wildfire in Virginia history. (Credit: U.S. Fish and Wildlife Service)

LOCATION AND SPATIAL EXTENT

In July 2003, the Virginia Department of Forestry (VDOF) released a GIS-based wildfire risk assessment for the Commonwealth of Virginia. While this assessment is not recommended for site-specific determinations of wildfire vulnerability, the data were used in this plan as an indicator of general hazard exposure within Chesapeake, as shown in **Figure 4.19**. Risk assessment designation involved several inputs, including slope, aspect, land cover, distance to railroads, distance to roads, population density, and historical fire occurrence (VDOF, July 2003, wra-03-statewide). Potential wildfire risk areas are presented in two categories indicating the relative level of threat to the area as high or moderate. Areas without a high or moderate designation are considered to be at low risk of wildfire. In addition to these two hazard levels, **Figure 4.19** also shows the location of seven woodland home communities as defined and identified by VDOF. Woodland home communities are clusters of homes located along forested areas at the wildland/urban interface that could possibly be damaged during a nearby wildfire incident. (VDOF, July 2003, Virginia Woodland Homes Communities).

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

FIGURE 4.19: WILDFIRE THREAT



Source: Virginia Department of Forestry, 2013

Aerial imagery indicates that the areas classified as high wildfire threat are lightly developed wooded areas, including some marshland and other forms of undeveloped land. The moderate wildfire threat areas include both undeveloped and developed land. Based on **Figure 4.19**, the areas of highest wildfire threat are in the northern portion of the City, and surround the southern perimeter of densely developed areas.

SIGNIFICANT HISTORICAL EVENTS

According to VDOF records, the agency responded to an average of 1.6 wildfire events per year, the majority of which are caused by fireworks, open burning, arson and smokers. These data were compiled from completed VDOF fire reports, and do not reflect every brush and woods fire occurrence in the region for this time period. Many more fires are likely to have occurred during this timeframe that local fire departments responded to and were able to contain quickly and efficiently. Because the 17 documented events required state-level assistance from VDOF, they are considered significant events for the purposes of this plan. Only minor property damages have been recorded as resulting from wildfire events. **Table 4.17** shows damages from wildfire events in the region between 1995 and 2011, the latest year for which data are available.

TABLE 4.17: CITY OF CHESAPEAKE WILDFIRE OCCURRENCES (1995-2011)				
YEAR	FREQUENCY	ACRES DAMAGED	COST OF DAMAGE ($)	VALUE OF RESOURCES PROTECTED ($)
1995	2	3.25	50	0
1996	1	.25	0	1,000
1997	3	12	0	15,000
1998	0	0	0	0
1999	2	6	0	30,000
2000	0	0	0	0
2001	4	55.8	0	0
2002	3	169	10,000	300,000
2003	0	0	0	0
2004	0	0	0	0
2005	1	113	0	0
2006	2	2	0	125,000
2007	0	0	0	0
2008	3	4	0	0
2009	0	0	0	0
2010	4	6	0	9 structures
2011	2	27	0	500,000
Totals	27	398.3	10,050	971,009

Source: Virginia Department of Forestry, 2013

It is important to note that not all wildfire incidents within the City of Chesapeake are reported to VDOF. The aforementioned statistics are only pertinent to incidents for which VDOF assisted in some way. For smaller more common wildfire incidents a local fire department would typically have sufficient resources to respond to the incident. As a result, these more frequent and smaller wildfires are not always including in the historical wildfire data VDOF maintains. Recent data from the City of Chesapeake's Fire Department local fire incident reporting system are summarized in **Table 4.18**. Also, the Great Dismal Swamp fires are managed by the U.S. Fish and Wildlife Service and are, therefore, not included in the data in Table 4.17 or 4.18.

TABLE 4.18: LOCAL WILDFIRE INCIDENTS			
Year	Frequency	Acres Damaged	Cost of Damage
2003-2008	610	356	$128,915
2009-2013	18	139	$36,500

Source: Chesapeake Fire Department, 2013

GREAT DISMAL SWAMP FIRE THREAT AND HISTORY

On the western edge of the City of Chesapeake's border lies the Great Dismal Swamp Wildlife Refuge, 111,000 acres of complete uninterrupted wilderness and swamp owned and managed by the U.S. Fish and Wildlife Service. While the City has very limited development in close proximity to the Refuge borders and does not actively manage fire or fire threats on federal lands, there are several unique factors which could present a large wildfire risk to the City:

- Limited road access means many thousands of acres are completely inaccessible for normal fire apparatuses. Most of the refuge is only accessible by canal.
- Dangerous soil conditions for fires. The soils within the refuge are primarily peat soils. Peat forms when plant material, usually in marshy areas, is inhibited from decaying fully by acidic and anaerobic conditions. Peat has high carbon content and can burn under low moisture conditions. Once ignited by the presence of a heat source (e.g., a wildfire penetrating the subsurface), it

smolders. These smoldering fires can burn undetected for very long periods of time (months, years and even centuries), propagating in a creeping fashion through the underground peat layer.

In 1923 a lighting strike within the Refuge ignited a fire that burn uncontrolled for three years. This fire became known as "The Great Conflagration" and burned over 150 square miles of the refuge. Yellow peat smoke filled the air around Hampton, Newport News, and Norfolk during this period. Since the mid-1940s, fire prevention and suppression techniques have reduced both the number and magnitude of fires within the refuge and adjacent areas. However, several notable fires during this period are summarized in **Table 4.19**. An active fire management program is housed on the refuge. Seasonal activities include the planning and implementation of controlled burns, and wildfire suppression. The zone program conducts burns nine months a year, and averages 35 burn days a year. Burns are conducted in a wide range of habitat types, including marsh, grasslands, pocosins, and upland pine and hardwood forest.

TABLE 4.19: GREAT DISMAL SWAMP NOTABLE FIRES

YEAR/FIRE NAME	BRIEF DESCRIPTION
1955 Easter Sunday Fire	Started along the railroad within the northern part of the current refuge and burned nearly 150 square miles, reaching the Portsmouth city line.
1967 South of Feeder Ditch	Someone burning debris ignited this fire that burned 1,350 acres.
1988 April Fools Fire	Escaped prescribed fire burned 640 acres along the state boundary south of Lake Drummond.
1993 Clay Hill Road Fire	Lightning caused fire that burned 150 acres of pine stands near the refuge's western boundary in Suffolk.
1993 Portsmouth Ditch Fire	Fire of unknown origin burned 75 acres adjacent the refuge in Chesapeake.
2004 Corapeake Road Fire	Lightning caused fire started on NC State Natural Area land and spilled over onto the refuge burning 286 acres.
2006 West Drummond Fire	Lightning strike caused fire that burned 535 acres of maple/gum stand north of Interior Ditch.
2008 South One Fire	The South One Fire was started when logging equipment working in fallen Atlantic White Cedar and logging slash caught fire. The fire grew to 4,884 acres before being contained three months later. The fire burned through slash on the surface of the ground and crept deep into the organic peat soils where it continued to smolder and spread ultimately igniting additional vegetation on the surface. The fire cost more than 10 million dollars to suppress.

Source: U.S. Fish & Wildlife Service, 2014

The South One Fire in 2008 burns in the distance. (Courtesy: Salter's Creek Consulting, Inc.)

Today, lightning is the cause of most wildfires at Great Dismal Swamp National Wildlife Refuge. A typical summer afternoon thunderstorm can often result in hundreds of lightning strikes on the refuge. Most of the time, the strikes do not create a wildfire, but surface and ground fires occur on average 2.6 times each year. In the spring, early season lightning events provide the best chance for large fire growth under dry, windy conditions. In the summer months, more frequent lightning brings more starts, but less chance of large fire growth due to higher humidity and greenness of vegetation.

PROBABILITY OF FUTURE OCCURRENCES

Wildfires remain a highly likely occurrence for the City, though most will likely continue to occur in less urban areas and be small in size before being contained and suppressed. Wildfire at Great Dismal Swamp National Wildlife Refuge is similarly a highly likely occurrence.

EXTREME HEAT

BACKGROUND

Extreme heat is defined by the heat index, which combines the air temperature and moisture in the air to provide a "feel like" temperature in a shaded environment. An excessive heat warning is issued by the NWS when the afternoon heat index is expected to reach or exceed 100 degrees for two or more hours. Excessive heat conditions usually last three days or less, but may last a week or more in extreme situations. Health risks from extreme heat include cramps, fainting, exhaustion and stroke. According to the NWS, heat is the leading weather-related killer in the United States. Most deaths are attributed to prolonged heat waves in large cities that rarely experience extended periods of hot weather. The elderly and those with medical conditions such as diabetes are most at-risk, along with those who work outdoors in hot, humid weather.

LOCATION AND SPATIAL EXTENT

Extreme heat typically impacts a large area that cannot be confined to any geographic boundaries. Therefore, it is assumed that Chesapeake would be uniformly exposed to this hazard and that the spatial extent of that impact is potentially large. Extreme heat typically does not cause significant damage to the built environment. Summertime temperatures in Chesapeake can easily climb into the high 90 to low 100 degree Fahrenheit range with high humidity values.

SIGNIFICANT HISTORICAL EVENTS

Temperatures between 90 and 100 degrees (with heat index values between 95 and 105 degrees) are commonplace in Chesapeake during the summer. However, extreme heat (heat index readings 110 degrees or higher) is relatively rare. Since the mid 1990s, the NCDC has only recorded three excessive heat episodes for the City. The committee acknowledges that there have been other, unrecorded extreme heat events prior to 1995. However, official records on these events are not available from the City or through the NCDC (NWS).

August 1-31, 1995: Heat Wave
There were 22 injuries and $100 property damage associated with this heat wave that gripped the region.

May 18−21, 1996: Extreme Heat
An early-season, four-day heat wave produced record or near record high temperatures across central and eastern Virginia. High temperatures were in the 80s and low 90s across the region on May 18. Then, on May 19, May 20 and May 21, high temperatures were in the 90s throughout the area. May 20 was the hottest of the four days as readings climbed into the mid- to upper-90s. Norfolk International Airport set a record with 98 degrees. The heat wave was responsible for numerous reports of heat exhaustion and forced many non-air conditioned schools to close or have early dismissals. There were no reported property damages, fatalities, or injuries.

July 21-23, 2011: Excessive Heat
An extended period of excessive heat and humidity occurred across most of central and eastern Virginia from July 21st to July 23rd. High temperatures ranged from 96 to 103 degrees during the afternoons, with heat index values ranging from 110 to 119. Overnight lows only fell into the lower 70s to lower 80s.

The NWS reported that the summer of 2010 (June - August) had an average temperature of 81.1 degrees Fahrenheit, ranking it as the warmest on record. Previously, the warmest summer on record had averaged 80.0 degrees Fahrenheit in 1994.

Although no event was recorded in the NCDC database, according to the Office of the Chief Medical Examiner, in 2012 there were 21 heat-related deaths in Virginia.

PROBABILITY OF FUTURE OCCURRENCES

It is likely that Chesapeake will experience periods of extreme heat in the future.

MOSQUITO BORNE DISEASES

BACKGROUND

Two arthropod-borne viruses (also known as arboviruses) that are currently of concern in the eastern United States are West Nile virus (WNV) and eastern equine encephalitis (EEE). Bird-feeding mosquitoes are the primary source vector for the diseases, which are then transmitted to humans or horses via a bridge mosquito species that bites both infected birds, and subsequently, humans or horses.

An estimated 80% of people infected with the WNV show no symptoms (Virginia Department of Health, 2013). Approximately 20% of infections cause a clinical presentation known as West Nile Virus fever, which is characterized by an acute onset of fever, and can be accompanied by, but not limited to, headache, muscle aches, fatigue, and joint pain.

In 1999, WNV was first documented in the United States during an outbreak of meningitis and encephalitis in New York City. Since its introduction, it became established throughout much of the United States, and has spread into Canada and Mexico.

One in 150 people infected with WNV will go on to develop severe symptoms, which can include fever, headache, stiff neck, disorientation or confusion, vision loss, seizures, and paralysis (Virginia Department of Health, 2013). In some cases, the neurological effects of WNV infection can be permanent. There is no treatment available for WNV. Treatment for severe cases consists of supportive care. The best defense against WNV is to protect humans from biting mosquitoes and to eliminate mosquito breeding areas.

Because of the rate of death among infected persons with EEE, the virus is regarded as one of the more serious mosquito-borne diseases in the United States. EEE occurs in the eastern half of the country and is most commonly detected around swamps in Virginia's coastal plain. Symptoms of EEE range from mild flu-like illness to encephalitis (inflammation of the brain), coma and death. About 35 percent of people who develop the disease die. It is estimated that 35 percent of people who survive EEE will have mild to severe neurologic after effects from this disease (Virginia Department of Health, 2013). Human cases of EEE are somewhat rare.

LOCATION AND SPATIAL EXTENT

The proximity of developed areas to standing water (i.e., potential breeding pools) may affect the probability of a bite from an infected mosquito that leads to transmission of WNV or EEE. Such areas may include:

- wetlands;
- containers where rainwater collects, such as potted plant trays, buckets, or toys;
- bird baths;
- old tires;
- roof gutters and downspout screens;
- flat roofs, boats, and tarps;
- obstructed ditches; and
- puddles with soil, or a mixture of sand and gravel.

Certain species of mosquitoes are associated with human activity, and developed areas tend to contain suitable manmade breeding habitats. The habitat of "container species" (a.k.a., tree-hole species) mosquitoes that breed in areas of standing water, is difficult to map, but these represent several common species that transmit disease because of their proximity to areas with high human populations.

HISTORICAL OCCURRENCE

Because infected birds must be present before the diseases can spread to humans, and because birds like chickens are stationary and easily tested for the presence of the viruses, birds can serve as sentinels or provide warning of outbreak through testing. According to data from the Chesapeake Mosquito Control Commission (**Table 4.20**), there have been several reported incidences since data collection began in 2003; however, there have been no human positive events. One human case of EEE in Chesapeake in 2012 is suspected to have originated outside the City.

TABLE 4.20: INCIDENTS OF MOSQUITO BORNE DISEASE (2003 - 2012), CITY OF CHESAPEAKE ONLY

Year	Mosquito Pool Positive EEE	Sentinel Chickens Positive Flocks EEE	Horse/Animal Positive EEE	Human Positive EEE	Mosquito Pool Positive WNV	Sentinel Chickens Positive Flocks WNV	Horse Positive WNV	Human Positive WNV
2003	18	18	1	0	15	21	7	0
2004	42	10	0	0	6	9	0	0
2005	114	58	4	0	3	1	0	0
2006	39	12	0	0	5	2	0	0
2007	13	13	0	0	1	0	0	0
2008	2	4	0	0	1	0	0	0
2009	49	27	3 horses, 1 goat, 1 emu	0	3	11	0	0
2010	2	5	0	0	2	9	0	0
2011	0	3	0	0	1	0	0	0
2012	58	20	0	1	18	6	0	0
Total	**337**	**170**	**10**	**1**	**55**	**59**	**7**	**0**

Source: Chesapeake Mosquito Control Commission, 2013

PROBABILITY OF FUTURE OCCURRENCES

The probability of future occurrences of mosquito borne disease in birds and horses is considered likely. The likelihood of human incidence is possible based on the history of occurrence in the region.

PANDEMIC FLU OR WIDESPREAD DISEASE OUTBREAK

BACKGROUND

An influenza pandemic is an epidemic of an influenza virus that spreads on a worldwide scale and infects a large proportion of the human population. In contrast to the regular seasonal epidemics of influenza, these pandemics occur irregularly. Pandemics can cause high levels of mortality.

Influenza pandemics occur when a new strain of the influenza virus is transmitted to humans from another animal species. Species that are thought to be important in the emergence of new human strains are pigs, chickens, and ducks. These novel strains are unaffected by any immunity people may have to older strains of human influenza and can therefore spread extremely rapidly and infect very large numbers of people. Influenza A viruses can occasionally be transmitted from wild birds to other species causing outbreaks in domestic poultry and may give rise to human influenza pandemics. The propagation of influenza viruses throughout the world is thought in part to be by bird migrations, though commercial shipments of live bird products might also be implicated, as well as human travel patterns.

The World Health Organization (WHO) has produced a six-stage classification that describes the process by which a novel influenza virus moves from the first few infections in humans through to a pandemic (**Table 4.21**). This starts with the virus mostly infecting animals, with a few cases where animals infect people, then moves through the stage where the virus begins to spread directly between people, and ends with a pandemic when infections from the new virus have spread worldwide.

TABLE 4.21: WORLD HEALTH ORGANIZATION PANDEMIC INFLUENZA PHASES

Phase	Description
Phase 1	No animal influenza virus circulating among animals have been reported to cause infection in humans.
Phase 2	An animal influenza virus circulating in domesticated or wild animals is known to have caused infection in humans and is therefore considered a specific potential pandemic threat.
Phase 3	An animal or human-animal influenza reassortant virus has caused sporadic cases or small clusters of disease in people, but has not resulted in human-to-human transmission sufficient to sustain community-level outbreaks.
Phase 4	Human to human transmission of an animal or human-animal influenza reassortant virus able to sustain community-level outbreaks has been verified.
Phase 5	Human-to-human spread of the virus in two or more countries in one WHO region.
Phase 6	In addition to the criteria defined in Phase 5, the same virus spreads from human-to-human in at least one other country in another WHO region.
Post peak period	Levels of pandemic influenza in most countries with adequate surveillance have dropped below peak levels.
Post pandemic period	Levels of influenza activity have returned to the levels seen for seasonal influenza in most countries with adequate surveillance.

LOCATION AND SPATIAL EXTENT

As indicated in the WHO phases shown in **Table 4.21**, Phase 5 is characterized by human-to-human spread of the virus into at least two countries in one WHO region. While most countries will not be affected at this stage, the declaration of Phase 5 is a strong signal that a pandemic is imminent and that the time to finalize the organization, communication, and implementation of the planned mitigation measures is short.

Designation of Phase 6 indicates that a global pandemic is under way. During the post-peak period, pandemic disease levels in most countries with adequate surveillance will have dropped below peak observed levels. The post-peak period signifies that pandemic activity appears to be decreasing; however, it is uncertain if additional waves will occur and countries will need to be prepared for a second wave.

Previous pandemics have been characterized by waves of activity spread over months. Once the level of disease activity drops, a critical communications task is balancing this information with the possibility of another wave. Pandemic waves can be separated by months and an immediate "at-ease" signal may be premature. In the post-pandemic period, influenza disease activity will have returned to levels normally seen for seasonal influenza. It is expected that the pandemic virus will behave as a seasonal influenza A virus.

SIGNIFICANT HISTORICAL EVENTS

Flu pandemics have occurred throughout history. There have been about three influenza pandemics in each century for the last 300 years. Since 1918, four significant events stand out, each with different characteristics.

1918 – 1919: Spanish Flu
Illness from the 1918 flu pandemic, also known as the Spanish flu, came on quickly. Some people felt fine in the morning but died by nightfall. People who caught the Spanish Flu but did not die from it often died from complications caused by bacteria, such as pneumonia. Approximately 20% to 40% of the worldwide population became ill, and an estimated 50 million people died, including early 675,000 people in the United States. Unlike earlier pandemics and seasonal flu outbreaks, the 1918 pandemic flu saw high mortality rates among healthy adults. In fact, the illness and mortality rates were highest among adults 20 to 50 years old. The reasons for this remain unknown.

1957 – 1958
In February 1957, a new flu virus was identified in the Far East. Immunity to this strain was rare in people younger than 65. A pandemic was predicted. To prepare, health officials closely monitored flu outbreaks. Vaccine production began in late May 1957 and was available in limited supply by August 1957.

In the summer of 1957, the virus came to the United States quietly with a series of small outbreaks. When children returned to school in the fall, they spread the disease in classrooms and brought it home to their families. Infection rates peaked among school children, young adults, and pregnant women in October 1957. By December 1957, the worst seemed to be over. However, a dangerous “second wave” of illness came in January and February of 1958.

Most influenza–and pneumonia–related deaths occurred between September 1957 and March 1958. Although the 1957 pandemic was not as devastating as the 1918 pandemic, about 69,800 people in the United States died. The elderly had the highest rates of death.

1968 – 1969: Hong Kong Flu Virus
In early 1968, a new flu virus was detected in Hong Kong. The first cases in the United States were detected as early as September 1968. Illness was not widespread in the United States until December 1968. Deaths from this virus peaked in December 1968 and January 1969. Those over the age of 65

were most likely to die. The number of deaths between September 1968 and March 1969 was 33,800, making it the mildest flu pandemic in the 20th century. The same virus returned in 1970 and 1972.

Several reasons may explain why fewer people in the United States died as a result of this virus:

1. The Hong Kong flu virus was similar in some ways to the 1957 pandemic flu virus. This might have provided some immunity against the Hong Kong flu virus.
2. The Hong Kong flu virus hit in December of 1968, when school children were on vacation. This caused a decline in flu cases because children were not at school to infect one another. This also prevented it from spreading into their homes.
3. Improved medical care and antibiotics that are more effective for secondary bacterial infections were available for those who became ill.

2009 – 2010: H1N1 (Swine Flu)
In the spring of 2009, a new flu virus spread quickly across the United States and the world. The first U.S. case of H1N1 (swine flu) was diagnosed on April 15, 2009. By April 21, the Centers for Disease Control and Prevention (CDC) was working to develop a vaccine for this new virus. On April 26, the U.S. government declared H1N1 a public health emergency.

By June, 18,000 cases of H1N1 had been reported in the United States. A total of 74 countries were affected by the pandemic. H1N1 vaccine supply was limited in the beginning. People at the highest risk of complications got the vaccine first.

By November 2009, 48 states had reported cases of H1N1, mostly in young people. That same month, over 61 million vaccine doses were ready. Reports of flu activity began to decline in parts of the country, which gave the medical community a chance to vaccinate more people. An estimated 80 million people were vaccinated against H1N1, which minimized the impact of the illness.

The CDC estimates that 43 million to 89 million people had H1N1 between April 2009 and April 2010. They estimate between 8,870 and 18,300 H1N1 related deaths.

On August 10, 2010 the World Health Organization (WHO) declared an end to the global H1N1 flu pandemic

In addition, several pandemic flu threats have occurred that did not prove as dangerous as the events described above. When the 1976 swine flu was identified at Fort Dix, New Jersey it was called the "killer flu." Experts were concerned because they thought the virus was similar to the 1918 Spanish flu. To prevent a major pandemic, the United States launched a vaccination campaign. In fact, the virus—later named "swine flu"—never moved outside the Fort Dix area. Later, research on the virus showed that it would not have been as deadly as the 1918 flu if it had spread.

In 1997, at least a few hundred people caught H5N1 (avian flu) in Hong Kong. Like the 1918 pandemic, most severe illness affected young adults. Eighteen people were hospitalized. Six of those people died. This avian flu was unlike other viruses because it passed directly from chickens to people. Avian flu viruses usually spread from chickens to pigs before passing to humans. To prevent the virus from spreading, all chickens in Hong Kong—approximately 1.5 million— were slaughtered. Because this flu did not spread easily from person to person, no human infections were found after the chickens were killed.

In 1999, a new avian flu virus appeared. The new virus caused illness in two children in Hong Kong.

PROBABILITY OF FUTURE OCCURRENCES

It is expected that Chesapeake will experience waves of pandemic flu and disease outbreak in the future.

DATA SOURCES

The following primary data sources were among those used to collect the information presented in this section.

- *American Society of Civil Engineers (ASCE), "Facts About Windstorms"* (www.windhazards.org/facts.cfm)
- *Bureau of Reclamation, U.S. Department of the Interior* (www.usbr.gov/)
- *Chesapeake Health District and www.flu.gov*
- *Climate Change in Hampton Roads, Phase II: Storm Surge Vulnerability and Public Outreach, Hampton Roads Planning District Commission (HRPDC), June 2011*
- *Federal Emergency Management Agency (FEMA)* (www.fema.gov)
- *National Climatic Data Center (NCDC), U.S. Department of Commerce, National Oceanic and Atmospheric Administration* (http://lwf.ncdc.noaa.gov/oa/ncdc.html)
- *National Drought Mitigation Center, University of Nebraska-Lincoln* (www.drought.unl.edu/index.htm)
- *National Hurricane Center, National Oceanic & Atmospheric Administration (NOAA)* (www.nhc.noaa.gov)
- *National Severe Storms Laboratory (NSSL), U.S. Department of Commerce, National Oceanic and Atmospheric Administration* (www.nssl.noaa.gov)
- *National Weather Service (NWS), U.S. Department of Commerce, National Oceanic and Atmospheric Administration* (www.nws.noaa.gov)
- *National Severe Storms Laboratory, U.S. Department of Commerce, National Oceanic and Atmospheric Administration (http://www.nssl.noaa.gov/education/svrwx101/tornadoes/)*
- *Sea Level Rise and Coastal Infrastructure: Prediction, Risks and Solutions,* Bilal M. Ayyub and Michael S. Kearney *(American Society of Civil Engineers Council on Disaster Risk Management, Monograph No. 6, January 2012)*
- *Storm Prediction Center (SPC), U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service* (www.spc.noaa.gov)
- *The Tornado Project, St. Johnsbury, Vermont* (www.tornadoproject.com)
- *U.S. Fish & Wildlife Services, Great Dismal Swamp Fire Suppression web site (http://www.fws.gov/refuge/Great_Dismal_Swamp/what_we_do/firesuppression.html)*
- *Virginia Department of Health (http://www.vdh.state.va.us/epidemiology/DEE/Vectorborne/factsheets/westnilevirus.htm)*

VULNERABILITY ASSESSMENT

2014 UPDATE

Section 5 was updated to align the document with the *2011 Southside Hampton Roads Hazard Mitigation Plan*.

Each of the hazards in this section was reviewed and updated to reflect the revised information obtained for the updated *Hazard Identification and Analysis* section. Discussion of vulnerability to Mosquito Borne Diseases, Extreme Heat, and Sea Level Rise and Land Subsidence has been appended. The vulnerability discussion for manmade hazards was excerpted, and all hazard names were edited to provide consistency with the *Hazard Identification and Analysis*. **Tables 5.1 and 5.4** were added with new Hazards U.S. Multi-Hazard (HAZUS) exposure data. **Table 5.3** was updated with more recent NFIP data. A new qualitative system of ranking the hazards was added as well. The tables at the end of the section regarding Conclusions on Hazard Risk were all added.

INTRODUCTION

The *Vulnerability Assessment* section builds on the information provided in the *Hazard Identification and Analysis* by identifying community assets and development trends in the region, then assessing the potential impact and amount of damage (loss of life and/or property) that could be caused by each hazard event addressed in this risk assessment. The primary objective of this level of vulnerability assessment is to prioritize hazards of concern to the region, adding to the foundation for mitigation strategy and policy development. Consistent with the preceding sections, the following hazards are addressed in this assessment:

- FLOODING
- SEA LEVEL RISE AND LAND SUBSIDENCE
- WIND EVENTS
  - HURRICANES
  - TORNADOES
  - WINTER STORMS AND NOR'EASTERS
  - SEVERE THUNDERSTORMS
- DROUGHT
- WILDFIRES
- EXTREME HEAT
- MOSQUITO BORNE DISEASES
- PANDEMIC FLU OR WIDESPREAD DISEASE OUTBREAK

To complete the vulnerability assessment, best available data were collected from a variety of sources, including local, state and federal agencies, and multiple analyses were applied through qualitative and quantitative means (further described below). Additional work will be done on an ongoing basis to enhance, expand, and further improve the accuracy of the baseline results, and it is expected that this vulnerability assessment will continue to be refined through future plan updates as new data and loss estimation methods become available.

The findings presented in this section with regard to vulnerability were developed using best available data, and the methods applied have resulted in an approximation of risk. These estimates should be used to understand relative hazard risk and the potential losses that may be incurred; however, uncertainties are inherent in any loss estimation methodology, arising from incomplete knowledge concerning specific hazards and their effect on the built environment, as well as incomplete data sets and from approximations and simplifications that are necessary in order to provide a meaningful analysis. Further, most data sets contain relatively short periods of record which increases the uncertainty of any statistically-based analysis.

METHODOLOGIES USED

Two distinct risk assessment methodologies were used in the formation of this vulnerability assessment. The first consists of a ***quantitative*** analysis that relies upon best available data and technology, while the second approach consists of a ***qualitative*** analysis that relies on local knowledge and rational decision making. Upon completion, the methods are combined to create a "hybrid" approach for assessing hazard vulnerability for the region that allows for some degree of quality control and assurance. The methodologies are briefly described and introduced here and are further illustrated throughout this section. For each hazard addressed in this section, vulnerability is summarized in part by an annualized loss estimate specific to that hazard, along with a "PRI" value (described in detail below).

QUANTITATIVE METHODOLOGY

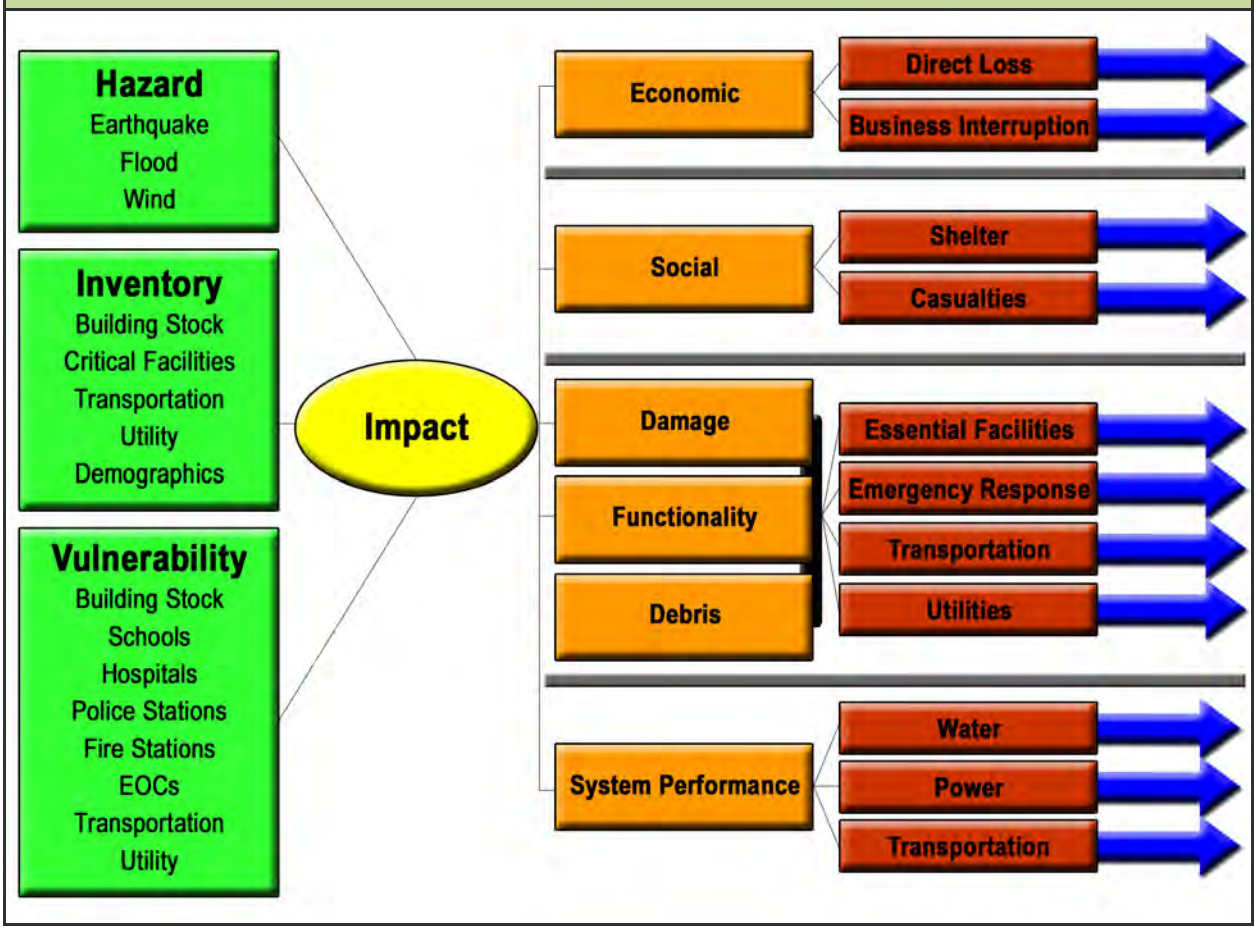
The quantitative assessment involved the use of Hazards U.S. Multi-Hazard (HAZUS-MH) software, a geographic information system (GIS)-based loss estimation tool available from the FEMA, along with a statistical risk assessment methodology for hazards outside the scope of HAZUS-MH. For the flood hazard, the quantitative assessment incorporates a detailed GIS-based approach. When combined, the results of these vulnerability studies are used to form an assessment of potential hazard losses (in dollars) along with the identification of specific community assets that are deemed at-risk.

Explanation of HAZUS-MH and Statistical Risk Assessment Methodology

HAZUS-MH is FEMA's standardized loss estimation software package, built on an integrated GIS platform using a national inventory of baseline geographic data (including information on the region's general building stock and dollar exposure). Originally designed for the analysis of earthquake risks, FEMA expanded the program in 2003 to allow for the analysis of multiple hazards: namely the flood and wind (hurricane wind) hazards. By providing estimates on potential losses, HAZUS-MH facilitates quantitative comparisons between hazards and assists in the prioritization of hazard mitigation activities.

HAZUS-MH uses a statistical approach and mathematical modeling of risk to predict a hazard's frequency of occurrence and estimated impacts based on recorded or historic damage information. The HAZUS-MH risk assessment methodology is parametric, in that distinct hazard and inventory parameters—such as wind speed and building type—were modeled using the HAZUS-MH software to determine the impact on the built environment. **Figure 5.1** shows a conceptual model of HAZUS-MH methodology. More information on HAZUS-MH loss estimation methodology is available through FEMA at www.fema.gov/hazus.

FIGURE 5.1: CONCEPTUAL MODEL OF HAZUS^{MH} METHODOLOGY



Sources: FEMA

This risk assessment used HAZUS-MH to produce regional profiles and estimated losses for two of the hazards addressed in this section: coastal floods and hurricane winds. For each of these hazards, HAZUS-MH was used to generate probabilistic "worst case scenario" events to show the extent of potential damages.

Explanation of GIS-based (Non-HAZUS^{MH}) Risk Assessment Methodology

For hazards outside the scope of HAZUS-MH, a statistical risk assessment methodology was designed and applied to generate potential loss estimates. The approach is based on the same principles as HAZUS-MH, but does not rely on readily available automated software. First, historical data are compiled for each hazard to relate occurrence patterns with existing hazard models. Statistical evaluations are then applied in combination with engineering modeling to develop damage functions that generate annualized losses.

The use of the statistical risk assessment methodology provides a determination of estimated annualized loss[1] for the following hazards:

- Tornadoes
- Winter Storms and Nor'easters
- Severe Thunderstorms
- Wildfires

When possible, quantitative hazard loss estimates are compared with historical damage data as recorded through the National Climatic Data Center (NCDC) and other reliable data sources.

The first step in conducting this analysis included the collection of relevant GIS data from local, state and national sources. These sources include the City's GIS Department, FEMA, Virginia Department of Forestry, and NOAA. Once all data were acquired, ESRI® ArcGIS™ was used to assess specific risks to people, public buildings and infrastructure using digital hazard data in combination with the locally-available GIS data layers. Primary data layers included Census 2010 data, along with geo-referenced point locations for public buildings, critical facilities, and infrastructure elements. Using these data layers, risk was assessed and described by determining the parcels and/or point locations that intersected with the delineated hazard areas.

QUALITATIVE METHODOLOGY

The qualitative assessment relies less on technology and more on historical and anecdotal data, community input, and professional judgment regarding expected hazard impacts. The qualitative assessment completed for Chesapeake is based on committee member dot voting to indicate their priorities for mitigation spending. The members present at the second planning meeting on October 23, 2013, were divided into groups of four people and provided "dot mitigation grants" in the following amounts: 1 - $1,000,000 grant (yellow dot); 2 - $250,000 grants (blue dots); and 4 - $25,000 grants (red dots).

Each group was then tasked with determining how they would spend their mitigation dollars. The groups were reminded that projects must be cost-beneficial and that FEMA urges communities to "Prioritize mitigation actions based on level of risk a hazard poses to lives and property." Each group then discussed amongst themselves, and placed their dot grants next to the hazards they considered a priority for spending. Results are shown in **Table 5.12** at the end of this section.

While the quantitative assessment focuses on using best available data, computer models and GIS technology, this qualitative ranking system relies more on historical data, local knowledge, and the general consensus of NEMAC. The results allow identified hazards to be ranked against one another.

SUMMARY

Using both the qualitative and quantitative analyses to evaluate the hazards that impact the City provided members of NEMAC with a dual-faceted review of the hazards. This allowed officials to recognize those hazards that may potentially be costly, but also to plan and prepare for hazards that may not cause much monetary damage, but could put a strain on the local resources needed to recover.

All conclusions of the vulnerability assessment completed for the City are presented in "Conclusions on Hazard Risk" at the end of this section. Qualitative findings for each hazard are detailed in the hazard-by-hazard vulnerability assessment that follows, beginning with an overview of general asset inventory and exposure data for Chesapeake.

[1] By annualizing estimated losses, the historic patterns of frequent smaller events are coupled with infrequent but larger events to provide a balanced presentation of the long-term risk.

OVERVIEW OF CHESAPEAKE VULNERABILITY

GENERAL ASSET INVENTORY

The total dollar exposure of buildings within Chesapeake is estimated to be $12,863,632,000. This figure is based on an estimated 70,908 residential, commercial, industrial and other buildings located throughout the City, derived from HAZUS-MH data (**Table 5.1**). The data provide an estimate of the aggregated replacement value for the City's assets.

TABLE 5.1: BUILDING INVENTORY IN CHESAPEAKE

BUILDING TYPE	NUMBER OF BUILDINGS	BUILDING EXPOSURE (2006 dollars)	CONTENTS EXPOSURE (2006 dollars)	TOTAL (2006 dollars)
Residential	65,779	$9,989,977,000	$4,996,593,000	$14,986,570,000
Commercial	3,253	$1,925,296,000	$2,048,005,000	$3,973,301,000
Industrial	1,058	$470,025,000	$615,947,000	$1,085,972,000
Others	818	$478,334,000	$489,901,000	$968,235,000
Total	70,908	$12,863,632,000	$8,150,446,000	$21,014,078,000

Source: HAZUS-MH

ESSENTIAL FACILITIES

There is no universally accepted definition of what constitutes essential facilities and infrastructure, nor is one associated with FEMA and DMA 2000 planning requirements. However, for purposes of this Plan, essential facilities and infrastructure are identified as "*those facilities or systems whose incapacity or destruction would present an immediate threat to life, public health, and safety or have a debilitating effect on the economic security of the region*." This includes the following facilities and systems based on their high relative importance for the delivery of vital services, the protection of special populations, and other important functions in Chesapeake:

- Emergency Operations Center (EOC)
- Hospital and medical care facilities
- Police stations
- Fire stations
- Public schools designated as shelters
- Hazardous materials facilities
- Water (and wastewater) facilities
- Energy facilities (electric, oil and natural gas)
- Communication facilities

Essential facility data were acquired from the City's database of essential facilities. A closer examination of the HAZUS list of facilities was not deemed to be as reliable as the City's own data for the purposes of this report.

Table 5.2 shows the results of a simple overlay analysis of the essential facilities that are located in the high wildfire risk area, 100-year floodplain, 500-year floodplain and the Storm Surge Zone for a Category 3 hurricane. There are no essential facilities in the Coastal High Hazard Area (V Zone) in Chesapeake.

TABLE 5.2: ESSENTIAL FACILITIES LOCATED IN HAZARD AREAS

FACILITY TYPE	HIGH WILDFIRE RISK	100-YEAR FLOODPLAIN	500-YEAR FLOODPLAIN	STORM SURGE CATEGORY 3
Fire/Rescue Station	0	3	3	4
Public School Shelters	0	0	0	2
Water Facilities	0	0	0	1
Police Facilities	0	0	0	5
Medical Facilities	0	0	1	4
Elevated Storage Tanks	0	1	1	1
Emergency Operations	0	0	1	1
Senior Disabled Facility	0	1	1	2
Other City Buildings	0	0	0	3

FLOODING

Annualized Loss Estimate: $22,384,775 to $29,145,600

The vulnerability assessment for the flood hazard includes the findings of the qualitative assessment conducted, an overview of NFIP statistics, repetitive loss properties (as defined and identified by the NFIP), estimates of potential losses, and future vulnerability and land use.

As described in detail in the *Hazard Identification and Analysis* section, the NCDC has records for 21 significant flood events in the past 21 years (1993 to 2013) for the City of Chesapeake, amounting to approximately $1,155,000 in reported property damage. Also discussed in the *Hazard Identification and Analysis* are historic storms such as Hurricanes Isabel, Floyd and the 1933 hurricane that each caused notable flooding in the City. Historically, Chesapeake is vulnerable to the flood hazard and flood events occur on a frequent basis.

NFIP STATISTICS AND REPETITIVE LOSS PROPERTIES

As of July 2013, there were 9,429 flood insurance policies in place in Chesapeake, providing a total of $2.5 billion in coverage. Over 65% of those policies insure structures located within the 100-year floodplain. The City estimates that there are 12,625 improved residential and commercial properties within the 100-year floodplain, meaning that an estimated 49% of structures subject to flooding by the 100-year flood have NFIP coverage. In 2007, there were 9,109 flood insurance policies in place, so the City has experienced a 3.5% increase in the number of policies over the last six years.

Reducing the number of repetitive loss (RL) properties insured by the NFIP is a nationwide emphasis of FEMA. An RL property is any insurable building for which two or more claims over a 10-year period average at least 25% of the value of the structure, since 1978. An RL property may or may not be currently insured by the NFIP. As of 2010 (the latest data available from FEMA according to Insurance Services Office (ISO)), a total of 391 RL properties as defined by the NFIP have been identified within the City of Chesapeake. These 391 properties have experienced a total of $18.6 million individual insured losses for the structure and contents combined. The average payment for each qualifying claim was $5,183. There are 380 residential properties and 11 non-residential properties on the list.

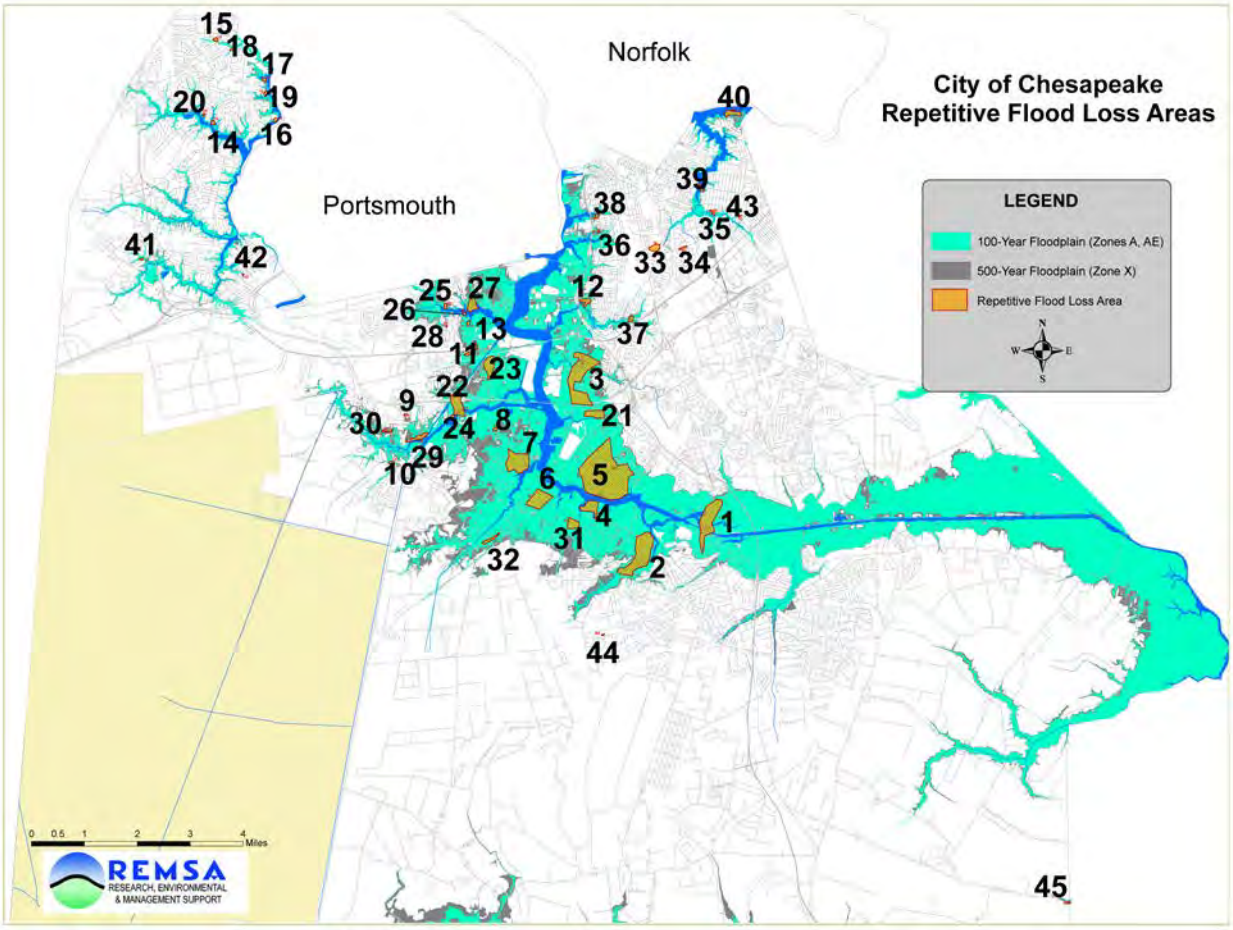
The NFIP also designates severe repetitive losses (SRL) in a community, meaning insurable structures with four or more claims payments of over $5,000 or two claims that exceed the value of the property. SRL for single family residences is defined as four or more claims, each for more than $5,000 and cumulatively more than $20,000. The City of Chesapeake has 58 SRL properties identified by the NFIP, with a total of 308 losses. Total payments for these 58 properties were over $7.8 million. **Table 5.3** provides summary details for Chesapeake with regard to the community's NFIP policies and repetitive losses.

TABLE 5.3: NFIP STATISTICS AND REPETITIVE LOSS PROPERTIES					
		REPETITIVE FLOOD LOSSES			
NUMBER OF NFIP POLICIES	TOTAL COVERAGE	NUMBER OF PROPERTIES	VALUE OF LOSSES	NUMBER OF QUALIFYING LOSSES	AVERAGE PAYMENT PER QUALIFYING CLAIM
9,429	$2,504,496,400	392	$19,202,192	1,194	$16,082
		SEVERE REPETITIVE FLOOD LOSSES			
		58	$7,840,476	308	$25,456

Sources: FEMA and NFIP (as of July 2013)

Figure 5.2 contains a map of the City's 45 repetitive loss areas, which were identified by referencing maps of the historically flooded properties on old and new NFIP RL lists and the SRL list. There are 391 properties on FEMA's repetitive loss list and an additional 2,024 structures identified as being within those repetitive loss areas. Structures, in this case, is very broad and includes any structure listed in the county assessor's database such as garages and sheds.

FIGURE 5.2: NATIONAL FLOOD INSURANCE PROGRAM REPETITIVE FLOOD LOSS AREAS



Source: ISO, 2013 data

ESTIMATES OF POTENTIAL LOSSES

HAZUS-MH was used to model the damage expected in association with the 100-year flood in the City. The standard HAZUS Level I methodology created a floodplain that was significantly smaller than the 100-year floodplain shown on the FEMA Flood Insurance Rate Map (FIRM). As a result, expected damages from the 100-year flood were negligible. After conducting a more detailed analysis using the Digital FIRM product from FEMA and generating a custom depth grid, a more dependable level of accuracy and resolution was achieved.

Table 5.4 provides a detailed listing of the number of structures expected to be damaged, and the dollar losses expected. An annualized loss estimate of $29,145,600 was determined based on the HAZUS loss estimate for the 100-year flood, a loss estimate of $0 for the 2-year frequency flood event, and a loss estimate of $200,000 for the 5-year event. (Expected annual damages and losses are calculated as the product of the flood probability times the scenario damages.) This annualized estimate likely overstates the annual losses, and the calculation could be made more precise through the inclusion of more precise community damage assessment data and flood height data if available in future updates.

For the 2008 update to this plan, the City's GIS Department performed an analysis that estimated damages of $235,113,424 resulting from the 100-year flood, or an estimated $22,384,775 in annualized

damages. Therefore, an annualized flood damage estimate in the range of $22,384,775 to $29,145,600 is considered appropriate for the City of Chesapeake.

TABLE 5.4: HAZUS-MH LOSS ESTIMATES FOR 100-YEAR FLOOD EVENT

NUMBER OF BUILDINGS MODERATELY DAMAGED (21-49% OF VALUE)	NUMBER OF BUILDINGS SUBSTANTIALLY DAMAGED	BUILDING LOSSES	BUSINESS INTERRUPTION LOSSES	TOTAL LOSSES
1,769	16	$303,630,000	$2,650,000	$306,280,000

Sources: HAZUS-MH

FUTURE VULNERABILITY AND LAND USE

Future vulnerability will be determined, in part, by local officials. Flood hazard and SLOSH maps have been developed to indicate what areas of the City are most vulnerable to these hazards. All of the SLOSH maps and flood hazard maps for Chesapeake have been updated since the initial 2003 plan was developed and can be used to help guide development away from hazardous areas. Local officials are responsible for enforcing local floodplain management regulations, flood damage prevention ordinances, and other forms of development policies that restrict new development in flood hazard areas.

SEA LEVEL RISE AND LAND SUBSIDENCE

Annualized Loss Estimate: **$30 million to $46 million (1 foot rise by 2100)**
$45 million to $87 million (3 foot rise by 2100)

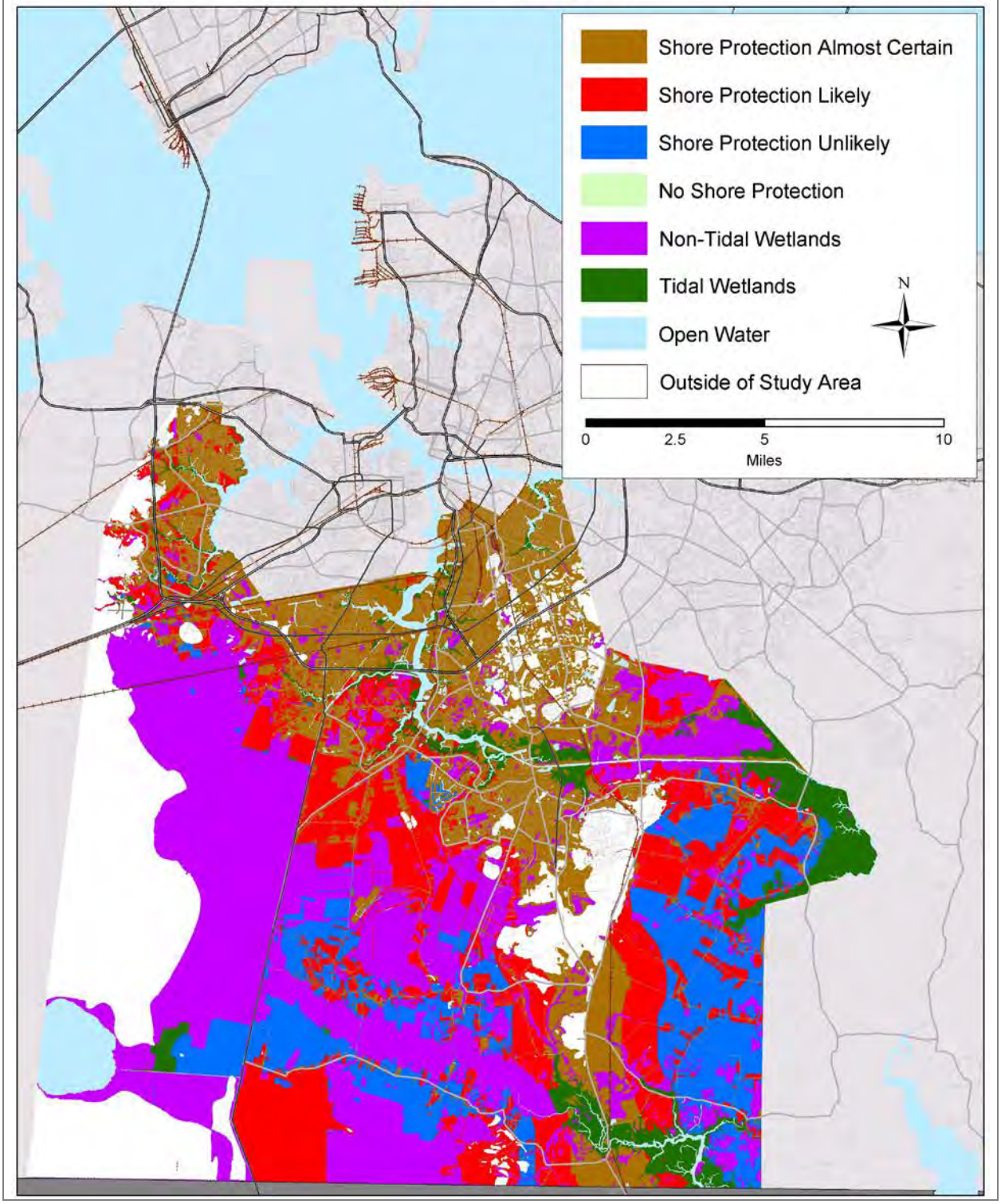
Historical evidence shows that the Southside Hampton Roads region, including Chesapeake, is already experiencing some degree of sea level rise. As discussed in detail in the *Hazard Identification and Analysis* section, data from Sewells Point at the Norfolk Naval Base indicate that sea level in the past 70 years has risen at a rate of approximately 4.44 millimeters per year. Although there is no guarantee that this rate will remain constant in the future, the rate of land subsidence is expected to remain somewhat steady, and that rate is a major component of the relative sea level rise experienced in Hampton Roads.

ESTIMATES OF POTENTIAL LOSSES

Detailed economic loss estimates for sea level rise and land subsidence are extremely difficult to develop because the response of individual property owners to sea level rise is inherently unpredictable and variable over both time and space. The lack of detailed elevation information for the existing pre-FIRM and post-FIRM building inventory in Chesapeake hinders efforts to calculate detailed future average annual flood damages using increasing 100-year flood elevations. For example, calculations of sea level rise losses may be supported by the argument that areas below a certain elevation will be permanently inundated and evacuated; however, regional experience over the past 50 years alone indicates that shoreline protection measures will be reinforced to protect threatened structures, hindering the ability of wetlands and shorelines to adjust naturally as the water level rises. So models based on permanent inundation dramatically overstate losses.

A recent project conducted by VIMS created maps depicting the likelihood of shore protection along the Virginia coast as part of a nationwide study reporting on the development of coastal land most vulnerable to rising sea level (*Environmental Research Letters*, 2009). The purpose of the project was to motivate dialogues about the appropriate measures to rising sea level by creating maps that depict the likely response given current practices and policies. The maps divide coastal low lands in Chesapeake into four categories: developed (shore protection almost certain), intermediate (shore protection likely), undeveloped (shore protection unlikely), and conservation (no shore protection) (**Figure 5.3**).

FIGURE 5.3: SEA LEVEL RISE PLANNING MAP



Source: Environmental Research Letters, 2009

One methodology for estimating average annual losses expected from sea level rise is supported by FEMA. In 1991, FEMA issued a report to Congress documenting the estimated impact of relative sea level rise on the Flood Insurance Rate Maps. The agency estimates that existing development in the coastal zone would experience a 36% to 58% increase in annual damages for a 1-foot rise in sea level by 2100, and a 102 to 200 percent increase resulting from a 3-foot rise by 2100. Based on this estimate, average annual flood damages from storm surge could be expected to increase to between $30 million and $46 million under a 1-foot rise scenario, and to between $45 million to $87 million under the 3-foot rise scenario.

However, the FEMA study assumes that the current elevation distribution of post-FIRM construction relative to the 100-year flood elevation holds steady for future construction, when in fact many communities in the region are implementing freeboard requirements, such as the one foot of freeboard now required in Chesapeake. The obsolescence of buildings is not accounted for in the FEMA predictions; realistically, the number of pre-FIRM and post-FIRM buildings built to outmoded floodplain management standards should decline with time. Replacement structures must be in compliance with NFIP regulations in effect at the time of their construction. Thus, loss expectations based on the FEMA formula are likely overestimated, but provide some basis for decision making in this planning environment.

FUTURE VULNERABILITY AND LAND USE

In *Vulnerability of Hampton Roads, Virginia to Storm-Surge Flooding and Sea-Level Rise*, Kleinosky, Yarnal and Fisher (*Natural Hazards,* 2006) compare data on the location of socially and economically vulnerable populations with storm surge flood risk exposure in order to map areas with the highest social vulnerability to storm surge in the future. The study premise is that sea level rise will cause an increase in the land area susceptible to storm surge flooding. Results indicate highest social vulnerability in much of northern and northeastern Chesapeake, with relatively low social vulnerability in the more rural southern portion of the City. The article and maps are copyright-protected and cannot be provided herein, but are available online at: http://www.cara.psu.edu/about/publications/2006-Kleinosky%20et%20al.pdf.

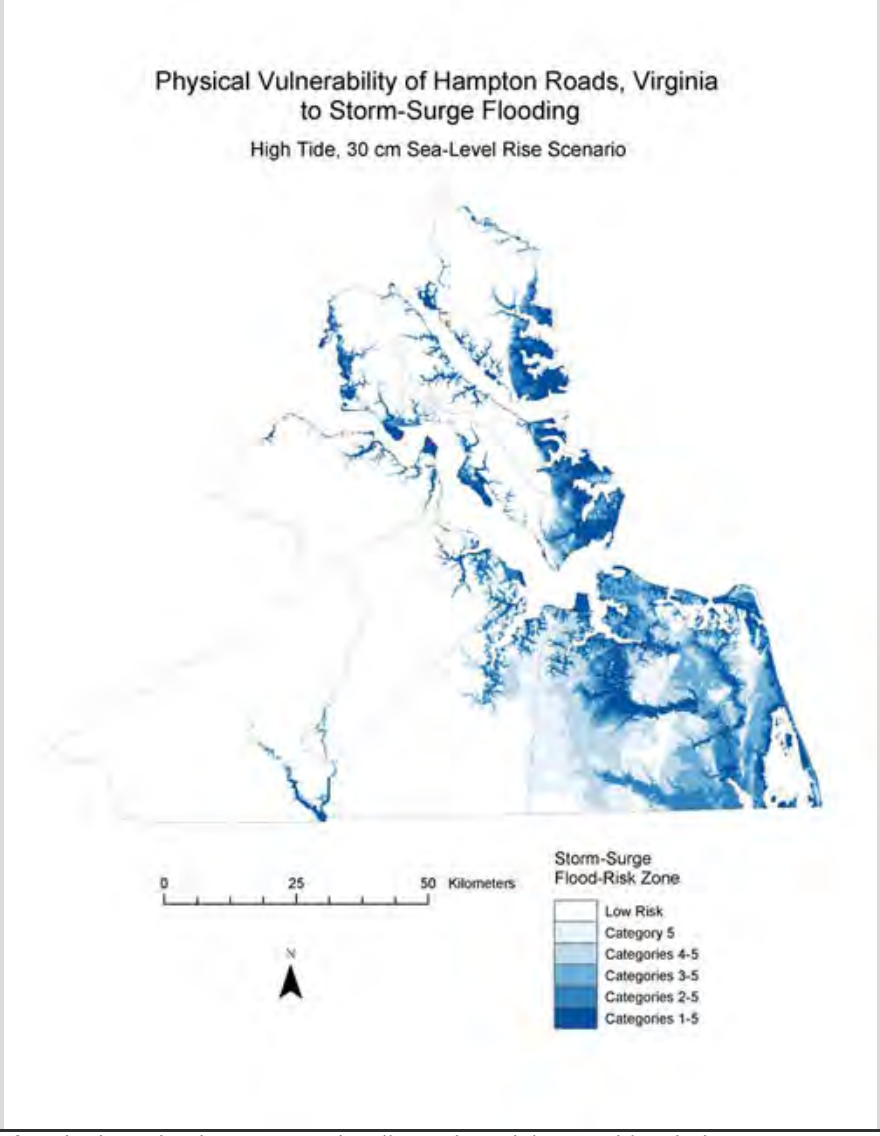
Figure 5.4 contains the results of the same case study regarding physical vulnerability of the Hampton Roads region to sea level rise. The map used SLOSH output data and a digital elevation model to create a visual representation of vulnerability as it changes over the region.

The Hampton Roads Planning District Commission, in a 2012 report entitled *Climate Change in Hampton Roads, Phase III: Sea Level Rise in Hampton Roads, Virginia,* compiled maps and data to document those areas of the City that are exposed to one meter of sea level rise above spring high tide **(Figure 5.5)**. **Table 5.5** summarizes the report's findings, which highlight over $6.5 billion of vulnerability or exposure in the built environment.

TABLE 5.5: EXPOSURE TO ONE METER SEA LEVEL RISE ABOVE SPRING HIGH TIDE (MIDDLE ESTIMATE)	
Land Area	32.4 square miles
Population	15,983
Housing Units	5,731
Number of Parcels	8,260
Improvement Value of Parcels (residential)	$2.3 billion
Roads (total miles)	65.2 miles
Businesses	380
Total Value of Parcels (commercial)	$4.2 billion
Protected Lands	10,177 acres

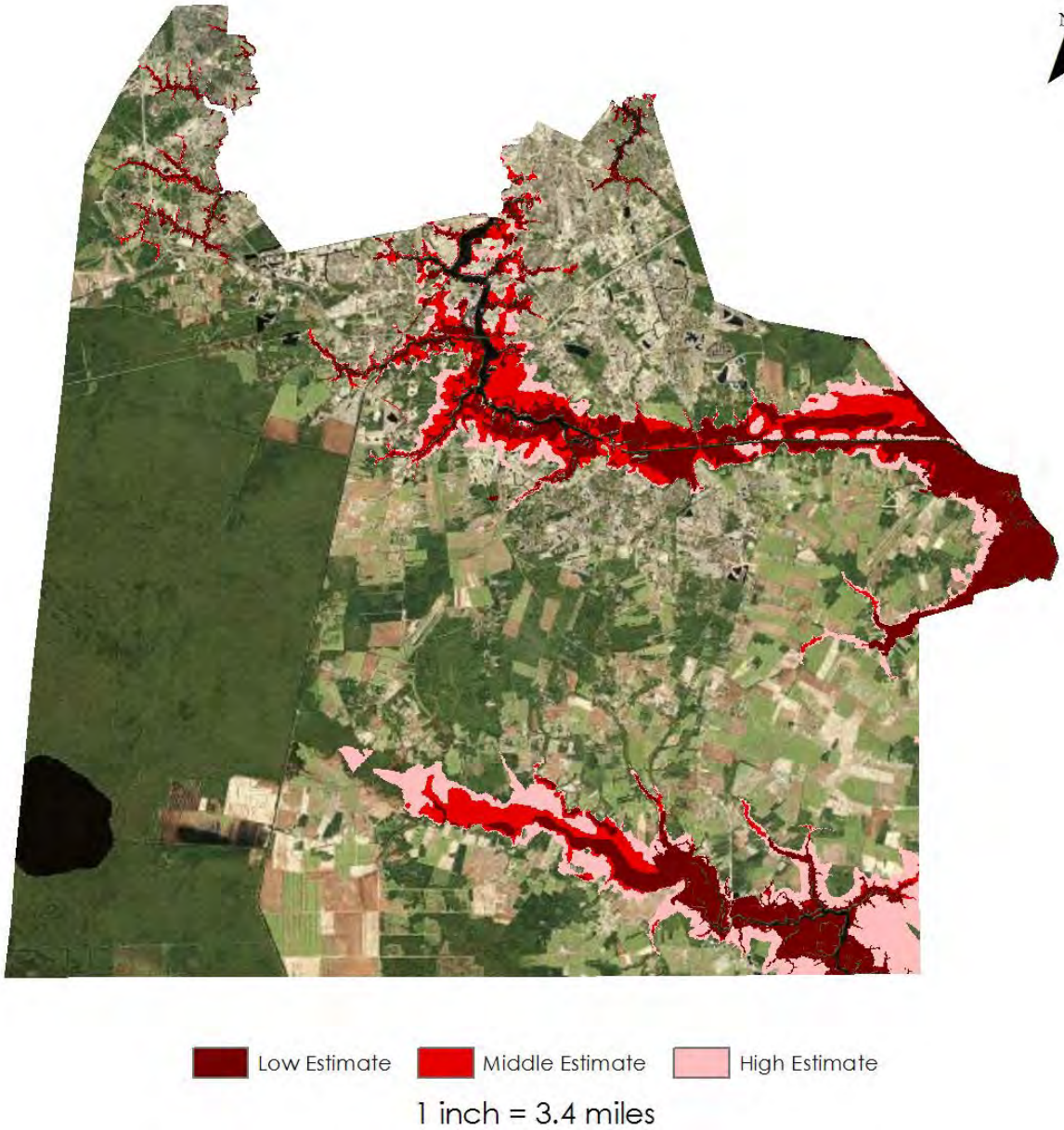
Source: *Climate Change in Hampton Roads, Phase III: Sea Level Rise in Hampton Roads, Virginia.* HRPDC, July 2012.

FIGURE 5.4: PHYSICAL VULNERABILITY OF HAMPTON ROADS TO 30 CM SEA LEVEL RISE



Source: Consortium for Atlantic Regional Assessment, http://ccrm.vims.edu/cara_web/results.htm.

FIGURE 5.5: AREAS EXPOSED TO ONE METER OF SEA LEVEL RISE ABOVE SPRING HIGH TIDE, CHESAPEAKE, VIRGINIA



Source: *Climate Change in Hampton Roads, Phase III: Sea Level Rise in Hampton Roads, Virginia.* HRPDC, July 2012.

WIND EVENTS: HURRICANES

Annualized Loss Estimate: $11,438,000

Historical evidence shows that Chesapeake is vulnerable to damaging hurricane and tropical storm-force winds. As discussed in detail in the *Hazard Identification and Analysis* section, 78 hurricanes and tropical storms have passed within 75 miles of the region since 1851. This equates to a 48 percent annual chance that a storm will impact the region.

ESTIMATES OF POTENTIAL LOSSES

Detailed loss estimates for the wind damage associated with the hurricane and tropical storm hazard were developed based on probabilistic scenarios using HAZUS-MH (Level 1 analysis). **Table 5.6** shows estimates of potential building damage for the 100- and 500-year return periods, as well as annualized losses. In summary, Chesapeake may be susceptible to an estimated total of approximately $181 million in building damages from a 100-year wind event, increasing up to $927 million for a 500-year event. Annualized losses are estimated to be approximately $11.4 million. These figures are based on "worst-case" scenarios.

TABLE 5.6: ESTIMATES OF POTENTIAL BUILDING DAMAGE – WIND ONLY

OCCUPANCY	DAMAGE TYPE	100-YEAR EVENT 2006 dollars	500-YEAR EVENT 2006 dollars
Residential	Property	$159,057,020	$704,593,970
	Business Interruption	$7,714,380	$89,140,490
Commercial	Property	$6,309,170	$61,260,220
	Business Interruption	$3,258,190	$23,805,800
Industrial	Property	$2,472,530	$25,418,600
	Business Interruption	$167,720	$2,064,250
Other	Property	$1,590,710	$14,366,080
	Business Interruption	$888,300	$6,655,770
TOTAL		$181,458,020	$927,305,180
ANNUALIZED LOSSES		**$11,438,000**	

Source: HAZUS-MH

HAZUS-MH was also used to produce building damage estimates based on percentage of damage (by damage state) for the 100- and 500-year return periods (**Table 5.7**). For the 100-year event, 9.98% of the buildings are expected to experience minor damage, while 0.03 percent is expected to be completely destroyed. For the 500-year event, 29.3 percent of the total number of buildings is expected to suffer minor damage, while 1.0 percent is expected to be completely destroyed.

TABLE 5.7: ESTIMATES OF POTENTIAL BUILDING DAMAGE, BY DAMAGE STATE[2]

OCCUPANCY TYPE	MINOR (%)		MODERATE (%)		SEVERE (%)		DESTRUCTION (%)	
	100-YR	500-YR	100-YR	500-YR	100-YR	500-YR	100-YR	500-YR
Residential	6,693 (10)	19,610 (30)	758 (1)	5,850 (9)	22 (<1)	779 (1)	27 (<1)	716 (1)
Commercial	244 (7)	726 (22)	55 (2)	453 (14)	8 (<1)	129 (4)	0 (0)	1 (<1)
Industrial	79 (7)	226 (21)	16 (2)	149 (14)	3 (<1)	46 (4)	0 (0)	3 (<1)
Other	66 (<1)	201 (25)	11 (1)	97 (12)	2 (<1)	30 (4)	0 (0)	3 (<1)
TOTAL	7,082	20,763	840	6,549	35	984	27	723

Source: HAZUS-MH

FUTURE VULNERABILITY AND LAND USE

All future structures built in Chesapeake will likely be exposed to hurricane and tropical storm-force winds and may also experience damage not accounted for in the loss estimates presented in this section.

[2] For detailed definitions of the four damage states, please refer to the HAZUS-MH User Manual for the Hurricane Model.

WIND EVENTS: TORNADOES

Annualized Loss Estimate: $78,326

Historical evidence shows that the City of Chesapeake is vulnerable to tornado activity, which is often associated with other severe weather events such as thunderstorm or tropical cyclone activity.

ESTIMATES OF POTENTIAL LOSSES

Because it cannot be predicted where a tornado may strike, it is not possible to map geographic boundaries for this hazard or produce detailed loss estimates. Therefore, the total dollar exposure figure of $21,014,078,000 for all buildings and contents within Chesapeake is considered to be exposed and could potentially be impacted on some level by the tornado hazard.

Based on historic property damages for the past 23 years (1990 to 2013), an annualized loss estimate of $78,326 and annual probability of 26.1% percent were generated for the tornado hazard.

FUTURE VULNERABILITY AND LAND USE

All future structures built in the City of Chesapeake are likely to be exposed to the tornado hazard and may experience damage not accounted for in the estimated losses presented in this section.

WIND EVENTS: WINTER STORMS AND NOR'EASTERS

Annualized Loss Estimate: $958,095

Historical evidence shows that the City of Chesapeake is vulnerable to winter storm activity and the wind-related impacts of nor'easters, including heavy snow, ice, extreme cold, freezing rain, and sleet.

ESTIMATES OF POTENTIAL LOSSES

Because winter storms and the winds associated with nor'easters typically affect large areas beyond county and municipal boundaries, it is not possible to map geographic locations at specific risk from this hazard or produce detailed loss estimates. Therefore, the total dollar exposure figure of $21,014,078,000 for all buildings and contents within the City is considered to be exposed and could potentially be impacted by the winter storm and nor'easter hazard.

Based on historic property damages for the past 21 years (June 1993 to June 2013), an annualized loss estimate of $958,095 was generated for the winter storm and nor'easter (wind) hazard. This annualized loss is presented in **Table 5.8** along with annual probability. Potential losses may be inflated by factors such as the costs associated with the removal of snow from roadways, debris clean-up, indirect losses from power outages, and the tendency of the NCDC data to lump metropolitan regional damages together.

Because winter weather impacts the City uniformly, no winter storm and nor'easter vulnerability maps have been created. For additional information on flooding vulnerability associated with nor'easters, refer to the Coastal Floods, Nor'easters and Storm Surge subsection above. For maps of critical facilities and infrastructure that could potentially be impacted, see **Appendix E.**

TABLE 5.8: ESTIMATED ANNUALIZED LOSSES

ANNUAL PROBABILITY	ANNUALIZED LOSSES
143%	$958,095

Source: Statistical Risk Assessment Methodology

FUTURE VULNERABILITY AND LAND USE

Because of the geographic location, all future structures built in the City of Chesapeake are likely to be exposed to the winter storm hazard and nor'easters and may experience damage not accounted for in the estimated losses presented in this section.

WIND EVENTS: SEVERE THUNDERSTORMS

Annualized Loss Estimate: $6,588

Historical evidence shows that the City of Chesapeake is vulnerable to severe thunderstorm activity.

ESTIMATES OF POTENTIAL LOSSES

Because it cannot be predicted where severe thunderstorms and hail may occur, it is not possible to map geographic boundaries for this hazard or produce detailed loss estimates. Therefore, the total dollar exposure figure of $21,014,078,000 for all buildings and contents within the planning area is considered to be exposed and could potentially be impacted on some level by this hazard. Based on historic property damages for the past 17 years (1996 to 2013), an annualized loss estimate of $6,588 was generated for severe thunderstorm with an annual probability of 335 percent in the planning area.

FUTURE VULNERABILITY AND LAND USE

All future structures built in the City of Chesapeake will likely be exposed to severe thunderstorms and may experience damage not accounted for in the estimated losses presented in this section.

DROUGHT

Annualized Loss Estimate: Undetermined

Droughts can impact natural systems and the ability of cities, towns and neighborhoods to function effectively. Specific effects may include a reduction in the production of food grains and other crops, the size and quality of livestock and fish, available forage for livestock and wildlife, and the availability of water supplies needed by communities and industry. As evidenced by previous occurrences, the City of Chesapeake is vulnerable to the drought hazard.

ESTIMATES OF POTENTIAL LOSSES

While drought impacts agricultural, recreational, and manufacturing industries, estimating losses to the built environment is difficult because drought causes little documented physical damage to the built environment. Annualized damages based on changes in total harvested cropland may not accurately represent drought impacts because losses in harvested cropland or the market value of crops cannot be attributed entirely to drought or other weather-related conditions, especially in rural areas that are being developed. Data on drought damages from the NCDC are incomplete and, when available, apply to a very large area including jurisdictions outside of the study area. As a result, the estimation of annualized damages due to drought is undetermined.

Table 5.9 provides a time series of data regarding the total harvested cropland, irrigated land, market value of crops, and percent of non-irrigated land in both 2002 and 2007. The 2012 Census data at the community level is not expected available until May 2014.

TABLE 5.9: AGRICULTURAL DATA RELATED TO DROUGHT VULNERABILITY

2002			2007		
TOTAL HARVESTED CROPLAND (acres)	IRRIGATED LAND (acres)	MARKET VALUE OF CROPS ($1,000)	TOTAL HARVESTED CROPLAND (acres)	IRRIGATED LAND (acres)	MARKET VALUE OF CROPS ($1,000)
53,188	313	35,899	41,391	239	35,627

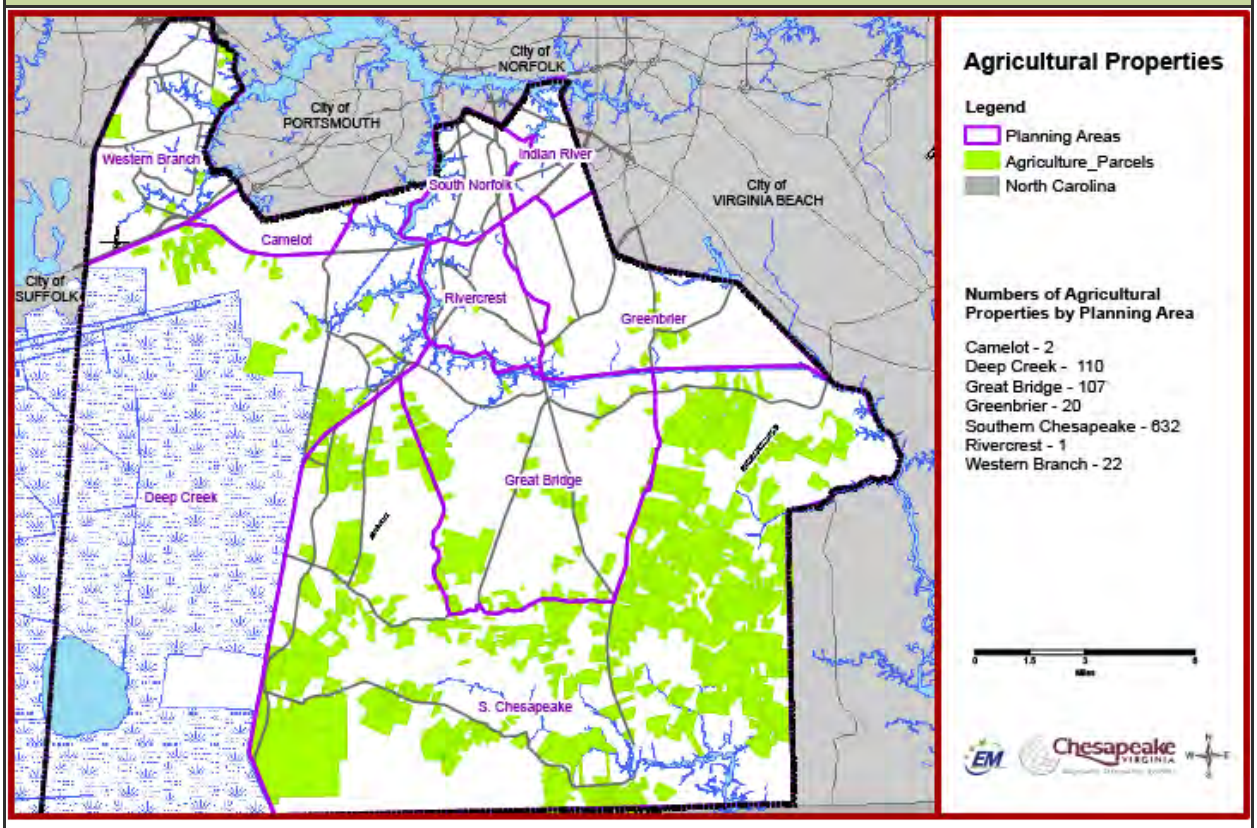
Source: U.S. Census of Agriculture (2002 and 2007)

FUTURE VULNERABILITY AND LAND USE

Figure 5.6 indicates agricultural parcels in Chesapeake. Mapping these properties provides an overview of the areas within the City that are most vulnerable to the effects of future drought events. The parcels are clustered in the Southern Chesapeake Planning Area, with high concentrations along the eastern municipal boundary and in the southwestern portion of the City near the boundary of the Great Dismal Swamp.

According the U.S. Census of Agriculture, the total harvested cropland in the City of Chesapeake increased 11% between 1997 and 2002, and decreased 22% between 2002 and 2007. Because these rates are indicative of many other land use changes, no conclusions can be drawn relating long-term drought conditions and land use at this time. At the time of this report, the 2012 Census of Agriculture had not been released.

FIGURE 5.6: AGRICULTURAL PROPERTIES SUBJECT TO THE EFFECTS OF DROUGHT



WILDFIRES

Annualized Loss Estimate: $15,628

According to VDOF statistics, Virginia has more than 4,000 woodland home communities. These areas are defined by VDOF as "clusters of homes located along forested areas at the wildland-urban interface (WUI) that could possibly be damaged during a nearby wildfire incident." In Chesapeake, seven woodland home communities have been identified. There are no woodland home communities that are located in areas identified as being high risk for wildfires, and three in areas identified as being moderate risk for wildfires. **Figure 4.19** shows the location of these woodland home communities in relation to the identified wildfire hazard areas. More information on these communities is readily available through the VDOF.

ESTIMATES OF POTENTIAL LOSSES

As shown in the *Hazard Identification and Analysis* section, VDOF documented an average of 1.6 wildfire events per year between 1995 and 2011, with only minor property damages (less than $11,000 total) reported. Annualized losses for state-response wildfires are, therefore, estimated to be $590. The City reported an additional 628 events between 2003 and 2013, resulting in $165,415 in damage. Local-response wildfires occur at an average frequency of 57 per year, with annualized losses of $15,038. Combined annualized losses total an estimated $15,628.

FUTURE VULNERABILITY AND LAND USE

In cities and counties throughout the U.S., population concentration increase has resulted in rapid development in the outlying metropolitan areas and in rural areas, both of which are areas already occupied by dense forests. Wildfire risk can increase when new developments are built in close proximity to large and dense stands of forest. WUI risk is not limited to new developments in large natural areas. Occasionally, forest and brushlands can grow up over time and engulf previously developed areas. Regardless of how the risk arises, the WUI creates an environment in which fire can move readily between structural and vegetative fuels. Expansion of the WUI over time has increased the likelihood that wildfires will threaten structures and people.

To determine future vulnerability to WUI fire in Chesapeake, a forest analysis was conducted using GIS. The first step was to determine the general size categories of forested areas within the City. The data supplied by the VDOF gave three distinct data breaks for categories: small (7 to 50 acres); medium (50.01 to 300 acres); and large (greater than 300 acres). Buffers from each forested area category were then mapped based on the premise that smaller forests produce smaller amounts of radiant heat and embers to spread fire in the WUI. Buffer distances were derived based on recommendations from VDOF and Silvis Laboratories at the University of Wisconsin: ¼ mile for smaller forests; ¾ mile for medium forests; and one mile for larger forests.

Figure 5.7 depicts the individual residential units within the forest buffer areas. Overall, the City of Chesapeake has 67,811 residential units within WUI buffer zones comprising 85.26% of the total residential units in the City. **Table 5.10** summarizes the data in a more detailed table format. Over 40% of Chesapeake's residential housing units are within at least one mile of forested areas larger than 300 acres.

FIGURE 5.7: RESIDENTIAL UNITS VULNERABLE TO WILDFIRE

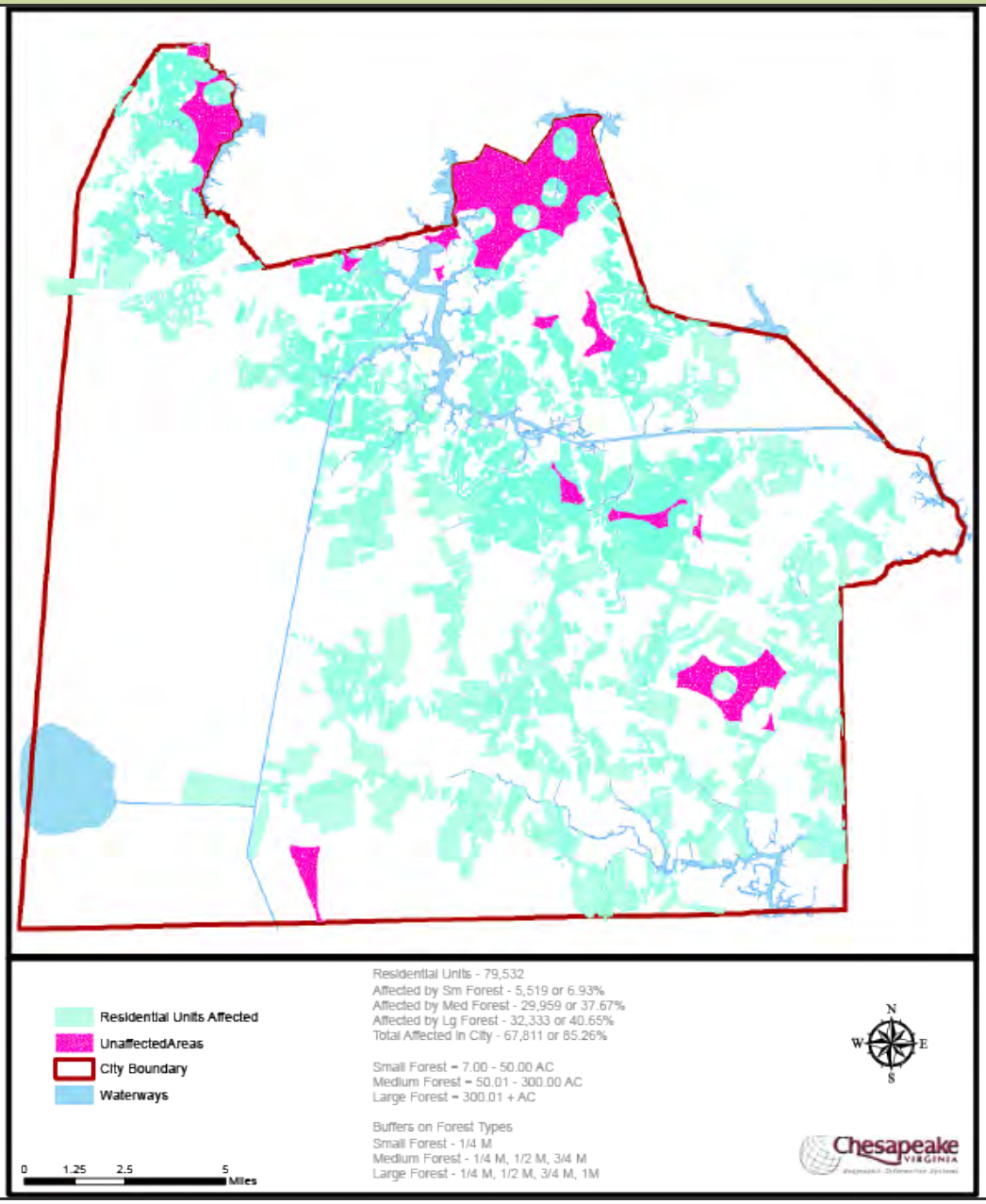
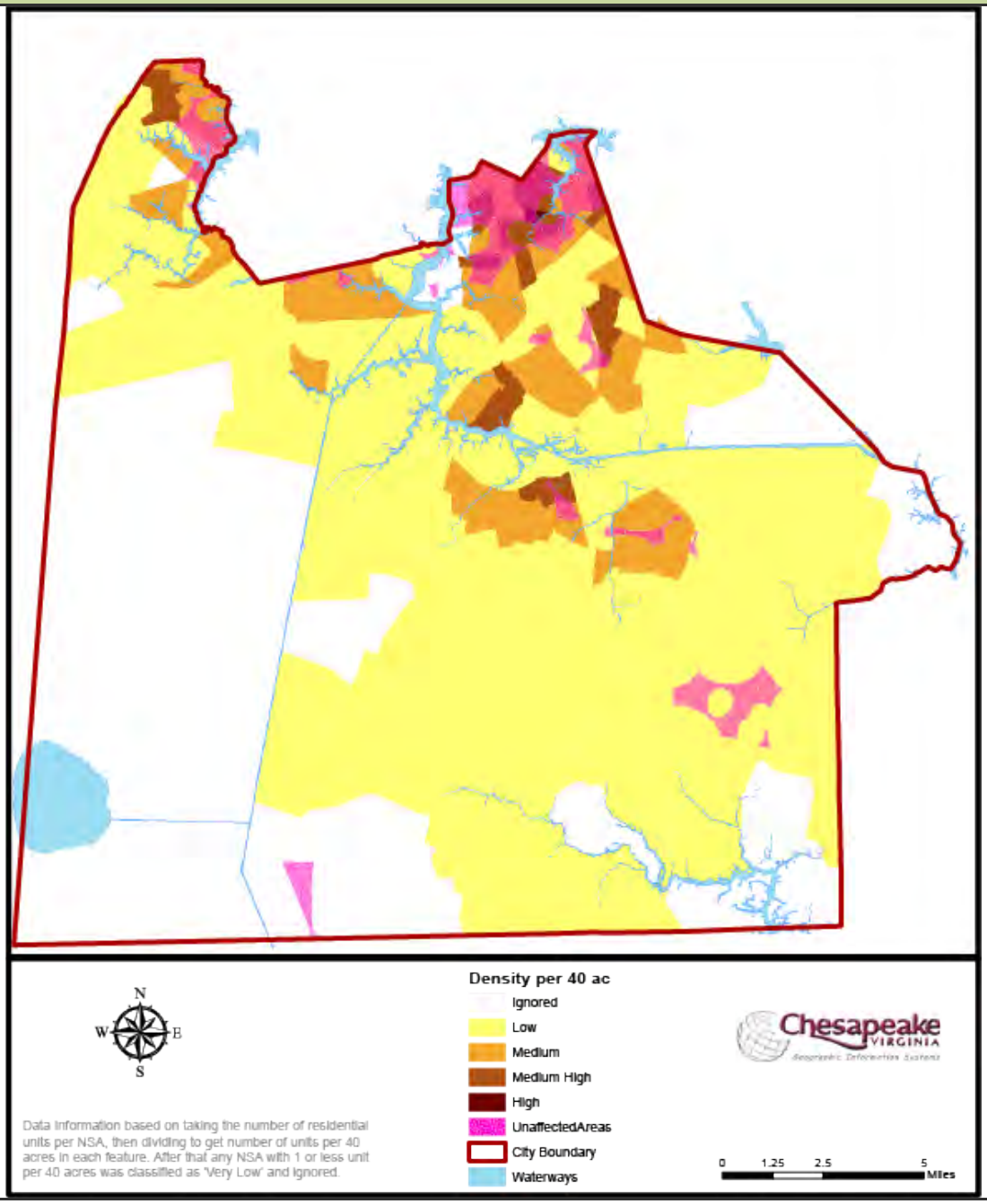


TABLE 5.10: RESIDENTIAL UNITS VULNERABLE TO WILDFIRE

FOREST SIZE	RESIDENTIAL UNITS AFFECTED	RESIDENTIAL UNITS AFFECTED (% OF TOTAL UNITS)
Small	5,519	6.93
Medium	29,959	37.67
Large	32,333	40.65
Total	67,811	85.26

The locations of densely populated housing developments in close proximity to the WUI provide an improved wildland fire risk assessment. Residential unit density per 40 acres was examined in the WUI buffer zone areas. **Figure 5.8** depicts the low, medium, and high risk areas relative to unit density and WUI. The map reveals that areas of Western Branch, South Norfolk, Greenbrier and Great Bridge have high WUI fire risk relative to housing density. As recently as the 1970s, many of these areas were beyond the line of suburban development. The area south of Deep Creek and South Norfolk was forest or farmland with very sparsely distributed residential units. In the 1980s, large swaths of the forests were cleared to allow more dense residential units. However, not all of the large forest stands were cleared, leaving some of these areas at risk for wildfire.

FIGURE 5.8: RESIDENTIAL UNIT DENSITY PER 40 ACRES IN THE WILDLAND URBAN INTERFACE



EXTREME HEAT

Annualized Loss Estimate: Negligible

ESTIMATE OF POTENTIAL LOSSES

Based on the previous historical occurrences, annualized losses to the built environment are considered to be negligible (less than $1,000). Loss of human life is a greater concern with extreme heat than is property damage.

FUTURE VULNERABILITY AND LAND USE

All future structures built in the City of Chesapeake will be exposed to extreme heat on a comparable level to existing structures; however, this hazard typically has little to no physical impact on the built environment in terms of substantial damage to structures, essential facilities, or infrastructure elements. Given the lesser nature of this hazard within the planning area, it is not expected that significant changes will be seen in the planning or construction of future building stock in response to this hazard.

MOSQUITO BORNE DISEASES

Annualized Loss Estimate: Negligible (Less than $1,000)

ESTIMATES OF POTENTIAL LOSSES

An outbreak of a Mosquito Borne Disease may burden local medical facilities in terms of capacity for treatment, and may burden the City's Mosquito Control Commission with mosquito abatement and control responsibilities, but would not be expected to impact the built environment or community infrastructure in any way.

SOCIAL VULNERABILITY

Eastern Equine Encephalitis: Residents of and visitors to areas with an established presence of the virus and people who engage in outdoor work and recreational activities are at increased risk of getting the diseases. Persons over age 50 and younger than age 15 seem to be at greatest risk for developing severe disease after outbreaks begin. (Virginia Department of Health, 2011)

West Nile Virus: Anyone can get WNV infection if bitten by an infected mosquito; however, even in areas where transmission of WNV is active, less than 1% of mosquitoes are likely to be infected. Additionally, less than one-percent of people bitten by an infected mosquito will become seriously ill. People who are over age 50 are at greater risk of severe illness. (Virginia Department of Health, 2011)

FUTURE VULNERABILITY AND LAND USE

Future land use is expected to have less impact on future vulnerability than the protection of public health through dissemination of proper individual protection measures and emergency notification with regard to mosquito borne disease outbreaks.

PANDEMIC FLU OR WIDESPREAD DISEASE OUTBREAK

Annualized Loss Estimate: Negligible (Less than $1,000)

ESTIMATES OF POTENTIAL LOSSES

An outbreak of widespread disease may burden local medical facilities in terms of capacity for treatment, may burden the City's Health Department and emergency responders with additional staff responsibilities, and may burden local funeral homes with higher demand for services, but would not be expected to damage the built environment or community infrastructure in any significant way.

SOCIAL VULNERABILITY

The Virginia Department of Health estimated the number of deaths that could possibly occur in Chesapeake if pandemic flu were to arrive in Virginia. These numbers are based on 2004 population data obtained from the Virginia Department of Health's Division of Health Statistics. Total deaths for Chesapeake were estimated to be 1,217 persons, or 0.57% of the 2004 population of 214,715 persons. That total is broken down into the estimated number of deaths that could occur in two waves due to pandemic flu during a 24-week period, and the mortality rates are based on historical data. A medium level pandemic could produce a projected 129 deaths over six months, with a peek one-week period producing 14 deaths. A worst case scenario is projected as 326 deaths over six months, with a peek one-week period producing 36 deaths. In the event of a future pandemic, there could be more or fewer waves than two, and it also could last longer or shorter than 24 weeks. Certain populations may be more vulnerable to specific flu strains, including the elderly, school-age children and pregnant women.

FUTURE VULNERABILITY AND LAND USE

Future land use is expected to have less impact on future vulnerability than the protection of public health through dissemination of proper individual protection measures and emergency notification with regard to flu or disease outbreak. Chesapeake's Pandemic Influenza Task Force has implemented several initiatives in this regard as outlined in Section 6 of this plan.

CONCLUSIONS ON HAZARD RISK

The vulnerability assessment performed for the City of Chesapeake provides significant findings that allow NEMAC to prioritize hazard risks and proposed hazard mitigation strategies and actions. Prior to assigning conclusive risk levels for each hazard, NEMAC reviewed the results of quantitative and qualitative assessments shown in the following tables.

Table 5.11 summarizes the degree of risk assigned to each category for all identified hazards in the City based on the application of the voting tool fully introduced in "Methodologies Used." Assigned risk levels were based on historical and anecdotal data, as well as input from NEMAC.

TABLE 5.11: SUMMARY OF QUALITATIVE ASSESSMENT

HAZARD	MITIGATION PRIORITY RANKING
Flooding	$5,000,000
Winter Storms and Nor'easters	$1,325,000
Hurricanes	$1,275,000
Sea Level Rise and Land Subsidence	$375,000
Tornadoes	$100,000
Mosquito Borne Diseases	$75,000
Pandemic Flu or Widespread Disease Outbreak	$75,000
Severe Thunderstorms	$25,000
Wildfires	$25,000
Extreme Heat	$0
Drought	$0

Source: NEMAC

Table 5.12 summarizes the annualized loss estimates that were generated for the applicable hazards based on the quantitative assessment and compares them with the rankings determined for each hazard based on the qualitative assessment. The results and comparisons of both assessments aided NEMAC in determining the final conclusions on overall hazard risk for the City.

TABLE 5.12: COMPARISON OF ANNUALIZED LOSS ESTIMATES			
QUANTITATIVE ASSESSMENT FINDINGS		QUALITATIVE ASSESSMENT RANKING	
HAZARD	ANNUALIZED LOSS ESTIMATES	HAZARD	RANK BASED ON RELATIVE SPENDING OF MITIGATION DOLLARS
Flooding	$22,384,775 to $29,145,600	Flooding	$5,000,000
Sea Level Rise and Land Subsidence	$30 million to $46 million (1 foot rise) $45 million to $87 million (3 foot rise)	Sea Level Rise and Land Subsidence	$375,000
Hurricanes	$11,438,000	Hurricanes	$1,275,000
Severe Thunderstorms	$6,588	Severe Thunderstorms	$25,000
Tornadoes	$78,326	Tornadoes	$100,000
Winter Storms and Nor'easters	$958,095	Winter Storms and Nor'easters	$1,325,000
Drought	Undetermined	Drought	$0
Wildfires	$15,628	Wildfires	$25,000
Extreme Heat	Negligible	Extreme Heat	$0
Mosquito Borne Diseases	Less than $1,000	Mosquito Borne Diseases	$75,000
Pandemic Flu or Widespread Disease Outbreak	Less than $1,000	Pandemic Flu or Widespread Disease Outbreak	$75,000

The conclusions drawn from the qualitative and quantitative assessments, combined with final determinations from NEMAC, were inserted into three categories for a final summary of hazard risk for the City based on High, Moderate or Low designations (**Table 5.13**). It should be noted that although some hazards are classified as posing Low risk, their occurrence is still possible.

TABLE 5.13: CONCLUSIONS ON HAZARD RISK FOR THE CITY OF CHESAPEAKE	
CRITICAL HAZARD - HIGH RISK	Flooding Hurricanes Winter Storms and Nor'easters
CRITICAL HAZARD - MODERATE RISK	Sea Level Rise and Land Subsidence Tornadoes Severe Thunderstorms
NONCRITICAL HAZARD - LOW RISK	Wildfires Drought Extreme Heat Mosquito Borne Diseases Pandemic Flu or Widespread Disease Outbreak

CAPABILITY ASSESSMENT

2014 UPDATE

Section 6 was updated to align the document with the *2011 Southside Hampton Roads Hazard Mitigation Plan*. The following major changes were incorporated:

1) All tables were updated to reflect new information;
2) Mitigation actions completed since 2008 were included as part of the "Previously Implemented Mitigation Measures" table; and,
3) A brief section detailing regional capabilities in conjunction with the Hampton Roads Planning District Commission, and state coastal zone management capabilities was added.

INTRODUCTION

This section of the Plan discusses the capability of Chesapeake with regard to hazard mitigation activities, and consists of the following four subsections:

- WHAT IS A CAPABILITY ASSESSMENT?
- CONDUCTING THE CAPABILITY ASSESSMENT
- CAPABILITY ASSESSMENT FINDINGS
- PREVIOUSLY IMPLEMENTED MITIGATION MEASURES

WHAT IS A CAPABILITY ASSESSMENT?

The purpose of conducting a capability assessment is to confirm that the community's resulting mitigation strategy is based on the principles found in (or missing from) existing authorities, policies, programs, and resources, and based on the community's ability to expand and improve these existing tools. This planning process strives to establish goals, objectives, and actions that are feasible, based on an understanding of the organizational capacity of the departments tasked with their implementation. A capability assessment helps to determine which mitigation actions are practical and likely to be implemented over time given a local government's planning and regulatory framework, level of administrative and technical support, level of fiscal resources, and current political climate.

Careful examination of local capabilities helps detect existing gaps, shortfalls, or weaknesses within ongoing government activities that could hinder proposed mitigation activities or exacerbate hazard vulnerability. A capability assessment highlights positive mitigation measures already in place or being implemented at the local and regional levels, which should continue to be supported and enhanced through future mitigation efforts.

CONDUCTING THE CAPABILITY ASSESSMENT

In order to inventory and analyze Chesapeake's capabilities, the planning subcommittee and consultant requested information on a variety of "capability indicators" such as existing local plans, policies, programs, or ordinances that may reduce, or in some circumstances, increase the community's hazard vulnerability. Other indicators included information related to Chesapeake's fiscal, administrative and technical capabilities such as access to local budgetary and personnel resources necessary to implement mitigation measures. Identified gaps, weaknesses, or conflicts can be recast as opportunities to implement specific mitigation actions.

For the 2014 update, NEMAC and the planning subcommittee were asked to review and provide feedback on: the 2008 capability assessment, and a slide presentation at the second meeting of NEMAC and planning subcommittee. The slide presentation included a summary of the 2008 capabilities, new mitigation actions, and other relevant regional and state capabilities. This section has been updated based on feedback from these reviews and discussions during the Committee meetings.

CAPABILITY ASSESSMENT FINDINGS

PLANNING AND REGULATORY CAPABILITY

Planning and regulatory capability is based on the implementation of plans, ordinances and programs that demonstrate a local jurisdiction's commitment to guiding and managing growth, including reconstruction following a disaster. Examples include emergency response, mitigation and recovery planning, comprehensive land use planning, transportation planning, and capital improvements planning. Additional examples include the enforcement of zoning or subdivision ordinances and building codes. These planning initiatives present significant opportunities to integrate hazard mitigation principles and practices into the local decision making process.

This assessment is designed to provide a general overview of the key planning and regulatory tools in place or under development in Chesapeake, along with their potential effect on hazard loss reduction. This information will help identify opportunities to address existing gaps, weaknesses or conflicts in the hazard mitigation strategy.

Table 6.1 provides a summary of the relevant local plans, ordinances, and programs already in place or under development. A checkmark (✓) indicates that the item is currently in place and being implemented, or that it is currently under development.

TABLE 6.1: RELEVANT PLANS, ORDINANCES, AND PROGRAMS

Hazard Mitigation Plan	Comprehensive Land Use Plan	Floodplain Management Plan	Open Space Management Plan	Stormwater Management Program	Emergency Operations Plan	SARA Title III Plan	Radiological Emergency Plan	Continuity of Operations Plan	Evacuation Plan	Disaster Recovery Plan	Capital Improvements Plan	Economic Development Program	Historic Preservation Plan	Flood Damage Prevention Ordinance	Zoning Ordinance	Subdivision Ordinance	Unified Development Ordinance	Post-disaster Redevelopment Ordinance	Building and Fire Code	NFIP	NFIP Community Rating System
✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓*

* Community Rating System application was submitted in November 2013.

Emergency Management

Hazard mitigation is one of four primary phases of emergency management. The three other phases include preparedness, response, and recovery. Each phase is interconnected with hazard mitigation as **Figure 6.1** suggests. Opportunities to reduce potential losses through mitigation practices are ideally implemented before a disaster strikes. Examples include the acquisition or elevation of flood-prone structures or the enforcement of regulatory policies that limit or prevent construction in known hazard areas. In reality, the post-disaster environment provides an important “window of opportunity” to implement hazard mitigation projects and policies. During this time period, federal disaster assistance, including the Hazard Mitigation Grant Program (HMGP), may be available. In addition, elected officials and disaster victims may be more willing to implement mitigation measures in order to avoid similar events in the future.

FIGURE 6.1: FOUR PHASES OF EMERGENCY MANAGEMENT

Source: Federal Emergency Management Agency

Planning for each phase is a critical part of a comprehensive emergency management program and key to the successful implementation of hazard mitigation actions.

Hazard Mitigation Plan: A hazard mitigation plan represents a community's blueprint for how it intends to reduce the impact of natural and human-caused hazards on people and the built environment. The essential elements of a hazard mitigation plan include a risk assessment, capability assessment and mitigation strategy.

- Chesapeake initially adopted a hazard mitigation plan in 2003. The Plan was updated in 2008 and again in 2014.

Disaster Recovery Plan: A disaster recovery plan guides the physical, social, environmental, and economic recovery and reconstruction process following a disaster. In many instances, hazard mitigation principles and practices are incorporated into local disaster recovery plans with the intent of capitalizing on opportunities to break the cycle of repetitive disaster losses. Disaster recovery plans can also lead to the preparation of disaster redevelopment policies and ordinances to be enacted following a hazard event.

- Chesapeake is a part of the first regional disaster recovery plan, the Regional Disaster Recovery Framework laid out by the Regional Catastrophic Planning Team.

Emergency Operations Plan: An emergency operations plan outlines responsibilities and the means by which resources are deployed during and following an emergency or disaster.

- Chesapeake has an Emergency Operations Plan in place that is updated every four years.

Continuity of Operations Plan: A continuity of operations plan establishes a clear chain of command, line of succession, and plans for backup or alternate emergency facilities in case of an extreme emergency or disaster.

- Chesapeake has a Continuity of Operations Plan.

Radiological Emergency Plan: A radiological emergency plan delineates roles and responsibilities for assigned personnel and the means to deploy resources in the event of a radiological accident.

- Chesapeake is covered by a Radiological Emergency Plan, as an element of the Emergency Operations Plan. The State plan for radiological emergencies is available online at: http://www.vaemergency.gov/webfm_send/522/COVEOP_2012_HSA_1_Radiological_Emergency_Respsonse.pdf.

SARA Title III Emergency Response Plan: A SARA Title III Emergency Response Plan outlines the procedures to be followed in the event of a chemical emergency such as the accidental release of toxic substances. These plans are required by federal law under Title III of the Superfund Amendments and Re-authorization Act (SARA), and the Emergency Planning and Community Right-to-Know Act (EPCRA).

- Chesapeake has a Local Emergency Planning Committee with a Strategic Plan and Goals in response to the requirements of SARA Title III.

General Planning

The implementation of hazard mitigation activities involves departments and individuals in a broad range of professions. Stakeholders may include local planners, public works officials, economic development specialists, and others. Concurrent local planning efforts can complement hazard mitigation goals even though they are not designed as such.

Comprehensive Land Use Plan: A comprehensive land use plan establishes the overall vision for what a community wants to be and serves as a guide to future governmental decision making. Typically, a comprehensive plan is comprised of demographic conditions, land use patterns, transportation elements and proposed community facilities. Given the broad nature of the plan and its regulatory standing in many communities, the integration of hazard mitigation measures into the comprehensive plan can serve as a far reaching, long-term risk reduction tool.

- Virginia law requires that all communities have a comprehensive land use plan and that it be updated every five years. Chesapeake is in the process of updating their Comprehensive Plan (*Moving Forward – Chesapeake 2035*). City Council scheduled a series of work sessions in December 2013 and January 2014 to review and consider Planning Commission's version of the 2035 Comprehensive Plan. The updated plan includes the Land Use Plan and Master Transportation Plan for the City. The Plan is consistent with good planning practices such as the promotion of economic development and vitality; promotion of infill and mixed-use development and the discouragement of sprawl; the continued inclusion of growth management strategies; the promotion of a harmonious development pattern that recognizes the City's agricultural, open space, and multi-focus area heritage; and the promotion of alternative transportation modes. The City's mitigation goals, as expressed in the 2008 Hazard Mitigation Plan, are incorporated into the 2035 Comprehensive Plan.

Capital Improvements Plan: A capital improvements plan guides the scheduling of spending on public improvements. A capital improvements plan can serve as an important mechanism to guide future development away from identified hazard areas. Limiting public investment in hazardous areas is one of the most effective long-term mitigation actions available to local governments.

- Chesapeake has a Capital Improvements Plan in place.

Historic Preservation Plan: A historic preservation plan is intended to preserve historic structures or districts within a community. An often overlooked aspect of the historic preservation plan is the assessment of buildings and sites located in areas subject to natural hazards to include the identification of the most effective way to reduce future damages. This may involve retrofitting or relocation techniques that account for the need to protect buildings that do not meet current building standards, or are within a historic district that cannot be easily relocated out of harm's way.

- Chesapeake has a Historic Preservation Plan in place (adopted by Council in 1996) and has nine Historic Districts.

Zoning Ordinances: Zoning represents the primary means by which land use is controlled by local governments. As part of a community's police power, zoning is used to protect the public health, safety and welfare. Since zoning regulations enable municipal governments to limit the type and density of development, it can serve as a powerful tool when applied in identified hazard areas.

- The City of Chesapeake's original Zoning Ordinance was adopted on September 27, 1969. It brought together the Zoning Ordinances of Norfolk County (adopted Oct 9, 1934) and the City of South Norfolk (adopted Jan 20, 1955). The City is currently operating under the 1993 revision of the original ordinance (date of adoption October 21, 1993). Zoning Administration enforces the regulations of the Zoning Code, provides information on zoning regulations, reviews documents and plans for compliance, and assists applicants with requests for land use reviews such as variances and rezonings.
- The Virginia General Assembly enacted the Chesapeake Bay Preservation Act in 1988, requiring local governments statewide to include water quality protection measures in their zoning and subdivision ordinances and in their comprehensive plans. Although the Act was developed with the intent of improving water quality throughout Virginia, the regulations have the additional benefit of controlling or restricting development in floodplain areas. The CBPA Overlay District consists of three components: Resource Protection Area (RPA) that includes a 100 foot RPA buffer, a Resource Management Area (RMA), and the Intensely Developed Areas (IDA). The lands that make up Chesapeake Bay Preservation Areas are those that have the potential to impact floodplains and water quality most directly. Generally, there are two main types of land features: those that protect and benefit water quality (RPAs); and those that, without proper management, have the potential to damage water quality (RMAs). Areas with intensive waterfront industrial land uses and activities are categorized as IDAs.

Subdivision Ordinances: A subdivision ordinance regulates development of housing, commercial, industrial or other uses, including associated public infrastructure, as land is subdivided into buildable lots. Subdivision design that accounts for natural hazards can dramatically reduce the exposure of future development.

- Chesapeake has a Subdivision Ordinance that is administered primarily by the Development and Permits Department. Each proposed subdivision plan is reviewed for conformity with the ordinance and with other relevant ordinances, regulations, and policies and Public Facilities Manual criteria applicable to the site.

Building Codes, Permitting and Inspections: Building codes regulate design and construction standards. Permits are issued and work is inspected on new construction and building alterations. Permitting and inspection processes both before and after a disaster can affect the level of hazard risk faced by a community.

- The Virginia Uniform Statewide Building Code (USBC) is administered by the Virginia Board of Housing and Community Development and regulates construction and maintenance of buildings and structures throughout the Commonwealth. The 2009 version of the International Building Code and International Fire Code were adopted by the Commonwealth of Virginia and are in effect in Chesapeake. The Department of Neighborhood Services, Code Compliance Division is principally responsible for enforcing Commonwealth and City codes for building residential and commercial structures, enforcing environmental codes and guidelines for maintaining existing structures.

The adoption and enforcement of building codes by local jurisdictions is routinely assessed through the Building Code Effectiveness Grading Schedule (BCEGS) program developed by the Insurance Services Office, Inc. (ISO). Under the BCEGS program, ISO assesses the building codes in effect in a particular community and how the community enforces its building codes, *with special emphasis on mitigation of losses from natural hazards*. The results of BCEGS assessments are routinely provided to ISO's member private insurance companies, which in turn may offer ratings credits for new buildings constructed in communities with strong BCEGS classifications.

In conducting the assessment, ISO collects information related to personnel qualifications and continuing education as well as the number of inspections performed per day. This type of information, combined with local building codes, is used to determine a grade for that jurisdiction. The grades range from 1 to 10, with the lower grade being more ideal. A BCEGS grade of 1 represents an exemplary commitment to building code enforcement, and a grade of 10 indicates less than a minimum level of recognized protection. Chesapeake received a rating of 4 in 2006.

Floodplain Management

The NFIP contains specific regulatory measures that enable government officials to determine where and how growth occurs relative to flood hazards. Participation in the NFIP is voluntary, but is promoted by FEMA as a crucial means to implement and sustain an effective hazard mitigation program.

In order to join the NFIP, a community must adopt flood damage prevention ordinance development standards in the floodplain. These standards require that all new buildings and substantial improvements to existing buildings be protected from damage by the 100-year flood, and that new floodplain development shall not aggravate existing flood problems or increase damage to other properties.

Another key service provided by the NFIP is the identification of flood hazard areas. FIRMs are used to assess flood hazard risk, regulate construction practices, and set flood insurance rates. FIRMs are an important source of information to educate residents, government officials, and the private sector about the likelihood of flooding in their community.

Table 6.2 summarizes NFIP participation for Chesapeake, along with general NFIP policy data.

TABLE 6.2: NFIP PARTICIPATION, CITY OF CHESAPEAKE

NFIP ENTRY DATE	CURRENT EFFECTIVE MAP	NUMBER OF POLICIES	INSURANCE IN FORCE	WRITTEN PREMIUM IN FORCE
February 2, 1977	May 2, 1999*	9,302	$2,475,301,700	$6,176,715

** Chesapeake received Preliminary Flood Insurance Rate Maps and was in the appeals period as of the date of this update. FEMA had not yet issued a Letter of Final Determination for the new study.*
Source: Federal Emergency Management Agency (as of October 31, 2013)

An additional indicator of floodplain management capability is participation in the Community Rating System (CRS). The CRS is an incentive program that encourages communities to undertake defined flood mitigation activities that go beyond the minimum requirements of the NFIP, adding extra local measures to provide protection from flooding. The creditable CRS mitigation activities are assigned a range of point values. As points are accumulated and identified thresholds are reached, communities can apply for an improved CRS class rating. Class ratings, which run from 10 to 1, are tied to flood insurance premium reductions as shown in **Table 6.3**. As class ratings improve (decrease), the percent reduction in flood insurance premiums for NFIP policy holders in that community increases.

TABLE 6.3: CRS PREMIUM DISCOUNTS, BY CLASS

CRS CLASS	PREMIUM REDUCTION
1	45 percent
2	40 percent
3	35 percent
4	30 percent
5	25 percent
6	20 percent
7	15 percent
8	10 percent
9	5 percent
10	0 percent

Source: Federal Emergency Management Agency

Community participation in the CRS is voluntary. Any community that is in full compliance with the rules and regulations of the NFIP may apply to FEMA for a CRS classification better than class 10.

- The City of Chesapeake submitted an application to participate in the CRS in the fall of 2013. A class rating had not been assigned as of the date of this updated plan.

Floodplain Management Plan: A floodplain management plan (or a flood mitigation plan) provides a framework for the identification and implementation of corrective and preventative measures specifically designed to reduce the impacts of floods.

- The City of Chesapeake does not have a separate floodplain management plan in place, but uses this hazard mitigation planning document to develop and enact flood mitigation activities.

Open Space Management Plan: An open space management plan is designed to preserve, protect and restore largely undeveloped lands, and to expand or connect areas in the public domain, including parks, greenways and other outdoor recreation areas. Open space management practices are consistent with the goals of reducing hazard losses, such as the preservation of wetlands or other flood-prone areas in their natural state.

- Through an ordinance dated February 25, 2003, Chesapeake City Council created the Open Space and Agriculture Preservation (OSAP) Program in response to the community's concern for the preservation of

the City's natural open spaces, rural character, and agricultural resources as an element of the City's overall growth management strategy. The program is a strictly voluntary, City-wide competitive program in which the City purchases development rights from willing landowners in exchange for a preservation easement on their property. The landowner receives fair market value for the development rights of the land, but still retains ownership as well as the ability to have a home on the land and to use the land for agricultural or open space purposes. In January 2007, the first easement was purchased under this program resulting in the permanent protection of 108 acres of prime agricultural land.

Stormwater Management Plan: A stormwater management plan is designed to address flooding associated with stormwater runoff. The stormwater management plan is typically focused on design and construction measures that are intended to reduce the impact of frequent urban nuisance flooding.

- Chesapeake has a Stormwater Management Plan, ordinance and program in place, all administered by the Public Works Department and supported by the Stormwater Committee. Chesapeake's Stormwater Management Division of Public Works continually maintains over 2,500 miles of open ditch, nearly 1,000 miles of underground pipe and 36,936 drainage structures throughout the City's drainage system. The Engineering Division has a Public Facility manual and a Storm water Management Plan, which outlines storm water design criteria and policies, City standards, and technical specifications for infrastructure development. Revenues needed to support the program are provided through a Stormwater Utility fee. The City has a variety of programs in place to reduce water pollution. The City will continue and enhance successful existing programs, as well as identify additional, cost-effective opportunities to reduce pollution from stormwater runoff. Several pollution prevention actions the City will continue or may implement in response to a recently required EPA "pollution diet" include:
    - Street sweeping;
    - Shoreline restoration projects on City properties;
    - Removal of sediment through ditch cleaning, pipe cleaning, yard waste pickup, etc.;
    - Focus on water quality capital projects;
    - Look for opportunities to enhance or "retrofit" existing water quality structures;
    - Tree planting;
    - Nutrient Management or elimination of fertilizer for City properties;
    - Continuing and enhancing our stormwater education program; and
    - Support and partner with local environmental groups.

Administrative and Technical Capability

The ability of a local government to develop and implement mitigation projects, policies, and programs is directly tied to its ability to direct staff time and resources for that purpose. Administrative capability is evaluated by determining how mitigation-related activities are assigned to local departments and if there are adequate personnel resources to complete these activities. The degree of intergovernmental coordination among departments will also affect administrative capability associated with the implementation and success of proposed mitigation activities. Technical capability is evaluated by assessing the level of knowledge and technical expertise of local government employees, such as personnel skilled in using GIS to assess community hazard vulnerability.

Staff interviews were used to capture information on administrative and technical capability through the identification of available staff and personnel resources. **Table 6.4** provides a summary of the results. A checkmark (✓) indicates that local staff members are tasked with the services listed.

TABLE 6.4: RELEVANT STAFF / PERSONNEL RESOURCES, CITY OF CHESAPEAKE

Planners with knowledge of land development and land management practices	Engineers or professionals trained in construction practices related to buildings and/or infrastructure	Planners or engineers with an understanding of natural and/or human-caused hazards	Emergency manager	Floodplain manager	Land surveyors	Scientist familiar with the hazards of the community	Staff with education or expertise to assess the community's vulnerability to hazards	Personnel skilled in Geographic Information Systems and/or HAZUS	Resource development staff or grant writers
✓	✓	✓	✓	✓	✓			✓	✓

Fiscal Capability

The ability of a local government to take action is often closely associated with the amount of money available to implement policies and projects. This may take the form of grant funding or locally-based revenue and financing. The costs associated with mitigation policy and project implementation vary widely. In some cases, policies are tied to staff time or administrative costs associated with the creation and monitoring of a given program. In other cases, direct expenses are linked to an actual project such as the acquisition of flood-prone homes, which can require a substantial commitment from local, state and federal funding sources.

Staff interviews were used to capture information on fiscal capability through the identification of locally available financial resources. **Table 6.5** provides a summary of the results. A checkmark (✓) indicates that the listed fiscal resource is locally available for hazard mitigation purposes (including match funds for state and federal mitigation grant funds).

TABLE 6.5: FISCAL CAPABILITY, CITY OF CHESAPEAKE

Capital Improvement Programming	Community Development Block Grants	Special Purpose Taxes	Gas / Electric Utility Fees	Water / Sewer Fees	Stormwater Utility Fees	Development Impact Fees	General Obligation Bonds	Partnering Arrangements or Intergovernmental Agreements
✓	✓			✓	✓	✓	✓	✓

The Public Utilities Department has water and sanitary sewer fees and usage rates. These fees and rates are set by City Code. The Public Utilities Department is a self-sustaining enterprise fund providing water and sanitary sewer utilities for Chesapeake. There are no development impact fees in Virginia, but Chesapeake uses "proffers and stipulations", which are voluntary development fees earmarked for schools, libraries, parks, or other City services. The amount is usually agreed upon at the site development planning stage.

Political Capability

One of the most difficult capabilities to evaluate involves the political will of a jurisdiction to enact meaningful policies and projects designed to reduce the impact of hazards. The adoption of hazard mitigation measures may be seen as an impediment to growth and economic development, which may adversely impact other hazard-related initiatives. Mitigation may not generate the same level of interest among local officials when compared with competing priorities.

The City Council is Chesapeake's legislative body, setting policy, approving budgets, and setting tax rates. Members also hire the City Manager, who is responsible for the day-to-day administration of the City, and serves as the Council's chief advisor. The City Manager prepares a recommended budget, recruits and hires most of the government's staff, and carries out the council's policies. While the City Manager may recommend policy decisions, he or she is ultimately bound by the actions of the Council. The Council appoints three additional staff members — the City Attorney, City Clerk, and City's Real Estate Assessor.

Council-appointed members of NEMAC have succeeded in recent years in advocating for special mitigation measures identified through this hazard mitigation planning process. A primary example was the adoption of recent amendments to the City's floodplain ordinance that added 1½ feet of freeboard to the base flood elevation and prohibiting new construction of critical infrastructure in the special flood hazard area. The ordinance further exceeds NFIP minimum requirements by disallowing the default 24-inch elevation requirement for some manufactured homes, and by requiring base flood elevation data for all proposed subdivisions and development, including manufactured homes parks and subdivisions, regardless of size or number of lots. The duties of the Floodplain Administrator include post-disaster actions such as issuing press releases, making public services announcements, and assisting property owners with documentation necessary to file claims for Increase Cost of Compliance through the NFIP.

Self-Assessment of Capabilities

In addition to the inventory and analysis of specific local capabilities, communities should self-assess their capability to implement hazard mitigation activities. Officials were encouraged to consider the barriers to implementing proposed mitigation strategies in addition to the mechanisms that could enhance or further such strategies. NEMAC classified each of the capabilities as either "limited," "moderate" or "high."

Table 6.6 summarizes the results of the self-assessment process. An "**L**" indicates limited capability; an "**M**" indicates moderate capability; and an "**H**" indicates high capability.

TABLE 6.6: SELF ASSESSMENT OF LOCAL CAPABILITY, CITY OF CHESAPEAKE

Planning and Regulatory Capability	Administrative and Technical Capability	Fiscal Capability	Political Capability	Overall Capability
H	H	M	M	H

PREVIOUSLY IMPLEMENTED MITIGATION MEASURES

The success of future mitigation efforts in a community can be gauged to some extent by its past efforts. Previously implemented mitigation measures indicate that there is, or has been, a desire to reduce the effects of natural hazards, and the success of these projects can be influential in building local government support for new mitigation efforts. Additional capability toward realizing mitigation goals is built through the integration of mitigation strategies into other local planning and administrative tasks. **Table 6.7** lists some of the recent mitigation measures undertaken by Chesapeake and describes how the City integrated their mitigation strategy into other planning mechanisms.

TABLE 6.7: MITIGATION MEASURES IN PLACE	
MITIGATION ACTIVITIES COMPLETED	**INTEGRATION OF MITIGATION GOALS**
• Established NEMAC in 2004. • Used HMGP funds in 2000 to install 138 watertight manhole inserts under the lids of sanitary sewer manholes for pump stations in several flood prone areas to prevent discharge of untreated sewage into public storm sewers during floods. Used City funds to install additional 1,735 inserts in 2003. Changed Public Facilities Manual to require stainless steel watertight manhole inserts in all new sanitary sewer manholes. • Appointed a Stormwater Committee to make recommendations for stormwater drainage/flooding issues. Implemented over $2 million in projects, including infrastructure improvements, embankment repairs, cleaning and maintenance of existing ditches, as well as stormwater runoff areas. Improvements significantly reduced frequency and severity of flooding throughout the City since 2000, and projects continue to be implemented as funding resources become available. Also used CDBG funds to provide stormwater improvements in Portlock and Money Point. • FEMA Project Impact community (program ended in 2003, but community integrated many of the philosophies). Constructed Hurricane House with Tidewater Builders Association. • In 2004, installed generator quick connects in the City's sanitary sewer pump stations. • Used HMGP funds to develop educational brochures on mitigation for citizens and one targeted to City employees. • Since Isabel, implemented numerous HMGP-funded projects to protect flood-prone properties through elevation above the base flood elevation. • Distributed free NOAA weather radios to residents most vulnerable to wind events. • Completed a study to evaluate moving Fire Station #8 (Deep Creek) out of the 100-year floodplain. Study completed, but grant to move facility not awarded. • Elevated the fuel tank fill valve on the emergency generator at the Harden City Jail. • Evaluated the designated Floodplain Administrator's roles and responsibilities and codified findings. • Submitted an initial application to the NFIP's CRS. Staff completed program training at FEMA's Emergency Management Institute, prepared repetitive loss planning materials, and submitted the initial application materials in November 2013. Additional annual follow-up is required to maintain class ranking in the program. • Added Mitigation Planner position in the Office of Emergency Management as a full-time, non-grant position. • In partnership with FEMA, City conducted a Flood Map Open House October 20, 2013, to share the City's new flood maps and provide citizens with information on flood hazards, flood insurance, flood mitigation programs, and Biggert-Waters 2012 impacts.	• Mitigation goals were integrated into the updated Comprehensive Plan. City planners served on both the NEMAC natural hazard mitigation planning subcommittee and the team to update the Comprehensive Plan. The City used a series of "open house" meetings to garner community support for the Comprehensive Plan. • NEMAC successfully presented the need for strengthening flood-prone building regulations through changes to floodplain management ordinance. The most significant changes included a requirement for 1½ feet of freeboard for new and substantially improved structures, and restrictions on new critical facilities in the special flood hazard area.

Regional Capabilities

The communities of Southside Hampton Roads are part of the Hampton Roads Planning District Commission (HRPDC), one of 21 Planning District Commissions in the Commonwealth of Virginia. The HRPDC is a regional organization representing the area's sixteen local governments. Planning District Commissions are voluntary associations and were created in 1969 pursuant to the Virginia Area

Development Act and a regionally executed Charter Agreement. The HRPDC was formed in 1990 by the merger of the Southeastern Virginia Planning District Commission and the Peninsula Planning District Commission.

The purpose of planning district commissions, as set out in the Code of Virginia, Section 15.2-4207, is "…to encourage and facilitate local government cooperation and state-local cooperation in addressing on a regional basis problems of greater than local significance." The HRPDC mission is to:

- Serve as a forum for local and elected officials and chief administrators to deliberate and decide issues of regional importance;
- Provide the local governments and citizens of Hampton Roads credible and timely planning, research and analysis on matters of mutual concern; and
- Provide leadership and offer strategies and support services to other public and private, local and regional agencies, in their efforts to improve the region's quality of life.

The HRPDC serves as a resource of technical expertise to its member local governments. It provides assistance on local and regional issues pertaining to Economics, Physical and Environmental Planning, Emergency Management, and Transportation. For example, the commission staff is currently working on cataloging GIS data for the region and improving compatibility of the data on a regional basis.

Additional regional capabilities exist with regard to the management of coastal zone resources in the Commonwealth. A permit must be obtained from the Virginia Marine Resources Commission (VMRC) to build, dump or otherwise trespass upon or over, encroach upon, take or use any material from the beds of the bays, ocean, rivers, streams or creeks within the jurisdiction of Virginia. The permitting process is designed to reduce the unnecessary filling of submerged land, to minimize obstructions or hazards to navigation and to avoid conflicts with other uses of state-owned submerged lands or state waters.

In addition, the VMRC is responsible for managing and regulating the use of Virginia's tidal wetlands in conjunction with Virginia's local wetlands boards. Under Virginia law, tidal wetlands include both vegetated and non-vegetated intertidal areas. Vegetated wetlands include all the land lying between and contiguous to mean low water and an elevation above mean low water equal to a factor 1.5 times the mean tidal range at the site and upon which is growing at least one of the botanical species specified in the Virginia Wetlands Act. Non-vegetated wetlands include all the land lying contiguous to mean low water and between mean low water and mean high water at the site.

Technical assistance and advice on dredging and filling operations that involve subaqueous bottoms and wetlands, all aspects of the marine environment, marine science and marine affairs is available from the Virginia Institute of Marine Science. The institute provides technical assistance, often at no cost, to businesses whose development plans have impacts on marine resources.

The Virginia Coastal Zone Management Program (CZM Program) was established in 1986 to protect and manage Virginia's "coastal zone." The CZM Program is part of a national coastal zone management program, a voluntary partnership between the National Oceanic and Atmospheric Administration, National Ocean Service Office of Ocean and Coastal Resource Management, and U.S. coastal states and territories authorized by the federal Coastal Zone Management Act. The Virginia program was established through an Executive Order, which is renewed by each new governor. The program is not a single centralized agency or entity, but a network of state agencies and local governments, including Chesapeake, which administer the following enforceable laws, regulations and policies that protect our coastal resources:

•Tidal and Nontidal Wetlands;
•Fisheries;
•Subaqueous Lands;

•Dunes and Beaches;
•Point Source Air Pollution;
•Point Source Water Pollution;
•Nonpoint Source Water Pollution;
•Shoreline Sanitation; and
•Coastal Lands.

The geographic areas of particular concern for the CZM Program include:
•spawning/nursery/feeding grounds;
•coastal primary sand dunes;
•barrier islands;
•significant wildlife habitat areas;
•significant public recreation areas;
•significant sand and gravel resource deposits;
•underwater historic resources;
•highly erodible/high hazard areas; and
•waterfront development areas.

Currently, some of the projects that the CZM Program is pursuing that have applications with regard to hazard capabilities include: adapting to climate change, special area management planning, coastal land conservation, shoreline management, and public access.

MITIGATION STRATEGY

2014 UPDATE

Section 7 was updated to align the document with the *2011 Southside Hampton Roads Hazard Mitigation Plan*. The following major changes were incorporated:

1) All tables were added or updated to reflect new information, including the new goals and objectives; and,
2) Mitigation actions were reconfigured into the new format, completed actions were deleted; and, new mitigation actions were revised and added as directed by NEMAC.

INTRODUCTION

This section of the Plan provides the "blueprint" for the City of Chesapeake to become less vulnerable to natural hazards. It is based on the general consensus of NEMAC along with the findings and conclusions of the *Capability Assessment* and *Risk Assessment*. The *Mitigation Strategy* section consists of the following four subsections:

- MITIGATION GOALS
- IDENTIFICATION AND ANALYSIS OF MITIGATION TECHNIQUES
- SELECTION OF MITIGATION TECHNIQUES
- MITIGATION ACTION PLAN

The intent of the *Mitigation Strategy* is to provide participants with the goals that will serve as the guiding principles for future mitigation policy and project administration, along with a list of proposed actions available to meet those goals and reduce the impact of natural hazards. It is designed to be comprehensive and strategic in nature.

The development of the strategy included a thorough review of all natural hazards and identified policies and projects intended to not only reduce the future impacts of hazards, but also to assist the City in achieving compatible economic, environmental, and social goals. The development of this section is also intended to be strategic, in that all policies and projects are linked to established priorities assigned to specific departments responsible for their implementation and assigned target completion deadlines. 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, action-oriented tasks listed in the *Mitigation Action Plan*. These actions include both hazard mitigation policies (such as the regulation of land in known hazard areas), and hazard mitigation projects that seek to address specifically targeted at-risk properties (such as the acquisition and relocation of flood-prone structures). Additional mitigation measures are then considered over time as new mitigation opportunities are identified, new data become available, technology improves, and mitigation funding becomes available.

The last step in designing the *Mitigation Strategy* is the creation of a jurisdictionally specific *Mitigation Action Plans* (MAPs). The MAPs represent the key outcome of the mitigation planning process. MAPs include a prioritized list of proposed hazard mitigation actions (policies and projects), including accompanying information such as those agencies or individuals assigned responsibility for their

implementation, potential funding sources, and an estimated target date for completion. The MAPs provide those individuals or agencies responsible for implementing mitigation actions with a clear roadmap that also serves as an important tool for monitoring progress over time. The collection of actions listed in the MAP also serves as a synopsis of activities for local decision makers.

In preparing the *Mitigation Action Plans*, Chesapeake officials considered their overall hazard risk and capability to mitigate natural hazards, in addition to the mitigation goals. Prioritizing mitigation actions was based on the following five factors: (1) effect on overall risk to life and property; (2) ease of implementation; (3) political and community support; (4) a general economic cost/benefit review; and (5) funding availability.

MITIGATION GOALS

The goals of the Chesapeake Hazard Mitigation Plan were crafted as part of a facilitated discussion and brainstorming session with NEMAC (see Section 2: *Planning Process*). Each of the following goal statements represent a broad target to achieve through implementation of specific Mitigation Action Plans. As part of the 2014 update, NEMAC reassessed each goal word for word, reprioritized the list, and edited overall for brevity. The original (2008) and updated (2014) goals are provided in **Table 7.1** below, with notes about the discussion leading to the changes. NEMAC also reviewed and considered the regional mitigation goals expressed in the *2011 Southside Hampton Roads, Virginia Hazard Mitigation Plan.*

TABLE 7.1: UPDATED GOALS AND OBJECTIVES

2008 GOALS	2014 GOALS AND OBJECTIVES
Overall Goal: To develop and maintain a disaster resistant community that is less vulnerable to the economic and physical devastation associated with natural hazard events.	**Goal 1:** To increase community resiliency by reducing vulnerability to the economic and physical impacts associated with natural hazard events. **Why the Change?** Shift focus to community resiliency rather than disaster resistance. "Devastation" removed because want to focus on all events, not just major devastation. Made this Goal 1 with other old goals as objectives.
Goal 1: Enhance the safety of residents and businesses by protecting new and existing development from the effects of hazards.	**Objective 1.1**: Enhance the safety of people and property by protecting new and existing development from the effects of hazards. **Why the Change?** "People and property" is more inclusive than "residents and businesses".
Goal 2: Protect new and existing public and private infrastructure and facilities from the effects of hazards.	**Objective 1.2**: Protect public and private utilities, infrastructure, facilities, and key resources. **Why the Change?** Needed to expand focus to specifically include utilities and other resources.
Goal 3: Increase the City's floodplain management activities and participation in the NFIP.	**Objective 1.3**: Broaden the City's floodplain management activities and strengthen participation in the NFIP. **Why the Change?** Tightened up the subject-verb agreement.

TABLE 7.1: UPDATED GOALS AND OBJECTIVES	
2008 GOALS	**2014 GOALS AND OBJECTIVES**
Goal 4: Ensure hazard awareness and risk reduction principles are institutionalized into the City's daily activities, processes, and functions by incorporating it into policy documents and initiatives.	**Objective 1.4**: Ensure hazard awareness and risk reduction principles are institutionalized into the City's daily activities, processes, and functions. **Why the Change?** The last phrase was redundant.
Goal 5: Enhance communitywide understanding and awareness of community hazards.	**Goal 2**: Enhance community-wide understanding and awareness of community hazards. **No Change**
Goal 6: Publicize mitigation activities to reduce the City's vulnerability to hazards.	**Objective 2.1:** Conduct public education programs that inform citizens regarding the nature and types of hazards and how to protect themselves and their property. **Why the Change?** Merely publicizing activities does little to reduce vulnerability. As revised, objective can include publicizing activities as an element in public education. New objective is more inclusive.
Mitigation Strategy: Reduce hazard impacts using methods that also achieve the preservation of natural areas, water quality, and open space.	**Goal 3**: Reduce hazard impacts using methods that also achieve the preservation of natural areas, water quality, and open space. **Why the Change?** In 2008 plan, this mitigation strategy was too broad to prompt action. As a goal, it can be applied to several mitigation strategies and helps align the goals of the mitigation plan with the City's Comprehensive Plan.

IDENTIFICATION AND ANALYSIS OF MITIGATION TECHNIQUES

44 CFR Requirement

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 Chesapeake's *Mitigation Strategy*, a wide range of activities was considered in order to help achieve the goals and address specific hazard concerns. At the third planning meeting, NEMAC and subcommittee members considered six broad categories of mitigation techniques. Committee discussions regarding each category are summarized beneath each category, including notes on the appropriateness and applicability of each specifically for the City of Chesapeake.

1. **Prevention**

Preventative activities are intended to reduce the impact of future hazard events, and are typically administered through government programs or regulatory actions that influence the way land is

developed and buildings are constructed. 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
- Shoreline/riverine setbacks

2014 Committee Discussion: Prevention activities have been implemented in the past in Chesapeake, are ongoing, and shall continue to be included in this and future mitigation action plans. The City's current capabilities with regard to open space preservation and floodplain regulations, as well as drainage system maintenance and stormwater management, mitigate several of the highest risk hazards and are consistent with the Comprehensive Plan goals and the goals of this plan. The committee decided to include a requirement for two staff members in the Department of Development and Permits to obtain Certified Floodplain Manager (CFM) certification through the Association of State Floodplain Managers in the Mitigation Action Plan, but decided not to act on any zoning changes such as setbacks or changes to the Zoning Code as those are not appropriate for the City.

2. Property Protection

Property protection measures involve the modification of existing buildings and structures or the removal of the structures from hazardous locations. Examples include:

- Acquisition
- Relocation
- Building elevation
- Critical facilities protection
- Retrofitting (i.e., windproofing, floodproofing, seismic design)
- Safe rooms, shutters, shatter-resistant glass
- Insurance

2014 Committee Discussion: Property protection measures have been implemented in the past in Chesapeake and in the Commonwealth of Virginia, shall be ongoing primarily through HMGP projects, and shall continue to be included in this and future mitigation action plans. Building elevation projects, critical facilities protection, and floodproofing/retrofitting are popular alternatives with NEMAC and the City's emergency managers, and the committee continually seeks ways to increase insurance coverage for vulnerable property owners. The Community Rating System application and related activities shall encompass and highlight several property protection measures ongoing in the City. The committee decided to continue acquisition, relocation, and elevations measures for repetitively flooded properties, including critical facilities retrofits, in the Mitigation Action Plan, but did not act on any actions specifically for safe rooms or shatter-resistance glass as tornadoes are not a high risk critical hazard.

3. Natural Resource Protection

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

- Land acquisition
- Floodplain protection
- Watershed management
- Beach and dune preservation

- Riparian buffers
- Forest and vegetation management (i.e., fire resistant landscaping, fuel breaks)
- Erosion and sediment control
- Wetland preservation and restoration
- Habitat preservation
- Slope stabilization
- Historic properties and archaeological site preservation

2014 Committee Discussion: As indicated in the revised Goal #3 regarding the use of "mitigation methods that also achieve the preservation of natural areas, water quality, and open space," Natural Resource Protection measures remain commonly-used both in Chesapeake and throughout the coastal Virginia region. Many state programs discussed in Section 6, such as the Chesapeake Bay Act, are established Natural Resource Protection measures that are not expected to be weakened in the near- or long-term. The most important of these measures in relation to Chesapeake's critical hazards are floodplain protection, erosion and sediment control, wetland preservation, and watershed management. Beach and dune preservation is not needed in Chesapeake as there are no beaches or dunes. The committee decided to continue floodplain protection measures along the Dismal Swamp in the Mitigation Action Plan, but did not act specifically on erosion and sediment control as those are considered to be sufficiently addressed through State regulations.

4. Structural Projects

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

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

2014 Committee Discussion: The low, flat topography of Chesapeake, the series of channels and ditches that provide drainage, and the tidal flood hazard preclude the use of some measures (e.g., dams, beach nourishment). Other structural protection measures are in place and must be maintained by the City or private owners. Channel modifications, diversions, and detention/retention have been effective in reducing flood hazards in some areas of the City and shall remain viable mitigation actions in the future, especially for reducing the effects of floods, nor'easters and sea level rise. Dry hydrants, seawalls, smoke testing of sanitary sewers, and the stormwater management preventive maintenance schedule were all discussed as potential structural projects. The committee decided not to implement new high-cost mitigation actions such as dams, levees or reservoirs in the Mitigation Action Plan.

5. Emergency Services

Although not typically considered a "mitigation" technique, emergency services can minimize the impacts of a hazard event on people and property. These actions are often taken prior to, during, or in response to an emergency or disaster. Examples include:

- Warning systems
- Evacuation planning and management
- Emergency response training and exercises
- Sandbagging for flood protection
- Installing temporary shutters for wind protection

2014 Committee Discussion: Traditional riverine warning systems are inappropriate for Chesapeake's flood hazard, but a system of citizen tidal gage monitoring provides limited input to

community emergency planners. They do not plan to expand this system. Evacuation planning is aided at the regional and state levels, but City planners use many tools to continually manage and improve the program. Bridge replacements at Deep Creek and Dominion Boulevard include bridge elevations, which were necessary as these roads are part of the evacuation routes for the region. The group discussed adding these as mitigation actions, but the replacements are already underway so the idea was dismissed. Likewise, sandbagging for flood protection is not feasible due to the large expanse of low-lying floodprone areas. Individual property owners may decide to sandbag for protection, but this is not an action NEMAC wants to include in the MAP, as structural protection methods are deemed preferable. Adding generator electrical circuits to support jail operations during power outages was discussed and included in the MAP. This activity is both an Emergency Services action and a Property Protection measure.

6. 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 used to educate and inform the public include:

- Outreach projects
- Speaker series/demonstration events
- Hazard mapping
- Real estate disclosure
- Library materials
- School children educational programs
- Hazard expositions
- Inter-governmental coordination

2014 Committee Discussion: Public education activities are a particular focus of NEMAC and the City's Office of Emergency Management. As the City geared up to gather CRS points and to receive new FEMA Flood Insurance Rate Maps, additional public education and awareness activities have been implemented. Although these activities are important, NEMAC does not consider each one appropriate for the mitigation action plan. Many will be captured under the umbrella mitigation action regarding development of a regional Plan for Public Information (PPI). Because that activity proposes a methodical and organized approach to public outreach as developed by a separate committee and possibly in conjunction with adjoining jurisdictions or the HRPDC, each individual proposed activity is not outlined in detail. Additional hazard mapping was discussed and not considered necessary at all for the City, and real estate disclosure is guided by State regulations and not influenced by local government. Library materials, school programs, open houses and coordination with other jurisdictions are included in the PPI umbrella action. NEMAC discussed train-the-trainer opportunities in conjunction with the City's Community Emergency Response Team (CERT) and the Tidewater Builders Association and decided to add this as an action. The CRS Coordinator indicated that all repetitive loss property owners will be invited to annual Open House forums on flood hazards, so this will also be added as a Public Awareness activity.

SELECTION OF MITIGATION TECHNIQUES

In order to determine the most appropriate mitigation techniques, NEMAC members and other community officials reviewed and considered the findings of the *Capability Assessment* and *Risk Assessment*. Other considerations included each mitigation action's effect on overall risk reduction, its ease of implementation, its degree of political and community support, its general cost-effectiveness and funding availability.

FEMA guidance for meeting the planning requirements of the Disaster Mitigation Act of 2000 also specifies that local governments should prioritize their mitigation actions based on the level of risk a hazard poses to the lives and property of a given jurisdiction. A Mitigation Technique Matrix (**Table 7.2**) shows that those hazards posing the greatest threat are addressed by the updated MAP.

The matrix provides the committee with the opportunity to cross-reference each of the priority hazards (as determined through the *Risk Assessment*) with the comprehensive range of available mitigation techniques, including prevention, property protection, natural resource protection, structural projects, emergency services, and public education and awareness. The *Mitigation Action Plan* includes an array of actions targeting multiple hazards, not just those classified as either high or moderate risk.

As part of the 2014 update, the Committee reviewed several documents to assist with the development of new mitigation actions and the assessment of existing actions. Review documents included: 1) an overview of the mitigation actions included in the 2013 *Commonwealth of Virginia Hazard Mitigation Plan*; 2) Chesapeake's Comprehensive Plan, specifically components that may be compatible with mitigation goals, or that may be appropriate as mitigation actions; 3) Floodplain Regulations and 4) the mitigation action items from the 2008 plan with 2014 status information.

TABLE 7.2: MITIGATION TECHNIQUE MATRIX

MITIGATION TECHNIQUE	HIGH RISK HAZARDS			MODERATE RISK HAZARDS			
	Flooding	Winter Storms and Nor'easters	Hurricanes	Sea Level Rise	Severe Thunderstorms	Tornadoes	Wildfires
PREVENTION	✓	✓	✓	✓	✓	✓	✓
PROPERTY PROTECTION	✓	✓	✓	✓	✓	✓	✓
NATURAL RESOURCE PROTECTION	✓						✓
STRUCTURAL PROJECTS	✓	✓	✓	✓	✓	✓	
EMERGENCY SERVICES	✓	✓	✓		✓	✓	✓
PUBLIC EDUCATION AND AWARENESS	✓	✓	✓	✓	✓	✓	✓

MITIGATION ACTION PLAN

The mitigation actions proposed for local adoption are listed in the MAP on the pages that follow. They shall be implemented according to the plan maintenance procedures established for the *City of Chesapeake Hazard Mitigation Plan* (see Section 8: Plan Maintenance Procedures). The action items have been designed to achieve the mitigation goals and priorities established by NEMAC.

Each proposed mitigation action has been identified as an effective measure to reduce hazard risk in Chesapeake. Each action is described with background information such as the specific location of the project and general cost benefit information.

Other information provided includes data on cost estimates and 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 City of Chesapeake Hazard Mitigation Plan remains a functional document that can be monitored for progress over time. Proposed actions are not listed in exact priority order though each has been assigned a priority level of “high,” “moderate” or “low” as described in the previous section.

Table 7.3 describes the key elements of the Mitigation Action Plan, and **Table 7.4** lists the additional considerations that were evaluated for each proposed action once selected for inclusion in the Mitigation Action Plan. This includes social, technical, administrative, political, legal, economic, and environmental considerations collectively known as “STAPLEE” evaluation criteria.

As part of the plan update process in 2014, NEMAC reviewed the list of recommended actions included in the existing (2008) plan to determine if the actions should be deleted because they are completed, deferred, cancelled, or continued, and made recommendations regarding modified and new actions. The results of this review are included in **Table 7.5**.

TABLE 7.3: KEY ELEMENTS OF THE MITIGATION ACTION PLAN	
Proposed Action	Identifies a specific action that, if accomplished, will reduce vulnerability and risk in the impact area. Actions may be in the form of local policies (i.e., regulatory or incentive-based measures), programs or structural mitigation projects and should be consistent with any pre-identified mitigation goals and objectives.
Site and Location	Provides details with regard to the physical location or geographic extent of the proposed action, such as the location of a specific structure to be mitigated, whether a program will be Citywide, countywide or regional, etc.
Cost Benefit	Provides a brief synopsis of how the proposed action will reduce damages for one or more hazards.
Hazard(s) Addressed	Lists the hazard(s) the proposed action is designed to mitigate for.
Goal(s) Addressed	Indicates the Plan's established mitigation goal(s) the proposed action is designed to help achieve.
Priority	Indicates whether the action is a "high" priority, "moderate" priority, or "low" priority based on the established prioritization criteria.
Estimated Cost	Indicates what the total cost will be to accomplish this action. This amount will be an estimate until actual final dollar amounts can be determined.
Potential Funding Sources	If applicable, indicates how the cost to complete the action will be funded. For example, funds may be provided from existing operating budgets or general funds, a previously established contingency fund, or a cost-sharing federal or state grant program.
Lead Agency/Department Responsible	Identifies the local agency, department or organization that is best suited to implement the proposed action.
Implementation Schedule	Indicates when the action will begin and when it is to be completed. Remember that some actions will require only a minimal amount of time, while others may require a long-term or continuous effort.

TABLE 7.4: ADDITIONAL CONSIDERATIONS (STAPLEE EVALUATION)	
Socially Acceptable	Is the proposed action socially acceptable to the community? Is the action compatible with present and future community values? Are there equity issues involved that would mean that one segment of the community is adversely affected?
Technically Feasible	Will the proposed action serve as a long term solution? Will it create any negative secondary impacts? Are there any foreseeable problems or technical constraints that could limit its effectiveness?
Administratively Possible	Does the community have the capability to implement the proposed action? Is there someone available to coordinate and sustain the effort?
Politically Acceptable	Is there political support to implement the proposed action? Is there enough public support to ensure the success of the action?
Legal	Is the community authorized to implement the proposed action? Is there a clear legal basis or precedent for the action? Are there any potential legal consequences of the action?
Economically Sound	What are the costs and benefits of the proposed action? Does the cost seem reasonable for the size of the problem and the estimated benefits? Are there funding sources available to help offset costs of the action? Is the action compatible with other economic goals of the community?
Environmentally Sound	How will the action impact the environment? Will the action require any environmental regulatory approvals? Is the action consistent with other environmental goals of the community?

TABLE 7.5: STATUS OF MITIGATION ACTIONS FROM THE 2008 MITIGATION ACTION PLAN		
2008 PLAN MITIGATION ACTIONS	**PROGRESS 2008- 2013**	**STATUS IN 2014 PLAN**
1. Conduct a study to evaluate moving Station 8 (Deep Creek) out of the floodplain.	Completed	Removed
2. Evaluate the Floodplain Manager's roles and responsibilities.	Completed	Removed
3. Provide single point of contact for NFIP and repetitive flood claims. Add Mitigation Grant Project Manager/Planner to Office of Emergency Management.	Completed	Removed
4. Submit an application to the NFIP's Community Rating System.	Completed	Removed
5. Distribute NOAA weather radios to residents that are most vulnerable to wind events.	Completed	Removed
6. Strengthen and enforce inspection and maintenance programs for private infrastructure.	Pending – No action taken	Removed. Representatives of private utilities indicate they have maintenance programs.
7. Hazard proof new community facilities to minimize damages.	Pending – No action taken	Removed. Committee determined this action is addressed in building code plan review and in the post-disaster plan.
8. Investigate manufactured homes, primary/secondary schools and critical facilities for wind and flood resistance. Note: this represents three combined actions from previous plan.	Pending – No action taken	Retained with modifications.
9. Target FEMA's repetitive loss properties for potential mitigation projects.	Ongoing	Retained with modifications.
10. Install dry hydrants at Indian Creek Rd and Centerville Tnpk, Rte 17 and Douglas Rd	Installation has been problematic.	Retained with modifications.
11. Develop recommendations for revenue sources for mitigation, planning and projects.	Ongoing	Retained with modifications.
12. Tie into existing State programs to reduce illegal dumping and related activities that negatively impact the environment.	Ongoing	Retained with modifications.
13. Reduce hazard impacts using methods that achieve preservation of natural areas, water quality and open space	Ongoing	Retained, but as a mitigation *goal* not an *action.*
14. Homeowner Tree Maintenance & Hazard Awareness Program (this action was part of another mitigation action, but has been separated out.)	Ongoing	Retained with modifications.
15. Harden City Jail building and generator against wind and flood events. (This action combines four separate actions in previous plan.)	Partially complete. Fill valve and vent for generator were elevated.	Retained with modifications.

TABLE 7.5: STATUS OF MITIGATION ACTIONS FROM THE 2008 MITIGATION ACTION PLAN, CONTINUED		
2008 PLAN MITIGATION ACTIONS	**PROGRESS 2008- 2013**	**STATUS IN 2014 PLAN**
16. Reduce flooding at Fire Station #2 and the surrounding community.	Ongoing – Phase I complete.	Retained with modifications.
17. Encourage installation of backup power for critical facilities and businesses.	Many critical facilities have been addressed or are specifically called out in separate actions.	Retained with modifications.
18. Evaluate overhead signs for wind resistance.	Ongoing – Damaged and destroyed signs are routinely replaced with more wind resistant materials.	Removed. Primary concern was VDOT signs, and City's actions in this regard are institutionalized, negating the need for a separate mitigation action.
19. Support Public Works initiatives to improve stormwater management infrastructure as part of Phase III improvements.	Ongoing	Retained.
20. Work with Public Works to ID locations and mitigation measures to protect flood-prone structures	Ongoing	Retained with modifications.
21. Target Repetitive flood loss properties for outreach and mitigation	Ongoing	Retained with modifications.
22. Increase education opportunities for NEMAC, staff, and public officials on floodplain management.	Ongoing	Retained with modifications.
23. Establish a program to publicize and celebrate the City's successes.	Ongoing	Retained with modifications.
24. Increase outreach and educational opportunities to residents, businesses, tourists and City officials about hazards.	Ongoing	Retained with modifications.
25. Continue HEAT outreach program to industrial facilities (particularly hazardous facilities) to discuss hazards and mitigation alternatives.	Ongoing	Retained.
26. Tidewater Buildings Association partnership, to include workshops for homeowners, post-disaster media efforts and Homeowner Tree Maintenance & Hazard Awareness Program.	Ongoing	Retained with modifications. Actions are individually identified under the PPI, and TBA is listed as potential stakeholder. Tree program separated out into new action.
27. Partner with TBA, Parent Teacher Associations, and HRPDC for hazard mitigation outreach and education (this action combines two actions in previous plan.)	Ongoing	Retained with modifications.
28. Work with Dept of Economic Development to develop materials for businesses on preparedness and mitigation.	Ongoing	Retained with modifications.
29. Coordinate with other hazard mitigation efforts of VDEM, DCR, & DEQ, and local governments.	Ongoing	Retained with modifications.

The following is a list of potential funding sources and their acronyms as may be indicated in the mitigation actions. Additional acronyms used throughout this plan are interpreted in Appendix F.

Key to Potential Funding Source acronyms:

DHS U.S. Department of Homeland Security
- **PDM –** Predisaster Mitigation Program
- **HMGP –** Hazard Mitigation Grant Program
- **FMA –** Flood Mitigation Assistance Program
- **RFC –** Repetitive Flood Claims Program

USACE U.S. Army Corps of Engineers
- **SFCP** – Small Flood Control Projects
- **FPMS** – Flood Plain Management Services Program

DOI U.S. Department of the Interior
- **LWCF –** Land and Water Conservation Fund Grants

EDA U.S. Economic Development Administration
- **DMTA –** Disaster Mitigation and Technical Assistance Grants

EPA U.S. Environmental Protection Agency
- **CWA –** Clean Water Act Section 319 Grants

HUD U.S. Department of Housing and Urban Development
- **CDBG –** Community Development Block Grant Program

USDA U.S. Department of Agriculture
- **EWP –** Emergency Watershed Protection
- **WPFP –** Watershed Protection and Flood Prevention
- **WSP –** Watershed Surveys and Planning

CITY OF CHESAPEAKE MITIGATION ACTION 1	
Participate in annual Hampton Roads Planning District Commission Mitigation Funding Workshop (if available).	
BACKGROUND INFORMATION	
Site and Location:	Citywide and regional
Cost Benefit:	HRPDC will provide no-cost assistance to the communities to help satisfy reporting requirements, make progress on mitigation actions, and apply for mitigation grant funding.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	All
Goal(s) Addressed:	Goals #1 and #2
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	Travel costs and staff time
Potential Funding Sources:	Existing budgets
Lead Agency/Department Responsible:	Emergency Management
Implementation Schedule:	Annually
ADDITIONAL COMMENTS	
Proposed workshop agenda: 1. HRPDC and VDEM to provide update on funds available, details on how to apply, and what projects are eligible; 2. HRPDC update on regional mitigation actions and progress; 3. Break into community-based work groups: a) provide report on status of each mitigation action (modified, complete, not started and why); b) implement one mitigation action that day at the workshop.	

CITY OF CHESAPEAKE MITIGATION ACTION 2	
Maintain participation in National Flood Insurance Program and Community Rating System. Continue enforcement of standards in existing ordinance that meet and exceed NFIP minimum requirements.	
BACKGROUND INFORMATION	
Site and Location:	Citywide
Cost Benefit:	The NFIP and related flood mapping and development regulations have proven benefits nationwide. Elevating new structures to 1.5 feet above the BFE has a benefit cost ratio of 6:1, according to FEMA (*2008 Supplement to the 2006 Evaluation of the National Flood Insurance Program's Building Standards)*. CRS benefits accrue through increased insurance coverage, improved hazard awareness and reduced flood insurance premiums. New construction and future development are protected from floods through existing standards that meet or exceed NFIP minimum requirements.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Sea Level Rise, Winter Storms and Nor'easters
Goal(s) Addressed:	Goal #1, Objectives 1.1, 1.2, 1.3
Priority (High, Moderate, Low):	High
Estimated Cost:	Travel costs and staff time
Potential Funding Sources:	Existing budgets
Lead Agency/Department Responsible:	Emergency Management
Implementation Schedule:	Annually
ADDITIONAL COMMENTS	
Additional activities that may be implemented in support of this primary action include: 1. Enacting floodplain management regulations that exceed NFIP minimum requirements, such as additional freeboard similar to Norfolk and Virginia Beach, and including freeboard for ductwork (ductwork currently exempted from freeboard requirement); and 2. Annual recertification activities related to maintaining class status in the CRS.	

CITY OF CHESAPEAKE MITIGATION ACTION 3	
Acquire, elevate, relocate, retrofit or floodproof structures in flood prone areas. Flood protection may include minor localized flood reduction projects, as well.	
BACKGROUND INFORMATION	
Site and Location:	Flood loss areas Citywide
Cost Benefit:	Retrofit measures that address flooded structures, particularly those designated as repetitive loss or severe repetitive loss by the NFIP, have quantifiable benefits. The City is proposing to collect elevation data as part of this action in order to more easily make cost-benefit analyses of these structures.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Sea Level Rise, Winter Storm and Nor'easters
Goal(s) Addressed:	Goal #1, Objective 1.1 and Goal #3
Priority (High, Moderate, Low):	High
Estimated Cost:	In multiple $750,000 phases as grant money becomes available.
Potential Funding Sources:	DHS: PDM, HMGP, FMA, RFC; USACE: SFCP, FPMS; HUD: CDBG; USDA: WPFP
Lead Agency/Department Responsible:	Emergency Management
Implementation Schedule:	Ongoing
ADDITIONAL COMMENTS	

There are 391 properties on FEMA's repetitive loss list, and an additional 2,024 structures identified as being within repetitive loss areas. Locally funded projects may be creditable under the Community Rating System.

Detailed activities to support this overall mitigation action include:

1. Coordinate with the City Surveyor in Public Works Department to complete Elevation Certificates for structures when doing other survey work in repetitive flood loss areas.
2. Use pictometry to further refine repetitive flood loss area identification and to collect approximate first floor elevation information for structures in those areas.
3. Use Public Works Department expertise to identify retrofit measures for flood-prone structures. This may be creditable under CRS.
4. Regularly crosscheck real estate market with repetitive flood loss list. Purchase of empty structures may be possible at lower cost.

CITY OF CHESAPEAKE MITIGATION ACTION 4	
Continue to cross reference locations of manufactured homes and manufactured home parks relative to repetitive flood loss areas and new FEMA 100-year floodplains. Review their vulnerability to flood and wind hazards. Implement measures to retrofit, relocate, or acquire vulnerable units.	
BACKGROUND INFORMATION	
Site and Location:	Flood-prone areas Citywide
Cost Benefit:	While the value of manufactured homes is quite low, the costs to elevate or retrofit them to protect from flood and wind can be low, as well. The costs to determine locations and review vulnerability are minimal versus the cost of additional hazard damage.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood, Sea Level Rise, Tornadoes, Severe Thunderstorms, Winter Storms and Nor'easters
Goal(s) Addressed:	Goal #1, Objective 1.1
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	Staff time for analysis; approx. $150,000 for retrofit measures such as elevation assistance and tie-downs
Potential Funding Sources:	DHS: PDM, HMGP, FMA, RFC; USACE: SFCP, FPMS; HUD: CDBG; USDA: EWP, WPFP, WSP
Lead Agency/Department Responsible:	Emergency Management, with support from GIS and Engineering Division
Implementation Schedule:	GIS analysis of vulnerable areas and identification of retrofit measures in 2014 and 2015; additional actions thereafter
ADDITIONAL COMMENTS	
Manufactured homes and their occupants are particularly vulnerable to wind and flood hazards. NEMAC recognizes that the cost of minor retrofits can have exponential benefits in reducing the risk to lives.	

CITY OF CHESAPEAKE MITIGATION ACTION 5	
Part I. Conduct detailed study of critical facilities relative to newly-identified repetitive flood loss areas and new FEMA 100-year floodplain elevations. Review detailed structural or facility vulnerability to flood and wind hazards using flood-frequency information and building elevation data. **Part II. Replace structures or implement retrofits, which may include but are not limited to: installation of emergency backup power, elevation of structure or components, relocation or retrofit of building components.**	
BACKGROUND INFORMATION	
Site and Location:	Critical facilities Citywide, but particularly City Jail, primary/secondary schools and Fire Station #2 and Fire Station #8
Cost Benefit:	Benefits of mitigating flood damage to critical facilities are realized by all citizens by maintaining operational capabilities post-disaster.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Sea Level Rise , Tornadoes, Severe Thunderstorms, Winter Storms and Nor'easters
Goal(s) Addressed:	Goal #1 and Objective 1.2
Priority (High, Moderate, Low):	High for Jail High for Fire Station #2 Medium for Schools Low for other Critical Facilities
Estimated Cost:	Jail – estimated $192,000 Fire Stations #2 and #8 – estimated $150,000 each Schools – to be determined after study complete
Potential Funding Sources:	DHS: PDM, HMGP, FMA, RFC; USACE
Lead Agency/Department Responsible:	Emergency Management, with GIS and Public Works Engineering Division
Implementation Schedule:	Immediately for Jail and Fire Station #2 and #8, through 2018 for others

ADDITIONAL COMMENTS
The highest priority retrofits previously identified are for the City Jail and include adding generator electrical circuits to support jail operations during power outages, especially for the kitchen, dining area and doors. Add generator electrical circuits to support the operation of the jail's kitchen, staff dining area, and sallyport roll-up doors. Only half of the jail's kitchen is supported by generator power. A generator load test was conducted and found sufficient to support additional circuits. Without additional emergency generator circuits, the jail cannot support the needs for properly cooling and cooking food products, feeding the inmate population, staff, and additional public safety personnel during emergency operations. The jail provides meals to public safety personnel on the street during emergencies, as well as to support staff called-in during emergencies. The sallyport doors are large, heavy overhead doors that are presently not supported by emergency generator power. Supplying power to these doors is important for providing ingress and egress to the jail for police and emergency personnel. Elevating the generator, installing additional emergency doors, and installing roof tie-downs are additional measures already under consideration. Ongoing drainage problems at Fire Station #2 result in frequent flooding of the back room. Only schools designated as shelters should be included in this effort.

CITY OF CHESAPEAKE MITIGATION ACTION 6	
Flow test and inspect existing City-owned and grant-funded dry hydrants annually to help maintain operability.	
BACKGROUND INFORMATION	
Site and Location:	Citywide
Cost Benefit:	Chesapeake has determined that maintaining the highest level of operability for the existing system is more feasible than installing new hydrants.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Wildfires
Goal(s) Addressed:	Goal #1 and Objective 1.2
Priority (High, Moderate, Low):	High
Estimated Cost:	Staff time
Potential Funding Sources:	Existing Budgets
Lead Agency/Department Responsible:	Fire Department
Implementation Schedule:	Ongoing
ADDITIONAL COMMENTS	
Installation of additional hydrants has proven challenging. This alternative presents a reasonable cost-effective method for maintaining capacity to fight wildfire. There are currently 56 dry hydrants in Chesapeake, mainly in the southern part of the City.	

CITY OF CHESAPEAKE MITIGATION ACTION 7	
Seek and use additional revenue sources and local matching funds for mitigation planning and projects.	
BACKGROUND INFORMATION	
Site and Location:	Citywide
Cost Benefit:	Local funding sources for mitigation projects can further the benefits of available federal funding. Untapped and unusual funding sources likewise reduce the burden of mitigation on Chesapeake citizens.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	All
Goal(s) Addressed:	Goal #1 and Objective 1.4
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	Staff time
Potential Funding Sources:	n/a
Lead Agency/Department Responsible:	Emergency Management
Implementation Schedule:	Ongoing
ADDITIONAL COMMENTS	
NEMAC submits recommendations annually to City Council regarding the status of current mitigation projects and this plan, programmatic problems, an inventory of new potential mitigation projects and unmet needs. City Council evaluates those needs against internal funding sources. NEMAC aggressively pursues and seeks public and private grants to support mitigation activities, and enlists a number of other stakeholders in this process. Related resources may address multiple objectives, such as environmental issues, preparedness, sustainability, and blight reduction. NEMAC is prepared to pursue special appropriations and grants that are available after a disaster.	

CITY OF CHESAPEAKE MITIGATION ACTION 8	
Develop and implement a Pre-Disaster Homeowner Tree Preventive Maintenance and Hazard Awareness Program.	
BACKGROUND INFORMATION	
Site and Location:	Citywide
Cost Benefit:	A low-cost effort can bring many benefits to individual property owners and significantly reduce response costs after a disaster. Benefits accrue to the City through reduced response needs, to homeowners through reduced damages, and through reduced vulnerability wildfire.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Tornadoes, Severe Thunderstorms, Winter Storms and Nor'easters, Wildfires
Goal(s) Addressed:	Goal #1, Objective 1.2, Goal #2, Objective 2.1, Goal #3
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	Approximately $7,500
Potential Funding Sources:	USDA, Soil and Water Conservation District, Va. Tech Agricultural Extension; DOI - LWCF
Lead Agency/Department Responsible:	Parks and Recreation Department, Emergency Management , Development and Permits
Implementation Schedule:	Within 4 years
ADDITIONAL COMMENTS	
This program expands on existing programs in the City that focus on the value of trees, particularly healthy old-growth trees, and how to properly care for trees to prevent them from causing additional damage during wind events. Chesapeake has been designated as a "Tree City USA" for over 27 years, protects trees in the Chesapeake Bay Preservation Area, and has a "What is a Tree?" program for schoolchildren in conjunction with the Agriculture Department. The Chesapeake Arboretum is active in tree resource management and will be approached about participating. A "Prune in June" campaign may be considered as a possible focus for this mitigation action. This action shall be done in coordination with the Plan for Public Information in Mitigation Action 15. This action is strongly supported by responses to the 2014 Public Participation Survey in **Appendix D** and by members of the public who participated in a public meeting January 16, 2014.	

CITY OF CHESAPEAKE MITIGATION ACTION 9	
Improve stormwater management infrastructure. Prepare and implement preventive maintenance schedule. Provide for replacement schedule for stormwater management and inspection equipment and vehicles, including purchases of plows for new trucks to assist with dual purpose of snow removal.	
BACKGROUND INFORMATION	
Site and Location:	Citywide
Cost Benefit:	Maintaining and improving the stormwater system provides Citywide benefits from both high and low frequency flood events. The preventive maintenance schedule is a new activity that will help sustain the highest level of operability for the existing system. Equipment replacement prevents downtime, purchases can be more cost effective than repair expenses on depreciated equipment, and new equipment provides for potential for use in other natural event responses (such as Winter Storms).
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Sea Level Rise, Severe Thunderstorms, Winter Storms and Nor'easters
Goal(s) Addressed:	Goal #1, Objectives 1.2 and 1.4
Priority (High, Moderate, Low):	High
Estimated Cost:	$1.8 million
Potential Funding Sources:	Approved and proposed budgets and stormwater utility fees
Lead Agency/Department Responsible:	Public Works
Implementation Schedule:	Ongoing
ADDITIONAL COMMENTS	
While NEMAC recognizes these activities are already ongoing, their importance to maintaining a functioning and effective stormwater system during flood events is critical to hazard management in Chesapeake.	

CITY OF CHESAPEAKE MITIGATION ACTION 10	
Part I. Maximize training and educational opportunities for NEMAC, City staff, elected officials, CERT members and citizen/neighborhood leaders regarding hazard mitigation, disaster preparedness and the relationship of mitigation to reduced recovery needs. **Part II. Accommodate training and related support for at least two staff in the Department of Development and Permits to receive and maintain Certified Floodplain Manager (CFM) certification through the ASFPM.**	
BACKGROUND INFORMATION	
Site and Location:	Citywide
Cost Benefit:	Many training opportunities are already available through FEMA, VDEM, and other agencies. Costs to provide or make arrangements for the training in Chesapeake are minimal versus the benefits of a well-informed citizenry and highly trained floodplain management staff.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	All
Goal(s) Addressed:	Goal #1, Objectives 1.3 and 1.4, Goal #2, Objective 2.1
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	Less than $12,000 over five years
Potential Funding Sources:	Existing budgets, staff time
Lead Agency/Department Responsible:	Emergency Management Department of Development and Permits
Implementation Schedule:	Ongoing as opportunities arise
ADDITIONAL COMMENTS	
A new aspect of this retained action is providing Train-the-Trainer opportunities for CERT and NEMAC members so that they become empowered to speak on a more grassroots level to neighbors, friends and businesses in their sphere of influence. Also planned is an annual briefing to NEMAC from the Department of Development and Permits regarding the status of the Statewide building code, and hazard prevention through the plan review process. This may include, for example, City-funded facilities that were reviewed, anticipated changes to the building code, or zoning changes that affect an area of the City that is prone to flooding or wildfire. This cross training will also better prepare NEMAC to update this plan in the future.	

CITY OF CHESAPEAKE MITIGATION ACTION 11	
Conduct Hazardous Environmental Action Team (HEAT) program to industrial facilities, particularly hazardous facilities, to discuss hazards and mitigation alternatives.	
BACKGROUND INFORMATION	
Site and Location:	Industrial facilities Citywide
Cost Benefit:	Reduces the likelihood of compounding incidents, thereby reducing response costs.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Hurricanes, Winter Storms and Nor'easters, Wildfire
Goal(s) Addressed:	Goal #1, Objectives 1.1, 1.2, Goal #2 and Objective 2.1
Priority (High, Moderate, Low):	Low
Estimated Cost:	$8,000
Potential Funding Sources:	Existing budgets
Lead Agency/Department Responsible:	Emergency Management
Implementation Schedule:	Within eight years of plan adoption
ADDITIONAL COMMENTS	

CITY OF CHESAPEAKE MITIGATION ACTION 12	
Support and maintain City's new Reverse-911 system. Prepare messages to release to citizens before and after a natural hazard event.	
BACKGROUND INFORMATION	
Site and Location:	Citywide
Cost Benefit:	Other methods of notifying citizens require massive amounts of staff time which exceeds budgetary restraints. Reverse 911 quickly and efficiently uses existing infrastructure to notify property owners of appropriate pre- and post-disaster mitigation actions.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	All
Goal(s) Addressed:	Goal #2
Priority (High, Moderate, Low):	High
Estimated Cost:	$7,500
Potential Funding Sources:	Existing budgets
Lead Agency/Department Responsible:	Emergency Management
Implementation Schedule:	Ongoing
ADDITIONAL COMMENTS	
While installation of the Reverse 911 system is already underway, an opportunity to use the system to urge property owners to take mitigative actions exists. Examine multi-language and special needs population capabilities, as well.	

CITY OF CHESAPEAKE MITIGATION ACTION 13	
Prevent sanitary sewer inflows to the system during flood events. Smoke test public and private sanitary sewer infrastructure to determine priorities.	
Site and Location:	Sewer infrastructure Citywide
Cost Benefit:	The consequences and costs of sanitary sewer inflows during a flood event are high for reasons related to human health and damage to infrastructure. Smoke tests are a low-cost alternative to televising all sanitary sewer lines and allow more detailed (and costly) methods to be used only where problems are identified during smoke tests.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Sea Level Rise, Nor'easters
Goal(s) Addressed:	Goal #1, Objective 1.2
Priority (High, Moderate, Low):	High
Estimated Cost:	$525,000, annually
Potential Funding Sources:	Existing capital budgets
Lead Agency/Department Responsible:	Public Utilities
Implementation Schedule:	Ongoing
ADDITIONAL COMMENTS	
10% of the system is checked annually	

CITY OF CHESAPEAKE MITIGATION ACTION 14	
Continue lease agreement and maintenance of facilities along the Dismal Swamp Canal Trail to accommodate recreational use of the floodplain.	
BACKGROUND INFORMATION	
Site and Location:	Along the Dismal Swamp Canal
Cost Benefit:	Recreational use of this vast floodplain area is the highest and best use, especially in light of projected sea level rise. Facilities to make this area accessible and enjoyed by so many residents of Hampton Roads and northeast North Carolina are low cost.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Sea Level Rise, Winter Storms and Nor'easters, Hurricanes, Wildfires
Goal(s) Addressed:	Goals #1 and #3
Priority (High, Moderate, Low):	High
Estimated Cost:	$400,000
Potential Funding Sources:	VDOT and others, as deemed appropriate
Lead Agency/Department Responsible:	Parks and Recreation
Implementation Schedule:	Two phases of construction of trail improvements are scheduled for completion in Spring 2014. Additional paved parking areas and a restroom are possible future additions to the recreational infrastructure.
ADDITIONAL COMMENTS	
The Dismal Swamp Canal Trail is a former section of Virginia State Route 17, now a multi-use trail open to bicycling, walking, running, horseback riding, and boating. The north trailhead is located at the intersection of Dominion Blvd. and Old Rt. 17 in Chesapeake, and runs south 8.5 miles, adjacent to the Dismal Swamp Canal. This multipurpose-linear nature trail threads through some of the most uniquely historical and ecologically-significant habitats in the United States. The Dismal Swamp Canal Trail is an historic, environmental and outdoor recreation delight open to walkers, hikers, boaters, bicyclists, and horse owners.	

CITY OF CHESAPEAKE MITIGATION ACTION 15	
Continue outreach efforts through a strategically-developed Plan for Public Information (PPI) using the following seven steps: **1. Create a PPI Committee** **2. Assess Chesapeake's public information needs** **3. Formulate messages** **4. Identify outreach projects to convey the messages** **5. Examine other public information initiatives** **6. Prepare the PPI document** **7. Implement, monitor and evaluate the program**	
BACKGROUND INFORMATION	
Site and Location:	Citywide
Cost Benefit:	Benefits derive from CRS credits and reduced flood insurance premiums as a result of this initiative. The organized nature of the approach reduces long-term costs by: 1) minimizing need to repeat messages; 2) involving outreach/marketing professionals from within City government; 3) investigating regional partnerships that could result in additional cost savings through cost sharing; 4) using existing programs and resources to maximum advantage.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	All, but primarily Flooding, Sea Level Rise, Hurricanes, Winter Storms and Nor'easters
Goal(s) Addressed:	Goal #2, Objective #2.1
Priority (High, Moderate, Low):	High
Estimated Cost:	Less than $7,500
Potential Funding Sources:	Existing budgets and staff time; DHS: PDM, HMGP
Lead Agency/Department Responsible:	Emergency Management (lead) Planning & Development Public Communications
Implementation Schedule:	2014 for Steps 1 and 2, 2016 for remainder

ADDITIONAL COMMENTS
Audiences include: property owners, tourists, businesses, City officials, pet owners, and schoolchildren. Stakeholders may include: Department of Economic Development, Department of Planning & Development, HRPDC, Tidewater Builders Association, Parent Teacher Associations, VDEM, DEQ, DCR, and American Red Cross. Potential outreach needs include: focus on repetitive loss property owners in outreach efforts, annual Flood Open House for flood-prone property owners, outreach to reduce illegal dumping using existing state programs, publicizing the City's mitigation efforts, informing property owners of long-term and short-term property protection measures (*e.g.,* protecting vinyl siding windows from wind damage), creating a dedicated web site/social media sites for NEMAC and for floodplain management permitting process, early preparation of post-disaster permitting and redevelopment materials such as press releases, videos, brochures, forms, and fees. Use questionnaires on social media to garner feedback.

PLAN MAINTENANCE PROCEDURES

2014 UPDATE

Section 8 was updated to align the document with the *2011 Southside Hampton Roads Hazard Mitigation Plan*.

INTRODUCTION

This section discusses how the *Mitigation Strategy* shall be implemented by the City and how the overall Hazard Mitigation Plan shall be evaluated and enhanced over time. This section also discusses how the public and participating stakeholders shall continue to be involved in the hazard mitigation planning process in the future. This section consists of the following three subsections:

- IMPLEMENTATION
- MONITORING, EVALUATION AND ENHANCEMENT
- CONTINUED PUBLIC INVOLVEMENT

IMPLEMENTATION

44 CFR Requirement

Part 201.6(c)(4)(i): The plan shall include a plan maintenance process that includes a section describing the method and schedule of monitoring, evaluating and updating the mitigation plan within a five-year cycle.

In addition to the assignment of a lead department or agency, an implementation time period has been established for each mitigation action in order to assess whether actions are being implemented in a timely fashion. Chesapeake shall seek outside funding sources to implement mitigation projects in both the pre-disaster and post-disaster environments. When applicable, potential funding sources have been identified for proposed actions listed in each *Mitigation Action Plan*.

44 CFR Requirement

Part 201.6(c)(4)(ii): The plan maintenance process shall include a process by which local governments incorporate the requirements of the mitigation plan into other planning mechanisms such as comprehensive or capital improvement plans, when appropriate.

NEMAC and Emergency Management officials shall be responsible for determining additional implementation procedures beyond those listed within the *Mitigation Action Plan*. This includes integrating the Hazard Mitigation Plan into other local planning documents such as comprehensive or capital improvement plans, when appropriate. The members of NEMAC remain charged with ensuring that the goals and strategies of new and updated local planning documents (such as Comprehensive

Plans and Zoning Ordinances) are consistent with the goals and actions of the Hazard Mitigation Plan, and shall not contribute to an increased level of hazard vulnerability in the City.

Opportunities to integrate the requirements of this Plan into other local planning mechanisms shall continue to be identified through future meetings of NEMAC and through the five-year review process described in this section.

Chesapeake shall integrate the tenets of this mitigation plan into relevant local government decision making processes or mechanisms. The primary means for integrating mitigation strategies into other local planning documents shall be accomplished through the revision, update, and implementation of the Mitigation Action Plan that requires specific planning and administrative tasks (i.e., plan amendments, ordinance revisions, capital improvement projects). In addition, Chesapeake shall incorporate existing planning processes and programs addressing flood hazard mitigation into this document by reference.

MONITORING, EVALUATION AND ENHANCEMENT

Periodic revisions and updates to the Plan are required to ensure that the goals of the Plan are kept current, taking into account potential changes in hazard vulnerability and mitigation priorities. In addition, revisions may be necessary to ensure that the Plan is in full compliance with applicable federal, state and local regulations. Periodic evaluation of the Plan shall also ensure that specific mitigation actions are being reviewed and carried out according to the *Mitigation Action Plan*.

NEMAC shall continue to meet bimonthly and following any disaster events warranting a re-examination of the mitigation actions. This will ensure that the Plan is continuously updated to reflect changing conditions and needs within the City. An annual report on the Plan shall be developed and presented to City Council in order to report progress on the actions identified in the Plan and to provide information on the latest legislative requirements. The report may also highlight proposed additions or improvements to the Plan. The report shall be released to the media and made available to the public via the City's web site.

ANNUAL PROGRESS REPORTS

NEMAC shall be responsible for producing an annual progress report to evaluate the Plan's overall effectiveness.

FIVE-YEAR PLAN REVIEW

At a minimum, the Plan shall be reviewed and must be updated every five years by NEMAC as required by the Disaster Mitigation Act of 2000. The purpose of the review and update is to determine whether there have been any significant changes that may, in turn, necessitate changes in the types of mitigation actions proposed. New development in identified hazard areas, an increased exposure to hazards, the increase or decrease in capability to address hazards, and changes to federal or state legislation are examples of factors that may affect changes in the content of the Plan.

The plan review provides community officials with an opportunity to evaluate those actions that have been successful and to explore the possibility of documenting potential losses avoided due to the implementation of specific mitigation measures. The plan review also provides the opportunity to address mitigation actions that may not have been successfully implemented. NEMAC shall be responsible for reconvening and conducting the five-year review.

During the five-year plan review process, the following questions shall be considered as criteria for assessing the effectiveness and appropriateness of the Plan:

- Do the goals and actions address current and expected conditions?
- Has the nature or magnitude of hazard risk changed?
- Are current resources adequate to implement the Plan?
- Should additional local resources be committed to address identified hazard threats?
- Are there any issues that have limited the current implementation schedule?
- Have the implementation of identified mitigation actions resulted in expected outcomes?
- Has NEMAC measured the effectiveness of completed hazard mitigation projects in terms of specific dollar losses avoided?
- Did the community, agencies and other partners participate in the plan implementation process as proposed?

Following the five-year review, any revisions deemed necessary shall be summarized and implemented according to the reporting procedures and plan amendment process outlined in this section. Upon completion of the review and update process, the Plan shall be submitted to the Virginia Department of Emergency Management State Hazard Mitigation Officer for review and approval. The State Hazard Mitigation Officer shall submit the Plan amendments to the Federal Emergency Management Agency for final review as required by the Disaster Mitigation Act of 2000.

DISASTER DECLARATION

Following a state or federal disaster declaration, NEMAC shall reconvene and the Plan shall be revised as necessary to reflect lessons learned or to address specific circumstances arising from the event. The committee may find it necessary to convene following localized emergencies and disasters in order to determine if changes to the Plan are warranted.

REPORTING PROCEDURES

The results of the five-year review shall be summarized by NEMAC in a report that shall include an evaluation of the effectiveness of the Plan and any required or recommended changes or amendments. The report shall also include a brief progress report for each mitigation action, including the identification of delays or obstacles to their completion along with recommended strategies to overcome them. Any necessary revisions to the Plan must follow the plan amendment process outlined herein.

PLAN AMENDMENT PROCESS

Upon initiation of the amendment process, Chesapeake shall forward information on the proposed change(s) to interested parties, including affected municipal departments. Information shall also be forwarded to the Virginia Department of Emergency Management. This information shall be disseminated in order to seek input on the proposed amendment(s) for not less than a 5-day review and comment period.

At the end of the 5-day review and comment period, the proposed amendment(s) and all comments shall be forwarded to NEMAC for final consideration. The committee shall review the proposed amendments along with the comments received from other parties, and if acceptable, the committee shall submit a recommendation for the approval and adoption of changes to the Plan. Minor revisions may be approved by the City's Chief Administrative Officer, while substantial amendments and addendums must be approved by City Council. In determining whether to recommend approval or denial of a Plan amendment request, the following factors shall be considered by NEMAC:

- There are errors, inaccuracies or omissions made in the identification of issues/needs in the Plan;
- New issues/needs have been identified which are not adequately addressed in the Plan;
- There has been a change in data or assumptions from those upon which the Plan is based.

Upon receiving the recommendation from NEMAC and prior to adoption of the Plan, City Council shall hold a public hearing. The governing body shall review the recommendation from the committee (including the factors listed above) and any oral or written comments received at the public hearing. Following that review, the governing body shall take one of the following actions:

- Adopt the proposed amendments as presented;
- Adopt the proposed amendments with modifications;
- Refer the amendments request back to NEMAC for further revision; or
- Defer the amendment request back to NEMAC for further consideration and/or additional hearings.

CONTINUED PUBLIC INVOLVEMENT

44 CFR Requirement

Part 201.6(c)(4)(iii): The plan maintenance process shall include a discussion on how the community will continue public participation in the plan maintenance process.

Public participation is an integral component of the mitigation planning process. As described above, significant changes or amendments to the Plan shall require a public hearing prior to any adoption procedures.

Other efforts to involve the public in the maintenance, evaluation and revision process shall be made as necessary. These efforts are expected to include:

- Advertising meetings of NEMAC in the local newspaper, public bulletin boards, web sites, social media and City buildings;
- Designating willing citizens and private sector representatives as official members of NEMAC;
- Using local media to update the public about any maintenance or periodic review activities taking place;
- Using questionnaires and Open Houses to obtain public comments on the Plan and its implementation;
- Using City web sites to advertise any maintenance or periodic review activities taking place; and
- Maintaining copies of the Plan in public libraries, on the web, or other appropriate venues.

APPENDIX A

This Appendix provides a copy of the FEMA Region III, Local Hazard Mitigation Plan Review Crosswalk. This crosswalk documents which sections of the Plan contain the FEMA hazard mitigation planning requirements.

LOCAL MITIGATION PLAN REVIEW TOOL

The *Local Mitigation Plan Review Tool* demonstrates how the Local Mitigation Plan meets the regulation in 44 CFR §201.6 and offers States and FEMA Mitigation Planners an opportunity to provide feedback to the community.

- The Regulation Checklist provides a summary of FEMA's evaluation of whether the Plan has addressed all requirements.
- The Plan Assessment identifies the plan's strengths as well as documents areas for future improvement.
- The Multi-jurisdiction Summary Sheet is an optional worksheet that can be used to document how each jurisdiction met the requirements of the each Element of the Plan (Planning Process; Hazard Identification and Risk Assessment; Mitigation Strategy; Plan Review, Evaluation, and Implementation; and Plan Adoption).

The FEMA Mitigation Planner must reference this *Local Mitigation Plan Review Guide* when completing the *Local Mitigation Plan Review Tool*.

Jurisdiction: Chesapeake, VA	Title of Plan: City of Chesapeake Hazard Mitigation Plan	Date of Plan: April, 2014 (expected)
Local Point of Contact: Martha Burns	Address: 304 Albemarle Drive Chesapeake, VA 23322	
Title: Senior Planner		
Agency: Chesapeake Office of Emergency Management		
Phone Number: 757-382-6462	E-Mail: mfburns@cityofchesapeake.net	

State Reviewer:	Title:	Date:

FEMA Reviewer:	Title:	Date:
Date Received in FEMA Region *(insert #)*		
Plan Not Approved		
Plan Approvable Pending Adoption		
Plan Approved		

SECTION 1:
REGULATION CHECKLIST

INSTRUCTIONS: The Regulation Checklist must be completed by FEMA. The purpose of the Checklist is to identify the location of relevant or applicable content in the Plan by Element/sub-element and to determine if each requirement has been 'Met' or 'Not Met.' The 'Required Revisions' summary at the bottom of each Element must be completed by FEMA to provide a clear explanation of the revisions that are required for plan approval. Required revisions must be explained for each plan sub-element that is 'Not Met.' Sub-elements should be referenced in each summary by using the appropriate numbers (A1, B3, etc.), where applicable. Requirements for each Element and sub-element are described in detail in this *Plan Review Guide* in Section 4, Regulation Checklist.

1. REGULATION CHECKLIST **Regulation** (44 CFR 201.6 Local Mitigation Plans)	**Location in Plan** (section and/or page number)	**Met**	**Not Met**
ELEMENT A. PLANNING PROCESS			
A1. Does the Plan document the planning process, including how it was prepared and who was involved in the process for each jurisdiction? (Requirement §201.6(c)(1))	Section 2		
A2. Does the Plan document an opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, agencies that have the authority to regulate development as well as other interests to be involved in the planning process? (Requirement §201.6(b)(2))	Section 2, particularly "Involving Stakeholders", p. 2:10		
A3. Does the Plan document how the public was involved in the planning process during the drafting stage? (Requirement §201.6(b)(1))	Section 2, particularly "Involving the Public", p. 2:8		
A4. Does the Plan describe the review and incorporation of existing plans, studies, reports, and technical information? (Requirement §201.6(b)(3))	Section 2, "2013/2014 Community Meetings & Workshops" p. 2:7, 2:8		
A5. Is there discussion of how the community(ies) will continue public participation in the plan maintenance process? (Requirement §201.6(c)(4)(iii))	Section 8, "Continued Public Involvemt" p. 8:4		
A6. Is there a description of the method and schedule for keeping the plan current (monitoring, evaluating and updating the mitigation plan within a 5-year cycle)? (Requirement §201.6(c)(4)(i))	Section 8		
ELEMENT A: REQUIRED REVISIONS			

1. REGULATION CHECKLIST Regulation (44 CFR 201.6 Local Mitigation Plans)	Location in Plan (section and/or page number)	Met	Not Met
ELEMENT B. HAZARD IDENTIFICATION AND RISK ASSESSMENT			
B1. Does the Plan include a description of the type, location, and extent of all natural hazards that can affect each jurisdiction(s)? (Requirement §201.6(c)(2)(i))	Section 4		
B2. Does the Plan include information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction? (Requirement §201.6(c)(2)(i))	Section 4, within each hazard sub-section		
B3. Is there a description of each identified hazard's impact on the community as well as an overall summary of the community's vulnerability for each jurisdiction? (Requirement §201.6(c)(2)(ii))	Sections 4 & 5		
B4. Does the Plan address NFIP insured structures within the jurisdiction that have been repetitively damaged by floods? (Requirement §201.6(c)(2)(ii))	Section 5, "Flooding" p. 5:7		
ELEMENT B: REQUIRED REVISIONS			
ELEMENT C. MITIGATION STRATEGY			
C1. Does the plan document each jurisdiction's existing authorities, policies, programs and resources and its ability to expand on and improve these existing policies and programs? (Requirement §201.6(c)(3))	Section 6		
C2. Does the Plan address each jurisdiction's participation in the NFIP and continued compliance with NFIP requirements, as appropriate? (Requirement §201.6(c)(3)(ii))	Section 4, p. 4:6 Section 5, p. 5:7 Section 6, p. 6:7		
C3. Does the Plan include goals to reduce/avoid long-term vulnerabilities to the identified hazards? (Requirement §201.6(c)(3)(i))	Section 7, Mitigation Goals, p. 7:2		
C4. Does the Plan identify and analyze a comprehensive range of specific mitigation actions and projects for each jurisdiction being considered to reduce the effects of hazards, with emphasis on new and existing buildings and infrastructure? (Requirement §201.6(c)(3)(ii))	Section 7, starting p. 7:3		
C5. Does the Plan contain an action plan that describes how the actions identified will be prioritized (including cost benefit review), implemented, and administered by each jurisdiction? (Requirement §201.6(c)(3)(iv)); (Requirement §201.6(c)(3)(iii))	Section 7, starting p. 7:14		
C6. Does the Plan describe a process by which local governments will integrate the requirements of the mitigation plan into other planning mechanisms, such as comprehensive or capital improvement plans, when appropriate? (Requirement §201.6(c)(4)(ii))	Section 8, "Implementation", p. 8:2		
ELEMENT C: REQUIRED REVISIONS			

1. REGULATION CHECKLIST Regulation (44 CFR 201.6 Local Mitigation Plans)	Location in Plan (section and/or page number)	Met	Not Met
ELEMENT D. PLAN REVIEW, EVALUATION, AND IMPLEMENTATION (applicable to plan updates only)			
D1. Was the plan revised to reflect changes in development? (Requirement §201.6(d)(3))	Sections 3, 5 & 6		
D2. Was the plan revised to reflect progress in local mitigation efforts? (Requirement §201.6(d)(3))	Section 6, Table 6.7 Section 7, Table 7.5		
D3. Was the plan revised to reflect changes in priorities? (Requirement §201.6(d)(3))	Section 7, starting p. 7:14		
ELEMENT D: REQUIRED REVISIONS			
ELEMENT E. PLAN ADOPTION			
E1. Does the Plan include documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval? (Requirement §201.6(c)(5))	to be contained in Appendix B		
E2. For multi-jurisdictional plans, has each jurisdiction requesting approval of the plan documented formal plan adoption? (Requirement §201.6(c)(5))	n/a		
ELEMENT E: REQUIRED REVISIONS			
ELEMENT F. ADDITIONAL STATE REQUIREMENTS (OPTIONAL FOR STATE REVIEWERS ONLY; NOT TO BE COMPLETED BY FEMA)			
F1.			
F2.			
ELEMENT F: REQUIRED REVISIONS			

APPENDIX B

This Appendix provides a copy of the adoption resolution for this plan, as well as the final approval letter from FEMA Region III.

14-R-046

RESOLUTION ADOPTING THE 2014 CHESAPEAKE HAZARD MITIGATION PLAN FOR THE CITY OF CHESAPEAKE, VIRGINIA.

WHEREAS, the Disaster Mitigation Act of 2000 requires that state and local governments develop and adopt hazard mitigation plans in order to remain eligible for pre-and-post disaster mitigation funding; and

WHEREAS, the purpose of a hazard mitigation plan is to assess the risk of any vulnerabilities to natural and man-made hazards and to make recommendations for mitigating the effects of such hazards. The plan is intended to recommend local hazard mitigation policies that will promote public safety, protection of natural resources and public awareness; and

WHEREAS, the City Council adopted the 2008-2013 All Hazards Mitigation Plan in April of 2009; and

WHEREAS, in 2013 and 2014, the Chesapeake Natural Event Mitigation Advisory Committee (NEMAC) met bimonthly to review the progress of mitigation activities and define necessary revisions to the 2008-2013 All Hazards Mitigation Plan; and

WHEREAS, based on recommendations of NEMAC and the standards contained in the Disaster Mitigation Act of 2000, the Fire Department has developed the 2014 Chesapeake Hazard Mitigation Plan; and

WHEREAS, the 2014 Chesapeake Hazard Mitigation Plan was submitted to the Federal Emergency Management Agency ("FEMA") for preliminary review and approval. The plan received a satisfactory rating for all required criteria, including the planning process, hazard identification, risk assessment, mitigation strategy and plan maintenance; and

City Attorney's Office
City of Chesapeake
Municipal Center
306 Cedar Road
Chesapeake, Virginia
23322
(757) 382-6586
Fax: (757) 382-8749

WHEREAS, prior to formal approval of the 2014 Chesapeake Mitigation Plan by FEMA, the City of Chesapeake is required to provide FEMA with a resolution adopting the Plan.

NOW THEREFORE BE IT RESOLVED by the Council of the City of Chesapeake, Virginia that the 2014 Chesapeake Hazard Mitigation Plan submitted and recommended by the Natural Event Mitigation Advisory Committee, and rated satisfactory by FEMA is hereby adopted for the City of Chesapeake, Virginia. The 2014 Chesapeake Hazard Mitigation Plan shall be submitted to the Virginia Department of Emergency Management, and the Federal Emergency Management Agency for final approval.

ADOPTED by the Council of the City of Chesapeake, Virginia, this 27th day of May, 2014.

APPROVED:

Mayor

ATTEST:

Clerk of the Council

City Attorney's Office
City of Chesapeake
Municipal Center
306 Cedar Road
Chesapeake, Virginia
23322
(757) 382-6586
Fax: (757) 382-8749

PLACEHOLDER FOR FINAL FEMA REGION III APPROVAL LETTER

APPENDIX C

This Appendix provides an excerpt of the City code that governs the formation, composition and operation of the NEMAC.

Chesapeake, Virginia, Code of Ordinances >> PART II - CODE OF ORDINANCES >> Chapter 2 - ADMINISTRATION >> ARTICLE V. - BOARDS, COMMITTEES AND COMMISSIONS >> DIVISION 25. NATURAL EVENT MITIGATION ADVISORY COMMITTEE >>

DIVISION 25. NATURAL EVENT MITIGATION ADVISORY COMMITTEE

Sec. 2-620.39. Creation; composition; appointment; compensation.
Sec. 2-620.40. Removal of members.
Sec. 2-620.41. Presiding officer; quorum.
Sec. 2-620.42. Duties and purpose.

Sec. 2-620.39. Creation; composition; appointment; compensation.

(a) There is hereby established an advisory committee to be known as the "Natural Event Mitigation Advisory Committee."

(b) The committee shall derive its authority from, and be administered by, city council.

(c) The committee shall consist of 17 members who shall serve on the committee without compensation. The membership shall consist of the following:

(1) Five persons who reside or work in the city;

(2) Two representatives of the city's business community;

(3) One representative of a non-profit organization providing services in the city;

(4) The city director of economic development, or designee;

(5) The city fire chief, or designee;

(6) The city director of development and permits, or designee;

(7) The bureau of community programs manager, or designee;

(8) The city director of planning, or designee;

(9) The city director of public communications, or designee;

(10) The city director of public utilities, or designee;

(11) The city director of public works, or designee; and

(12) One representative from the office of emergency management, to be designated by the city fire chief.

(d) All members of the committee, other than city employees hereby designated to serve in their official capacities, shall be appointed by city council. Such members shall be appointed by city council for terms of three years; provided, however, that of those first appointed, five members shall be appointed for three year terms and three members shall be appointed for two year terms. All vacancies on the committee shall be filled by the city council for the unexpired portion of the term.

(Ord. No. 03-O-114, 10-14-03; Ord. No. 05-O-034, 3-22-05; Ord. No. 10-O-097, 7-27-10; Ord. No. 12-O-111, 11-27-12)

Sec. 2-620.40. Removal of members.

Any member of the committee may be removed at the pleasure of the city council.

(Ord. No. 03-O-114, 10-14-03)

Sec. 2-620.41. Presiding officer; quorum.

(a) The committee shall elect annually a presiding officer and shall make rules and forms for the procedures consistent with the laws of the city and of the state.

(b) Notwithstanding any other provision of this Code to the contrary, a quorum shall consist of a majority of the members of the committee who are not city staff members serving in their official capacities.

(Ord. No. 03-O-114, 10-14-03)

Sec. 2-620.42. Duties and purpose.

(a) The committee shall monitor the efficiency and effectiveness of various natural hazard mitigation strategies and will make recommendations to city council for additional improvements. The committee shall have no authority to obligate or expend any city funds without the express authorization of city council.

(b) The committee shall review each year's local natural hazard events and impacts, community activities that may help or hinder mitigation capabilities, and the progress of mitigation activities. Results of this review shall be presented to the city council and state department of emergency management on or before June 1 of each year for the previous year.

(c) The committee shall undertake a comprehensive review and evaluation of the city's natural hazards mitigation plan every five years. Any revisions to the plan shall be presented to city council for consideration. Once adopted by city council, the plan shall be sent to the state department of emergency management and the federal emergency management agency.

(Ord. No. 03-O-114, 10-14-03)

APPENDIX D

This Appendix provides a copy of the 2014 Public Participation Survey and a summary of results collected.

Pro Sign Up Sign Up FREE Sign In

City of Chesapeake Public Participation Survey for Natural Hazard Mitigation Planning

Question Summaries Data Trends Individual Responses

241 responses

60 days (January 02, 2014 - now)

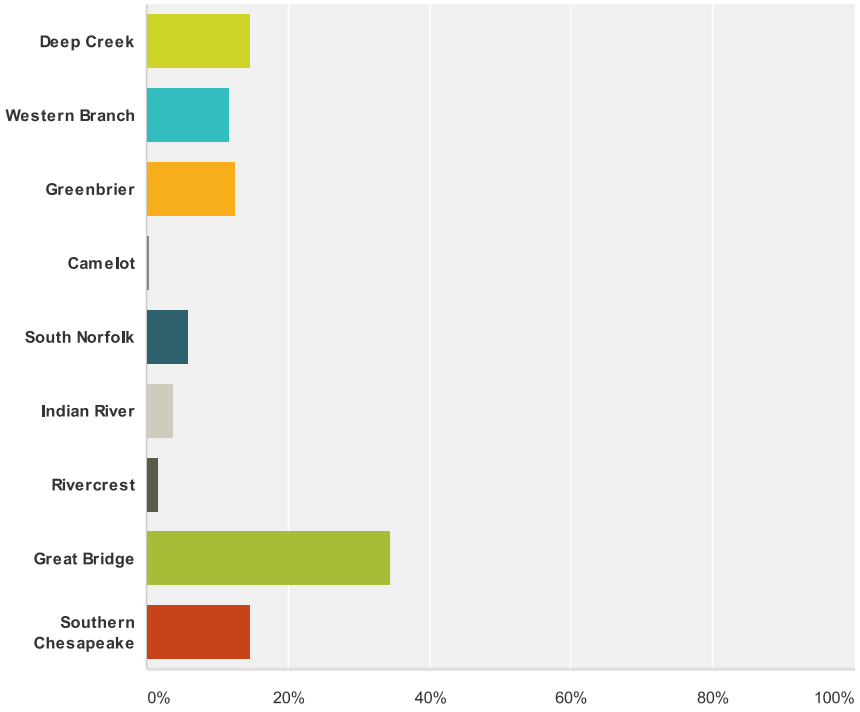
12 views

Need insights?
SurveyMonkey has dozens of expertly-designed survey templates.
Sign up FREE or Learn more

Q1

1. In what Chesapeake planning area do you live?

Answered: 238 Skipped: 3

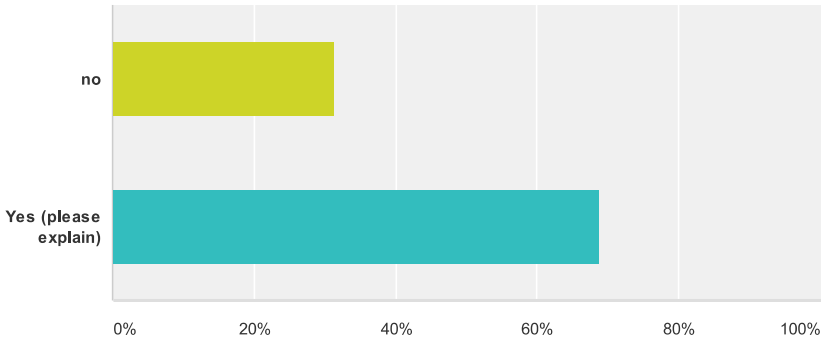


Answer Choices	Responses	
Deep Creek	**14.71%**	35
Western Branch	**11.76%**	28
Greenbrier	**12.61%**	30
Camelot	**0.42%**	1
South Norfolk	**5.88%**	14
Indian River	**3.78%**	9
Rivercrest	**1.68%**	4
Great Bridge	**34.45%**	82
Southern Chesapeake	**14.71%**	35
Total		238

Q2

Have you ever experienced or been impacted by a natural disaster?

Answered: 237 Skipped: 4

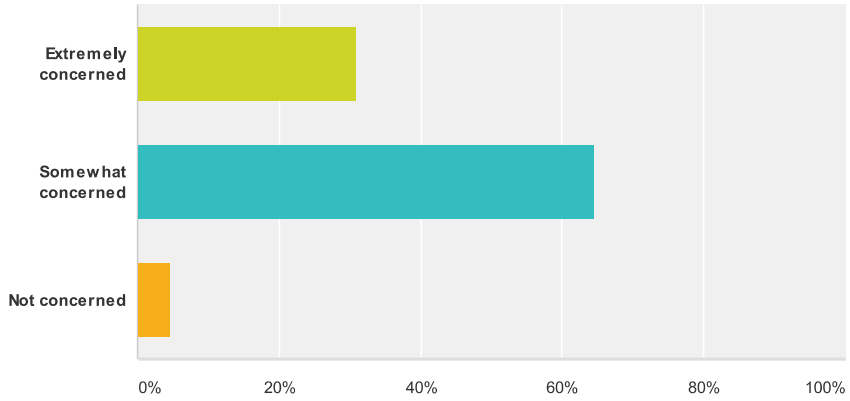


Answer Choices		Responses	
no		**31.22%**	74
Yes (please explain)	Responses	**68.78%**	163
Total			237

Q3

How concerned are you about the possibility of our community being impacted by a natural disaster?

Answered: 239 Skipped: 2



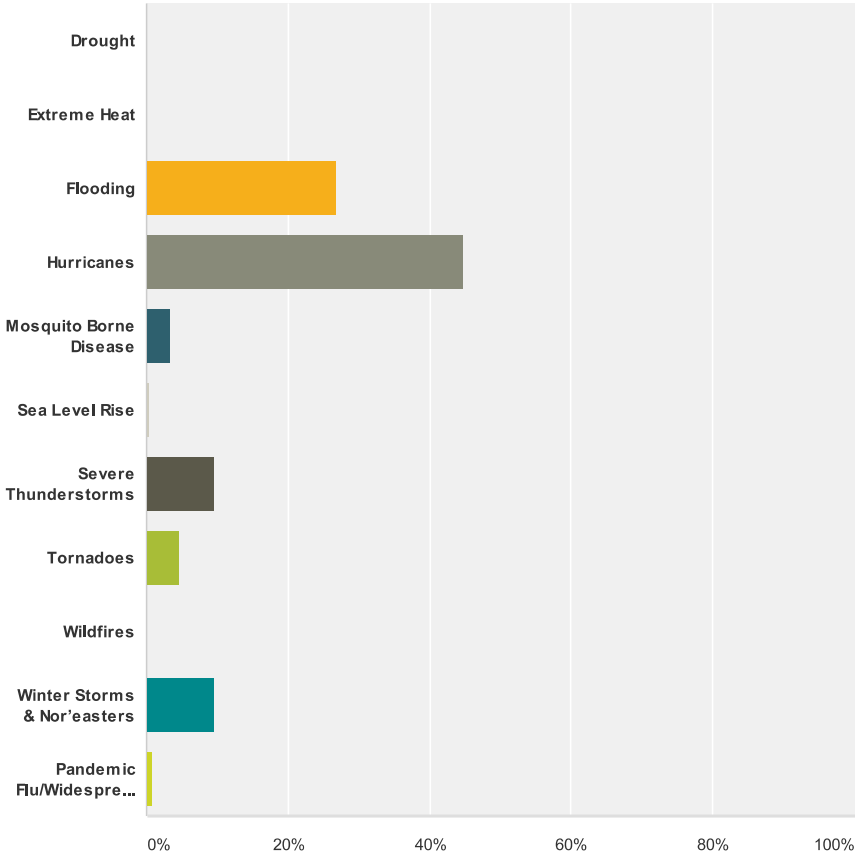
Answer Choices	Responses	
Extremely concerned	**30.96%**	74
Somewhat concerned	**64.44%**	154
Not concerned	**4.60%**	11
Total		239

Q4

Please select the one natural hazard you think is the highest threat to your

neighborhood:

Answered: 239 Skipped: 2

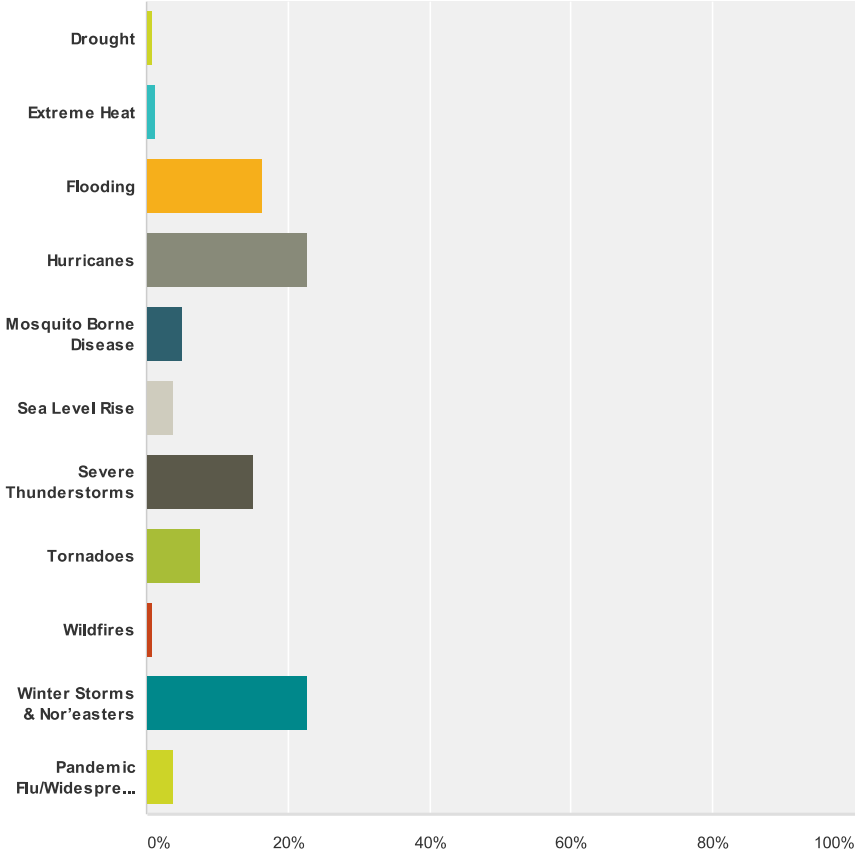


Answer Choices	Responses	
Drought	**0%**	0
Extreme Heat	**0%**	0
Flooding	**26.78%**	64
Hurricanes	**44.77%**	107
Mosquito Borne Disease	**3.35%**	8
Sea Level Rise	**0.42%**	1
Severe Thunderstorms	**9.62%**	23
Tornadoes	**4.60%**	11
Wildfires	**0%**	0
Winter Storms & Nor'easters	**9.62%**	23
Pandemic Flu/Widespread Disease Outbreak	**0.84%**	2
Total		239

Q5

Please select the one natural hazard you think is the second highest threat to your neighborhood

Answered: 238 Skipped: 3

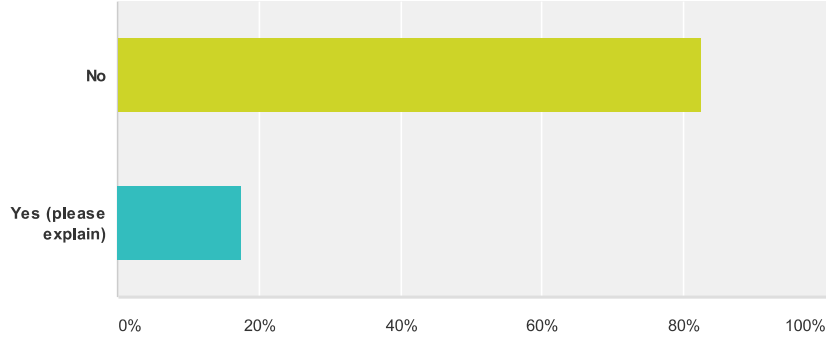


Answer Choices	Responses	
Drought	**0.84%**	2
Extreme Heat	**1.26%**	3
Flooding	**16.39%**	39
Hurricanes	**22.69%**	54
Mosquito Borne Disease	**5.04%**	12
Sea Level Rise	**3.78%**	9
Severe Thunderstorms	**15.13%**	36
Tornadoes	**7.56%**	18
Wildfires	**0.84%**	2
Winter Storms & Nor'easters	**22.69%**	54
Pandemic Flu/Widespread Disease Outbreak	**3.78%**	9
Total		238

Q6

Is there another natural hazard not listed above that you think is a wide-scale threat to your neighborhood?

Answered: 210 Skipped: 31

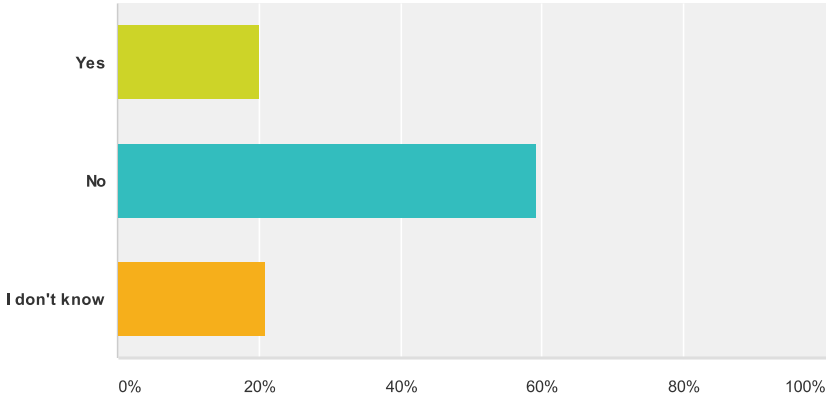


Answer Choices		Responses	
No		**82.38%**	173
Yes (please explain)	Responses	**17.62%**	37
Total			210

Q7

Is your home located in a floodplain?

Answered: 239 Skipped: 2

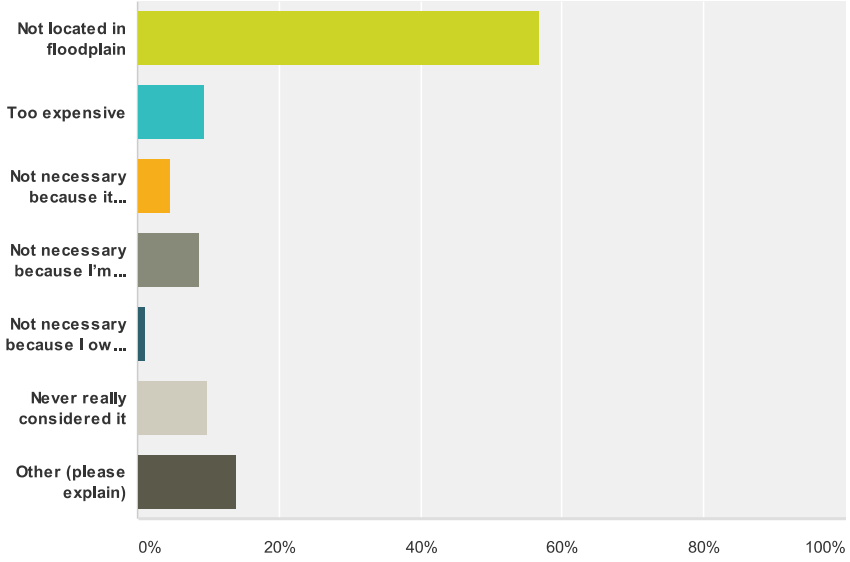


Answer Choices	Responses	
Yes	**20.08%**	48
No	**59.00%**	141
I don't know	**20.92%**	50
Total		239

Q8

If do not have flood insurance, why not?

Answered: 192 Skipped: 49

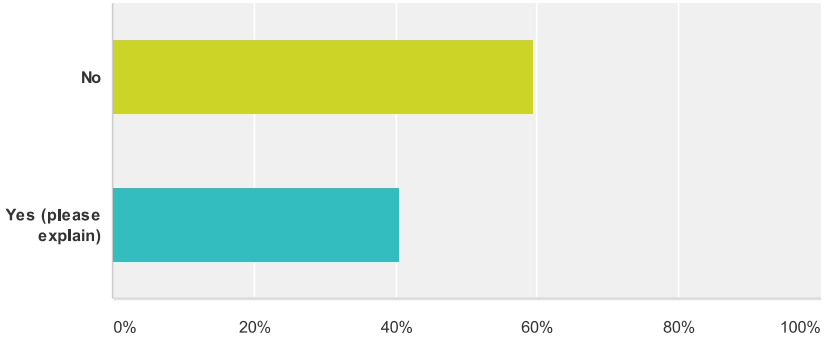


Answer Choices		Responses	
Not located in floodplain		**56.77%**	109
Too expensive		**9.38%**	18
Not necessary because it never floods		**4.69%**	9
Not necessary because I'm elevated or otherwise protected		**8.85%**	17
Not necessary because I own my house		**1.04%**	2
Never really considered it		**9.90%**	19
Other (please explain)	**Responses**	**14.06%**	27
Total Respondents: 192			

Q9

Have you taken any actions to make your home or neighborhood more resistant to natural hazards?

Answered: 239 Skipped: 2

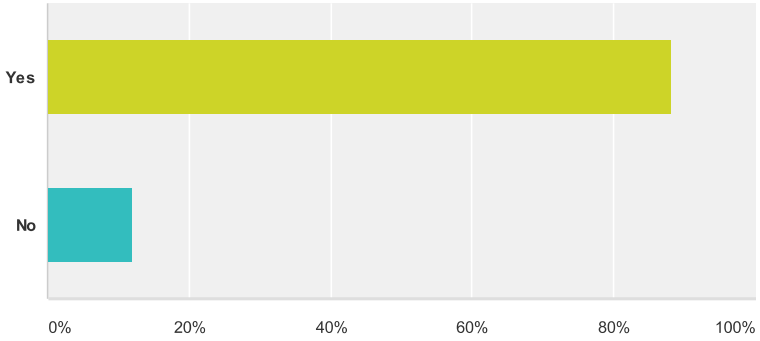


Answer Choices		Responses	
No		**59.41%**	142
Yes (please explain)	**Responses**	**40.59%**	97
Total			239

Q10

Are you interested in making your home or neighborhood more resistant to natural hazards?

Answered: 237 Skipped: 4

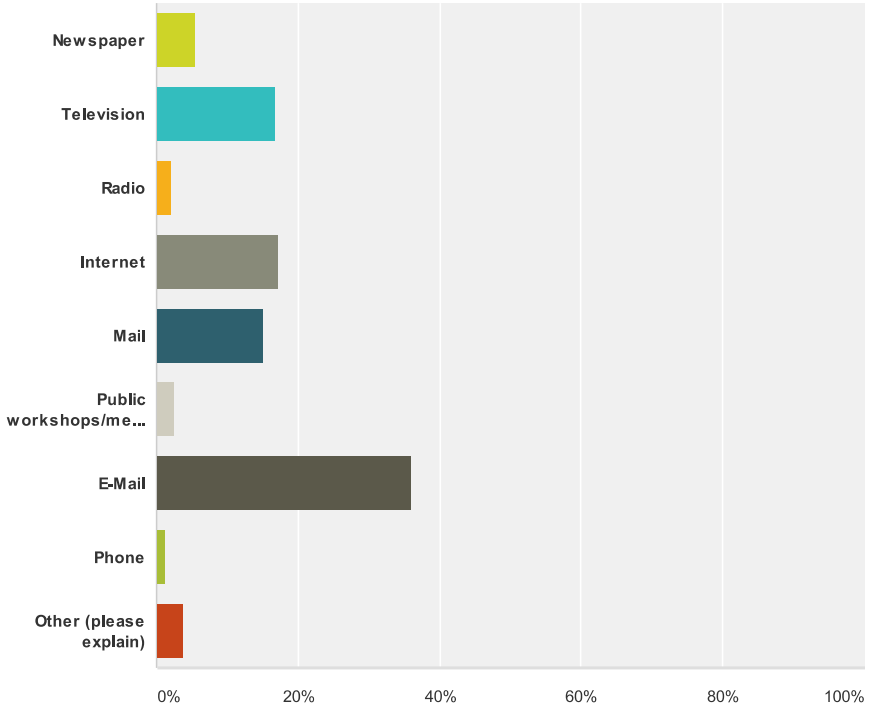


Answer Choices	Responses	
Yes	**88.19%**	209
No	**11.81%**	28
Total		237

Q11

What is the most effective way for you to receive information about how to make your home and neighborhood more resistant to natural hazards?

Answered: 239 Skipped: 2



Answer Choices		Responses	
Newspaper		**5.44%**	13
Television		**16.74%**	40
Radio		**2.09%**	5
Internet		**17.15%**	41
Mail		**15.06%**	36
Public workshops/meetings		**2.51%**	6
E-Mail		**35.98%**	86
Phone		**1.26%**	3
Other (please explain)	**Responses**	**3.77%**	9
Total			239

Q12

In your opinion, what are some steps your local government could take to reduce or eliminate the risk of future natural hazard damages in your neighborhood?

Answered: 175 Skipped: 66

Find a building that is safe for evacuation.
1/16/2014 8:40 AM

Complete simulated training events/ provide preparedness info/ prevention approaches/ sucessful outcomes as a result of best responses and actions taken.
1/16/2014 8:30 AM

education and actions to correct any potential dangers
1/16/2014 7:52 AM

Encourage people to be more independent and resourceful rather than relying on governement to take care of us in time of need.
1/16/2014 7:18 AM

DRAINAGE
1/16/2014 6:26 AM

Oops! There was a problem loading your responses. Try Again

Q13

Are there any other issues regarding the reduction of risk and loss associated with natural hazards or natural disasters in the community that you think are important?

Answered: 98 Skipped: 143

Community is not prepared for any prolonged or widespread disease outbreak
1/15/2014 9:15 AM

Look at any large trees that might fall and take out power lines.
1/15/2014 9:12 AM

Having under ground power lines would help
1/15/2014 9:07 AM

na
1/15/2014 9:04 AM

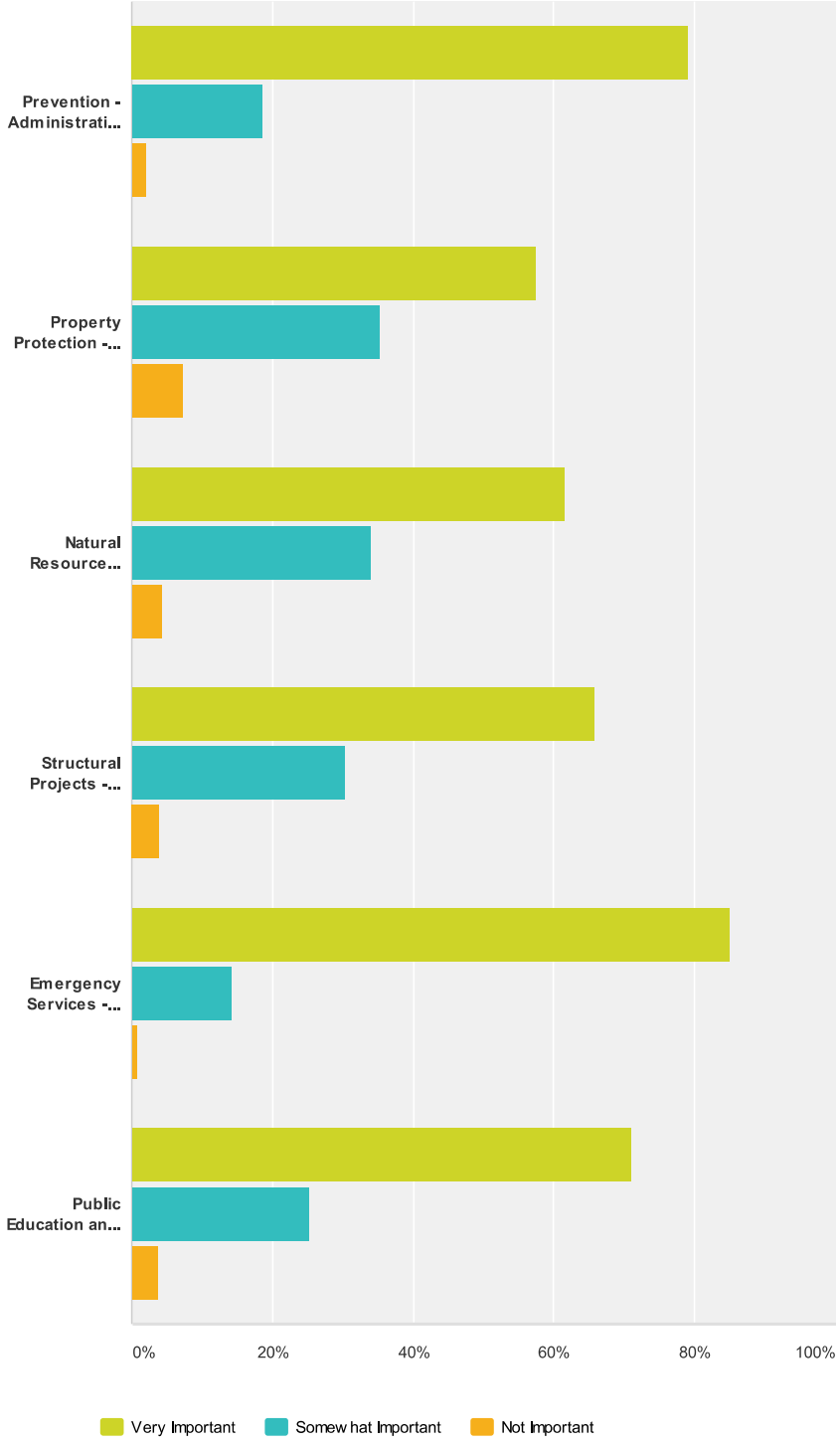
Perhaps not building in areas prone to flooding and/or a better study of the impact of developement on flooding.
1/15/2014 9:03 AM

Oops! There was a problem loading your responses. Try Again

Q14

A number of community-wide activities can reduce our risk from natural hazards. In general, these activities fall into one of the following six broad categories. Please tell us how important you think each one is for your community to consider pursuing.

Answered: 235 Skipped: 6



	Very Important	Somewhat Important	Not Important	Total
Prevention - Administrative or regulatory actions that influence the way land is developed and buildings are built. Examples include planning and zoning, building codes, open space preservation, and floodplain regulations.	**79.22%** 183	**18.61%** 43	**2.16%** 5	231
Property Protection - Actions that	**57.33%** 133	**35.34%** 82	**7.33%** 17	232

involve the modification of existing buildings to protect them from a natural hazard or removal from the natural hazard area. Examples include acquisition, relocation, elevation, structural retrofits, and storm shutters.				
Natural Resource Protection - Actions that, in addition to minimizing natural hazard losses, also preserve or restore the functions of natural systems. Examples include: floodplain protection, habitat preservation, slope stabilization, riparian buffers, and forest management.	**61.64%** 143	**34.05%** 79	**4.31%** 10	232
Structural Projects - Actions intended to lessen the impact of a natural hazard by modifying the natural progression of the natural hazard. Examples include dams, levees, seawalls, detention/retention basins, channel modification, retaining walls and storm sewers.	**65.80%** 152	**30.30%** 70	**3.90%** 9	231
Emergency Services - Actions that protect people and property during and immediately after a natural hazard event. Examples include warning systems, evacuation planning, emergency response training, and protection of critical emergency facilities or systems.	**85.04%** 199	**14.10%** 33	**0.85%** 2	234
Public Education and Awareness - Actions to inform citizens about natural hazards and the techniques they can use to protect themselves and their property. Examples include outreach projects, school education programs, library materials and demonstration events.	**70.94%** 166	**25.21%** 59	**3.85%** 9	234

Q15

Thank you for your participation! This survey may be submitted anonymously, however if you provide us with your name and contact information below we will have the ability to follow up with you to learn more about your ideas or concerns (optional):

Answered: 88 Skipped: 153

Answer Choices		Responses	
Name:	**Responses**	**89.77%**	79
Company:	**Responses**	**0%**	0
Address:	**Responses**	**87.50%**	77
Address 2:	**Responses**	**7.95%**	7
City/Town:	**Responses**	**94.32%**	83
State:	**Responses**	**94.32%**	83
ZIP:	**Responses**	**95.45%**	84
Country:	**Responses**	**0%**	0
Email Address:	**Responses**	**0%**	0
Phone Number:	**Responses**	**65.91%**	58

Powered by SurveyMonkey

Check out out our sample surveys and create your own now!

APPENDIX E: ESSENTIAL FACILITIES

FOR OFFICIAL USE ONLY

The Chesapeake Office of Emergency Management has conducted extensive studies on Protected Critical Infrastructure Information (PCII), including loading identified facilities into the CADD system. PCII facilities can only be accessed in accordance with strict safeguarding and handling requirements by only trained and certified government employees or contractors.

PLEASE CONTACT THE CHESAPEAKE OFFICE OF EMERGENCY MANAGEMENT FOR ADDITIONAL INFORMATION

APPENDIX F: ACRONYMS

The following list of acronyms may help with interpretation of terms used in this document.

Acronym List

ASCE – American Society of Civil Engineers

BCEGS - Building Code Effectiveness Grading Schedule

BFE – Base Flood Elevation

CBIC – Chesapeake Bay Impact Crater

CDBG – Community Development Block Grant Program

CERT – Community Emergency Response Team

CFM – Certified Floodplain Manager

CRS – Community Rating System

CWA – Clean Water Act Section 319 Grants

CZM – Virginia Coastal Zone Management Program

DHS – U.S. Department of Homeland Security

DMA 2000 – Disaster Mitigation Act of 2000

DMTA – Disaster Mitigation and Technical Assistance Grants

DOI – U.S. Department of the Interior

DPW – Department of Public Works

EDA – U.S. Economic Development Administration

EEE – Eastern Equine Encephalitis

EPA – U.S. Environmental Protection Agency

EPCRA - Emergency Planning and Community Right-to-Know Act

EWP – Emergency Watershed Protection

FEMA – Federal Emergency Management Agency

FIRM – Flood Insurance Rate Map

FMA – Flood Mitigation Assistance Program

FPMS – Flood Plain Management Services Program

GIS – Geographical Information System

HAZUS-MH – Hazards U.S. Multi-Hazard

HIRA – Hazard Identification Risk Assessment

HMA – Hazard Mitigation Assistance (1:2)

HMGP – Hazard Mitigation Grant Program

HRPDC – Hampton-Roads Planning District Commission

HUD – U.S. Department of Housing and Urban Development

HVA – Hazard Vulnerability Assessment

IDA – Intensely Developed Area

ISO – Insurance Services Office

LEPC – Local Emergency Planning Committee

LWCF – Land and Water Conservation Fund Grants

MAC – Mitigation Advisory Committee

MAP – Mitigation Action Plan

MLLW – Mean Lower Low Water

NAS – Naval Air Station

NESIS – Northeast Snowfall Impact Scale

NCDC – National Climatic Data Center

NEMAC – National Event Mitigation Advisory Committee

NFIP – National Flood Insurance Program

NOAA – National Oceanic Atmospheric Administration

NWS – National Weather Service

OSAP - Open Space and Agriculture Preservation

PCII - Protected Critical Infrastructure Information

PDM – Pre-Disaster Mitigation Program

PDSI – Palmer Drought Severity Index

RFC – Repetitive Flood Claims Program

RL – Repetitive [flood] Loss

RMA – Resource Management Area

RPA – Resource Protection Area

SARA - Superfund Amendments and Reauthorization Act

SFCP – Small Flood Control Projects

SFHA – Special Flood Hazard Area

SLOSH – Sea, Lake and Overland Surges from Hurricanes

SRL – Severe Repetitive [flood] Loss

STAPLE/E – Social, Technical, Administrative, Political, Legal, Economic and Environmental

TBA – Tidewater Builders Association

USACE – U.S. Army Corps of Engineers

USBC - Virginia Uniform Statewide Building Code

USDA – United States Department of Agriculture

USGS – United States Geological Survey

VDEM – Virginia Department of Emergency Management

VDEQ – Virginia Department of Environmental Quality

VDOF – Virginia Department of Forestry

VIMS – Virginia Institute of Marine Science

VMRC – Virginia Marine Resources Commission

WHO – World Health Organization

WNV – West Nile Virus

WPFP – Watershed Protection and Flood Prevention

WSP – Watershed Surveys and Planning

WUI – Wildland Urban Interface

APPENDIX G: REVIEW COMMENTS

This section of the Plan includes each of the written comments received by various parties during review of the plan, as well as a response from the primary consultant addressing each comment in detail.

Reviewer: Bill Sammler, National Weather Service
Date: October 7-8, 2013

1. Comment: page 4:13 - Change "An unnamed hurricane struck the region..." to "The Chesapeake-Potomac hurricane struck the region..."
   Response: Revised
2. Comment: page 4:14 - regarding Isabel - change "The storm produced a high storm surge (7.5 feet at the Chesapeake Bay Bridge-Tunnel) which inundated the tidal floodplains of the region's creeks and rivers." to "The storm produced a high storm surge (4 to 5 feet in Southside Hampton Roads) which inundated the tidal portions of the region's creeks and rivers."
   Response: Revised.
3. Comment: page 4:14 - regarding the November 2009 nor-easter - change "In Norfolk, a storm surge of 7.74 feet was measured on November 13." to "At Sewells Point a max storm tide of 7.74 feet MLLW was recorded on November 13th, the third highest all time at that location".
   Response: Revised.
4. Comment: Pages 4:37-4:39 - Is there a reason for the lengthy discussion of nor-easter intensity scales, especially the little used Dolan-Davis scale? I am not sure this discussion adds anything meaningful to the document. The committee should consider deleting.
   Response: VDEM specifically requested this information be included in the last plan this consultant submitted for review.
5. Comment: Page 4:45 - 1st paragraph, 3rd line - Change "hailstorms" to "large hail".
   Response: Revised.
6. Comment: Page 4:46 - 1st paragraph 5th line - remove the following sentence (redundant/inaccurate) - "Derechos can carry extremely strong winds and often deliver torrential rains and perhaps flash floods."
   Response: Revised.
7. Comment: Page 4:60 - Wildfires - paragraph below Table 4.19 - The following sentence needs to be researched, as it conflicts with the VA Dept. of Forestry wildfire seasons: "Analysis of 30 years of fire history at the refuge has identified the wildfire season as March through October, with the peak fire season occurring from July 10 through August 18." The VA Dept. of Forestry wildfire seasons are October 15th to November 30th, and February 15th through April 30th.
   Response: Revised to remove reference to a peak fire season, but indicate major cause of fires in the main seasons.
8. Comment: Page 4:61 - Excessive Heat (BACKGROUND) - Change "Extreme heat is defined as temperatures that hover ten degrees or more above the average high temperature for the region and last for several weeks. Humid conditions may also add to the discomfort of high temperatures." to "Extreme heat is defined by the heat index, which combines the air temperature and moisture in the air to provide a "feel like" temperature in a shaded environment. An excessive heat warning is issued by the NWS when the afternoon heat index is expected to reach or exceed 100 degrees for 2 or more hours. Excessive heat conditions usually last 3 days or less, but may last a week or more in extreme situations."
   Response: Revised.
9. Comment: Page 4:61 - Excessive Heat (LOCATION and EXTENT) - last sentence - Change "high humidity rates" to "high humidity values".
   Response: Revised.
10. Comment: Page 4:61 - Excessive Heat (SIGNIFICANT HISTORICAL EVENTS) - Change entire paragraph to read as follows "Temperatures between 90 and 100 degrees (with heat index values between 95 and 105 degrees) are commonplace in Chesapeake during the summer. However, extreme heat (heat index readings 110 degrees or higher) is relatively rare. Since the mid 1990s,

the NCDC has only recorded three excessive heat episodes for the City. The committee acknowledges that there have been other, unrecorded extreme heat events prior to 1995. However, official records on these events are not available from the communities, or through the NCDC (NWS)."
Response: Revised.

Reviewer: Doug Bruno, NEMAC
Date: October 11, 2013

1. Comment: page 3:10, first paragraph - Langley Air Force Base is now the "Joint Base Langley-Eustis"; Fort Monroe is no longer an active Army post; Little Creek Amphibious Base is now the "Joint Expeditionary Base Little Creek-Fort Story".
   Response: Revised.
2. Comment: page 4:2, last sentence does not end properly. Should it end with “hazards”?
   Response: Revised.

Reviewer: Stuart Spatz, NEMAC
Date: October 15, 2013

1. Comment: p.1:2 and elsewhere, remove “the” before “NEMAC”
   Response: Revised.
2. Comment: p. 1:2, capitalize “Plan” in reference to this Plan
   Response: Revised.
3. Comment: p. 1:2, call out VDEM acronym
   Response: Revised.
4. Comment: p. 2:4, I do not see any members from the 2003 committee.
   Response: This information was not provided to the contractor. It is not necessary to meet plan guidelines, and since it was quite some time ago, the 2008 and 2014 committee membership is sufficient.
5. Comment: p. 2:6 - Why do you [keep] redefining who FEMA is? It was defined in the first section and I hope that it would be defined in an appendix of Definitions.
   Response: Document was reviewed for acronyms by a technical editor in an effort to reduce redundancy.
6. Comment: p. 2:10 – I like the idea of an electronic survey.
   Response: Based on your comment, we moved forward with the Survey Monkey Questionnaire as part of the planning process. See Appendix D.
7. Comment: p. 3:1, last paragraph - Should we list a reference where these numbers came from?
   Response: First part of the sentence indicates the source. This is a general statistic and was copied from the previous plan.
8. Comment: p. 3:2, first paragraph, last sentence - Where did these numbers come from?
   Response: This is a general statistic and was copied from the previous plan.
9. Comment: p. 3:3, last paragraph climate data – Are these figures up to date?
   Response: Revised.
10. Comment: p. 3:4, last paragraph – change to “While the Cities of Poquoson and Norfolk have experienced . . . .” and delete “except Norfolk”.
    Response: Revised.
11. Comment: p. 3:5, last paragraph – any source available for “12 miles of deep draft channels.”
    Response: This is a general statistic and was copied from the previous plan.

12. Comment: p. 3:6 – Regarding the list of marinas, Google indicates there are 6. I do not consider a ramp and park to be a marina. If we consider it a marina then how about the ramp and park by Great Bridge Locks?
    Response: List of marinas revised using more current data, but still only verified 4.
13. Comment: p. 3:6, first full paragraph, first sentence - I believe that Chesapeake Regional Airport is owned by the City and is a public airport.
    Response: Revised.
14. Comment: p. 3:6 – 2nd full paragraph – Revise to show that Verizon, Verizon Wireless, FIOS and Cox Communications are primary service providers for cable phone and internet.
    Response: Revised.
15. Comment: p. 3:10 first paragraph, last sentence – Add "located in Chesapeake" after "Naval Auxiliary Field"
    Response: Revised.
16. Comment: p. 3:10 2nd paragraph, first sentence – remove radio station and indicate this is "Naval Support Activity Northwest"
    Response: Revised.
17. Comment: p. 3:10, 2nd to last paragraph – Source for the numbers on horses?
    Response: This was information provided in the previous plan.
18. Comment: p. 4:3, description of Table 4.1 - sentence says ten, but why are only 8 listed below [in the table]?
    Response: Revised.
19. Comment: p. 4:5, first paragraph, first sentence - Where did these deaths take place. In the US, Chesapeake, the world?
    Response: Revised to remove reference to flood deaths.
20. Comment: p. 4:5, 2nd paragraph, last 2 sentences – break into 2 sentences and reword 2nd.
    Response: Revised.
21. Comment: p. 4:7, first sentence – Change 2014 to 2013.
    Response: Not revised. The update will be dated 2014, not 2013.
22. Comment: p. 4:10, Table 4.2 – remove "continued" in first data cell on top left and make sure Planning Area is noted on p. 4:11, top left cell.
    Response: Revised.
23. Comment: Table 4.4 - Should table be formatted the same as table 4.3 with the location centered in the middle of the cell?
    Response: Revised.
24. Comment: Table 4.4 - Need some type of continuation of location.
    Response: Revised.
25. Comment: p. 4:18 – Perhaps references should be footnoted for consistency?
    Response: Footnotes removed throughout in favor of this format.
26. Comment: p. 4:24, 2nd paragraph – indicate peak of season is September 10th.
    Response: Revised.
27. Comment: p. 4:27, 2nd paragraph, 2nd sentence – does this sentence make sense?
    Response: Many eyes have tracked over other parts of the state, having made their landfall farther west or south of Virginia. Camille is an example.
28. Comment: p. 4:27, 3rd paragraph - Above we say 72 storms have tracked across Virginia, now 120. Numbers to me do not add up.
    Response: Checked and revised accordingly.
29. Comment: p. 4:28, several paragraphs – MLLW has been defined; use acronym.
    Response: Revised.
30. Comment: p. 4:28, paragraph on Hurricane Floyd – indicate it was "downgraded Hurricane Floyd"

Response: Revised.

31. Comment: Table 4.8 - What about Sandy and any other storms in 2012?
    Response: Not revised; data was rechecked for 2012 and there were no storms that met the 75 mile criteria.
32. Comment: Figure 4.11 – Are there any more recent historical tracks?
    Response: Not revised; this track map is barely legible as it is because there are so many tracks, so rather than add more recent tracks to it, we created Figure 4.10 which more clearly indicates the tracks of recent storms.
33. Comment: p. 4:33, 2nd paragraph, 1st sentence - Any more recent figures?
    Response: Data were verified on a 2014 NOAA web site so "2014" was added to the citation.
34. Comment: p. 4:34, 1st paragraph, last sentence – Any newer figures?
    Response: Data were verified in 2013 Virginia Mitigation Plan, but uses the same reporting period. Citation was revised.
35. Comment: Table 4.10 and others – Table needs to show it is continued from previous page.
    Response: Revised.
36. Comment: Figure 4.14 – Any newer data?
    Response: Not revised. Newer data could not be located.
37. Comment: Table 4.15 – To what section of Chesapeake do these data entries refer? [Suggested revisions made to several rows.] Change Pentress to Fentress.
    Response: Your suggestions were incorporated as shown; however, this data is from the NCDC database and is otherwise shown as the raw data. The nature of thunderstorms would indicate that the entire City was likely affected by each storm, with notable damages as included under "Details".
38. Comment: p. 4-65 - Need to provide source of information provided in these paragraphs.
    Response: Revised.
39. Comment: p. 4-71 – Shouldn't the source be referenced by a footnote in the document?
    Response: Not revised. Our format uses a slightly modified citation that includes the citation in the document and then full citation at the end of this chapter.
40. Comment: p. 5.1, 1st sentence – Change to "Section 5"
    Response: Revised.
41. Comment: p. 5:8, 1st sentence – Source?
    Response: The sentence immediately after this describes the basis and source of data.
42. Comment: p. 5:10, bulleted list – make EOC and hospital both singular
    Response: Revised.
43. Comment: p. 5:16 – wasn't VIMS defined in a previous section?
    Response: Yes; revised.

Reviewer: Cherie Walton, NEMAC
Date: October 28, 2013

1. Comment: The use of the last comma in a series is inconsistent throughout the document. My preference is for the presence of the final comma in a series (rather than lack thereof).
   Response: Together with a technical editor, we made an attempt to revise this throughout the document.
2. Comment: p. 1:1, Recommend changing "there is much we can do..." to "much can be done to...". I think the use of a personal pronoun is unprofessional in a document such as this.
   Response: Revised.
3. Comment: p. 1:2 – multiple comments, mainly editorial in nature.
   Response: Revised as indicated.
4. Comment: p. 1:3, Authority - I assume these have all been verified to make sure the Final Rules have not been published.
   Response: Revised to update the authorities.
5. Comment: Section 2 - The font appears to be different in this section than in previous sections. Does the City have a standard style manual or document? If not, studies have shown that serif fonts provide better readability in the body of documents -- although the most important thing is consistency.
   Response: Revised to provide consistency.
6. Comment: p. 2:2 - Maybe we should address business continuation plans as a mitigation strategy.
   Response: Not proposed during mitigation strategy discussions.
7. Comment: p. 2:2 - Check the use of the number instead of the word.
   Response: Revised throughout.
8. Comment: p. 2:3, 1st bullet – Can we delete "all"? I don't know if all members attended all meetings.
   Response: Revised.
9. Comment: p. 2:6, 1st paragraph - Don't need the abbreviation since it's already been used earlier in the document.
   Response: Revised.
10. Comment: p. 2:6, 4th paragraph - This should either be "composed of" of "comprising". "Comprised" means "composed of".
    Response: Revised.
11. Comment: p. 2:7, 2nd paragraph - "possibly" can come out. CRS has been one of NEMAC's top priorities ever since we found out about it.
    Response: Revised.
12. Comment: p. 2:7, 3rd paragraph - Add something like "...the hazards of sea level rise..." and remove the capital letters OR say something like "...the hazard categories of Sea Level Rise..." They are not capitalized unless they are titles rather than just types of hazards.
    Response: Revised.
13. Comment: p. 2:7, 3rd paragraph - It is not accurate to say man made hazards are a low priority for NEMAC; rather, they are rightly not within the scope of NEMAC (since they are not natural as per the title of the committee) and since they are covered elsewhere.
    Response: Revised.
14. Comment: p. 2:7, 4th paragraph - I don't get it. What background?
    Response: Background refers to the materials that were presented in the sentence prior. No revision made.

15. Comment: p. 2:8, 1st set of bullets – Have we really reviewed all these documents? Maybe we will before it's over.
    Response: Yes; consultant presented bulleted highlights from these documents.
16. Comment: p. 2:9, 2013 Public Meetings, 2nd paragraph - How about if we get rid of "academia" and say "...and other public and private interests..." since academia can be either and there really isn't a reason to call out that category specially.
    Response: Revised.
17. Comment: p. 3:3, 1st paragraph - Change to either "comprises" or "is composed of" -- just not "is comprised of".
    Response: Revised.
18. Comment: p. 3:3, 2rd paragraph - This font looks smaller than the text above. It might be my eyes.
    Response: Revised.
19. Comment: p. 3:5, 2nd full paragraph - I think [Route 168] is past being new or even relatively new.
    Response: Revised.
20. Comment: p. 4:5, 1st paragraph - In the City or the region or the country? Please add where the deaths have occurred.
    Response: Revised.
21. Comment: p. 4:5, 2nd paragraph - Is tidal flooding covered in one of those categories?
    Response: Yes.
22. Comment: p. 4:39, 4th paragraph – Tidewater Virginia shouldn't capitalized.
    Response: Revised.
23. Comment: p. 4:56, last sentence - I think "could possibly" should be replaced by "is likely to". Drought is fairly common to Chesapeake.
    Response: Revised.
24. Comment: p. 4:60, general Wildfire comment - Someone at the last meeting (a City person) said we should add something about the swamp being federal property (or is it state property?), but I forget exactly what he said.
    Response: Revised.
25. Comment: p. 4:62, last sentence - "likely" is more realistic than "possible".
    Response: Revised.
26. Comment: p. 4:63, 5th paragraph, last sentence - Should we mention horses here? Seven died in 2012, which contradicts the table on the next page. Most of the deaths were in the Tidewater area according to an article I saw. I'm really not sure if we should elaborate about the horses or not. This is a natural event that affects property as well as people. I've never had a horse, but I bet they aren't real cheap. The chart on the next page says there were 10 cases since 2003, but I don't see how it can be correct if there were 7 deaths in 2012.
    Response: Revised to remove unverifiable data.
27. Comment: Table 4.20 - The table could benefit from some formatting. The years are hard to spot and you can't tell if the bottom line is a total unless you add up some columns to find out.
    Response: Revised.
28. Comment: p. 5:1, first subheading – Should that say "2013"?
    Response: Revised to read 2014 because the final plan will have a 2014 adoption date.
29. Comment: p. 5:1, 2nd paragraph - Is HAZUS spelled out before now? If so, I missed it. If not, it should be spelled out now.
    Response: Revised.

Reviewer: Matt McCullough, FEMA RIII (Required Revisions)
Date: March 4, 2014

1. Comment: Please include documentation of advertisements, sign-in sheets, meeting minutes, etc… for participation. Acknowledgement: Numerous citizen participation, very good to see.
   Response: These documents are all included in the final document, Appendices D, H and I.
2. Comment: Section 4 - Please include a more detailed description as to the impacts of flood on the City.
   Response: Revised.
3. Comment: Please include the types of the 392 RL properties on pg. 5:7
   Response: Revised.
4. Comment: Please include an action that refers to the continual support of enforcing and reviewing floodplain ordinance standards. Please include language to that references all structures in flood prone areas being afforded the opportunity to be mitigated, as well as language that includes all possible structural project types
   Response: Revised Mitigation Actions 2 and 3 clarify as indicated above.
5. Comment: Mr. McCullough and Mr. Wall (VDEM) recommended that a method for administrative approval of minor amendments be included to allow minor adjustments to the plan, if necessary.
   Response: Revised.

Reviewer: Public Meeting Participants
Date: January 16, 2014

1. Comment: Mitigation Action 8 – Strongly support this action. Indicate that it should focus on "preventive strategies"
   Response: Revised.
2. Comment: Mitigation Action 8 – Strongly support this action. Indicate that it should focus on "pre-disaster"
   Response: Revised.
3. Comment: Mitigation Action 16 – Strongly support this action. Indicate that it should include guidance on how to protect vinyl siding windows from storm damage
   Response: Revised.

Reviewer: Martha Burns
Date: March 18, 2014

1. Comment: Acknowledgements: since Salter's Creek is acknowledged, shouldn't the NEMAC Committee members also be acknowledged?
   Response: Revised.
2. Comment: Page 1:1, Introduction>2014 Update>second reference to 2013 update: I think it should say …concluded that the 2013 update process, or say the 2014 update.
   Response: Revised.
3. Comment: Page 2:5, *City Employees: you do not have the asterisk beside all the city employees contained in the chart.
   Response: Revised to remove asterisks.
4. Comment: Page 3:3, "..portions of 2significant watersheds… ' needs to be two significant watersheds.
   Response: Revised.

5. Comment: Page 3:6: I'm not accustomed to seeing numbers less that nine in numeral form. You and the number 4 in the first paragraph rather than four. There are other numerals throughout the page and document also. Maybe it's the custom of a HMP?
   Response: Revised throughout for consistency.
6. Comment: Page 4:1: under 2014 Update, point 2. "The manmade annex…" should read the manmade hazard annex, I think.
   Response: Revised.

Reviewer: Stu Spatz, NEMAC
Date: March 18, 2014

1. Comment: Key to Potential Funding Source acronyms: page 7.13 check and make sure it is in acronyms and also does it belong there.
   Response: Revised.

2. Comment: The City of Chesapeake is referred to in various ways; City of Chesapeake, Chesapeake, and City. Possibly using on and not all?
   Response: Not revised. The use of various terms adds sentence structure variety. Revised capitalization of City versus city where appropriate.

3. Comment: The word city is capitalized some time when referring to Chesapeake and at other times not capitalized. I believe it should be on or the other for consistency. Also see comment on Page 7.6.
   Response: Document was rechecked and revisions made where appropriate.

4. Comment: The use of the word of shall vs. will especially in Section 8.
   Response: Document was rechecked and revisions made where appropriate.

5. Comment: Page 3.3 – first line a space is needed after "2".
   Response: Revised.

6. Comment: Page 3.6 – first paragraph - how about the Park at Great Bridge. It has a boat landing also.
   Response: Revised.

7. Comment: Page 3.6 – last paragraph – Figure 3.3 is not below, it is on the next page.
   Response: Revised.

8. Comment: Page 3.9 – Paragraph 1 – are there any newer figures than 2006?
   Response: In several drafts, consultant requested updated information and/or review of this section but received no response.

9. Comment: Page 3.9 – Possible adding Dollar Tree as a major business.
   Response: Revised.

10. Comment: Page 4.29 – 5th paragraph. Why is "Hurricane Isabel" in bold?
    Response: Revised.

11. Comment: Page 4.29 – Last paragraph. Why is "Hurricane Isabel" in bold?
    Response: Revised.

12. Comment: Page 4.40 – First paragraph. Why is "Nor'easter" in bold?
    Response: Revised.

13. Comment: Pages 4.41 and 4.42 – Why in paragraphs are dates bold? On page 4.29 dates are not bold. Consistency?? See comments for pages 4.56. 4.64, and 4.69.
    Response: Revised.

14. Comment: Page 4.48 – Paragraph 1, line 9. Consider change the "A warm-weather phenomenon…" to "Usually a warm-weather phenomenon…" to be consistent with the next sentence. Or change the last sentence to read "However, they may occur…
    Response: Revised.

15. Comment: Page 4.56 – Consistency. Why are "Significant Historical Events" dates formatted differently? Not formatted like others. See pages 4.28 and 4.41 for examples.
    Response: Revised.

16. Comment: Page 4.64 – Same comment as page 4.56.
    Response: Revised.

17. Comment: Pages 4.69 and 4.70 – Same comment as page 4.56
    Response: Revised.

18. Comment: Page 5.4 SUMMARY – First line, last word. Change "provides" to "provided".
    Response: Revised.

19. Comment: Page 5.4 SUMMARY – Second line, change"allows" to "allowed".
    Response: Revised.

20. Comment: Page 6.2 – Last line. Put the (check mark) after the word checkmark vice after the word indicates. Just like it is in the last line on page 6.9.
    Response: Revised.

21. Comment: Page 7.4 - Property Discussion, 2014 Property Discussion, first sentence. Suggest the following rewrite. "Property protection measures that have been implemented in the past in Chesapeake and in the Commonwealth of Virginia, shall be ongoing primarily through HMGP projects, and shall continue to be included in this and future mitigation action plans.
    Response: Revised.

22. Comment: Page 7. Section 6. Public Education and Awareness, 2014 Committee Discussion: - In the paragraph the word city is not capitalized. I believe it should be since we are talking about Chesapeake. If the previous section the word city was capitalized.
    Response: Revised.

23. Comment: Page 8.2 MONITORING, EVALUATION AND ENHANCEMENT – Second paragraph, first line change the word annually to bimonthly since NEMAC normally meets every other month.
    Response: Revised.

24. Comment: Page 8.2 FIVE-YEAR PLAN REVIEW – First paragraph, first line, change will be reviewed to shall be reviewed. The word will means an attempt but is not mandatory. Shall means mandatory.
    Response: Revised.

25. Comment: Page 8.2 FIVE-YEAR PLAN REVIEW – Second paragraph, last line, change NEMAC will be to NEMAC shall be.
    Response: Revised.

26. Comment: Page 8.3 – Second paragraph, change will to shall.
    Response: Revised.

27. Comment: Appendix A. Where is the rest of it? I can't see any cross walks.
    Response: Revised. The FEMA Crosswalk has an "Appendix B" heading on it which has caused confusion. The FEMA form has been modified to white-out the header.

28. Comment: Why different headers for Appendix A and Appendix B?
    Response: See response to comment #27 above.

29. Comment: Appendix B. Page B-2. A4 section – printing not in box, run into next box.
    Response: This is a .pdf form that was filled in. The form cannot be modified to accommodate the text.

30. Comment: Why two Appendix B?
    Response: See response to comment #27 above.

31. Comment: Appendix E. Need Table E.1.
    Response: The table is only allowed to be distributed by Emergency Management. If the NEMAC wishes to review the table and figure for this Appendix, approval from Emergency Management will be required.

32. Comment: Appendix E. Need Figure E.1.
    Response: The table is only allowed to be distributed by Emergency Management. If the NEMAC wishes to review the table and figure for this Appendix, approval from Emergency Management will be required.

APPENDIX H: PUBLIC NOTIFICATIONS

This section of the Plan includes both print and social media notifications made to the public regarding the preparation of this Plan.

THE VIRGINIAN-PILOT
NORFOLK, VIRGINIA
AFFIDAVIT OF PUBLICATION

The Chesapeake Clipper

LEIGH CHAPMAN, CFM
1 PEEK ST
HAMPTON VA 23669

REFERENCE: 39061254
23745619 9/19/13 NEMAC hazard

State of Virginia
City of Norfolk

This day, Jacqueline Whitfield appeared before me and, after being duly sworn, made oath that: 1) she is affidavit clerk of the Virginian-Pilot, a newspaper published by The Virginian-Pilot Media Companies, LLC, in the cities of Norfolk, Portsmouth, Chesapeake, Suffolk, and Virginia Beach, Commonwealth of Virginia and in the state of North Carolina 2.) That the advertisement hereto annexed has been published in said newspaper on the dates stated

FRANCISCO A. KELLY
COMMONWEALTH OF VIRGINIA
Expires 10-31-15
ID# 7145124
NOTARY PUBLIC

PUBLISHED ON: 09/08 09/15

TOTAL COST: 138.96 AD SPACE: 36 LINE
FILED ON: 09/20/13

Legal Affiant

Subscribed and sworn to before me in my city and state on the day and year aforesaid this 24 of September in the year of 2013.(NRN:7145124)

Notary: My commission expires October 31, 2015.

Chesapeake VIRGINIA

NOTICE OF PUBLIC MEETING
FOR SEPTEMBER 19, 2013

Chesapeake's Natural Event Mitigation Advisory Committee (NEMAC) and Hazard Mitigation Planning Subcommittee will meet **Thursday, September 19, 2013 at 7:30PM** at the Chesapeake Emergency Operations Center, 304 Albemarle Drive, to solicit public input.

NEMAC will present the draft 2014 City of Chesapeake Hazard Mitigation Plan which identifies the City's critical hazards and updates assessment of vulnerability and capabilities to mitigate damage. Comment on these aspects of the plan is being sought at this meeting.

For more information, contact Robb Braidwood at the Chesapeake Office of Emergency Management, 382-8890, or rbraidwood@cityofchesapeake.net.

Clipper September 8 & 15, 2013
23745619

THE VIRGINIAN-PILOT
NORFOLK, VIRGINIA
AFFIDAVIT OF PUBLICATION

The Chesapeake Clipper

LEIGH CHAPMAN, CFM
1 PEEK ST
HAMPTON VA 23669

REFERENCE: 39061254
23902636 1/16/14 NEMAC hazard

State of Virginia
City of Norfolk

This day, Jacqueline Whitfield appeared before me and, after being duly sworn, made oath that: 1) she is affidavit clerk of the Virginian-Pilot, a newspaper published by The Virginian-Pilot Media Companies, LLC, in the cities of Norfolk, Portsmouth, Chesapeake, Suffolk, and Virginia Beach, Commonwealth of Virginia and in the state of North Carolina 2.) That the advertisement hereto annexed has been published in said newspaper on the dates stated

FRANCISCO A. KELLY
COMMONWEALTH OF
Expires
10-31-15
ID#
7145124
VIRGINIA
NOTARY PUBLIC

PUBLISHED ON: 01/03 01/10

TOTAL COST: 133.96 AD SPACE: 34 LINE
FILED ON: 01/10/14

Legal Affiant

Subscribed and sworn to before me in my city and state on the day and year aforesaid this 13 of January in the year of 2014.(NRN:7145124)

Notary: My commission expires October 31, 2015.

Chesapeake VIRGINIA

NOTICE OF PUBLIC MEETING FOR JANUARY 16, 2014

Chesapeake's Natural Event Mitigation Advisory Committee (NEMAC) and Hazard Mitigation Planning Subcommittee will meet **Thursday, January 16, 2014 at 7:00PM** at the St. Thomas Episcopal Church Parish Hall, 233 Mann Drive, Chesapeake, 23322, to solicit public input.

NEMAC will present the draft *2014 City of Chesapeake Hazard Mitigation Plan* which identifies the City's critical hazard vulnerabilities, capabilities to mitigate damage, mitigation goals and objectives and mitigation actions proposed for the updated plan. Comment is being sought at this meeting.

For more information, contact Robb Braidwood at the Chesapeake Office of Emergency Management, 382-6504, or rbraidwood@cityofchesapeake.net.

Clipper January 3 & 10, 2014 23902636

City of Chesapeake, Virginia Government - Mozilla Firefox

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https://www.facebook.com/CityofChesapeake

Google

Facebook (7) | City of ... | Active Login | (1) Twitter / Home | HamptonRoads.com | ...

City of Chesapeake, Virginia Government

Home 20+ Lizz

You are posting, commenting, and liking as **City of Chesapeake, Virginia Government** – Change to Lizz Gunnufsen

City of Chesapeake, Virgin... | Timeline | 2014

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2009
Founded

City of Chesapeake, Virginia Government shared a link.
January 15

Reminder - Chesapeake emergency planners need your input for natural hazard mitigation planning. There will be a community meeting January 16, or you can share your concerns by taking a short survey.

Public Meeting - Chesapeake Hazard Mitigation Plan
www.cityofchesapeake.net

Chesapeake's Natural Event Mitigation Advisory Committee (NEMAC) and Hazard Mitigation Planning Subcommittee will meet Thursday, January 16, 2014 at 7:00PM at the St. Thomas Episcopal Church Parish Hall, 233 Mann Drive, Chesapeake, 23322, to solicit public

Like · Comment · Share 2 1

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City of Chesapeake, Virginia
www.cityofchesapeake.net

From Residential to Visitor, Business to Government, Online Services and beyond, find the answers to any questions you may have about the City of Chesapeake. Request a City service or apply for a permit online. View Real Estate Assessments and read updates on happenings

Like · Comment · Share 8 1

609 people saw this post | Boost Post

City of Chesapeake, Virginia Government shared a link.
January 8

Natural Hazard Mitigation Planning – your input is needed. Natural disasters can strike any community at any time. City of Chesapeake emergency planners are working on a plan to minimize and manage the risks and damage. What are your concerns? Learn more about an public meeting on January 16 and share your concerns by taking a short survey.

Twitter:

City of Chesapeake (AboutChesapeake) on Twitter - Mozilla Firefox

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Twitter, Inc. (US) https://twitter.com/AboutChesapeake

Facebook (7) | City of ... Active Login (1) Twitter / Home HamptonRoads.com | ...

Search

the City's website for more info. cityofchesapeake.net/Home.htm

Expand

City of Chesapeake @AboutChesapeake · Jan 8

Public meeting on hazard mitigation plan coming Jan 16. Your input needed!

Meeting details & survey: cityofchesapeake.net/Calendar/Publi…

Expand

City of Chesapeake @AboutChesapeake · Jan 6

mitigation

Highlight All Match Case

Notice on the website:

Public Meeting - Chesapeake Hazard Mitigation Plan - Mozilla Firefox

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Everbridge - Mass Notification | Spotlight | Public Meeting - Chesapeake Hazard ...

www.cityofchesapeake.net/Calendar/Public-Meeting---Chesapeake-Hazard-Mitigation-Plan_s_p9063.htm?EventMode=View&Event

Facebook (7) | City of ... | Active Login | (1) Twitter / Home | HamptonRoads.com | ... | Active Customer Portal | WebEOC 7.3

< Back to Calendar

Public Meeting - Chesapeake Hazard Mitigation Plan

Date:	January 16, 2014
Time:	7:00 PM - 8:00 PM
Location:	St. Thomas Episcopal Church Parish Hall **Map it** 233 Mann Drive Chesapeake, VA

Email Event

Chesapeake's Natural Event Mitigation Advisory Committee (NEMAC) and Hazard Mitigation Planning Subcommittee
16, 2014 at 7:00PM at the St. Thomas Episcopal Church Parish Hall, 233 Mann Drive, Chesapeake, 23322, to solici

NEMAC will present the draft *2014 City of Chesapeake Hazard Mitigation Plan* which identifies the City's critical haz
to mitigate damage, mitigation goals and objectives and mitigation actions proposed for the updated plan. The pres
The public is encouraged to comment following the presentation.

Can't make the meeting? Please take a few minutes to complete a short survey so that we are better aware of yo

For more information, contact Robb Braidwood at the Chesapeake Office of Emergency Management, 382-6504, or
rbraidwood@cityofchesapeake.net.

Homepage - I can't replicate the home page, but the notice was there January 8 – February 17. After the meeting, we just pushed people to the survey. Here's the copy before the meeting:

Natural Hazard Mitigation Planning – Your Input Needed

Natural disasters can strike any community at any time. City of Chesapeake emergency planners are working on a plan to minimize and manage the risks and damage. What are your concerns? Share them by taking this short survey. You can learn more and discuss your concerns with staff at a public meeting on January 16, at 7:00 pm. Meeting Details.

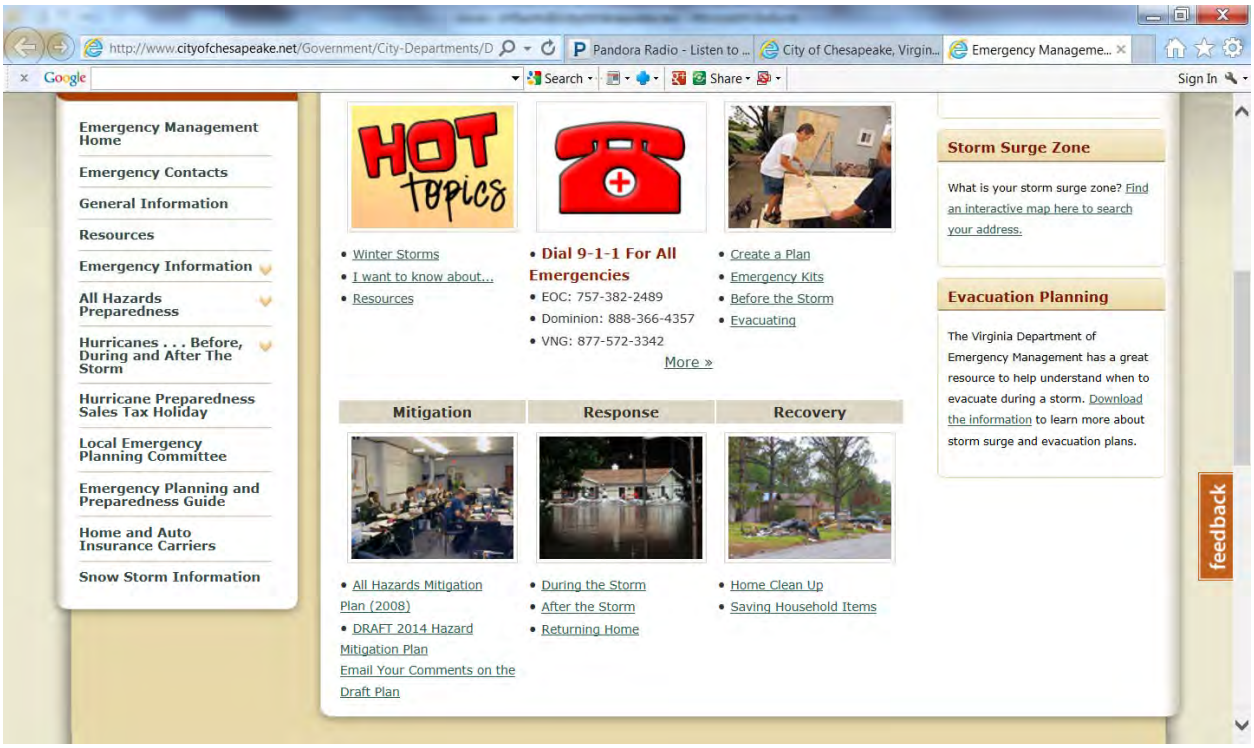
Here's the copy after the meeting:

Natural Hazard Mitigation Planning – Your Input Needed

Natural disasters can strike any community at any time. City of Chesapeake emergency planners are working on a plan to minimize and manage the risks and damage. What are your concerns? Share them by taking this short survey.

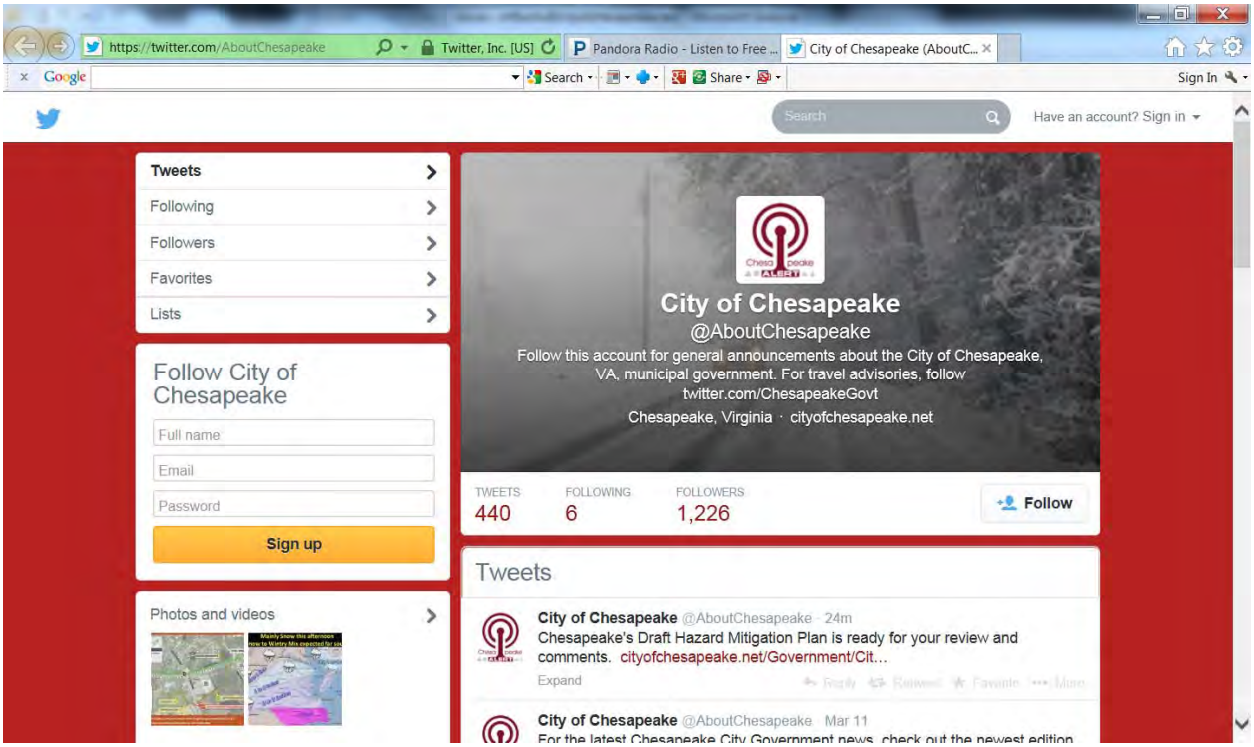
Screen shots for draft 2014 HMP notices: retrieved March 13, 2014

Screen Shot from CFD/OEM web page 3-13-14

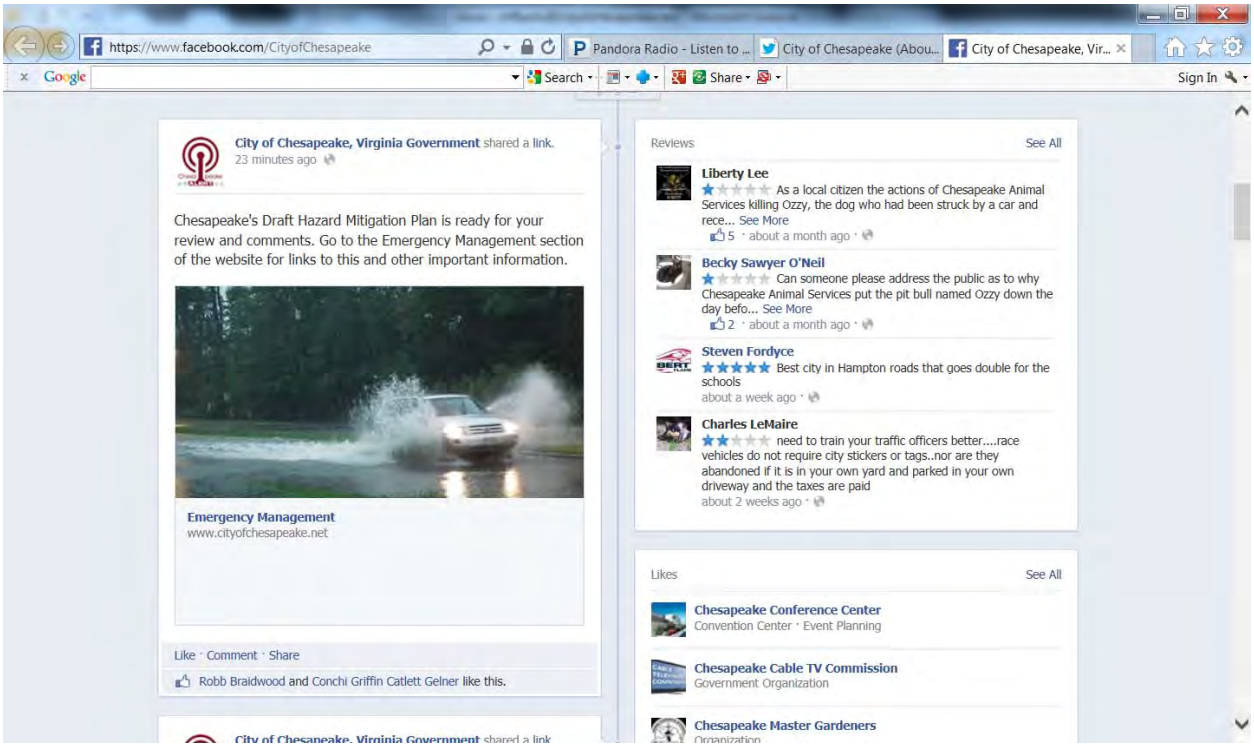


Screen shots for draft 2014 HMP notices: retrieved March 13, 2014

Twitter Page 3-13-14



Facebook 3-13-14



APPENDIX I: NEMAC MEETINGS

This section of the Plan includes the NEMAC and Public meeting minutes, notes, attendance sheets and photographs collected during the process of updating this Plan.

City of Chesapeake
Hazard Mitigation Plan Update

NEMAC Meeting #1 and Public Meeting #1 Minutes

Thursday, September 19, 2013 at 6:00pm; public meeting at 7:30pm
City of Chesapeake, Sheriff's Office Training Room

AGENDA

- Opening Remarks and Introductions
- Review of Planning Process and Progress
- Hazard Risk Assessment Highlights
    - Changes to Hazards Identified
    - Updated History Data since Previous Plan
    - Qualitative and Quantitative Analysis Results
- Next Meeting Dates & Locations
- Discussion and Comment

MEETING NOTES

- The EM Department is hosting a Public Map Meeting on October 30 at the Convention Center, from 2 to 7pm, regarding the new Flood Insurance Rate Maps for Chespeake.
- Total Exposure table needs to be doublechecked as the math appears incorrect.
- Ms. Chapman will verify with Mary Moneypenny whether the floodplain data provided in GIS format is the currently effective data or the preliminary map data for Chesapeake. Participants indicated desire for the plan to reflect the preliminary data.
- Note the period of annualization for the flood data in the plan.
- There was much discussion regarding the analysis of critical facilities subject to flood. Ms. Chapman explained the difference between the 3 analyses. She will verify that the City's list of schools is public schools only. Committee may determine that the list of critical facilities from the HAZUS is unreliable and exclude from the final plan.
- Mr. Braidwood indicated that he would like to see the Money Point gage data added to the Sea Level Rise analysis.
- The slide representing City exposure to one meter of sea level rise has data from the incorrect column. Ms. Chapman will correct this in the draft plan.
- Discussion regarding the qualitative analysis system or PRI resulted in conclusion that the results would be further analyzed at the next meeting in conjunction with the overall planning goals and objectives. There was discussion regarding whether the "impact" number should be focused more on impacts to people or infrastructure/buildings.
- Discussion regarding dates for subsequent meetings. Robb will send out a poll to participants to determine best date for October meeting as the October 17 proposed data did not look good. November 21 is the next regularly scheduled NEMAC meeting, so that date will hold for NEMAC Meeting #3, and December 5 appears to be a good date for the final public meeting to present the draft plan.
- There were no attendees for the Public Meeting at 7:30pm. The NEMAC continued to meet for another 20 minutes and the meeting concluded at 7:50pm.

DATA NEEDS

- Ms. Chapman needs current data since 2008 regarding the City's wildfire responses. The number of fires each year, and the damages resulting from those fires is needed. Any additional descriptive or narrative data on the nature or cause of those fires would be beneficial.
- Ms. Chapman needs pictures of damages from recent natural hazard events in Chesapeake. Apparently, George had many and was going to sort through and provide the best, but none were forwarded.
- Robb Braidwood will poll participants to determine a meeting date that works best for October, preferably in the middle of the month.

INVITEES

Email invitations were issued 9/13/13 to each of the following planning committee members:

- Voting NEMAC members
  Bruno, Doug Citizen
  Johnson, Becky Citizen
  Poulin, Tom Citizen
  Spatz, Stu Citizen
  Wakefield, Pam Non-Profit Org.
  Walton, Cherie Business
  Webb, Steven Business
  Yacus, George Citizen
- City Staff
  Ackiss, Carl Fire
  Burkard, Richard Development & Permits
  Covey, Heath Public Information
  Gilbreath, Von Economic Development
  Braidwood, Robb Emergency Management
  Knowles, John Public Utilities
  Sawan, Sam Public Works
  Sweats, Brian Planning
  Winslow, Tim Public Works
- Temporary Planning Subcommittee
  Bradshaw, Alan Dominion Power
  Calderon, Val Cox Communication Risk Mgmt Specialist
  *Carter, Jeff Chesapeake Police
  *Fisher, Josh Chesapeake Parks & Recreation
  *Foley, Kirby Mosquito Control
  *Kirkby, Mark Chesapeake Sherriff's Office
  *Lackey, Kelly City Attorney
  Lawrence, Watson Virginia Agricultural Extension
  Lewis, Pat Chesapeake General Hospital, Security Office
  Miller, Pam Virginia Health Dept., Emergency Planner
  Sammler, Bill National Weather Service
  Sommer, Pete Tidewater Community College
  Lawrence, Robert Hampton Roads Planning District Commission
  Coates, Robbie Virginia Department of Emergency Management

PUBLIC ADVERTISEMENT

Public advertisement of the NEMAC meeting and the followup Public Meeting the same night was published on September 8 and September 15 in *The Clipper*, the local news supplement to the *Virginia- Pilot* newspaper. The scanned clippings and email invites are shown below.

Leigh Morgan Chapman

From: Leigh Morgan Chapman <leigh.morgan2@verizon.net>
Sent: Friday, September 13, 2013 10:07 AM
To: 'cackiss@cityofchesapeake.net'; 'rburkard@cityofchesapeake.net'; 'hcovey@cityofchesapeake.net'; 'vgilbreath@cityofchesapeake.net'; 'rbraidwood@cityofchesapeake.net'; 'jknowles@cityofchesapeake.net'; 'sawan@cityofchesapeake.net'; 'bswets@CityOfChesapeake.Net'; 'twinslow@cityofchesapeake.net'; 'Alan.bradshaw@dom.com'; 'Vidal.Calderon@cox.com'; 'jcarter@cityofchesapeake.net'; 'jdfisher@cityofchesapeake.net'; 'kfoley@CityOfChesapeake.Net'; 'kirkby@cityofchesapeake.net'; 'klackey@cityofchesapeake.net'; 'wlawrence@cityofchesapeake.net'; 'Patrick.lewis@chesapeakeregional.com'; 'Pamela.b.miller@vdh.virginia.gov'; 'william.sammler@noaa.gov', 'psommer@tcc.edu'
Cc: Rob Braidwood; Cherie C. Walton (c.c.walton@reactives.com); Sharon L. Chamberlin (schamberlin@cityofchesapeake.net); Coates, Robert (Robert.Coates@vdem.virginia.gov)
Subject: NOTIFICATION OF NEMAC MEETING AND PUBLIC MEETING
Attachments: PRESS RELEASE.docx

Importance: High

Good morning NEMAC and Planning Subcommittee members,

Thank you all for your work thus far on the City of Chesapeake's Hazard Mitigation Plan and, to those of you who are new to this process, thank you for agreeing to assist with the planning process in this 2014 update. Our first planning meeting is scheduled in conjunction with the regular NEMAC meeting next week. The Press Release for the working session (at 6:00pm Thur night) and the public meeting to follow (7:30 pm) is attached so you can see the details. While I would appreciate the support of NEMAC members at the 7:30pm meeting, it is not necessary for everyone to stay for both sessions. The material presented will be very much the same.

I hope you are able to join us next Thursday night. If, however, you are unable to attend, I can provide the meeting materials and the review drafts of Chapters 1 to 5 following the meeting. I do plan to edit the chapters based on feedback provided at the meeting and then distribute to everyone as part of a standard 2 week comment period.

I look forward to meeting you all next week and working with you to complete this project. Please let me know if you have questions or concerns.

Leigh

Leigh Morgan Chapman, CFM
REMSA, Inc.
124 W. Queens Way
Hampton VA 23669
Phone (757) 726-9640
Fax (270) 721-9649
Mobile (757) 593-0250

1

Leigh Morgan Chapman

From: Leigh Morgan Chapman <leigh.morgan2@verizon.net>
Sent: Friday, September 13, 2013 10:28 AM
To: 'douglasjbruno@cox.net'; 'becky.johnson@va.nitto.com', 'Thomas.Poulin@Capella.edu', 'slspatz@cox.net'; 'pamela.wakefield@redcross.org'; 'mpawebb@cox.net'; 'George.M.Yacus@uscg.mil'
Cc: 'c.c.walton@reactives.com'; Sharon L. Chamberlin (schamberlin@cityofchesapeake.net); Rob Braidwood
Subject: NOTIFICATION OF NEMAC MEETING AND PUBLIC MEETING
Attachments: PRESS RELEASE.docx

Importance: High

Good morning NEMAC members,

Thank you all for your work thus far on the City of Chesapeake's Hazard Mitigation Plan. Our first planning meeting is scheduled in conjunction with the regular NEMAC meeting next week. The Press Release for the working session (at 6:00pm Thur night) and the public meeting to follow (7:30 pm) is attached so you can see the details. While I would appreciate the support of NEMAC members at the 7:30pm meeting, it is not necessary for everyone to stay for both sessions. The material presented will be very much the same.

I hope you are able to join us next Thursday night. If, however, you are unable to attend, I can provide the meeting materials and the review drafts of Chapters 1 to 5 following the meeting. I do plan to edit the chapters based on feedback provided at the meeting and then distribute to everyone as part of a standard 2 week comment period.

I look forward to meeting you all next week and working with you to complete this project. Please let me know if you have questions or concerns.

Leigh

Leigh Morgan Chapman, CFM
REMSA, Inc.
124 W. Queens Way
Hampton VA 23669
Phone (757) 726-9640
Fax (270) 721-9649
Mobile (757) 593-0250

1

9/15/13

classified mark

Meetings

Chesapeake VIRGINIA

NOTICE OF PUBLIC MEETING
FOR SEPTEMBER 19, 2013

Chesapeake's Natural Event Mitigation Advisory Committee (NEMAC) and Hazard Mitigation Planning Subcommittee will meet **Thursday, September 19, 2013 at 7:30PM** at the Chesapeake Emergency Operations Center, 304 Albemarle Drive, to solicit public input.

NEMAC will present the draft 2014 City of Chesapeake Hazard Mitigation Plan which identifies the City's critical hazards and updates assessment of vulnerability and capabilities to mitigate damage. Comment on these aspects of the plan is being sought at this meeting.

For more information, contact Robb Braidwood at the Chesapeake Office of Emergency Management, 382-8890, or rbraidwood@cityofchesapeake.net.

Clipper September 8 & 15, 2013
23745619

Meetings

9/8/13

classified mark

Meetings

Chesapeake VIRGINIA

NOTICE OF PUBLIC MEETING
FOR SEPTEMBER 19, 2013

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For more information, contact Robb Braidwood at the Chesapeake Office of Emergency Management, 382-8890, or rbraidwood@cityofchesapeake.net.

Clipper September 8 & 15, 2013
23745619

ATTENDANCE

- 19 people were in attendance. Attendance sheets are shown below.

SIGN-IN SHEET
CITY OF CHESAPEAKE NEMAC & PLANNING SUBCOMMITTEE
MEETING #1
Thursday, September 19, 2013

NAME	AGENCY	PHONE #	E-MAIL
Pam Wakefield	Red Cross		
MARK MALAMO	City of Chesapeake		
Cherie Walton	citizen		
Kelly Lackey	City Atty's Office		
Doug Bruno	Citizen@Large		
Mark Kirkly	Sheriff		
Kevin Bradwood	OEM		

SIGN-IN SHEET
CITY OF CHESAPEAKE NEMAC & PLANNING SUBCOMMITTEE
MEETING #1
Thursday, September 19, 2013

NAME	AGENCY	PHONE #	E-MAIL
R. Burkard	city of Ches.		
John Knowles	Chesapeake Public Utilities		
Bill Sammler	NWS Wakefield		
Tim Winslow	City of Ches		
Pamela Miller	Health Dept		

SIGN-IN SHEET
CITY OF CHESAPEAKE NEMAC & PLANNING SUBCOMMITTEE
MEETING #1
Thursday, September 19, 2013

NAME	AGENCY	PHONE #	E-MAIL
Kirby Foley	Chesapeake Medical Center		
ALAN BRADSHAW	DOMINION VA Power		
Stuart Spitz	Citizen		
MARK WEBB	NEMAC		
Von Gilbreath	NEMAC		
Steve G. Jones	citizen		
Leigh Chapman	planning Consultant		

City of Chesapeake
Hazard Mitigation Plan Update

NEMAC Meeting #2 Minutes

Wednesday, October 23, 2013 at 4:00pm
City of Chesapeake, Emergency Operations Center

AGENDA

- Opening Remarks and Introductions
- Review of Planning Process and Progress
- Revisiting Hazard Identification and Risk Assessment
- Capability Assessment Highlights
- Reworking Goals and Objectives
- Repetitive Flood Loss Area Review

MEETING NOTES

- There was discussion amongst the group regarding use of the preliminary flood maps in the hazard mitigation plan. Ms. Chapman advised that FEMA requires use of the effective maps. Mr. Braidwood, Ms. Chapman and Ms. Moneypenny will continue the discussion of this topic offline.
- Mr. Braidwood indicated that the plan needs to clearly indicate that the Great Dismal Swamp refuge is not included in the Wildfire HIRA.
- Ms. Chapman will verify currency of the Virginia Coastal Zone Management Program capabilities
- Discussion ensued regarding the Emergency Alert System for the region. Mr. Sammler with NWS indicated that Chesapeake is in the eastern Virginia ops area.
- Chesapeake is in the 50-mile ingestion pathway of Surry, but not in the 10-mile zone.
- Discussion regarding shipyard warning zones. Ms. Chapman will check the Portsmouth section of the Southside plan to see if those zones are still relevant.
- The group discussed the status of current hazard mitigation action items, especially the Fire Station 8 study.
- Ms. Chapman reminded Mr. Braidwood to invite Jay Tate, the City's Floodplain Manager, to the next NEMAC meeting.
- Mr. Braidwood will send an updated copy of the floodplain ordinance to Ms. Chapman. The City now has 1.5 feet of freeboard which is not reflected in the Municode flood ordinance online.
- Next meeting will be held November 21 at 6pm; Pam Wakefield is researching locations.
- Mr. Braidwood discussed the October 30 FEMA Open House and invited the committee. He requested that Ms. Chapman send the committee a list of important upcoming dates.

DATA NEEDS

- Ms. Chapman needs pictures of damages from recent natural hazard events in Chesapeake. Apparently, George had many and was going to sort through and provide the best, but none were forwarded. Ms. Chapman did contact a person from Public Information at the Oct 30 Open House and provided contact information.
- Ms. Chapman needs current floodplain ordinance.
- Mr. Braidwood will invite Jay Tate to the November 21 meeting.

INVITEES

Email invitations were issued10/16/13 to each of the following planning committee members:

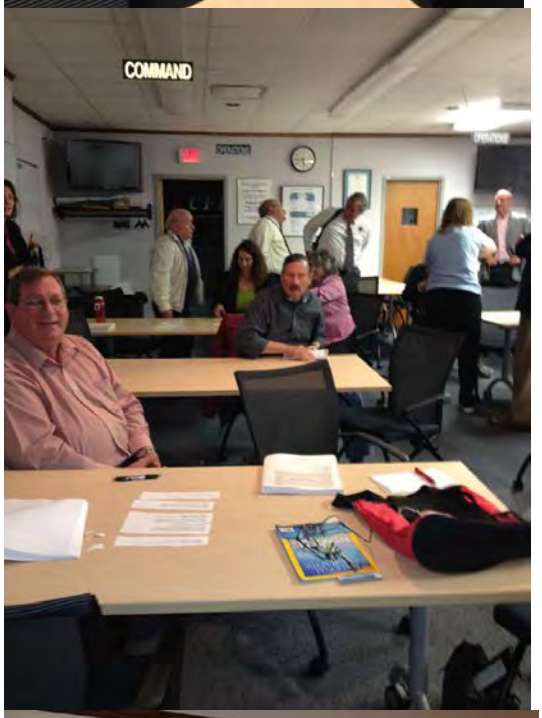
- Voting NEMAC members
  Bruno, Doug Citizen
  Johnson, Becky Citizen
  Poulin, Tom Citizen
  Spatz, Stu Citizen
  Wakefield, Pam Non-Profit Org.
  Walton, Cherie Business
  Webb, Steven Business
  Yacus, George Citizen
- City Staff
  Ackiss, Carl Fire
  Burkard, Richard Development & Permits
  Covey, Heath Public Information
  Gilbreath, Von Economic Development
  Braidwood, Robb Emergency Management
  Knowles, John Public Utilities
  Sawan, Sam Public Works
  Sweats, Brian Planning
  Winslow, Tim Public Works
- Temporary Planning Subcommittee
  Bradshaw, Alan Dominion Power
  Calderon, Val Cox Communication Risk Mgmt Specialist
  *Carter, Jeff Chesapeake Police
  *Fisher, Josh Chesapeake Parks & Recreation
  *Foley, Kirby Mosquito Control
  *Kirkby, Mark Chesapeake Sherriff's Office
  *Lackey, Kelly City Attorney
  Lawrence, Watson Virginia Agricultural Extension
  Lewis, Pat Chesapeake General Hospital, Security Office
  Miller, Pam Virginia Health Dept., Emergency Planner
  Sammler, Bill National Weather Service
  Sommer, Pete Tidewater Community College
  Lawrence, Robert Hampton Roads Planning District Commission
  Coates, Robbie Virginia Department of Emergency Management
- Adjacent communities
  Portsmouth
  Virginia Beach
  Norfolk
  Suffolk

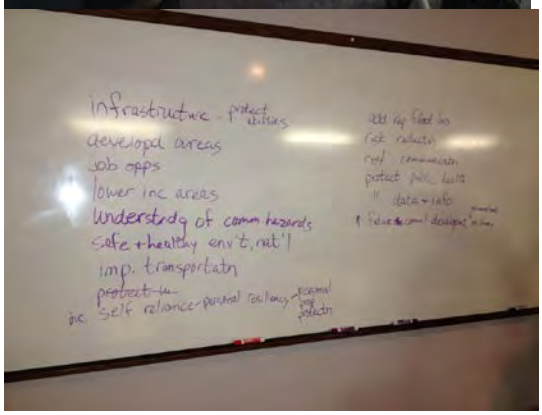
ATTENDANCE

- 20 people were in attendance. Attendance sheet is shown below.

NEMAC Meeting #2
Sign-In Sheet

Name	Agency	Phone	E-mail
Leigh Chapman	Salter's Creek/REM		
Mark Marchbank	City of Va. Beach		
John Knowles	Public Utilities		
Cherie Walton	Citizen		
Stuart Spatz	Citizen		
Kirby Foley	Mosquito Control		
Kelly Lackey	City Atty's Office		
Richard Burkard	Development + Pern		
MARK WEBB	CITIZEN		
Pamela Miller	Ches Health Dept		
Pam Wakefield	Red Cross		
GEORGE YACUS	CITIZEN		
Brian Sweet	Planning		
Robb Bradwell	OEM		
Margit Monaghan	COC IT/GIS		
PATRICK LEWIS	CRMC		
Watson Lawrence	(Agriculture Dept.) Virginia Cooperative Extension		
Doug Bruno	Citizen At Large		
Bill Seminee	NWG WAREFIELD		
ALAN BRADSHAW	DOMINION VA POWER		


COMMAND


infrastructure - protect utilities
developed areas
job opps
lower inc areas
understdg of comm hazards
safe + healthy env't, nat'l
imp. transportatn
inc. self reliance - personal resiliency
add rip flood ins
risk reductn
prot communicatn
protect public health
" data + info

City of Chesapeake
Hazard Mitigation Plan Update

NEMAC Meeting #3 Minutes

Thursday, November 21, 2013 at 6:00pm
St. Thomas Episcopal Church, 204 Mann Drive, Chesapeake, VA 23322

AGENDA

- **Opening Remarks and Introductions**
- **Review of Planning Process and Progress**
- **Revisiting the Goals and Objectives**
- **Reviewing Possible Mitigation Activities for Flood**
- **Reviewing Existing Mitigation Actions**
- **Finalizing Mitigation Actions – All Hazards**

MEETING NOTES

- The status of each action in the current mitigation plan was discussed to determine whether it would remain, remain with edits, or be removed. Notes on each action will be included in the updated plan.
- Prior to the meeting, the current mitigation actions were identified as Preventive, Property Protection, Natural Resource Protection, Emergency Services, Structural, Public Information. As each mitigation action in the existing plan was discussed, the group considered myriad other actions in each category and whether they were appropriate to Chesapeake. Notes from this discussion will be included in the updated plan.
- The group arrived at a consensus on actions to be included in the plan. The consultant will do additional research on each action and provide updated actions in the draft plan to be distributed prior to the next meeting.
- The previously proposed December 5 meeting was postponed until January 16 to allow the final Public Meeting to coincide with the regularly-schedule January NEMAC meeting. The consultant will follow up with the City's public information specialists to advertise the January meeting, a questionnaire, and the meeting advertisements.
- John Knowles provided Ms. Chapman with pictures from Hurricane Sandy.

DATA NEEDS

- Ms. Chapman needs additional pictures of damages from recent natural hazard events in Chesapeake and pictures of Open House from Public Information. (John Knowles provided some pictures from Hurricane Sandy.)

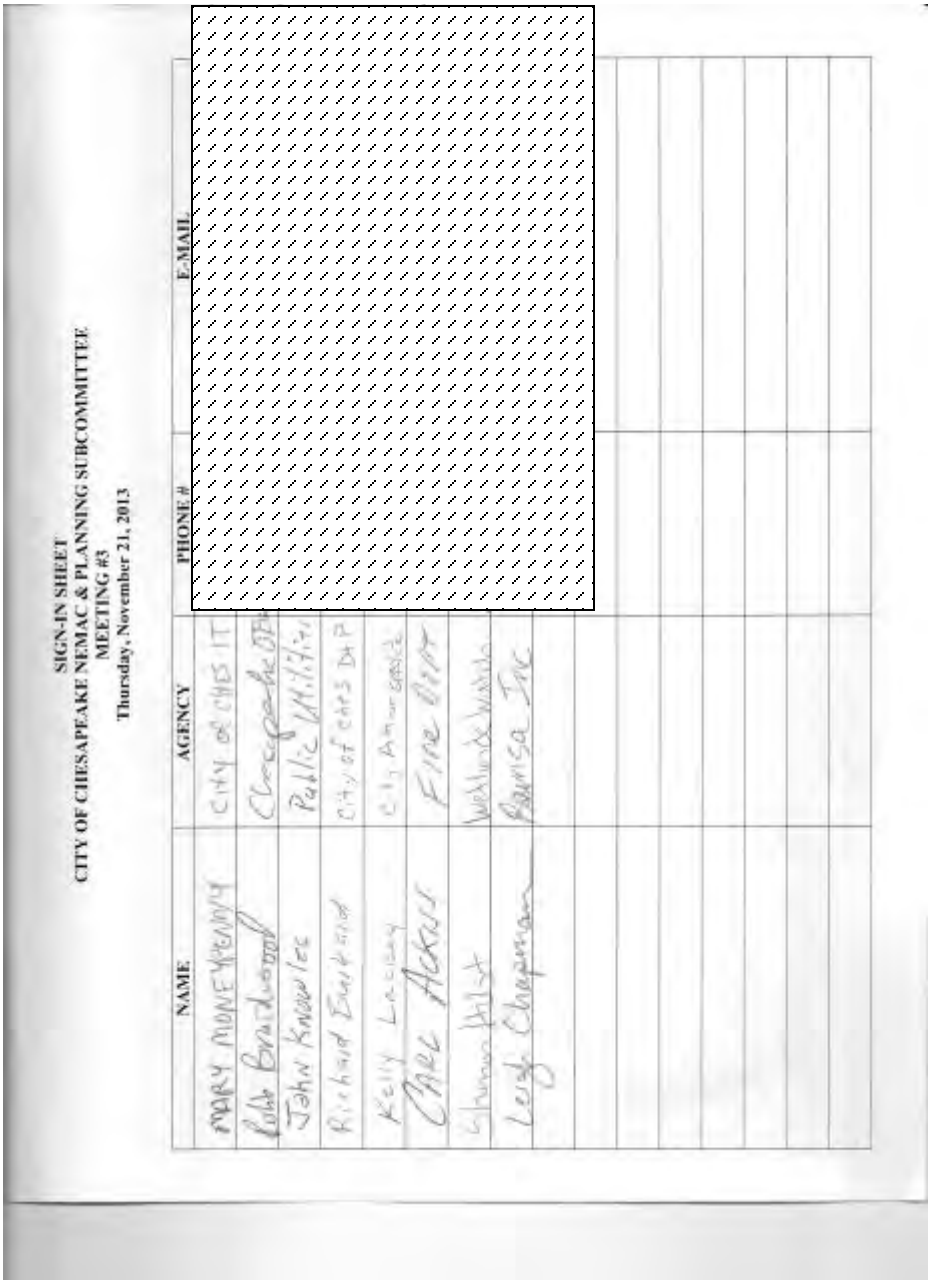
INVITEES

Email invitations were issued several times to each of the following planning committee members:

- Voting NEMAC members
  Bruno, Doug Citizen
  Johnson, Becky Citizen
  Poulin, Tom Citizen
  Spatz, Stu Citizen
  Wakefield, Pam Non-Profit Org.
  Walton, Cherie Business
  Webb, Steven Business
  Yacus, George Citizen
- City Staff
  Ackiss, Carl Fire
  Burkard, Richard Development & Permits
  Covey, Heath Public Information
  Gilbreath, Von Economic Development
  Braidwood, Robb Emergency Management
  Knowles, John Public Utilities
  Sawan, Sam Public Works
  Sweats, Brian Planning
  Winslow, Tim Public Works
- Temporary Planning Subcommittee
  Bradshaw, Alan Dominion Power
  Calderon, Val Cox Communication Risk Mgmt Specialist
  *Carter, Jeff Chesapeake Police
  *Fisher, Josh Chesapeake Parks & Recreation
  *Foley, Kirby Mosquito Control
  *Kirkby, Mark Chesapeake Sherriff's Office
  *Lackey, Kelly City Attorney
  Lawrence, Watson Virginia Agricultural Extension
  Lewis, Pat Chesapeake General Hospital, Security Office
  Miller, Pam Virginia Health Dept., Emergency Planner
  Sammler, Bill National Weather Service
  Sommer, Pete Tidewater Community College
  Lawrence, Robert Hampton Roads Planning District Commission
  Coates, Robbie Virginia Department of Emergency Management
- Adjacent communities
  Portsmouth
  Virginia Beach
  Norfolk
  Suffolk

ATTENDANCE

- 15 people were in attendance. Attendance sheet is shown below.



SIGN-IN SHEET
CITY OF CHESAPEAKE NEMAC & PLANNING SUBCOMMITTEE
MEETING #3
Thursday, November 21, 2013

NAME	AGENCY	PHONE #	E-MAIL
MARY MONEYWEIGHT	CITY OF CHES IT		
Rob Bradwood	Chesapeake OEM		
John Knowles	Public Utilities		
Richard Burdette	City of Ches DHP		
Kelly Lacey	City Attorney's Office		
Chel Ackers	Fire Dept		
Shawn Hirst	Waterside Marina		
Leigh Chapman	Pamlico Inc		

SIGN-IN SHEET
CITY OF CHESAPEAKE NEMAC & PLANNING SUBCOMMITTEE
MEETING #3
Thursday, November 21, 2013

NAME	AGENCY	PHONE #	E-MAIL
Lt. Mark Kirby	Chesapeake Sheriff's Office		
Stuart Seale	Citizen		
[illegible]	[illegible]		
[illegible]	Citizen		
[illegible]	[illegible]		
Jay Tate	Ches. Dept		
Whitney McNamara	Citizen		

City of Chesapeake
Hazard Mitigation Plan Update

NEMAC Meeting #4 Minutes
Public Meeting #2 Notes

Thursday, January 16, 2014 at 6:00pm
St. Thomas Episcopal Church, 204 Mann Drive, Chesapeake, VA 23322

Public Meeting for Public Comment followed, 7:00 PM to 8:00 PM

AGENDA

- **Opening Remarks and Introductions**
- **Review of Planning Process and Progress**
- **Revisiting the Goals and Objectives**
- **Reviewing All Mitigation Activities**

MEETING NOTES

- Plan goes to VDEM next for an informal preliminary review next week; this is Remsa's last meeting with NEMAC, and now Leigh will finalize the Hazard Mitigation Plan and submit for adoption to City Council.
- Leigh Chapman reviewed the 10-step process within the four-phase guidance that NEMAC members and REMSA have completed and said we're at the "Draft an Action Plan" stage; Leigh has combined some of the actions in the objectives within the goals and thus consolidates to 16 mitigation actions.
- NEMAC members reviewed the 16 Mitigation Actions and commented on and edited the actions that needed to be changed; notes were made on the changes and the group rated the priority. One proposed action was deleted resulting in a final 15 actions.

PUBLIC MEETING:

- Three residents of Chesapeake attended the Public Meeting. Robb Braidwood and Leigh Chapman introduced themselves, thanked them for their participation, and Leigh explained the reasons and legislation behind the NEMAC committee and mitigation planning.
- Leigh reviewed the PowerPoint presentation with the three members of the public and the accompanying rough draft copy of the *City of Chesapeake Hazard Mitigation Plan* 2014.
- Members of the public had numerous questions on the reasoning of requirements and on the goals for their City.
- Leigh reviewed the 15 mitigation actions with the members of the public.
- Mitigation Actions of particular interest and questioning were: acquisitions, elevations and such mitigation actions for repetitive losses; dry hydrants; wording on Action 8 which was confusing and will be reworded and they recommended eight be cross-referenced with 16, and suggested adding social media as a means for PPI for Action 16.

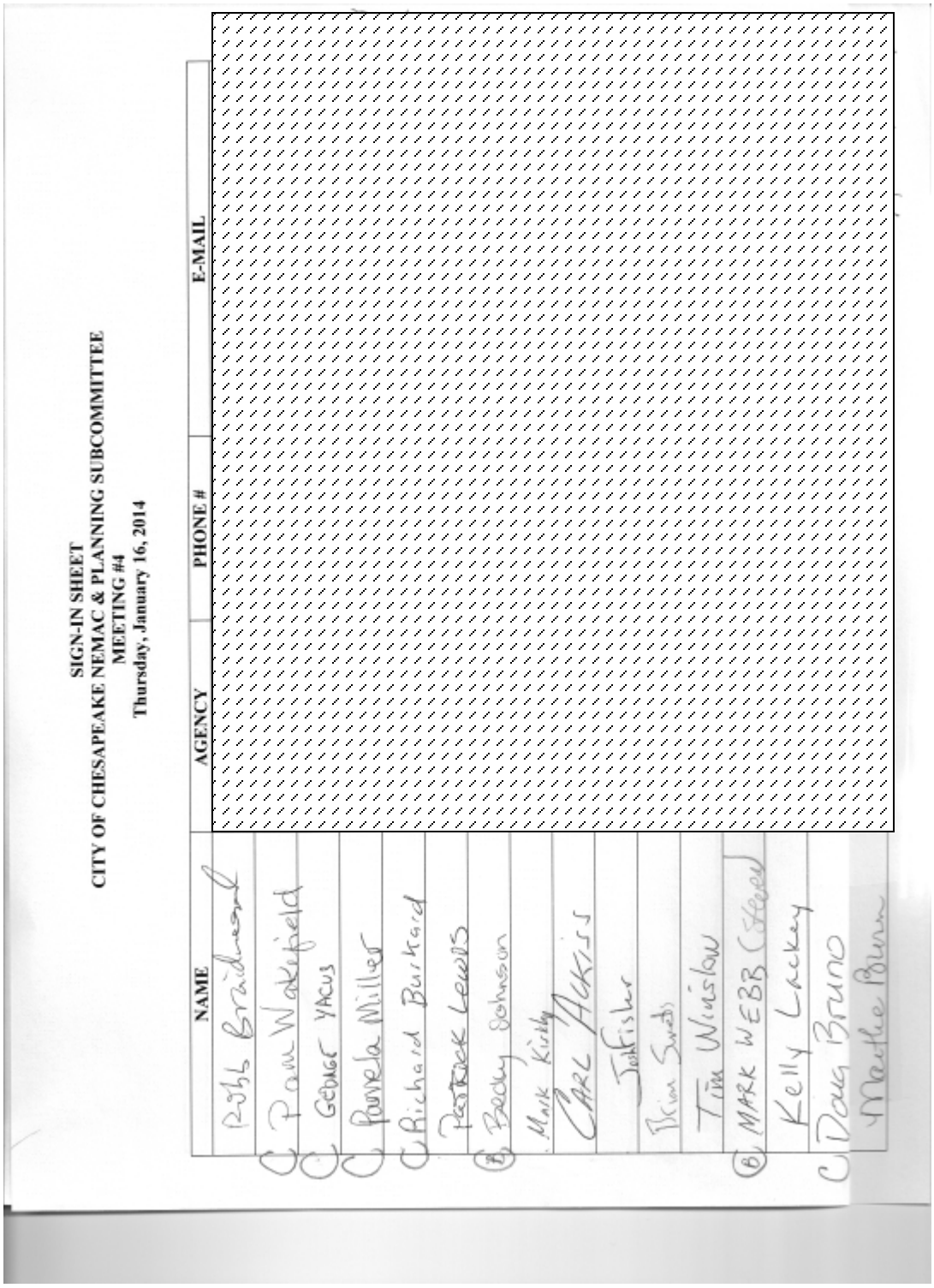
INVITEES:
Email invitations were issued several times to each of the following planning committee members:

- Voting NEMAC members
  Bruno, Doug Citizen
  Johnson, Becky Citizen
  Jones, Steve Citizen
  Poulin, Tom Citizen
  Spatz, Stu Citizen
  Wakefield, Pam Non-Profit Org.
  Walton, Cherie Business
  Webb, Steven Business
  Yacus, George Citizen
- City Staff
  Ackiss, Carl Fire
  Burkard, Richard Development & Permits
  Covey, Heath Public Information
  Gilbreath, Von Economic Development
  Braidwood, Robb Emergency Management
  Knowles, John Public Utilities
  Sawan, Sam Public Works
  Sweats, Brian Planning
  Winslow, Tim Public Works
- Temporary Planning Subcommittee
  Bradshaw, Alan Dominion Power
  Calderon, Val Cox Communication Risk Mgmt Specialist
  *Carter, Jeff Chesapeake Police
  *Fisher, Josh Chesapeake Parks & Recreation
  *Foley, Kirby Mosquito Control
  *Kirkby, Mark Chesapeake Sherriff's Office
  *Lackey, Kelly City Attorney
  Lawrence, Watson Virginia Agricultural Extension
  Lewis, Pat Chesapeake General Hospital, Security Office
  Miller, Pam Virginia Health Dept., Emergency Planner
  Sommer, Pete Tidewater Community College
  Lawrence, Robert Hampton Roads Planning District Commission
- Adjacent communities
  Portsmouth
  Virginia Beach
  Norfolk
  Suffolk

ATTENDANCE

- 16 people were in attendance for the NEMAC meeting. Attendance sheet is shown below.

- Three (3) residents attended the Public Meeting.



SIGN-IN SHEET
CITY OF CHESAPEAKE NEMAC & PLANNING SUBCOMMITTEE
MEETING #4
Thursday, January 16, 2014

NAME	AGENCY	PHONE #	E-MAIL
Bill Braidwood			
Pam Wakefield			
George Yacus			
Pamela Miller			
Richard Burkard			
Patrick Lewis			
Becky Johnson			
Mark Kirby			
Carl Akers			
Josh Fisher			
Kim Smith			
Tim Winslow			
MARK WEBB (Steed)			
Kelly Lackey			
Doug Bruno			
Martha Blevins			

SIGN-IN SHEET
CITY OF CHESAPEAKE NEMAC PUBLIC MEETING
MEETING #2
Thursday, January 16, 2014

NAME	AGENCY	PHONE #	E-MAIL
BILL REISKE	PUBLIC		
MICHAEL WILKINSON	CITY OF CHES		
Chris Lowie	Great Dismal Swamp NWR		

PHOTOGRAPHS