2017

Hampton Roads Hazard Mitigation Plan

City of Hampton
City of Newport News
City of Poquoson
City of Williamsburg
James City County
York County
City of Norfolk
City of Portsmouth
City of Suffolk
City of Virginia Beach
City of Chesapeake
Isle of Wight County
Town of Smithfield
Town of Windsor
City of Franklin
Southampton County
Town of Boykins
Town of Branchville
Town of Capron
Town of Courtland
Town of Ivor
Town of Newsoms

REPORT DOCUMENTATION

TITLE	REPORT DATE
Hampton Roads Hazard Mitigation Plan	January 10, 2017

ABSTRACT

The *Hampton Roads Hazard Mitigation Plan* is being updated for 2017. The region 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 *Hampton Roads Hazard Mitigation Plan* recommends specific actions designed to protect residents, business owners and the built environment.

GRANT/SPONSORING AGENCY

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INTRODUCTION

2017 UPDATE

As part of the 2017 update process, six hazard mitigation plans have been combined into this single plan. The six separate plans and their year of adoption include:

Southside Hampton Roads Hazard Mitigation Plan (2011)
City of Franklin All-Hazards Mitigation Plan (2011)
Southampton County All-Hazards Mitigation Plan (2011)
Peninsula Hazard Mitigation Plan (2011)
City of Chesapeake, Virginia Hazard Mitigation Plan (2014)
City of Poquoson, Virginia Hazard Mitigation Plan (2015)

Accordingly, each section of this plan has been broadly updated as part of the 2017 update process. At the beginning of each section, there is a synopsis of the changes made to that section as part of the update, although the process of combining the six plans accounts for many of the changes that cannot be individually enumerated.

Section 1 was updated to modify the scope to include all 22 communities participating in this planning process.

BACKGROUND

The Hampton Roads region of southeastern Virginia 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.

FEMA Definition of Hazard Mitigation

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

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*. As discussed in the National Mitigation Framework, mitigation includes the capabilities necessary to reduce loss of life and property by lessening the impact of disasters.

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 Hampton Roads Hazard Mitigation Plan (hereinafter referred to as “Hazard Mitigation Plan”, “Plan”, or “HMP”) 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 of structures, 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 region’s future vulnerability to identified hazards.

In keeping with federal requirements and to present a review of Hampton Road’s risk and vulnerability, state and regional capabilities, and current local capabilities, the Hampton Roads Planning District Commission (HRPDC) prepared this updated Hazard Mitigation Plan in 2015 and 2016. The planning committee worked throughout the two-year planning period 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 2015/2016 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 the committee and 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.

NATIONAL MITIGATION FRAMEWORK

The National Mitigation Framework establishes a common platform and forum for coordinating and addressing how the Nation manages risk through mitigation capabilities. Mitigation reduces the impact of disasters by supporting protection and prevention activities, easing response, and speeding recovery to create better prepared and more resilient communities. This Framework describes mitigation roles across a whole community. The Framework addresses how the Nation will develop, employ, and coordinate core mitigation capabilities to reduce loss of life and property by lessening the impact of disasters. Building on a wealth of objective and evidence-based knowledge and community experience, the Framework seeks to increase risk awareness and leverage mitigation products, services, and assets across a whole community or, in this case, across a region.

National Mitigation Framework, May 2013 was published by the Department of Homeland Security to further discuss seven core capabilities required for entities involved in mitigation: threat and hazard identification, risk and disaster resilience assessment, planning, community resilience, public information and warning, long-term vulnerability reduction, and operational coordination. The document focuses on the need for the whole community (or region) to be engaged in examining and implementing the doctrine contained in the Framework and to create a culture that embeds risk management and mitigation in all planning, decision making and development.

The operational work plan for this Hazard Mitigation Plan Update considered the objectives of the National Mitigation Framework in many aspects of its implementation: building the committee and choosing committee leaders; providing risk and vulnerability data early in the planning process; requesting capability update information from communities to foster understanding of capability gaps early in the planning process; and creating regional mitigation actions that help create a culture of mitigation at the regional level that brings together a larger group of stakeholders.

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 Hampton Road's planning committees to prioritize mitigation actions based on those hazards which present the greatest risk to lives and property.

The planning area includes the following communities in Hampton Roads, which were further broken down into 3 categories based on geography:

- The Peninsula:
  - City of Hampton
  - City of Newport News
  - City of Poquoson
  - City of Williamsburg
  - James City County
  - York County
- The Southside:
  - City of Norfolk
  - City of Portsmouth
  - City of Suffolk
  - City of Virginia Beach
  - City of Chesapeake
- Western Tidewater:
  - Isle of Wight County
  - Town of Smithfield
  - Town of Windsor
  - City of Franklin
  - Southampton County

Town of Boykins
Town of Branchville
Town of Capron
Town of Courtland
Town of Ivor
Town of Newsoms

AUTHORITY

This updated Hazard Mitigation Plan was adopted by each of the participating communities in early 2017. A copy of each 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

2017 UPDATE

Summaries of each meeting and the procedures followed during the update process were created for each subsection. Summaries of previous planning processes were removed for brevity and because they are available in other plans.

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, and to include information wherever possible to demonstrate when the plan is or has been implemented through other planning mechanisms.

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.

The HRPDC used FEMA 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 DMA 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 eight major steps that were completed during 2015 through 2017; they are shown in green and yellow 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.

Table 2.1 provides a summary of the National Flood Insurance Program's Community Rating System (CRS) User's Manual 10-step guidance for plan preparation and how that guidance fits within the 10-step, 4-phase process advocated by FEMA. This plan strives to accomplish the steps in each of these processes.

TABLE 2.1: FEMA GUIDANCE AND CRS HAZARD MITIGATION PLANNING GUIDANCE

FEMA Guidance	CRS Guidance
Phase I: Organize Resources Step 1. Get Organized Step 2. Plan for Public Involvement Step 3. Coordinate with Other Departments & Agencies	 Step 1. Organize Step 2. Involve the Public Step 3. Coordinate
Phase II: Assess Risk Step 4. Identify the Hazards Step 5. Assess the Risks	 Step 4. Assess the hazard Step 5. Assess the Problem
Phase III: Develop Mitigation Plan Step 6: Review Mitigation Alternatives Step 7: Draft an Action Plan Step 8: Set Planning Goals	 Step 6. Set Goals Step 7. Review Possible Activities Step 8. Draft an Action Plan
Phase IV: Adopt & Implement Step 9: Adopt the Plan Step 10: Implement the Plan	 Step 9. Adopt the Plan Step 10. Implement, Evaluate, Revise

FIGURE 2.1: HAMPTON ROADS HAZARD MITIGATION PLANNING PROCESS

THE PLANNING COMMITTEE

A community-based planning team made up of local government officials and key stakeholders has continually helped guide the development of this 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 public meetings that described the planning process, the findings of the risk assessment, and the proposed mitigation actions. The committee convened in 2015.

HAMPTON ROADS MITIGATION PLANNING COMMITTEE

Due to the large geographic area covered and the number of communities participating, the project leaders felt that a Steering Committee was necessary to help more efficiently guide the planning process and facilitate the numerous Working Group members. Thus, the representatives for the communities and stakeholders were divided into a primary Steering Committee and a Working Group. The division was based on discussions with potential committee members from each community and stakeholders and a determination as to which members were most willing to commit themselves to the entire process, to do the majority of the work, to debate goals and objectives and discuss alternatives, and to report back to their constituencies and Working Group members. The participants listed in **Table 2.2** are the Steering Committee members for the 2017 Hampton Roads Hazard Mitigation Plan Update. Specifically, the tasks assigned to the Steering 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.

In many cases, the Working Groups for individual communities also met outside of the more official planning process in informal meetings facilitated by Steering Committee members. Additional participation and input from other identified community staff and stakeholders was sought by the Steering Committee during the planning process primarily through e-mails and phone calls. Stakeholder involvement is discussed in more detail later in this section.

TABLE 2.2: HAZARD MITIGATION PLANNING STEERING COMMITTEE MEMBERS

NAME	COMMUNITY	DEPARTMENT and/or EXPERTISE
Gayle Hicks	City of Hampton	Public Works/ Structural Flood Control Projects
Hui-Shan Walker	City of Hampton	Emergency Management, Public Information
George Glazner	City of Newport News	Emergency Management/Public Information
Louis Bott	City of Newport News	Environmental Services/Property Protection
Michael Bryant	City of Poquoson	Emergency Management, Public Information
Ken Somerset	City of Poquoson	Preventive Measures, Property Protection
Kate Hale	James City County	Emergency Management, Public Information
Darryl Cook	James City County	Capital Projects Engineer/Structural Flood Control Projects
Stephen Kopczynski	York County	Fire Department/Emergency Management, Public Information
Kent Henkel	York County	Property Protection, Natural Resource Protection
Robert Tajan	City of Norfolk	Planning/Preventive Measures, Property Protection
Steven Pyle	City of Norfolk	Emergency Management, Public Information
Meg Pittenger	City of Portsmouth	Environmental Manager/Natural Resource Protection
B.K. Russell	City of Portsmouth	Emergency Management, Public Information
Whitney McNamara	City of Virginia Beach	Planning Department
Erin Sutton	City of Virginia Beach	Emergency Management, Public Information

TABLE 2.2: HAZARD MITIGATION PLANNING STEERING COMMITTEE MEMBERS		
NAME	**COMMUNITY**	**DEPARTMENT and/or EXPERTISE**
Martha Burns	City of Chesapeake	Emergency Management, Public Information
Rob Braidwood	City of Chesapeake	Emergency Management, Public Information
Andrea Clontz	Isle of Wight County	Emergency Management, Public Information
Kim Hummel	Isle of Wight County	GIS/Property Protection
Stuart Speitz	Stakeholder: Chesapeake NEMAC, Citizen member	Public Information, Property Protection
Charles Kline	Stakeholder: Va Department of Conservation & Recreation	Preventive Measures, Property Protection
Charley Banks	Stakeholder: Va Department of Conservation & Recreation	Preventive Measures, Property Protection
Bill Sammler	Stakeholder: NOAA National Weather Service	Public Information
Shep Moon	Stakeholder: Va Department of Environmental Quality, Coastal Zone Management Program	Natural Resource Protection
John Sadler	Stakeholder: Hampton Roads Planning District Commission	Emergency Management, Public Information
Ben McFarlane	Stakeholder: Hampton Roads Planning District Commission	Natural Resource Protection, Property Protection
Josh Gillespie	Stakeholder: Fort Monroe Authority	Property Protection
Michelle Hamor	Stakeholder: U.S. Army Corps of Engineers	Structural Flood Control Projects
Skip Stiles	Stakeholder: Wetlands Watch	Natural Resource Protection
Mary-Carson Stiff	Stakeholder: Wetlands Watch	Natural Resource Protection
Amy Howard	Stakeholder: Va Department of Emergency Management	Emergency Services
Matt Wall	Stakeholder: Va Department of Emergency Management	Emergency Services
Matt McCullough	Stakeholder: FEMA, Region III	Emergency Services
Cynthia Darden	Stakeholder: American Red Cross	Emergency Services
Christine Tombleson	Stakeholder: Virginia Institute of Marine Science	Natural Resource Protection, Public Information
Kenton Towner	Stakeholder: College of William & Mary	Emergency Management, Public Information
Karen Stone	Colonial Williamsburg	Public Information
Leigh Chapman	Stakeholder: Salter's Creek Consulting, Inc.	Preventive Measures, Property Protection
Chris Harvey	Stakeholder: MITRE	Emergency Services
Emily Frye	Stakeholder: MITRE	Emergency Services
Patrick Lewis	Stakeholder: Chesapeake Regional Medical Center	Public Information

2015/2016 COMMUNITY MEETINGS AND WORKSHOPS

Below is a summary of the key meetings and community workshops during the 2015/2016 update process. Routine discussions and additional meetings were held by local officials to accomplish planning tasks specific to their department or agency. A consultant (Salter's Creek Consulting, 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 assist each community with adoption of the final plan. All meeting summary information is included in Appendix C, which includes committee and public meeting minutes, attendance sheets, and correspondence with committee members and stakeholders.

FEBRUARY 2, 2015: PROJECT KICKOFF MEETING

Participants in the Kickoff Meeting discussed the overall approach to updating the Hazard Mitigation Plan, including strategies for outreach and public participation, as well as the steps necessary to meet the requirements of the DMA 2000, and the CRS of the National Flood Insurance Program (NFIP). The consultant initiated data collection efforts at the meeting and reviewed the existing list of hazards with the representatives present.

The group discussed project schedule, 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. Due the large land area encompassed by the Plan, the group and the consultant decided that each of the main three meetings would be held in three different locations, providing opportunity for each community to travel to the location closest or most convenient to their location and schedule.

OCTOBER 21, 22 AND 23, 2015: FIRST PLANNING COMMITTEE MEETINGS

The consultant provided an overview of the proposed update approach to committee members. The Committee reviewed the Hazard Identification and Vulnerability Assessment information updated by the consultant prior to this meeting. Committee members discussed the hazards of most critical concern to the region, and concurred to adjust the names of several hazards, removed several hazards and added hazards.

The committee members present voted on their mitigation priorities and ranked hazards using the methodology described in Section 5. The committee considered a list of hazards that included flood, sea level rise, tropical storm, severe thunderstorm, tsunami, urban fire, winter storm/nor'easter, drought, dam failure, tornado, extreme heat, earthquake, wildfire, erosion, sinkhole, mosquito diseases, hazardous materials incidents, terrorism, biological threats, radiological threats, and pandemic flu.

Members of the Hazard Mitigation Committee discuss the Hazard Identification and Risk Analysis for the 2016 update at the October 21, 2015 meeting in Virginia Beach.

The committee reviewed and discussed manmade (or man-influenced) and technological hazard planning as it was incorporated into the existing plans. The Committee agreed to focus this plan on natural hazards because the manmade hazard identification and vulnerability analyses contain a great deal of protected data. The public, and even some committee members, cannot view this data and therefore cannot participate in the planning process for updating the manmade hazard portion contained in some of the existing plans. Another significant consideration was that previous mitigation action items to address manmade hazards were either excerpted from or incorporated into other types of community plans already in existence, such as Emergency Operation Plans, SARA Title III Emergency Response Plans, existing state plans for radiological emergencies, and the Hampton Roads Homeland Security Strategy. In addition, DMA 2000 specifically requires mitigation planning for *natural hazards*, but not for manmade hazards. The manmade hazards examined and discussed during this planning process included: Hazardous Materials Incidents, Terrorism, Biological Threats, Radiological Threats, Pandemic Flu and Electro-Magnetic Pulse/sustained power disruption. While these hazards were determined to be outside the scope of this Committee's work, the group acknowledged that these threats do exist in Hampton Roads, but felt that existing plans are sufficient at this time. The exception was Hazardous Materials Incidents, which the Committee determined has enough overlap with natural hazards to warrant consideration as part of the Plan.

NOVEMBER 17, 18, AND 19, 2015: SECOND PLANNING COMMITTEE MEETINGS

The second Planning Committee meeting was the beginning of the "Mitigation Strategy Workshop." The meeting began with a detailed presentation on how a complete capability assessment contributes to identification of effective mitigation strategies. The discussion focused on local capabilities, the capability matrix each community was asked to complete, and updated information regarding completed mitigation actions in each community.

The consultant helped Committee members review several documents in preparation for the goal setting exercise which was the focus of the workshop. 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:

- Each community's Comprehensive Plan goal statements and Land Use plans –
    - These goals were reviewed during the meeting to update goals and objectives to determine community priorities primarily for future land use planning and capital improvement projects.
- Each community's Emergency Operations Plan (EOP) -
    - Familiarity with these plans on behalf of the emergency managers on the committee was used primarily during the development of the Mitigation Action Plan and tying the mitigation priorities to the response and preparedness activities in the EOP.
- *2013 Commonwealth of Virginia Hazard Mitigation Plan* goals and objectives –
    - These items were reviewed by committee members prior to the work on updating the goals and objectives to help ensure that the regional plan supports and does not contradict the State's goals and objectives.
- Virginia *Governor's Commission on Climate Change Final Report*, December 2008 –
    - The conclusions of this report, while slightly dated, represent some level of State opinion on sea level rise and what the Commonwealth can do to address the issue. The conclusions were reviewed by committee members again to help provide linkages between the regional mitigation goals and the State's approach.
- *Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards*, FEMA January 2013
- Hampton Roads Planning District Commission three-part study entitled "Climate Change in Hampton Roads"
    - Impacts and Stakeholder Involvement (Phase I, released in February 2010)
    - Storm Surge Vulnerability and Public Outreach (Phase II, released June 2011)
    - Sea Level Rise in Hampton Roads, Virginia (Phase III, released July 2012)

- *Recommendations to the Secure Commonwealth Panel on the Issue of Sea Level Rise and Recurrent Flooding in Coastal Virginia*, September 5, 2014, by the Recurrent Flooding Sub-Panel
- VDEM *2015 Report on the Status of Emergency Response Plans and Preparedness Efforts in the Commonwealth*, December 2015
- Each of the six existing plan's Goals and Objectives –
  - As discussed in the next paragraph, this plan is an update to six separate plans and common ground between the plans' goals and objectives was a necessary starting point to the update process.
- Each community's:
  - Flood Insurance Rate Map (FIRM) and Flood Insurance Study (FIS) – used in the Hazard Identification and Risk Assessment section to determine high flood risk areas;
  - floodplain management regulations – reviewed by the consultant to highlight community capabilities and possible mitigation opportunities;
  - site plan review process – reviewed by the consultant to highlight possible mitigation opportunities; and,
  - permitting procedures - reviewed by the consultant to highlight possible mitigation opportunities.

The group was provided a list of potential, broad community goal key words extracted from the existing plans 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. The group chose their top key phrases, and then went to work carefully reviewing the existing mitigation plan goal statements. At each of the three workshops, each subgroup 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 at the final two meetings so that each group could arrive at a consensus on the broader mitigation goals and objectives associated with the updated mitigation plan.

DECEMBER 9, 10 AND 11, 2015: THIRD MITIGATION PLANNING COMMITTEE MEETINGS

The consultant shared additional review notes on floodplain management regulations, as well as other capabilities of note, and suggested numerous possible 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 their existing 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 each community.

INFORMAL COMMUNITY-SPECIFIC WORKING GROUP MEETINGS

Several communities involved in the plan, including Hampton, Newport News, Norfolk, Virginia Beach, and Chesapeake held informal meetings at the community level to discuss their final Mitigation Action Plan. Additional information on these meetings, including dates and attendance, are available from the Emergency Managers in those communities.

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 initially sought using three primary methods: (1) open public meetings advertised in local newspapers with highest circulation; (2) HRPDC web site posting regarding committee meetings (which were open to the public, but not advertised via newspaper); and, (3) the posting of the draft Hazard Mitigation Plan on the HRPDC web site. Public meetings were held at two stages of the planning process; early in the process to introduce the plan update process, and after the planning committee workshops, but well prior to adoption by governing bodies.

2015/2016 Public Meetings

Participants in the March 2, 2015 Public Meeting listen to information regarding the planning process.

Seven open public meetings were held to present the planning process and to review mitigation actions to be included in the Hazard Mitigation Plan.

The first public meeting to be held was scheduled and advertised for February 26, 2015, in Hampton. Unfortunately, due to inclement weather, the meeting facility was closed and the meeting was cancelled and not rescheduled because two other meetings being held the following week were deemed sufficient by project leaders. The second and third public meetings were held March 2, 2015 in Smithfield, and March 3, 2015, in Norfolk.

The meetings were advertised twice each in *The Virginian-Pilot* (weekday circulation 300,000), *The Daily Press* (weekday circulation 55,000), *The Tidewater News* (circulation 5,000), and the *New Journal and Guide*. These publications have 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. Additionally, HRPDC and several communities advertised the meetings on their web sites. The public meeting advertisements are included in Appendix C, which also includes all committee and public meeting minutes, attendance sheets, and invitation correspondence.

Upon completion of a draft Plan, the Committee held three open public meetings on the draft Hazard Mitigation Plan on May 31, June 2 and June 9, 2016. The meetings were advertised in the same manner, and provided further opportunities for the public and identified stakeholders to review and comment on the draft plan (minus Appendix D). At least two communities, Williamsburg and Chesapeake, advertised the public meetings and provided a link to the plan on their community web sites (see Appendix C for screenshots). The plan was posted on the HRPDC web site on May 24, 2016, and contact information for the HRPDC Emergency Management Division was provided if the public needed instructions for submitting comments. The meetings and initial 2-week review period after the June 9 meeting, provided citizens with an opportunity to review the content of the Plan's sections. In response to a citizen's request, the review period was extended by an additional week.

Despite the best intentions of the committee, resulting public feedback was far less than anticipated, and less than seen in similar, previous regional planning efforts; there was also public concern on this topic. As a result, in early summer 2016, the Steering Committee committed to provide additional opportunities for:

- guided committee member assessment of the draft plan based on compiled public input (see Appendix H);
- public input via posting of the Public Participation Survey on Survey Monkey in coordination with community's Public Information Officers, or equivalent staff;
- reposting of the plan draft for public input in coordination with community's Public Information Officers, or equivalent staff; and,
- readvertising and conduct of an additional feedback session held on September 27, 2016.

The session on September 27, 2016 was termed the "Feedback Forum" in an effort to solicit public comment and feedback on the draft plan. Once again, the committee relied on the efforts of multiple community Public Information Officers, web masters, and other communication specialists to use a variety of sources to spread the word about the planning effort. Because newspaper advertisement of public meetings had resulted in limited turnout previously, project leaders attempted alternative methods of social media advertisement and terminology in order to attract more citizen involvement in the Feedback Forum. Records of these advertisements and solicitations for involvement are included in Appendix C (meeting minutes), Appendix D (public survey response summaries), Appendix E (responses to public comments), and Appendix H (Committee Assessment of Public Input forms).

Additionally, the plan was reviewed and presented to each community's elected officials at a public hearing prior to adoption. Though the plan was in its final format for these meetings, this did provide additional opportunity to answer questions and present findings to the public and elected officials. The resolution of adoption by each community is included in Appendix B. Adoption dates are shown in **Table 2.3**.

TABLE 2.3: DATE OF PLAN ADOPTION BY ELECTED OFFICIALS		
SUBREGION	**COMMUNITY**	**DATE OF PLAN ADOPTION**
Peninsula	City of Hampton	February 22, 2017
	City of Newport News	January 10, 2017
	City of Poquoson	February 27, 2017
	City of Williamsburg	January 12, 2017
	James City County	March 14, 2017
	York County	March 21, 2017
Southside	City of Norfolk	March 28, 2017
	City of Portsmouth	February 28, 2017
	City of Suffolk	February 15, 2017
	City of Virginia Beach	March 7, 2017
	City of Chesapeake	February 14, 2017
Western Tidewater	Isle of Wight County	February 16, 2017
	Town of Smithfield	February 7, 2017
	Town of Windsor	March 14, 2017
	City of Franklin	February 27, 2017
	Southampton County	January 23, 2017
	Town of Boykins	February 14, 2017
	Town of Branchville	February 20, 2017
	Town of Capron	March 6, 2017
	Town of Courtland	February 14, 2017
	Town of Ivor	February 13, 2017
	Town of Newsoms	March 6, 2017

Public Survey

A public survey was distributed at all public meetings to solicit additional feedback from attendees. As indicated above, the public survey was also distributed online via Survey Monkey in Summer 2016 as part of the committee's effort to improve and use public feedback. The results of a total 1,115 responses collected over the planning period are summarized in Appendix D. Appendix H details how the communities assessed all of the public feedback and used it in their review and analysis of various sections of the plan.

HRPDC Web Site

Throughout the planning process, HRPDC maintained a web site at http://www.hrpdcva.gov/departments/emergency-management/hampton-roads-hazard-mitigation-plan/ that provided a description of the planning process and posted meeting information. The page posted a copy of the draft plan prior to the final Public Meetings to provide the public an opportunity to comment. Those comments are addressed through the standard comment/response format documented in Appendix E. The web site was also used in summer and fall 2016 to post information related to the additional public comment period and public survey data collection effort.

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 Workshops.

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 the HRPDC web page postings provided opportunities for local officials, residents, and businesses to offer input.

During the 2015/2016 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;
- HRPDC;
- Neighboring jurisdictions;
- Representatives from colleges and universities in the region;
- the National Weather Service;
- Representatives from utilities servicing the region;
- Representatives from military bases in the region; and,
- Representatives from the medical community.

The stakeholders identified as such in **Table 2.2** responded to a more formal request to serve as stakeholders and to participate in the planning process through one of the methods identified above.

2017 UPDATE

Section 3 was updated to align the format and content of the existing plans and incorporate the most recent data available for each community. Tables and figures were updated, when necessary, to incorporate data from the 2010 U.S. Census, the HRPDC and other sources.

GEOGRAPHY AND THE ENVIRONMENT

Located in the southeastern quadrant of Virginia, the portion of Hampton Roads included in this study is bordered to the north by Gloucester County, to the south by Currituck and Camden Counties in North Carolina, to the east by the Atlantic Ocean and Chesapeake Bay, and to the west by the counties of Surry, Sussex and Greenville **(Figure 3.1)**. Although Surry County and Gloucester County are generally considered part of the Hampton Roads region for planning purposes, those counties are participating in hazard mitigation planning processes in conjunction with other, adjacent planning districts.

Table 3.1 provides a summary of the geographic characteristics of each of the participating communities derived from the U.S. Census Bureau, 2010 Census.

FIGURE 3.1: THE HAMPTON ROADS REGION OF VIRGINIA

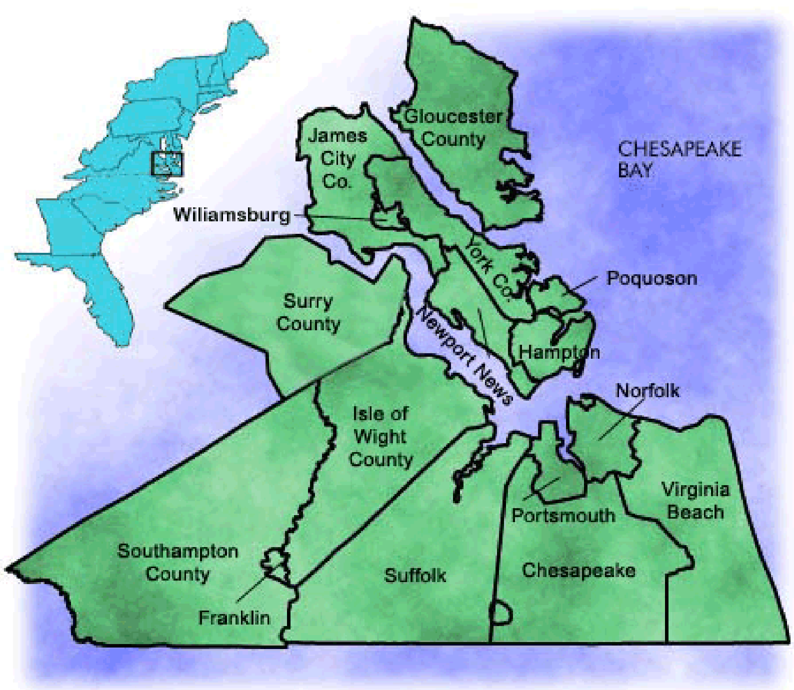


TABLE 3.1: SUMMARY OF GEOGRAPHIC CHARACTERISTICS

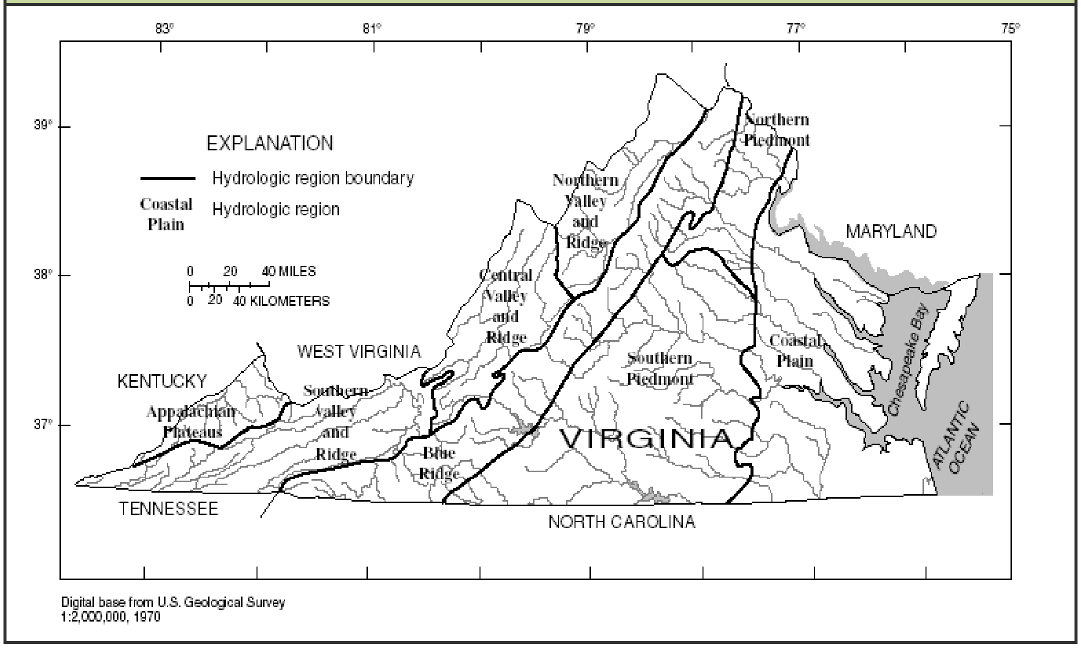
SUBREGION	COMMUNITY	AREA IN SQUARE MILES			DENSITY PER SQUARE MILE OF LAND AREA	
		TOTAL AREA	WATER AREA	LAND AREA	POPULATION	HOUSING UNITS
Peninsula	Hampton	136	85	51	2673	1159
	Newport News	119	51	69	2630	1109
	Poquoson	78	63	15	793	309
	Williamsburg	9	0.2	9	1559	574
	James City County	179	37	142	470	209
	York County	215	110	105	625	256
Southside	Norfolk	96	43	54	4,496	1,760
	Portsmouth	47	13	33	2,895	1,237
	Suffolk	429	29	400	211	83
	Virginia Beach	497	249	248	1,766	717
	Chesapeake	351	10	341	652	244
Western Tidewater	Isle of Wight County	363	47	316	112	46
	Smithfield	10	1	10	809	332
	Windsor	1	0	1	2,626	1,059
	Franklin	8.75	0.14	8.21	1,046	475
	Southampton County	602	3	599	31	13
	Boykins	0.69	0	0.69	812.3	388.9
	Branchville	0.43	0	0.43	267.1	121.8
	Capron	0.17	0	0.17	1004.2	423.5
	Courtland	0.92	0	0.92	1400.3	567.1
	Ivor	1	0	1	339	156
REGION TOTAL		**3143.96**	**741.34**	**2404.42**		

Source: U.S. Census Bureau, 2010

Hampton Roads is located within the Atlantic Coastal Plain Physiographic Province, which is characterized by its low, flat relief **(Figure 3.2)**. Much of the region's elevation is nearly level, with the highest elevation point in the study area being just 177 feet above sea level. For example, the overall elevation for the City of Chesapeake averages about 12.2 feet above sea level.

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 (U.S. Geological Survey (USGS) 2001).

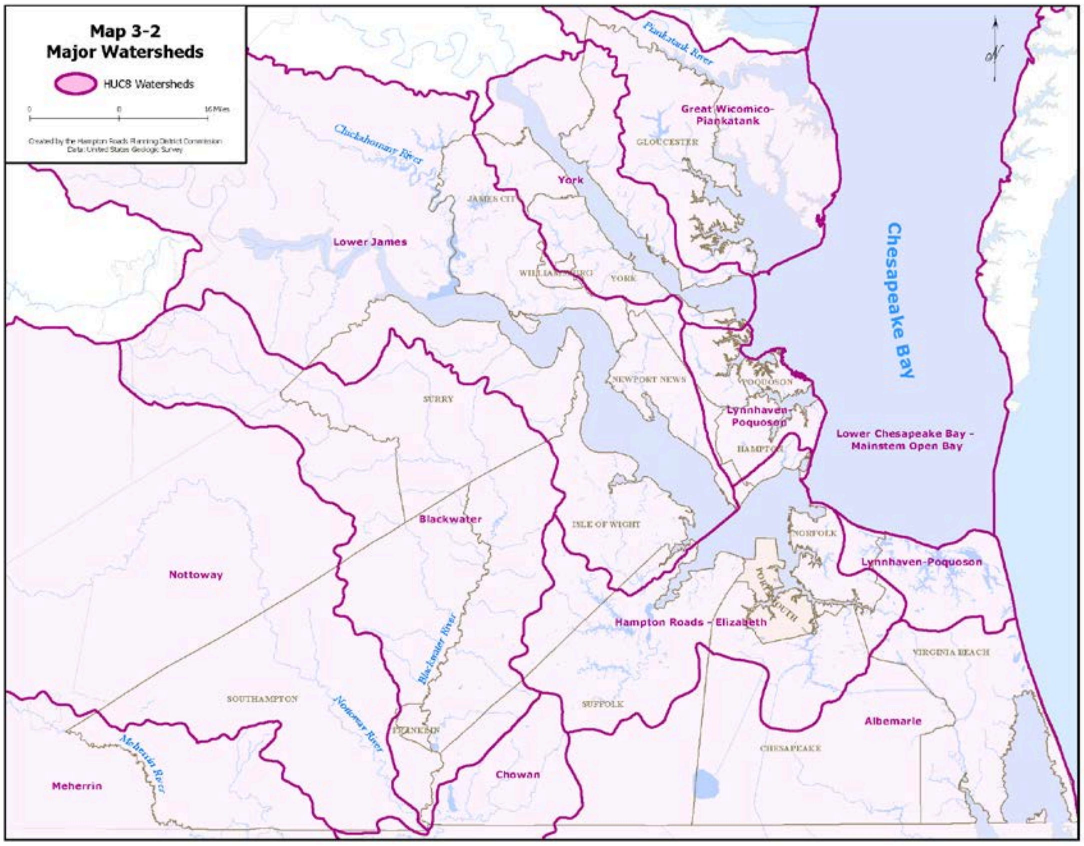
FIGURE 3.2: PHYSIOGRAPHIC REGIONS OF VIRGINIA



Hampton Roads contains portions of four major river basins: the James River Basin, the York River Basin, Lower Chesapeake Bay, and the Albemarle-Chowan Basin. **Figure 3.3** provides a graphical illustration of the watersheds designated by their USGS Hydrologic Unit Code (HUC). The James River Watershed encompasses approximately 10,200 square miles, and its headwaters are located in Bath and Highland Counties. The James River, which is a part of the larger Chesapeake Bay Basin, empties into the Chesapeake Bay at Hampton Roads. The Lower James subbasin, as shown in **Figure 3.3**, has an area of 1,440 square miles, and the Hampton Roads – Elizabeth subbasin has an area of 425 square miles. The York River Basin encompasses 2,626 square miles with headwaters in Orange County, Virginia. The Lower York River subbasin shown in **Figure 3.3** has an area of just 275 square miles. Several tributaries in the study area flow directly into the Chesapeake Bay, including Poquoson River, Back River, and Lynnhaven River, but the basin also includes the small bays, river inlets, islands and shoreline of the Bay. While the entire basin includes just over 3,000 square miles of land area, just 53% of that land area is within the study area.

Land in both North Carolina and Virginia contribute runoff to the Albemarle-Chowan River Basin. The drainage basin within Virginia is 4,061 square miles, and the basin begins as far west as Charlotte County. Major tributaries include the Meherrin, Nottaway and Blackwater Rivers. In Virginia, there are 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.

FIGURE 3.3: HYDROGRAPHIC REGIONS OF HAMPTON ROADS



Source: *Hampton Roads Regional Water Supply Plan, HRPDC, 2011*

According to the Virginia Department of Conservation and Recreation (DCR) natural heritage inventory, there are at least seven important ecological community groups in Hampton Roads that are interrelated with the water resources of the region:

- Pine/Scrub Oak Sandhills – includes slightly elevated sand deposits along the Blackwater and Nottoway Rivers in Southampton and Isle of Wight counties and the City of Suffolk.
- Fluvial Terrace Woodlands – Nottoway River and Chickahominy River
- Bald Cypress – Tupelo Swamps – swamps dominated by old-growth bald cypress along the Blackwater River in Isle of Wight County and the Nottoway River in Southampton County.
- Coastal Plain/Piedmont Swamp Forests;
- Coastal Plain/Piedmont Floodplain Forests;
- Tidal Bald Cypress Forests and Woodlands; and,
- Tidal Freshwater and Oligohaline Aquatic Beds

The Virginia Scenic Rivers program, administered by DCR, identifies, recognizes and provides limited protection to rivers whose scenic beauty, historic importance, recreation value, and natural characteristics make them resources of particular importance. Reaches of the Blackwater, lower James, North Landing and Nottoway Rivers are all designated scenic rivers through the program. Similarly, the Nationwide Rivers Inventory is a register of river segments that possess unique, rare or exemplary features that are significant at a comparative regional or national scale. Segments of the Blackwater, Chickahominy, James, Northwest, Nottoway, Ware, Yarmouth, and York Rivers are designated on the National Rivers Inventory for various reasons. Additional information on the significance of each designated reach can be found at: http://www.nps.gov/ncrc/programs/rtca/nri/states/va.html.

The summer, fall, spring, and winter temperatures in the Hampton Roads region are typically mild. **Table 3.2** provides the annual meteorological averages for maximum, minimum, and mean temperatures, as well as total precipitation from three airports in the coastal part of the region. The region usually receives small amounts of snowfall annually. Additional discussion of weather extremes, including winter storms, are included in Section 4.

TABLE 3.2: ANNUAL METEOROLOGICAL AVERAGES

WEATHER STATION	TEMPERATURE (DEGREES FAHRENHEIT)			TOTAL PRECIPITATION (INCHES)
	MAXIMUM	MINIMUM	MEAN	
Joint Base Langley-Eustis (Hampton) 1918-2007	67.5	51.3	59.4	43.6
Holland (Suffolk) 1933-2008	70.2	47.4	58.8	48.4
Norfolk International Airport 1946-2008	68.5	51.4	59.9	45.3

Source: *Hampton Roads Regional Water Supply Plan, HRPDC, 2011*

The following information provides a brief overview of the history, geography and unique characteristics of the jurisdictions in the study area.

City of Hampton

Hampton is the oldest continuously settled English-speaking community in the United States. The area now occupied by Hampton was first noted by English colonists before they sailed up the James River to settle in Jamestown, where they visited an Indian village called Kecoughtan.

In 1610, the construction of Fort Henry and Fort Charles at the mouth of Hampton Creek marked the beginnings of Hampton. In 1619, the settlers chose an English name for the community, Elizabeth City. The settlement was known as Hampton as early as 1680, and in 1705 Hampton was recognized as a town. The City of Hampton was first incorporated in 1849. In 1952, Hampton, the independent town of Phoebus, and Elizabeth City County, encompassing Buckroe and Fox Hill, were consolidated under one municipal government.

Benjamin Syms and Thomas Eaton founded the first free public schools in the United States in Hampton. Hampton is the site of Hampton University, established in 1868 to educate freed slaves. St. John's Episcopal parish was founded in 1610, making it the oldest in the country.

Fort Monroe was the only active moat-encircled fort in the country from 1819 until it was decommissioned in 2011. For a long period during the Civil War, the fort was the only Union outpost in the Confederacy. The famous battle between the first ironclad battleships, the Monitor and the Merrimac, was fought just offshore in Hampton Roads, near the Hampton-Newport News municipal boundary.

During the Civil War, rather than surrender to the Federal army, Hampton was burned down by its own troops. Before the fire, Hampton had 30 businesses and over 100 homes. Fewer than six buildings remained intact after the fire. In 1884, fire again besieged Hampton and almost completely destroyed the downtown business district.

Hampton is now a thriving city with numerous industries including high-tech firms, seafood processing, NASA, military, and tourism. Fort Monroe was the headquarters for the U.S. Army Training and Doctrine Command until its decommission in 2011. It has since been redeveloped as a result of the 2005 Base Realignment Closure Commission. The *Fort Monroe Reuse Plan* was signed into effect August 2008, and the city, the Fort Monroe Authority and the Federal government have worked together on implementation of the Plan. Today, Fort Monroe is a National Park with housing units, offices, and public access to the waterfront and the entire fort. The Fort Monroe Authority works to preserve the history of the Fort and maintain the buildings and grounds for continued use. Langley Air Force Base, where historic Langley field was constructed in 1917, is home of the First Fighter Wing. NASA Langley Research Center, where America's first astronauts were trained, is now a major center for aviation research.

City of Newport News

Established as a town in 1880, Newport News was incorporated as a city in 1896. In the 1960s, the City of Newport News merged with Warwick County to create today's incorporated area.

The most widely accepted version of how Newport News was named relates to Captain Christopher Newport's return to the area from England in 1610. Newport met the Jamestown colonists on Mulberry Island, (located offshore on the James River) as they were preparing to return to England. The news of his arrival with three vessels, a plentiful supply of provisions, and 150 men gave heart to the dispirited colonists who agreed to go back to Jamestown. In gratitude, they named the point of landing "Newport's News." Over the years, the "s" was dropped, thus the name Newport News.

The City of Newport News played a major role in the Peninsula Campaign during the Civil War. Numerous earthen fortifications and attractions that relate to the Civil War are still visible. Additionally, the famous Battle of the Ironclads took place off the shores of Newport News in 1862. Collis P. Huntington, a Northern railroad tycoon from Connecticut, established two major industries in Newport News: the C&O Railroad and Newport News Shipbuilding. Newport News Shipbuilding and Dry Dock Company, established in 1886, built many of the United States' aircraft carriers, including the Enterprise, Kennedy, Washington, Vinson, and Roosevelt. On November 7, 2001, Newport News Shipbuilding signed a merger agreement with Northrop Grumman, and officially became Northrop Grumman Newport News.

The U.S. Army designated the City of Newport News as a Port of Embarkation immediately after America's entry into World War I. The final major military base during WWI was Camp Eustis, which later became known as Fort Eustis. Named after the founder of Fort Monroe's Artillery School of Practice and a War of 1812 veteran, Brigadier General Abraham Eustis, the camp was created in 1918 to meet the need for an artillery firing range. Today, Fort Eustis is the home of the U.S. Army Transportation Corps, and the Transportation Corps Regiment. The U.S. Army Transportation Museum is also located at Fort Eustis.

City of Poquoson

The name "Poquoson" comes from a Native American term that has been translated as either "flat land" or "great marsh." Plum Tree Island National Wildlife Refuge covers approximately 5.5 square miles and dominates the eastern portion of the City. Together with privately owned salt marsh lands, the area makes up the largest saline marsh in the lower Chesapeake Bay.

Poquoson was part of York County for over three centuries and incorporated as a town in 1952. It was later chartered as a city in 1975. It is the oldest continuously named city in Virginia. General agriculture and seafood related businesses remained the predominant activities of the City until the construction of Langley Field in 1917 prior to the United States' entry into World War I. The Field offered residents many employment opportunities either working directly for Langley Field, its many military contractors, or ancillary businesses. Since World War II, Poquoson has been a residential community for people working all over the peninsula.

City of Williamsburg

In 1699, the General Assembly of Virginia established the City of Williamsburg as the colony's capital. The new city, formerly known as Middle Plantation, was named in honor of King William III. In 1722, King George I granted a royal charter incorporating the City of Williamsburg after the fashion of the English municipal borough.

During the 1700's, Williamsburg developed into a bustling capital city and played a singularly historic role in events leading to American Independence. In 1780, the capital of Virginia moved to Richmond, and the Williamsburg area reverted to a quiet college town and rural county seat. In retrospect, Williamsburg's loss of capital city status was its salvation. Many eighteenth century buildings survived into the early twentieth century, when John D. Rockefeller Jr. supported a massive restoration effort. Now a center of tourism and history, the area is preserved and managed by the Colonial Williamsburg Foundation, a non-profit organization.

The College of William and Mary, located in Williamsburg, currently enrolls 5,800 undergraduate and almost 2,000 graduate students. Originally founded on February 8, 1693, William and Mary is the second-oldest institution of higher learning in the United States and the fourth oldest in North America. The school was one of the original Colonial colleges; the College's Wren Building is one of the oldest academic buildings in continuous use in the United States. The College educated several American leaders, including three U.S. Presidents. George Washington served as one of the College's first Chancellors. Current chancellor, Sandra Day O'Connor, was the first woman to serve on the United States Supreme Court.

William and Mary was occupied during the Civil War and closed from 1882-1888 due to financial strains (the College had invested in Confederate bonds). In 1888, William and Mary reopened its doors and began to expand. Today, William and Mary is one of Virginia's most-cherished universities and was one of the first universities to become coeducational in 1918. William and Mary is consistently ranked among the premier public universities in America.

James City County

On May 13, 1607, 144 English explorers arrived and soon established James Towne as the administrative center or capitol. In 1634, by order of the King of England, Charles I, eight shires or counties with a total population of approximately 5,000 inhabitants were established in the colony of Virginia. James City Shire, as well as the James River and Jamestown, took their name from King James I, the father of King Charles I. During 1642 or 1643, the name of the James City Shire was changed to James City County. The original county included what is now Surry County across the James River, part of Charles City County, and some of New Kent County.

Williamsburg became an independent city from James City County in 1884; however, the city is still the county seat of James City County, and they share a school system, courts, and some constitutional officers.

James City County encompasses land important in the early history of our nation. Three jurisdictions, James City County, York County, and the City of Williamsburg, work collaboratively on policies, programs, infrastructure, and land use to preserve this historic area.

York County

York County was formed in 1634 as Charles River Shire, named for King Charles I. It was one of the eight original shires in the Colony of Virginia. The county was renamed in 1642-43 as York County. The river, county, and town are believed to have been named for York, a city in Northern England. The first courthouse and jail were located near what is now Yorktown, although the port used for shipping tobacco to Europe was variously called Port of York, Borough of York, York, or Town of York, until Yorktown was established in 1691. Never incorporated as a town, Yorktown is the county seat of York County. The only town ever incorporated within the county's boundaries was Poquoson, which was incorporated in 1952 and became an independent city in 1975.

York County is most famous as the site of the surrender of General Cornwallis to General George Washington in 1781, ending the American Revolutionary War. Yorktown also figured prominently in the Civil War, serving as a major port to supply both Union and Confederate towns, depending upon who held Yorktown at the time.

Yorktown is part of an important national resource known as the Historic Triangle of Yorktown, Jamestown, and Williamsburg, and is the eastern terminus of the Colonial Parkway.

City of Norfolk

The City of Norfolk, located on the Elizabeth River, was founded in 1682 but was not incorporated as a city until 1845. Initially comprised of only 50 acres, the city has grown to a total of 96 square miles today.

Norfolk has seven miles of Chesapeake Bay waterfront and a total of 144 miles of shoreline, including lakefront, rivers and the Bay. Naval Station Norfolk, which was established on the old Jamestown Exposition grounds in 1917, is the world’s largest naval base. The city is also home to the North American Headquarters for the North American Treaty Organization (NATO). Norfolk is the most densely developed jurisdiction in the Southside Hampton Roads region at 4,486 people per square mile.

City of Portsmouth

The City of Portsmouth was founded as a town in 1752 on the shores of the Elizabeth River by Colonel William Crawford. In 1858, the town was separated from the county government and given status as an independent city.

Portsmouth’s location as an East Coast deep-water port, and available business sites in proximity to the nation’s largest shipyard, have provided a significant impetus for economic growth in the area. Today Portsmouth is in the middle of the dynamic Norfolk-Virginia Beach metropolitan area and home to almost 100,000 people. In addition to the many medical, cultural and recreational facilities within the immediate community, Portsmouth’s downtown is bustling with retail, restaurant and service-related businesses. The historic waterfront neighborhood of Olde Towne lines the Elizabeth River and is easily traversed by the famous downtown seawall, and the City of Norfolk is easily accessible by a 5-minute ferry ride across the river.

City of Suffolk

In 1742, the Town of Suffolk, which was originally part of the County of Nansemond, was established. The town was burned by the British in 1779 and damaged by other fires throughout the next century, but survived to eventually become incorporated as a city in 1910. In 1974, the City of Suffolk consolidated with the towns of Holland and Whaleyville, and the County of Nansemond. At that point it became the largest city (geographically) in Virginia and the 11th largest in the country, encompassing a total of nearly 430 square miles. This large area is made up of land with woods, lakes, rivers, and rolling terrain.

The City of Suffolk is located along the Nansemond River and is still largely recognized as the “Peanut Capital” of the world and as the home of “Mr. Peanut.” In 1912, an Italian immigrant named Amedeo Obici moved from Pennsylvania to Suffolk and opened Planters Nut and Chocolate Company. Today, Suffolk remains a major peanut processing center and transportation hub.

City of Virginia Beach

The first settlement inside the city limits of Virginia Beach was made on Lynnhaven Bay in 1621, and the area first became incorporated as a town in 1908. In 1963, the Town of Virginia Beach merged with Princess Anne County to form the independent City of Virginia Beach.

The city consists of 249 square miles of inland water and 248 square miles of land. The topography is relatively flat with an average elevation of twelve feet above sea level. The area contains extensive brackish tidal areas, such as the Lynnhaven and Elizabeth River systems, and expansive freshwater tidal areas, such as the North Landing River and Back Bay systems.

Due to a combination of the city's geographic position on the mid-Atlantic coastline and the straddling of two ecologically significant estuaries, Chesapeake Bay and Pamlico Sound, the area serves as the southern limit of many northern plant and animal species. The Back Bay National Wildlife Refuge, established in 1938 and managed by the U.S. Fish and Wildlife Service, is an 8,000-acre fresh water refuge that borders the Atlantic Ocean on the east and Back Bay on the west. The barrier islands feature large sand dunes, maritime forests, fresh water marshes, ponds, ocean beach, and large impoundments for wintering wildfowl.

Virginia Beach is best known as a major resort destination, with miles of beaches and dozens of hotels, motels, and restaurants. It is also home to several state parks, several protected beach areas, four military bases, a number of large corporations, and two universities. Much of the land remained undeveloped until World War II when the Navy built Oceana Naval Air Station, followed by three more military bases, including Little Creek, Fort Story, and Dam Neck. Since the end of the war, Virginia Beach has experienced continued rapid growth and is the region's most populous jurisdiction at more than 430,000 people.

City of Chesapeake

Chesapeake's history dates back much further than 1963 when Norfolk County and the City of South Norfolk merged to create Chesapeake. The first English settlement of the area began around 1620 along the banks of the Elizabeth River. Norfolk County's founding dates back to 1636.

In the early months of the Revolutionary War, in December 1775, British Royal Governor Lord Dunmore moved his forces from Norfolk to Great Bridge where his army entrenched itself to await the arrival of American forces. The two armies clashed on December 9, 1775, in the historic Battle of Great Bridge, just a few hundred yards from where the Chesapeake Municipal Center complex stands today. In a brief but decisive battle, the Americans routed Lord Dunmore's forces which fled to Norfolk and later abandoned that city.

In 1793, work began on the Dismal Swamp Canal, an idea first envisioned by George Washington in 1763, when he visited the swamp. Because the canal was dug completely by hand, progress was slow and expenses were high. The canal opened in 1805. Now on the National Register of Historic Places, the Dismal Swamp Canal is the oldest operating artificial waterway in the country. Both the Dismal Swamp Canal and the Albemarle and Chesapeake Canal are operated by the Army Corps of Engineers and form part of the Atlantic Intracoastal Waterway. 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 first local encounter of the Civil War occurred at Sewell's Point in May 1861. Although no battles were fought in the Chesapeake area, Union troops occupied and laid waste to much of the land. When the war ended, Norfolk County took advantage of its abundant natural resources. Its coastal location, miles of riverfront and deep-water harbors and the fertile, level farmland allowed county residents to recover quickly from the wartime destruction, moving without hesitation into the 20th century.

While most of the area retained its rural atmosphere through the early 1900s, the northern section near the growing City of Norfolk began to develop as the suburb of South Norfolk. By 1900, South Norfolk had its own waterworks, public schools and a post office. Two rail lines spurred rapid growth, allowing South Norfolk to incorporate as an independent town in 1919 and a city of the first class, independent of Norfolk County, in 1950.

The area that now comprises Chesapeake grew with residential and commercial development of "community crossroads." These areas are still commonly referred to today with community names such as Pleasant Grove, Great Bridge, Oak Grove, Fentress, South Norfolk, Portlock, Deep Creek, Western Branch, Indian River and Hickory.

During the 1950s, both Norfolk County and South Norfolk fell victim to annexation suits filed by neighboring cities. Between 1950 and 1960, the county lost nearly 50,000 residents and 30 square miles of land area. Under these circumstances, both Norfolk County and South Norfolk officials found it difficult to plan for the future.

In the fall of 1961, city and county officials met to discuss the feasibility of a merger. After several weeks of negotiations, both governing bodies approved a merger agreement on December 22, 1961. On February 13, 1962, citizens of both communities turned out in near-record numbers for a special election and approved the merger. Later that year, in June, the citizens voted again and selected the name "Chesapeake" for the new city. On January 2, 1963, the Chesapeake City Council, with five members from South Norfolk and five from Norfolk County, met for the first time.

Isle of Wight County

Isle of Wight County was established as Worrosquoyacke County in 1634, one of eight counties divided from the Virginia colony. The original boundaries of the county included Lawne's Creek to the north, the James River to the east, the head of Colonel Pitt's Creek to the south and undeveloped wooded area to the west. In 1656, Ragged Island and Nansemond County were incorporated into Isle of Wight County. A long dispute between the counties of Isle of Wight and Nansemond continued until 1674, when the General Assembly established the boundaries that exist today.

Isle of Wight County is thirty-seven miles in length and maintains an average breadth of eleven miles. The county is comprised of approximately 363 square miles, of which 80 percent is land area. The area contains relatively flat, but rolling terrain with average elevation of approximately 80 feet above sea level. The land generally dips to the northeast from a plateau west of Bethel Church, and from that same plateau, the land dips to the northwest and west. Several swamps, ravines and creeks drain to the James River, the Blackwater River and the Nansemond River.

Today, Isle of Wight's residents enjoy the rural nature of the County coupled with the quaint atmosphere of the two incorporated towns, Smithfield and Windsor. While the local economy remains agriculturally-based, the area's scenic beauty, history and proximity to other attractions in the Hampton Roads area greatly contribute to the tourist draw. In addition, the County is close enough to the transportation hubs and employment centers of the Norfolk-Virginia Beach area to attract year round residents and businesses alike.

Town of Smithfield

The Town of Smithfield was incorporated in 1752 by Arthur Smith, IV, who parceled out his family farm into 72 lots and 4 streets in order to house British merchants and ship captains. The town is located on the banks of the Pagan River, which flows into the James River. Smithfield was a river town from its very beginning, and the livelihood of its residents and continued growth over the years has been influenced by the river. The town measures approximately ten square miles.

Nurtured by trade and commerce, Smithfield soon became a town of industry with four plants devoted to the art of curing the world famous "Smithfield Ham." Located within the town is Smithfield Foods, Inc., the area's largest meat-processing industry as well as a major employer for the region.

Smithfield has many of the charms associated with Hampton Roads communities, including many historic homes representing 18th and 19th century architecture, a revitalized historic downtown, and the character of a former colonial seaport. To preserve the historical charm, the Town of Smithfield and individual property owners enacted a Historic Preservation District Ordinance in 1979. Smithfield offers residents a small-town atmosphere, a high quality school system, affordable housing, a historic downtown, and a state-of-the-art community/conference center.

Town of Windsor

The Town of Windsor is located in the heart of Isle of Wight County. The town's original name was Corrowaugh and it was established as a post office in 1852. Five years later, the Norfolk and Petersburg Railroad obtained the post office and built a depot called Windsor Station. In 1902, a town charter was granted by the General Assembly and the town became known simply as Windsor.

In 1950, the Windsor Ruritan Club and the Town of Windsor built a "Community House" which has been a valuable asset to the community over the years. Over the next three decades, town services improved and expanded. The streets were upgraded and paved, sidewalks extended, additional streetlights installed, drainage improved, and ditches piped. The privately owned water systems in the town limits were purchased by the town, upgraded, extended and an above ground water storage tower was erected. In 1971, the Windsor Volunteer Rescue Squad was founded and continues to provide service to the town and surrounding community.

In July 2001, the Town of Windsor annexed 2.82 square miles of Isle of Wight County. As a result, the total area increased from one square mile to 3.82 square miles and population increased from approximately 900 to 2,347. Also in 2001, Isle of Wight County helped install a central sewer system in the town which opened up many areas for new homes and businesses. The Town of Windsor remains a small rural town amidst the region's larger, more populated cities which are easily accessible through two main roads bisecting the town, Route 460 and Route 258.

City of Franklin

Franklin was incorporated as a Town within Southampton County in March of 1876. The first official census of 1880 indicated that there were 447 inhabitants within its limits. By 1970, nearly 7,000 people lived in Franklin.

Franklin developed considerable steamboat commerce along the Blackwater River southward to North Carolina ports from the late 1800s and early 1900s through the 1920s. The combination of rail and water transportation led to more rapid growth in Franklin than in the other towns. The steady growth of the Camp family's lumber business after the Civil War accelerated this growth. Franklin also became a major collection point for peanuts in that period. Franklin is now the major center of commerce and industry for Southampton County.

The Blackwater River is a relatively slow moving, dark river that traverses the City and serves as a valuable resource. Residents rely on the river for recreation, using it heavily for boating and freshwater fishing.

Southampton County and towns

The earliest explorations of the area began a few years after the settlement of Jamestown. The inhabitants were then members of several small Indian tribes, mainly the Nottoways and Meherrins, with settlements along the rivers that now bear their names. In 1634, the western limit of English colonization was established at the "Blackwater Line," which extended southeast from Fort Henry (now Petersburg) through the Blackwater Swamp. Increasing pressure from colonists resulted in lifting of the line in 1705, and in following years the County lay in the path of the general southwesterly migration from the James River settlements. The soils were good for farming and there were forests for timber. More settlers were attracted, and later their slaves, as the Indians were gradually collected in reservations before they finally dispersed. There was a remnant of the Nottoway reservation still in existence in 1856 and probably for some years thereafter.

Water commerce to the south on the Blackwater and Nottoway Rivers was prominent in the early history of the County during both the Revolutionary and Civil Wars. Efforts to maintain or interrupt these routes for military supplies resulted in skirmishes on several occasions, but no major battles. South Quay on the Blackwater River was an established port from the early years of the 18th century. A most dramatic event of the County's history between the Revolutionary and Civil Wars was the slave rebellion led by Nat Turner in 1831. This bloody revolt and its aftermath resulted in the deaths of approximately 100 blacks and whites and drew national and international attention from both pro- and anti-slavery factions.

In order to establish a more convenient administrative center, the present County was split off from Isle of Wight County in 1749. The County seat was Jerusalem, renamed and incorporated as Courtland in 1888. The new County is believed to have been named for Henry Wriothesley, third Earl of Southampton, who was active in promoting colonization of Virginia under the English King James I.

The isolation of Southampton County diminished with the coming of the first railroad in 1834, as the first leg of the Portsmouth and Roanoke Railroad (now CSX) extended to the Nottoway River on its way to western Virginia and made connection with water travel to the south on the river. The Petersburg Railroad (now also CSX) had gone into operation west of the Meherrin only a year before. With the coming of the Portsmouth and Roanoke line, Southampton farmers now had access to both the Petersburg and Norfolk markets. In 1858, the Petersburg and Norfolk Railroad was completed, crossing the northeastern section of the County. Courtland eventually gained rail service with the coming of the Atlantic and Danville Railroad in 1888, about the same time the Surry, Sussex and Southampton Railway (now abandoned) provided service from the north central County to Scotland Wharf on the James River in Surry County. The Virginian Railroad (also abandoned) was built through Sebrell and Sedley in 1906. Over the years, the economic life of the County became centered on the railroad depots that were established at road crossings. Towns and villages gradually formed at these points: Newsoms, Boykins, and Branchville; Courtland, Capron, and Drewryville; and Sedley and Sebrell. Ivor to the northeast, perhaps somewhat more associated with the other towns along its railroad (Waverly, Wakefield and Zuni) also formed.

In more recent times the County's highways have assumed an increasing share of the responsibility for transporting farm products, timber, and manufactured products. In addition, improved roads and widespread automobile ownership have enabled the same kind of widely dispersed residential pattern once maintained by farming, but now maintained by community centers of trade, services, and manufacturing employment.

POPULATION AND DEMOGRAPHICS

According to the *U.S. Census Bureau 2009-2013 American Community Survey 5-Year Estimates*, the study area portion of Hampton Roads has a population of 1,633,548 people. **Table 3.3** 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 3.3 are based on 2010 Census data and the most recent American Community Survey.

TABLE 3.3: DEMOGRAPHIC CHARACTERISTICS						
SUBREGION	COMMUNITY	TOTAL POPULATION (2013 ACS)	UNDER 18 YEARS OLD (%)	65 YEARS AND OVER (%)	MEDIAN AGE	PERSONS IN POVERTY (%)
Peninsula	Hampton	136,957	30,705 (22)	17,152 (13)	35.5	19,474 (14)
	Newport News	181,025	43,506 (24)	19,717 (11)	32.5	25,090 (14)
	Poquoson	12,117	2,853 (24)	1,964 (16)	43.6	492 (4)
	Williamsburg	14,579	1,491 (10)	2,009 (14)	24.0	1,730 (12)
	James City County	68,171	14,534 (21)	14,546 (21)	45.1	5,760 (8)
	York County	65,762	16,741 (25)	8,348 (13)	39.5	3,454 (5)
Southside	Norfolk	244,090	50,408 (21)	23,159 (10)	29.8	40,416 (17)
	Portsmouth	95,901	22,669 (24)	12,836 (13)	35.2	16,002 (17)
	Suffolk	84,842	21,850 (26)	10,143 (12)	38.1	9,670 (11)
	Virginia Beach	442,151	104,513 (24)	48,819 (11)	34.9	31,634 (7)
	Chesapeake	225,597	57,312 (25)	24,455 (11)	36.6	18,002 (8)
Western Tidewater	Isle of Wight County	35,373	7,760 (22)	5,444 (15)	44.2	3,697 (10)
	Smithfield	8,159	1,857 (23)	1,187 (15)	43.4	1,075 (13)
	Windsor	2,624	641 (24)	374 (14)	42.9	355 (14)
	Franklin	8,539	2,090 (24)	1,468 (17)	39.9	1,944 (23)
	Southampton County	18,444	3,734 (20)	2,994 (16)	44.8	2,977 (16)
	Boykins	718	163 (23)	159 (22)	39.5	146 (22)
	Branchville	113	25 (22)	9 (8)	35.3	11 (9)
	Capron	118	25 (21)	24 (20)	46.5	9 (9.4)
	Courtland	1,605	468 (29)	302 (19)	37.4	733 (44)
	Newsoms	456	78 (17)	77 (17)	35.7	68 (14)
	Ivor	400	99 (25)	67 (17)	43.2	22 (5)

Source: *U.S. Census Bureau 2010 Census and 2009-2013 American Community Survey 5-Year Estimates*

Table 3.4 provides the population change experienced by communities in the region between 1970 and 2010, as well as the HRPDC population projection through 2040. While the cities of Hampton, Newport

News, Norfolk and Portsmouth have experienced stable to small decreases in recent population, other jurisdictions have experienced a fairly steady increase since 1970.

TABLE 3.4: REGIONAL POPULATION CHANGE AND PROJECTED CHANGE, 1970 - 2040

SUBREGION	COMMUNITY	1970	1980	1990	2000	2010	2040
Peninsula	Hampton	120,779	122,617	133,811	138,437	137,436	137,200
	Newport News	138,177	144,903	171,439	180,150	180,719	189,100
	Poquoson	5,441	8,726	11,005	11,566	12,150	12,400
	Williamsburg	9,069	10,294	11,530	11,998	14,068	17,200
	James City County	17,853	22,339	34,859	48,102	67,009	104,200
	York County	27,762	35,463	42,422	56,297	65,464	82,700
Southside	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
	Chesapeake	89,580	114,486	151,982	199,184	222,209	314,600
Western Tidewater	Isle of Wight County	18,285	21,603	25,053	29,728	35,270	62,800
	Franklin	6,880	7,308	7,864	8,346	8,582	10,800
	Southampton County	18,582	18,731	17,550	17,482	18,570	25,500
REGION TOTAL		**1,090,422**	**1,189,826**	**1,419,897**	**1,527,192**	**1,624,404**	**1,990,140**

Source: *Hampton Roads 2040 Socioeconomic Forecast and TAZ Allocation,* HRPDC, 2013

HOUSING, INFRASTRUCTURE AND LAND USE

According to the U.S. Census Bureau, *2009-2013 American Community Survey 5-Year Estimates*, there are 662,161 housing units in the study area portion of Hampton Roads with more than 90-percent of the units classified as occupied. The majority of structures were built after 1970 (65%), and 56% of all housing units are owner-occupied. Slightly more than 40% of the housing units are mortgaged. **Table 3.5** summarizes data on housing characteristics. More specific information regarding the vulnerability of residential units to various hazards is provided in Section 5 *Vulnerability Assessment*.

TABLE 3.5: HOUSING CHARACTERISTICS						
SUBREGION	COMMUNITY	TOTAL HOUSING UNITS	AVERAGE HOUSEHOLD SIZE	MEDIAN VALUE	OCCUPIED UNITS (%)	HOUSING STRUCTURES BUILT BEFORE 1970 (%)
Peninsula	Hampton	59,746	2.52 persons	$195,400	52,511 (88%)	30,403 (51%)
	Newport News	76,637	2.50 persons	$200,100	69,211 (90%)	30,355 (40%)
	Poquoson	4,736	2.62 persons	$302,400	4,591 (97%)	1,589 (34%)
	Williamsburg	5,192	2.29 persons	$311,800	4,391 (85%)	1,898 (37%)
	James City County	30,253	2.50 persons	$327,100	26,883 (89%)	2,819 (9%)
	York County	26,797	2.69 persons	$316,800	24,071 (90%)	5,432 (20%)
Southside	Norfolk	95,271	2.59 persons	$202,800	85,557 (90%)	59,411 (62%)
	Portsmouth	40,833	2.52 persons	$175,600	36,690 (90%)	24,521 (60%)
	Suffolk	33,372	2.75 persons	$242,000	30,492 (91%)	10,135 (30%)
	Virginia Beach	178,753	2.62 persons	$267,600	164,944 (92%)	39,881 (22%)
	Chesapeake	84,403	2.77 persons	$261,600	79,421 (94%)	19,540 (23%)
Western Tidewater	Isle of Wight County	14,781	2.59 persons	$249,600	13,560 (92%)	3,630 (25%)
	Franklin	3,895	2.37 persons	$186,700	3,551 (91%)	1,796 (46%)
	Southampton County	7,492	2.52 persons	$150,000	6,708 (90%)	3,072 (41%)
REGION TOTAL		662,161	2.61 persons	$240,000	602,581 (91%)	234,482 (35%)

Source: U.S. Census Bureau, 2009-2013 American Community Survey 5-Year Estimates

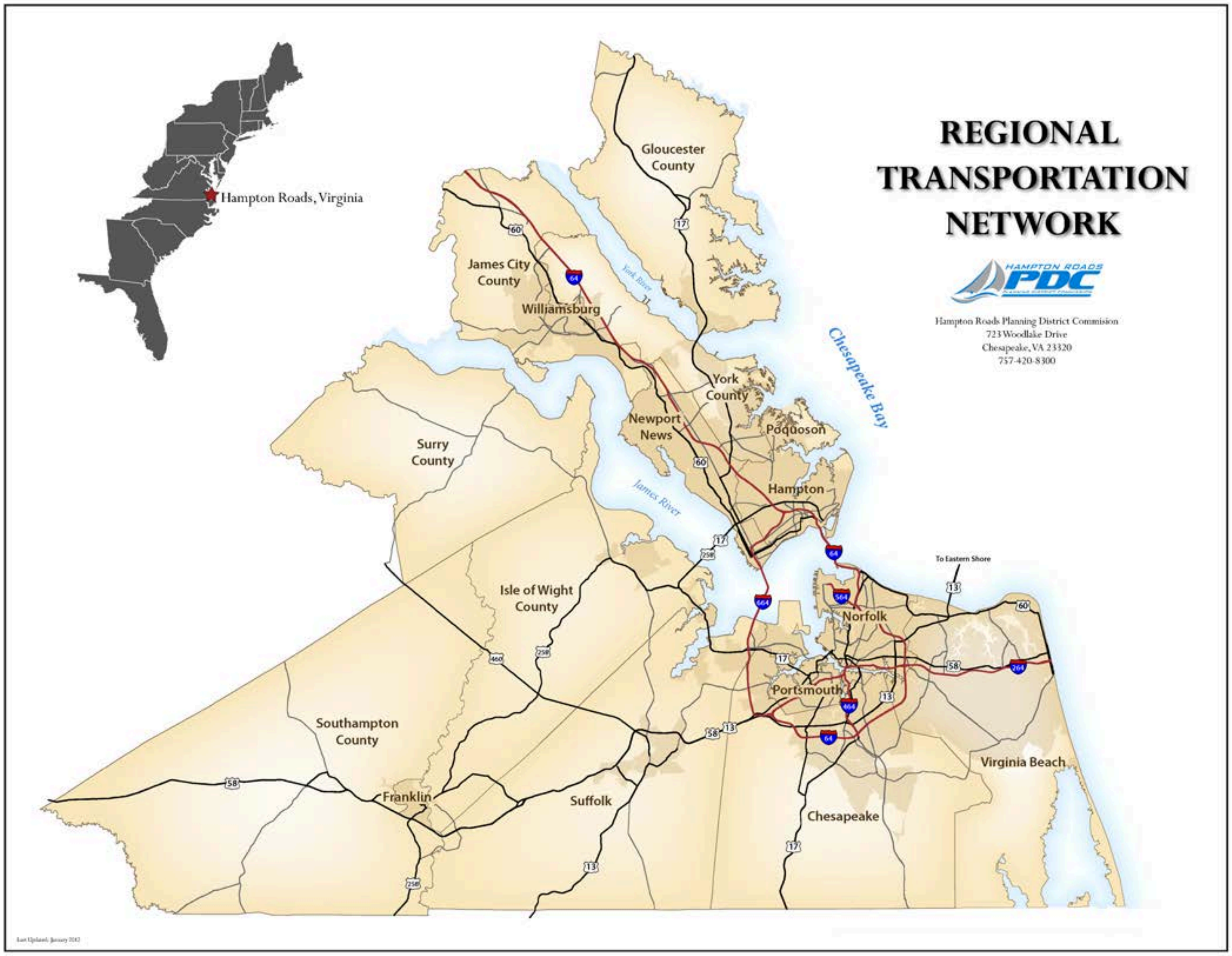
The Hampton Roads region provides an integrated network of transportation facilities and infrastructure that includes many interstates (I-64, I-264, I-464, I-564, I-664) and highways (U.S. 13, 17, 58, 60, 258, 460 and State Route 164), along with hundreds of secondary roadways and bridges throughout the area. 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 and Interstate 64 link Hampton Roads with I-95 and I-85, which are the primary north-south interstate highways in Virginia. The Chesapeake Bay Bridge-Tunnel, which opened in 1964, connects Virginia's Eastern Shore with Virginia Beach and remains one of the world's modern engineering wonders. **Figure 3.4** illustrates the transportation network in the region. Freight rail service is provided by CSX Transportation and Norfolk Southern, Commonwealth Railroad, the Chesapeake and Albemarle Railroad, and the Norfolk/ Portsmouth Beltline. The nearest passenger rail is available through Amtrak at the Newport News station on the Peninsula and a recently added station in downtown Norfolk.

Convenient commercial air service is available through two major airports: Southside's Norfolk International Airport which offers over 260 flights per day, and the Peninsula's Newport News/Williamsburg International Airport, which services over 544,000 customers each year. The military maintains a long list of airfields in the region with national significance, including Oceana Naval Air Station in Virginia Beach, Naval Station Norfolk, the airfield at Joint Base Langley-Eustis in Hampton, and Fentress Naval Auxiliary Landing Field in Chesapeake. Several other small airports across the region service private aviation.

Water-related infrastructure is prevalent throughout the region's waterways for commercial, industrial, and recreational uses. On the Peninsula, Newport News Shipbuilding, a Division of Huntington Ingalls Industries, is located near the mouth of the James River in Newport News. Massive coal loading piers and facilities were established in the late 19th and early 20th century by the Chesapeake & Ohio (C&O), Norfolk & Western, and Virginian Railways at the end of the Peninsula in Newport News. CSX Transportation now serves the former C&O facility at Newport News. On Southside, over 95 percent of the world's shipping lines call on the Port of Norfolk and Portsmouth linking Virginia and the U.S. to more than 250 ports in over 100 countries around the world. With its four marine terminals, the Port of Hampton Roads is the second largest volume port on the East Coast in terms of general cargo (break-bulk and containerized cargo), and the leading U.S. port in total tonnage.

Also intersecting the southern part of the study area 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.

FIGURE 3.4: REGIONAL TRANSPORTATION NETWORK



Source: Hampton Roads Planning District Commission

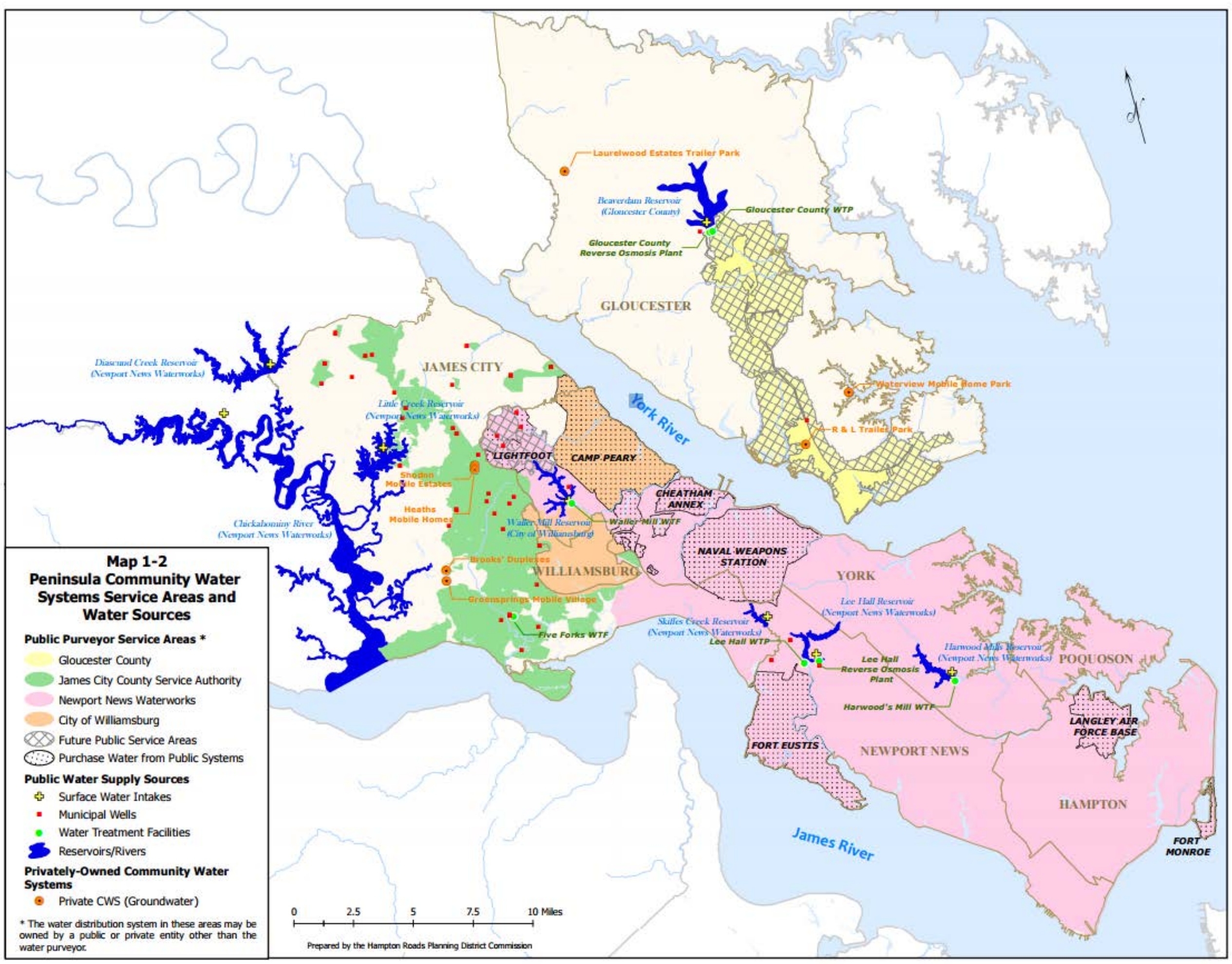
According to the HRPDC, *Hampton Roads Benchmarking Study,* 2015, the transportation network in Hampton Roads has garnered considerable attention as aging infrastructure and traffic congestion are closely tied to the economy and quality of life within the region. The recent downturn in the economy has affected many aspects of the region's transportation system, with growth in roadway travel coming to a halt and a decrease in air travel from Hampton Roads airports. Over the last decade, Hampton Roads has experienced a decrease in terms of per capita vehicle miles traveled. In spite of relatively lower amounts of travel per capita in Hampton Roads than in competitor regions, congestion is a significant issue, particularly at the bridges and tunnels. Only Washington, DC, Baltimore, and Atlanta had a higher indexed measurement of the extra amount of time trips take during congested peak travel periods in 2011.

Public transportation continues to play a small role in the region when compared to some other areas of similar size due in part to low population density and the geography of interspersed water bodies. Norfolk has completed building the region's first light rail line, running 7.4 miles from Eastern Virginia Medical Center to Newtown Road. Light rail has the capability to impact future land use decisions and encourage increased density in development.

The communities of Hampton Roads maintain a significant number of critical facilities and infrastructure that include hospitals, schools, police stations, fire stations, energy facilities, water and wastewater facilities and hazardous material facilities (further discussed in Section 5: *Vulnerability Assessment*). The large military presence provides its own significant facilities and infrastructure base, though these are located on federal land and outside the planning area. Electrical service is supplied throughout the region by Dominion Virginia Power and Franklin Municipal Power & Light (City of Franklin and surrounding areas), and natural gas is provided by Columbia Gas and Virginia Natural Gas. Verizon, Verizon Wireless, FIOS and Cox Communications are primary service provider for cable television, phone and internet service.

In order to examine the existing sources of water in Hampton Roads, the region is divided into three sub-regions. The first sub-region is the Peninsula sub-region, and it is composed of the cities of Hampton, Newport News, Poquoson, and Williamsburg and the counties of Gloucester, James City, and York. There are 26 community water systems that provide water to this sub-region as seen in **Figure 3.5**. According to the Hampton Roads District Planning Commission, these community water systems serviced about 512,000 people in 2011. The water used in the Peninsula sub-region comes from groundwater, reservoirs and the Chickahominy River and serves both urban and rural areas. The majority of the water used comes from surface water in five reservoirs located throughout the sub-region.

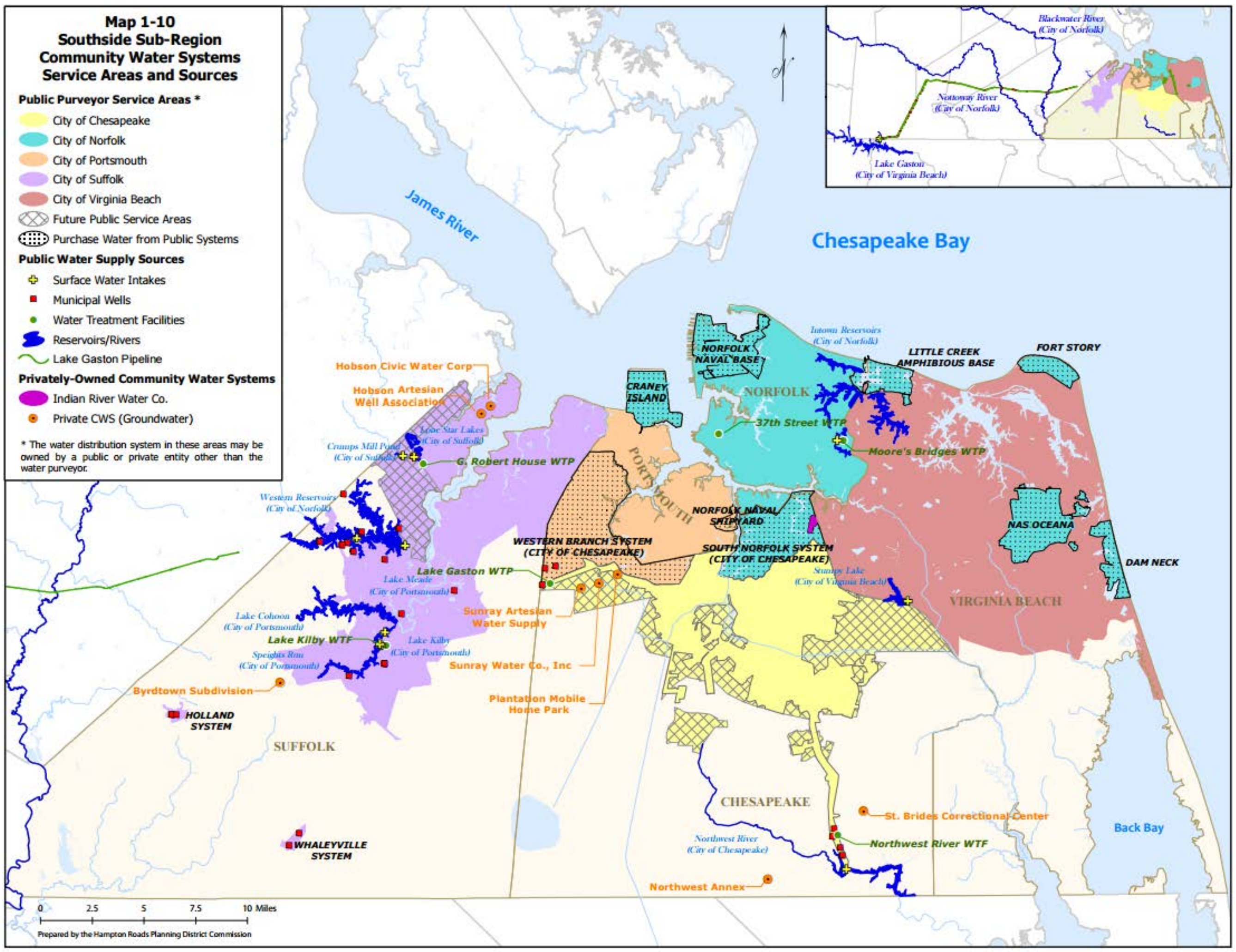
FIGURE 3.5: PENINSULA SUB-REGION WATER SOURCES



Source: *Hampton Roads Regional Water Supply Plan, HRPDC, 2011*

The Southside sub-region includes the cities of Chesapeake, Norfolk, Portsmouth, Suffolk, and Virginia Beach. Approximately 975,000 people were served by 15 publicly-owned community water systems in 2011. Water sources for the Southside sub-region include aquifers, reservoirs, Lake Gaston, and the Northwest, Blackwater, and Nottoway Rivers and can be seen in **Figure 3.6**. Both urban and rural areas are serviced by the community water systems in the Southside sub-region.

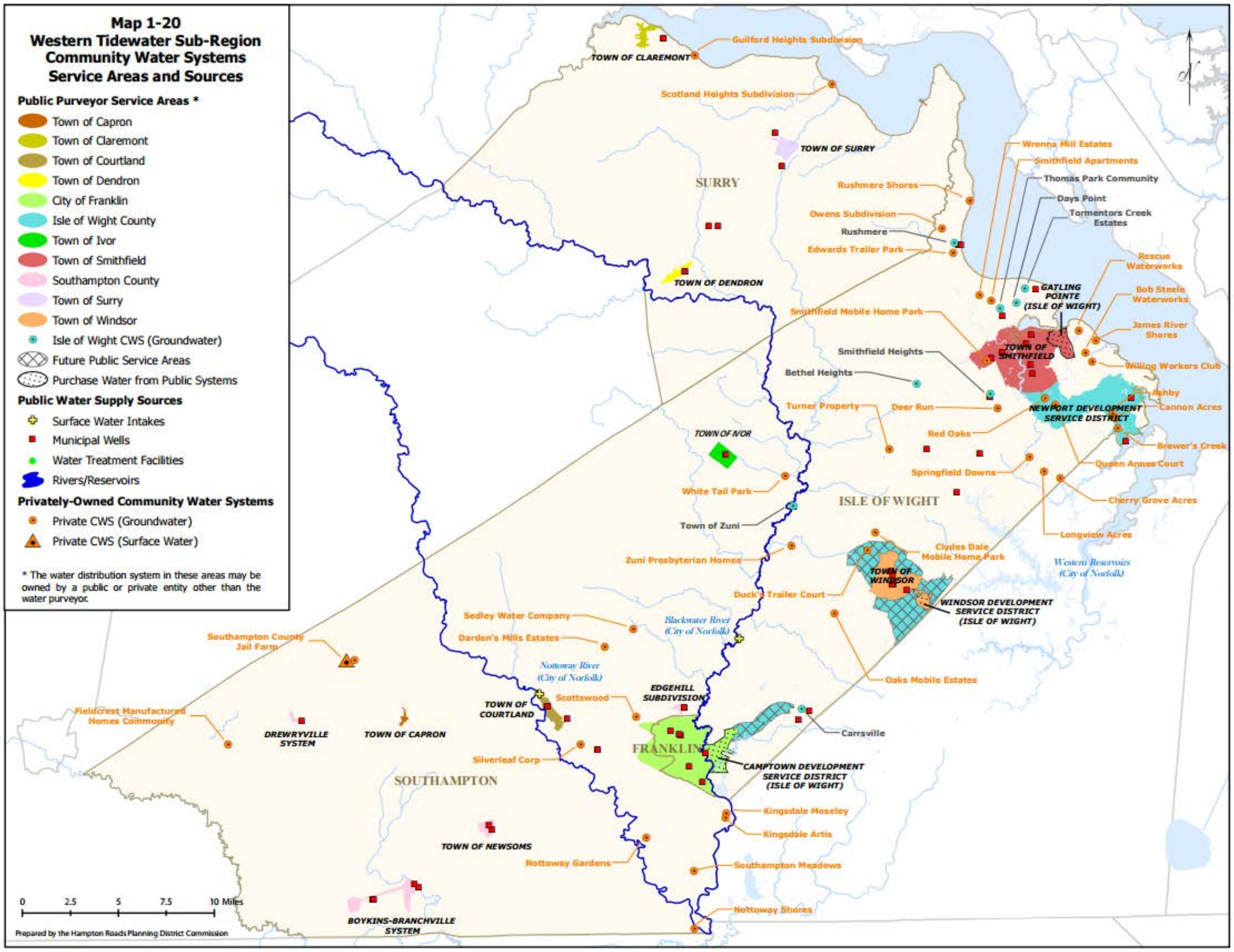
FIGURE 3.6: SOUTHSIDE SUB-REGION WATER SOURCES



Source: *Hampton Roads Regional Water Supply Plan, HRPDC, 2011*

The third sub-region in Hampton Roads is the Western Tidewater sub-region. It includes the city of Franklin and the Counties of Isle of Wight, Southampton, and Surry. Since it is a mostly rural sub-region, all but one of the 24 community water systems use groundwater to service 28,000 people. The water sources for the Western Tidewater sub-region can be seen in **Figure 3.7**.

FIGURE 3.7: WESTERN TIDEWATER SUB-REGION WATER SOURCES



Source: *Hampton Roads Regional Water Supply Plan, HRPDC, 2011*

EMPLOYMENT AND INDUSTRY

Nearly two million people live in or within an hour's drive of the Hampton Roads region, and because of the presence of several military 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 3.6 shows basic employment data for the study area.

TABLE 3.6: REGIONAL EMPLOYMENT

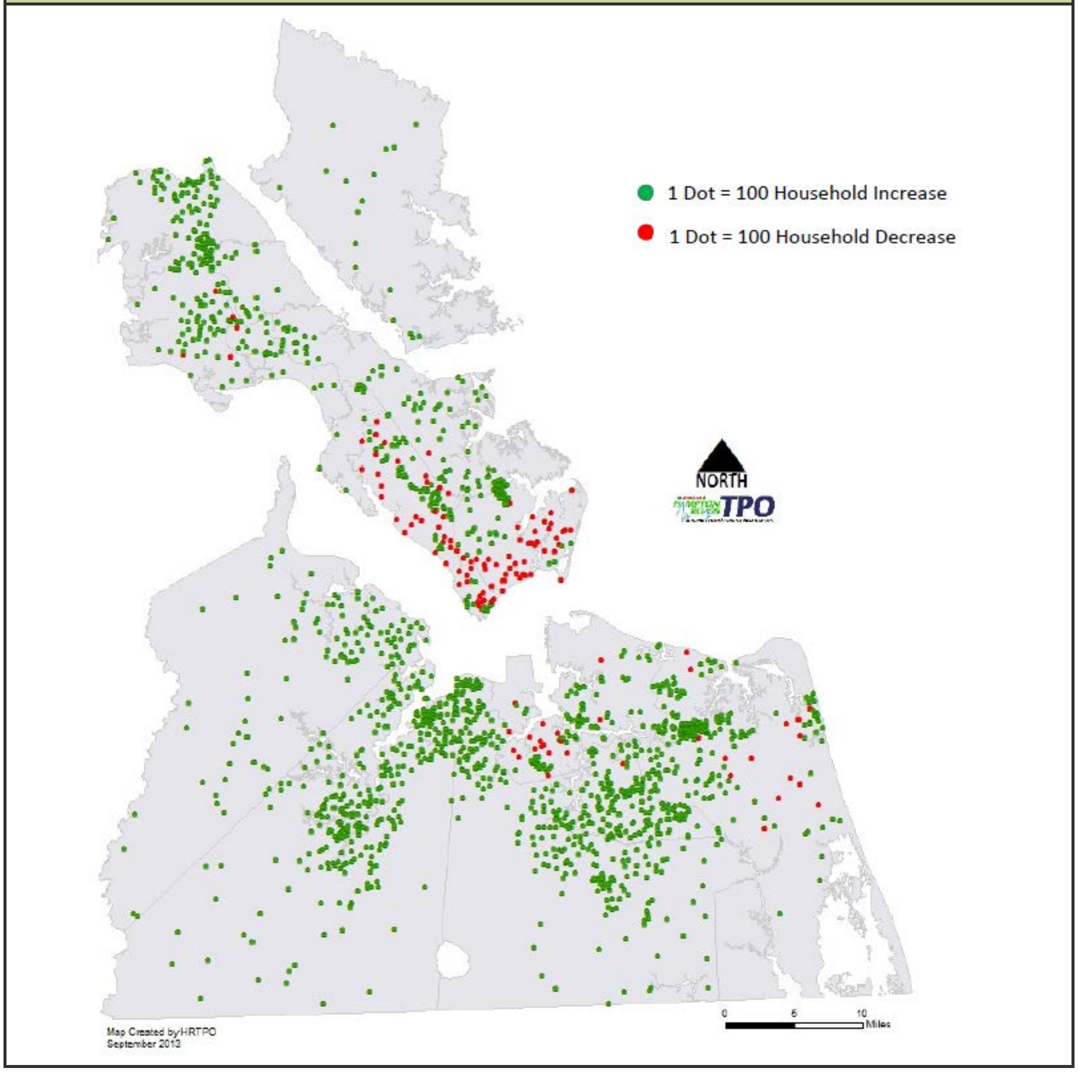
SUB-REGION	COMMUNITY	CIVILIAN LABOR FORCE (2013)	UNEMPLOYMENT RATE (%) (2013)
Peninsula	Hampton	67,144	10.7
	Newport News	91,426	9.8
	Poquoson	6,105	4.4
	Williamsburg	6,540	8.4
	James City County	32,238	6.4
	York County	30,934	5.1
Southside	Norfolk	116,232	11.9
	Portsmouth	45,810	10.6
	Suffolk	41,772	8.6
	Virginia Beach	226,234	6.5
	Chesapeake	113,620	7.5
Western Tidewater	Isle of Wight County	18,500	7.7
	Franklin	3,709	12.3
	Southampton County	8,812	6.9
	VIRGINIA	**4,238,636**	**5.4**

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

DEVELOPMENT TRENDS

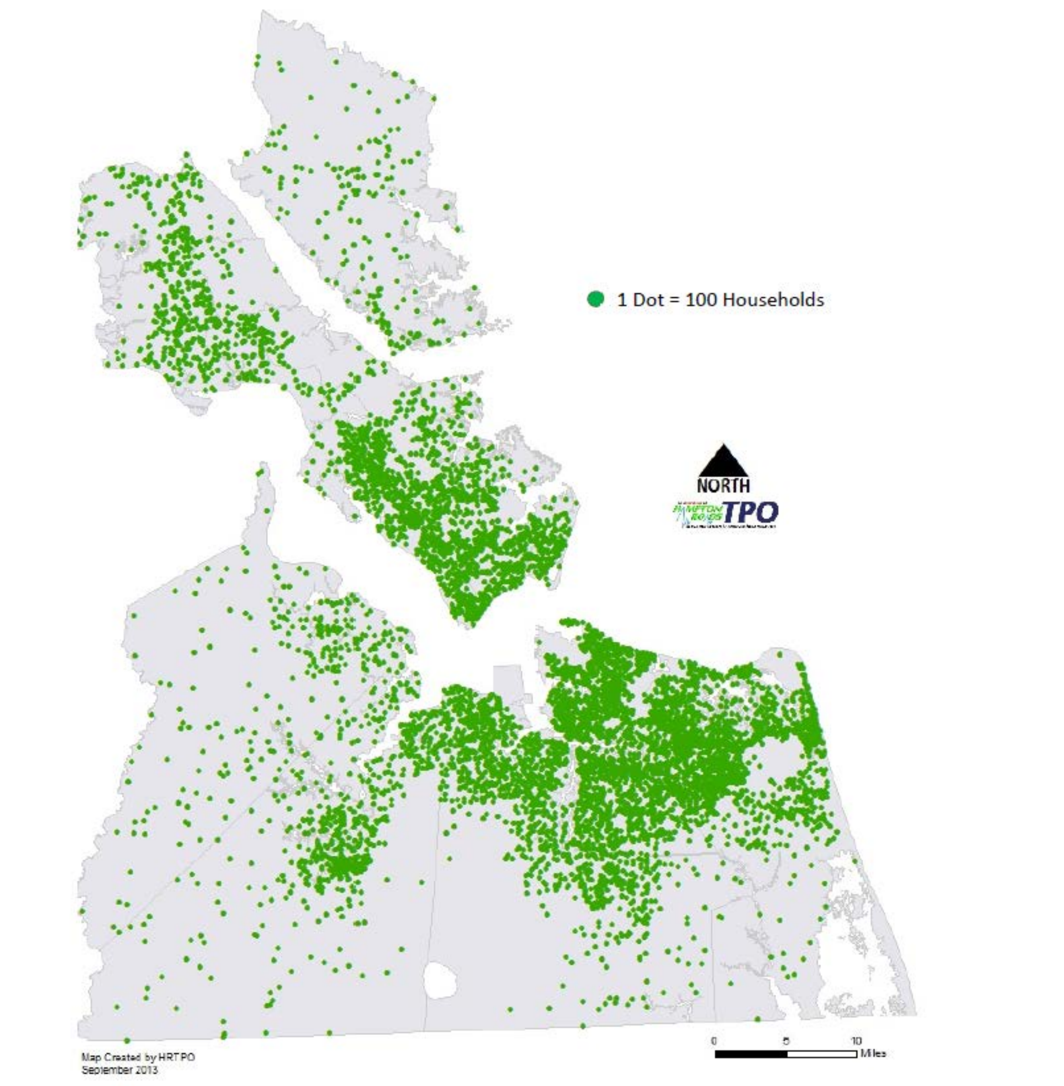
The Hampton Roads 2040 Socioeconomic Forecast prepared by the Hampton Roads Transportation Planning Organization in October 2013 provides the maps shown in **Figures 3.8 and 3.9** to help visualize where demand for employment will impact the number of households in the region. These growth patterns show expected change from 2009 through 2040 and provide a regional summary intended for the purpose of transportation planning; however, the data points shown are also relevant to hazard mitigation planning in that they provide a relative indicator of future housing needs in the region. Where and how those houses will be built influences the region's vulnerability to a range of hazards.

FIGURE 3.8: CHANGE IN HOUSEHOLDS, 2009 TO 2040



Source: Hampton Roads Transportation Planning Organization, *Hampton Roads 2040 Socioeconomic Forecast and Transportation Analysis Zones (TAZ) Allocation*, October 2013.

FIGURE 3.9: 2040 HOUSEHOLDS



Source: Hampton Roads Transportation Planning Organization, *Hampton Roads 2040 Socioeconomic Forecast and TAZ Allocation*, October 2013.

The Hampton Roads area expects to add 124,356 net new jobs by 2033. These net new jobs would increase employment by 16.4% with jobs being added to professional and business services, health services, construction and administrative, and waste service sectors. In order to attract workers to these jobs and remain a competitive region that people want to live in, it is imperative that there is adequate housing and transportation and a skilled workforce to do the jobs.

The amount of houses needed will vary by jurisdiction. It is estimated that 86,098 net new housing units must be built by 2033. In order to be able to house all of the workers of Hampton Roads, 4,305 net new units must be built each year. Assuming people live near where their jobs are and do not commute, Virginia Beach and Chesapeake will see the most job growth in the region, resulting in more housing units being built. **Table 3.7** illustrates where the housing units need to be built based on how many net new jobs will be in the jurisdiction and whether workers will commute to work or live close to their jobs. The "Remainder of Region" includes Suffolk, Franklin, Gloucester, Isle of Wight, Southampton, Surry, and York County. Surry County and Gloucester County could not be separated out of these published data.

TABLE 3.7: PROJECTED HOUSING DEMAND FOR NEW NET WORKERS 2013-2033

SUBREGION	COMMUNITY	NET NEW JOBS	BY WORK LOCATION	BY CURRENT COMMUTING PATTERNS		
				NON-COMMUTERS	COMMUTERS	TOTAL BY COMMUTING PATTERN
Peninsula	Hampton	2,698	1,800	838	2,693	2,556
	Newport News	5,930	3,911	1,897	3,418	5,316
	James City County and Williamsburg	23,707	17,222	6,860	645	7,506
Southside	Norfolk	13,061	8,947	3,719	3,418	5,316
	Portsmouth	1,675	1,196	414	2,142	2,556
	Virginia Beach	24,661	16,659	11,987	7,974	19,962
	Chesapeake	20,868	13,578	6,634	5,864	12,498
Remainder of Region*		31,756	22,785	12,312	7,976	20,285

* Includes Surry County and Gloucester County.
Source: Sturtevant, Lisa. *Housing the Future Workforce in the Hampton Roads Region*, May 2014. Prepared for Housing Virginia and shared on Hampton Roads Planning District Commission web site.

Due to changes in the demographic of the average net new worker, the type of housing that will need to be built will be different than it has been in the past. The new workers who will move to Hampton Roads will be young people working for lower wages. They will require more single family houses and rental units with moderately priced rent. According to a survey done by the American Community Survey, the percentage of multi-family housing units will increase by 5.2% to 39.7% in the coming years. The percentage of rental units will also increase to 46.5%, compared to 36.4% in previous years. **Table 3.8** illustrates how many housing units will need to be built in each community and the number of units that will be owned compared to those that will be rented. The Remainder of Region includes Franklin, Gloucester, Isle of Wight, Southampton, Surry, and York.

TABLE 3.8: HOUSING UNIT TYPES 2013-2033

SUBREGION	COMMUNITY	TOTAL UNITS	SINGLE FAMILY		TOWNHOUSE/MULTI-FAMILY	
			OWNER	RENTER	OWNER	RENTER
Peninsula	Hampton	1,800	1,019	118	240	423
	Newport News	3,911	1,311	495	323	1,782
	James City County and Williamsburg	17,222	8,420	2,938	1,002	4,863
Southside	Norfolk	8,947	3,400	927	930	3,690
	Portsmouth	1,196	401	233	31	531
	Virginia Beach	16,659	6,124	1,920	1,618	6,997
	Chesapeake	13,578	7,684	1,961	916	3,017
	Suffolk	13,730	6,743	2,286	881	3,820
Remainder of Region*		9,055	4,445	1,513	549	2,545
Hampton Roads Region		86,098	39,547	12,391	6,491	27,668

* Includes Surry County and Gloucester County.
Source: Sturtevant, Lisa. *Housing the Future Workforce in the Hampton Roads Region*, May 2014. Prepared for Housing Virginia and shared on Hampton Roads Planning District Commission web site.

Virginia law requires that all communities have a comprehensive land use plan and that it be updated every five years. Each county or city government in the study area has adopted a comprehensive plan that provides additional detail on the development trends for that community. Additionally, zoning maps and ordinances within each community further dictate allowable uses and show where future development is guided, or where higher density housing is allowable. **Figures 5.6, 5.8 and 5.10** in the Section 5 *Vulnerability Assessment* show recent community development patterns.

2017 UPDATE

The hazards significantly affecting the region, as determined by the planning group during the process outlined in Section 2, were 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, 2013 Hazard Mitigation Plan*.

INTRODUCTION

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

- FLOODING
- SEA LEVEL RISE AND LAND SUBSIDENCE
- TROPICAL/COASTAL STORM
- SHORELINE EROSION
- TORNADO
- WINTER STORM
- EARTHQUAKE
- WILDFIRE
- DROUGHT
- EXTREME HEAT
- HAZARDOUS MATERIALS INCIDENT

As stated in Section 2, the committee reviewed and discussed manmade (or man-influenced) and technological hazard planning as it was incorporated into the existing plans. The Committee agreed to focus this plan on natural hazards. The exception was Hazardous Materials Incidents, which the Committee determined has enough overlap with natural hazards to warrant consideration as part of the Plan.

The committee also discussed Lightning and Tsunamis, two hazards included in previous plans. While the group acknowledged that Lightning is a natural hazard that can affect the Hampton Roads region and that there is a history of occurrence, there is no *widespread* risk to lives, structures and infrastructure from Lightning and thus the group determined it should be excluded from the plan update. The damages and injuries that have occurred in the past are very isolated in nature. Lightning as a major cause of Wildfire is retained in the discussion on Wildfire.

Regarding Tsunamis, there have been no known Tsunamis to directly impact the Hampton Roads region. Further, there is no record of a catastrophic Atlantic basin tsunami impacting the mid-Atlantic coast of the United States. Tsunami inundation zone maps are not available for communities located along the U.S.

East Coast. FEMA Guidance in State and Local Mitigation Planning How-To Guide: Understanding Your Risks (p. 1-8), indicates that Atlantic Coast communities have a relatively low tsunami risk "and can probably avoid conducting a tsunami risk assessment at this time." The lack of historical evidence of any damages caused by Tsunamis led the group to conclude that it is not a natural hazard to which the region is generally exposed, and thus, the hazard was excluded from the plan update.

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., tropical/coastal storm events can cause flooding and tornado activity, and flooding can be associated with winter storms and erosion); 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 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 terms "likely", "highly likely" and "unlikely" are used to describe the probability of future occurrence for each hazard. Hazards termed "likely" to occur again in the future are expected to occur but may not have occurred with such high frequency in the past that future events are a certainty. Hazards termed "highly likely" have a history of occurrence or particular characteristics that make a future event almost guaranteed. "Unlikely to occur" indicates that committee members, based on review of past events, have the impression that any future occurrence will be a rare and unique event.

The *Vulnerability Assessment*, Section 5 of this plan, expands upon the foundation provided here and assesses the vulnerability of the region 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 region has been named in twelve 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 Hampton Roads 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 HAMPTON ROADS

YEAR	DATE OF DECLARATION	DISASTER NUMBER	DISASTER TYPE	DESIGNATED AREAS
1972	September 8	339	Tropical Storm Agnes	Chesapeake, Hampton, Isle of Wight Co, James City Co, Newport News, Norfolk, Portsmouth, Suffolk, Virginia Beach, Williamsburg, York Co
1996	February 16	1086	Blizzard of 1996	All study area communities
1996	October 23	1135	Hurricane Fran	Hampton, Isle of Wight Co, James City Co, Newport News, Poquoson, Suffolk, Williamsburg, York Co
1998	October 9	1242	Hurricane Bonnie	Chesapeake, Norfolk, Portsmouth, Suffolk, Virginia Beach
1999	September 6	1290	Tropical Storm Dennis and Tornadoes	Hampton
1999	September 24	1293	Hurricane Floyd	All study area communities
2000	February 28	1318	Severe Winter Storms	Franklin, Isle of Wight Co, James City Co, Newport News, Southampton Co, Suffolk, Williamsburg, York Co
2003	September 18	1491	Hurricane Isabel	All study area communities
2005	September 12	3240	Hurricane Katrina Evacuation	All study area communities
2006	September 22	1661	Tropical Depression Ernesto	Isle of Wight Co, James City Co, Newport News, Poquoson, York Co
2009	December 9	1862	Tropical Depression Ida and a Nor'easter	Chesapeake, Hampton, Isle of Wight Co, Newport News, Norfolk, Poquoson, Portsmouth, Virginia Beach
2011	August 26	4024	Hurricane Irene	All study area communities

Source: FEMA, 2015

NATIONAL CLIMATIC DATA CENTER STORM EVENT DATABASE

Much of the data in the remaining tables of 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: city, 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 to supplement the NCDC data and to provide a more accurate depiction of historic hazard events in the region.

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. Hampton Roads 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 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 typically make landfall with less warning than hurricanes (due to their rapid formation along the coast), residents and business owners may be caught unprepared for the impacts. Fortunately, 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.

Additional causes of flooding, especially in the western Tidewater portion of the study area, may include features, such as roadways and pipelines, that act as choke points in the river, blocking debris and restricting the flow of water during heavy flooding events; development of the watershed resulting in the loss of riparian zone and vegetation coverage; land management, including forestry and farming practices; and deficiencies in manmade drainage systems.

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

Lake Burnt Mills in Suffolk. (Photo courtesy of City of Suffolk)

Though dams have many benefits, they also can pose a risk to communities if not designed, operated and maintained properly. In the event of a dam failure, the energy of the water stored behind even a small dam is capable of causing loss of life and great property damage if development exists downstream of the dam. The failure of dams has the potential to place large numbers of people and great amounts of property in harm's way.

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 region. Localized riverine flooding can occur in areas of Hampton Roads not adjacent to a major body of water. Large sections of the region 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 because the storms tend to move faster and affect only 1 to 2 tidal cycles. The main impacts from flooding include:

- Inundation of low-lying residential neighborhoods and subsequent damage to structures, contents, garages, and landscaping;
- 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, including ships, ports and shipyards;
- Inundation of critical facilities, possibly including some fire stations, police facilities, public shelters, emergency operations centers (EOC), and several publicly-owned buildings. Public shelter availability is limited by the expected severity of flooding. (See Table 5.2 for number of critical facilities in flood hazard areas.)
- Recovery time needed to bring critical infrastructure, schools and employers back online. Of particular concern in the region are transportation routes, including school buses, housing for displaced residents and debris management.

Communities in the study area have outlined specific plans for activating their EOC, protecting critical facilities and taking specific drainage system actions when faced with an impending flood. Since power outages and threats to the water supply can result from both the wind and flood hazard (which often occur simultaneously in the region), residents are advised of appropriate precautions and specific low-lying areas are evacuated to protect the safety of residents, tourists and responders, and to minimize loss of life.

When severe floods occur, the regional economy is severely impacted by the inability of flooded homeowners to get back to work quickly, the slow rebound of closed or debris-strewn transportation routes, the closing of schools and businesses, and the general state of emergency. Power outages and boil-water advisories are common and can affect many thousands of residents and businesses in the region for several days or even weeks if the damage is severe. Severely flooded homes and even whole neighborhoods result in displaced residents, including schoolchildren. Loss of life due to people traversing flooded roads, remaining in or becoming trapped in flooded structures, and curiosity-seekers watching storm surge is possible. Flooded businesses that decide to close, move or cease operations in the region have an impact on land values and the labor force, as does flood damage to the facilities of large port-related employers in the region such as shipyards and marinas. Time spent repairing flood damage versus productive value-added labor is costly to employers.

Over time, the pressure on communities and elected officials to fix flooding problems has increased in the region. Longer-term impacts to the real estate market from flooding and flood insurance costs are impacting property sales, especially for older homes in the densely-populated floodplains of Hampton, Newport News, Poquoson, Norfolk, Portsmouth and Virginia Beach. The large number of structures vulnerable to flood damage (see Section 5 for more details) and the cost of measures needed to mitigate such a large-scale problem is daunting for emergency managers, floodplain managers, planners and building professionals throughout the region.

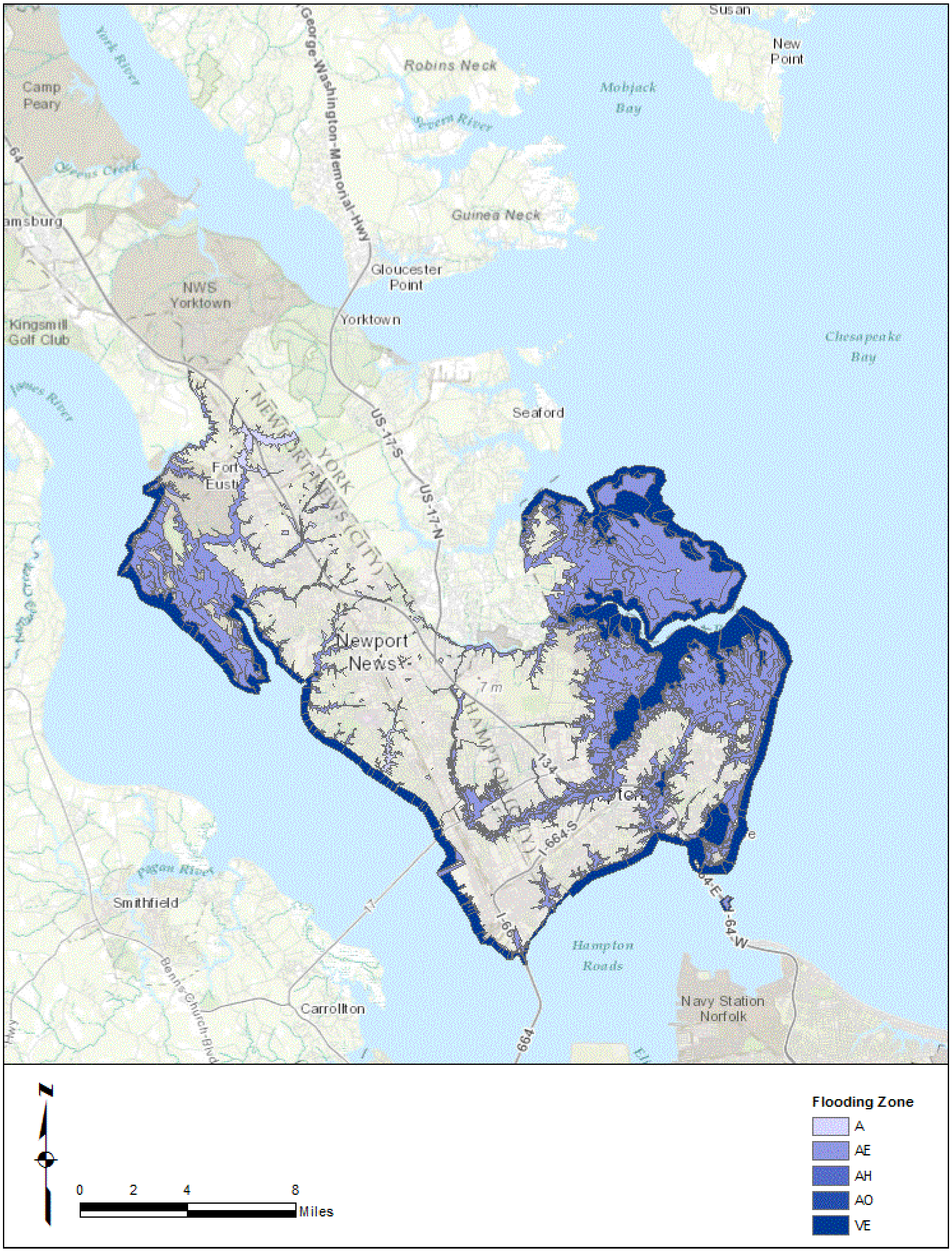
Areas identified as vulnerable to flooding are depicted on FEMA's Flood Insurance Rate Maps (FIRMs), which were developed through the National Flood Insurance Program (NFIP), show the existing potential flood hazard areas throughout the region based on the estimated 100-year floodplain (**Figures 4.1 through 4.3).** 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. FIRM data is available through several sources for more detailed viewing at the parcel level:

- Paper FIRMs are available for viewing in each jurisdiction in the study area that participates in the NFIP;
- The FEMA Map Service Center at https://msc.fema.gov/portal/ is the official public source for flood hazard information produced in support of the NFIP; and,
- Most localities in the study area have property information viewer tools with flood data layers, and several have included additional sea level rise inundation viewers. The following may be helpful:

  Hampton - http://webgis.hampton.gov/sites/ParcelViewer/Account/Logon
  Newport News - http://gis2.nngov.com/gis/
  Poquoson - http://poquoson.mapsdirect.net/
  Williamsburg - http://williamsburg.timmons.com/flex/index.html

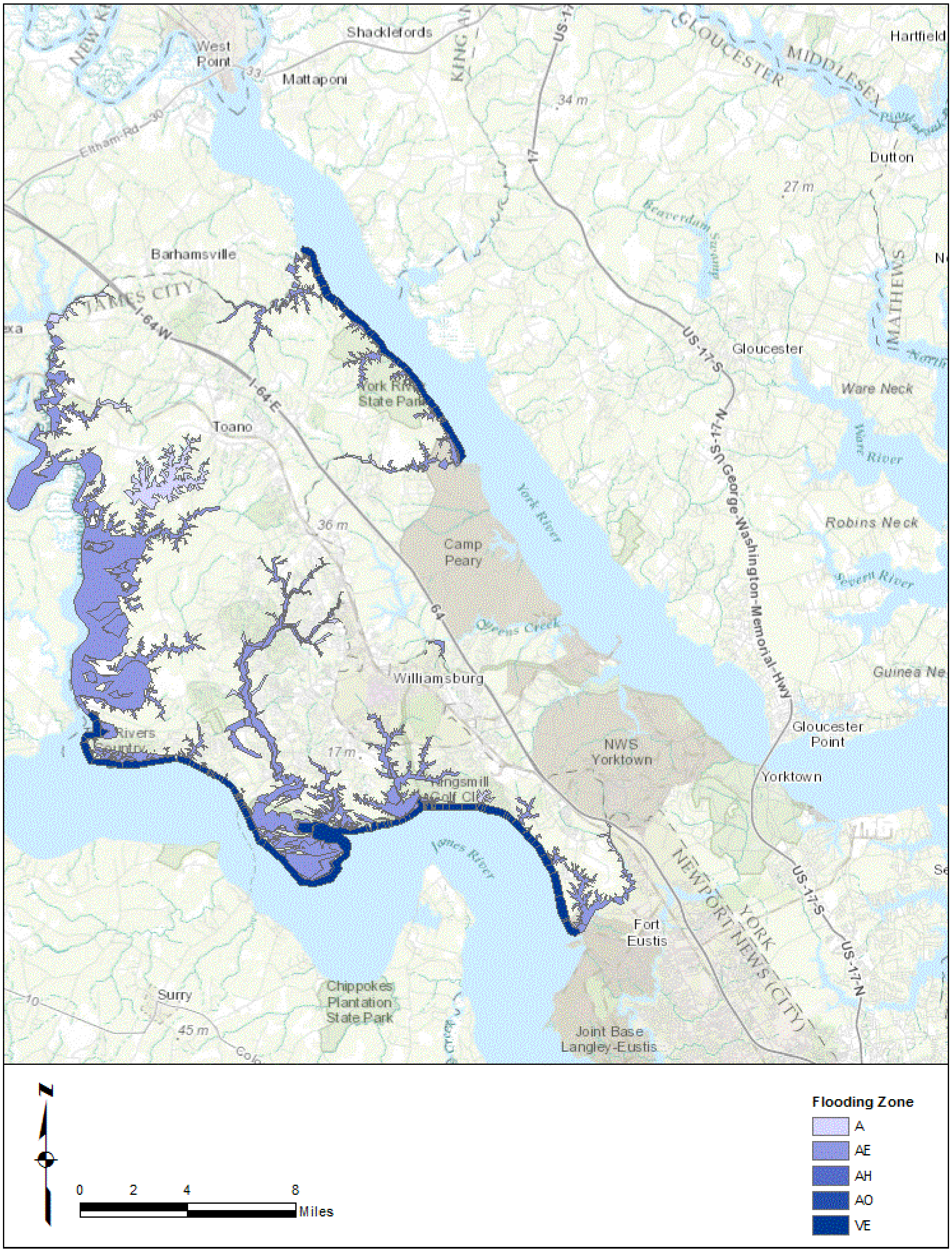
James City County - http://property.jamescitycountyva.gov/JamesCity/Account/Logon
York County - http://maps.yorkcounty.gov/York/Account/Logon
Norfolk - http://www.norfolk.gov/flooding/flood_prone_areas.asp and http://www.norfolk.gov/index.aspx?NID=1949
Portsmouth - http://www.portsmouthva.gov/assessor/data/
Suffolk - http://apps.suffolkva.us/realest/
Virginia Beach - https://www.vbgov.com/map/
Chesapeake - https://cityapps.cityofchesapeake.net/REIS/RealEstateSearch/Details
Isle of Wight County, Smithfield, Windsor - http://iowgis.maps.arcgis.com/apps/webappviewer/index.html?id=4889333b70534c018c2c723b4d953f51
Southampton County, Franklin, towns - http://www.southampton.interactivegis.com/index.php#

FIGURE 4.1: FEMA-IDENTIFIED 100-YEAR FLOOD HAZARD AREAS, HAMPTON, NEWPORT NEWS, POQUOSON



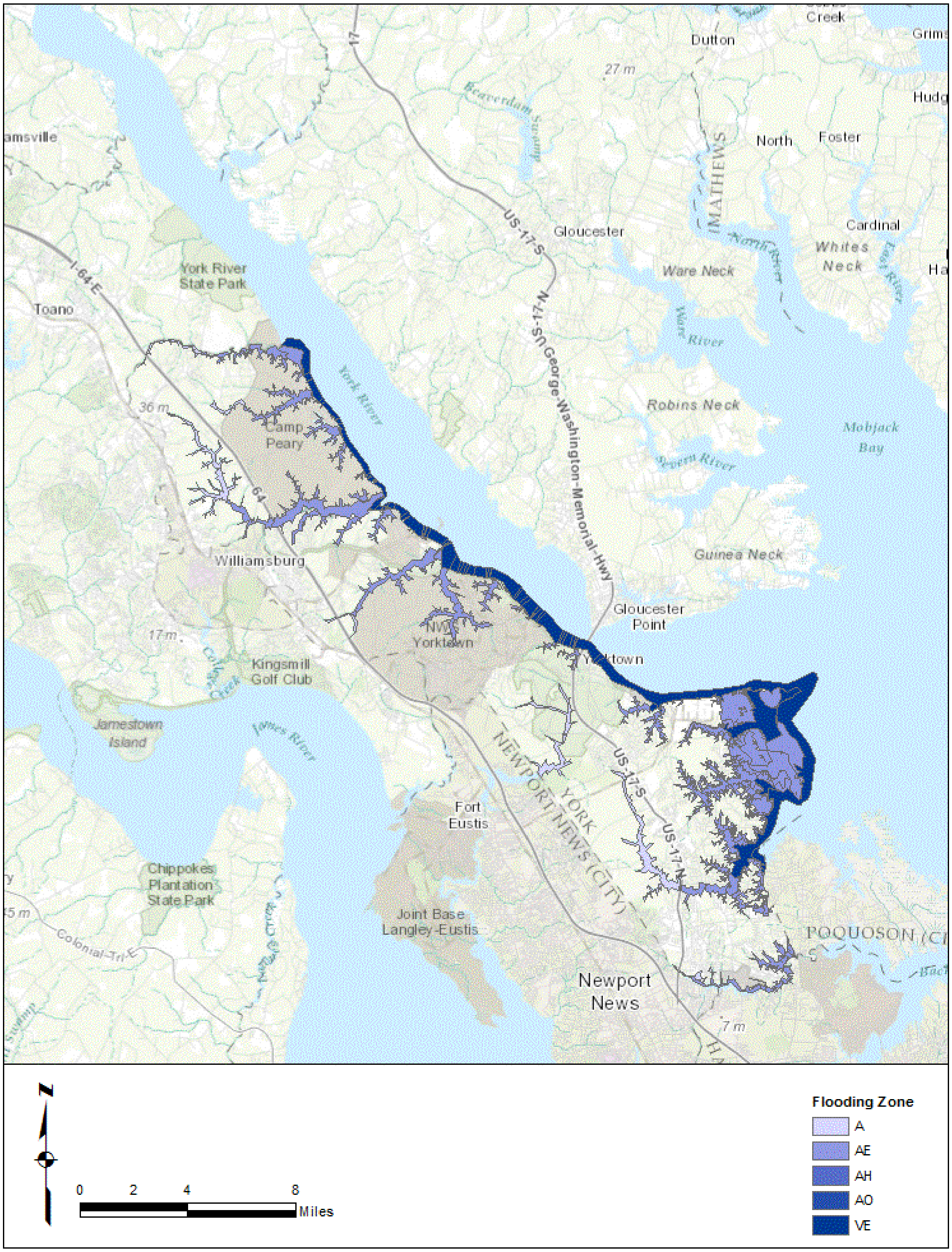
Source: Federal Emergency Management Agency, 2016

FIGURE 4.2: FEMA-IDENTIFIED 100-YEAR FLOOD HAZARD AREAS, JAMES CITY COUNTY, WILLIAMSBURG



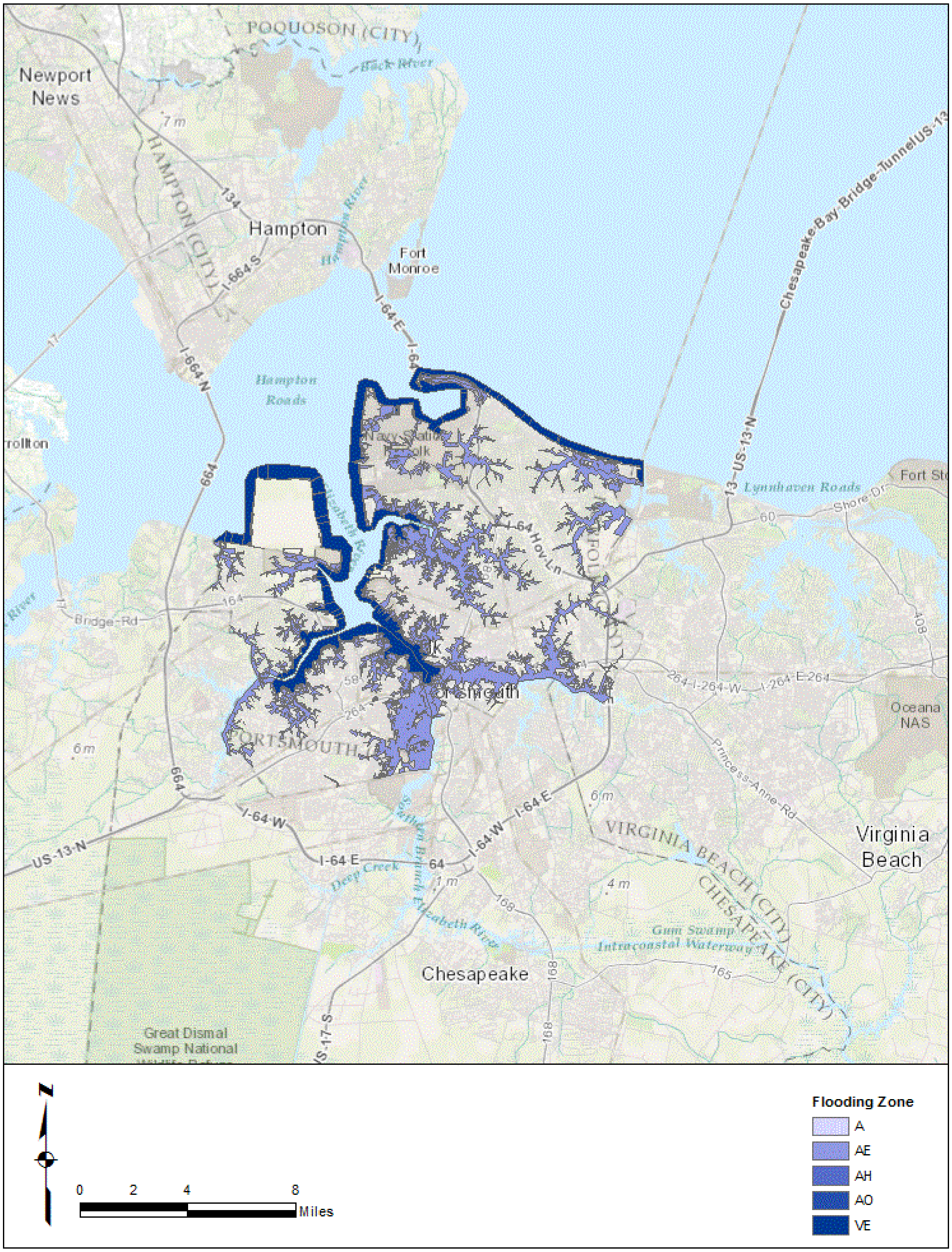
Source: Federal Emergency Management Agency, 2016

FIGURE 4.3: FEMA-IDENTIFIED 100-YEAR FLOOD HAZARD AREAS, YORK COUNTY



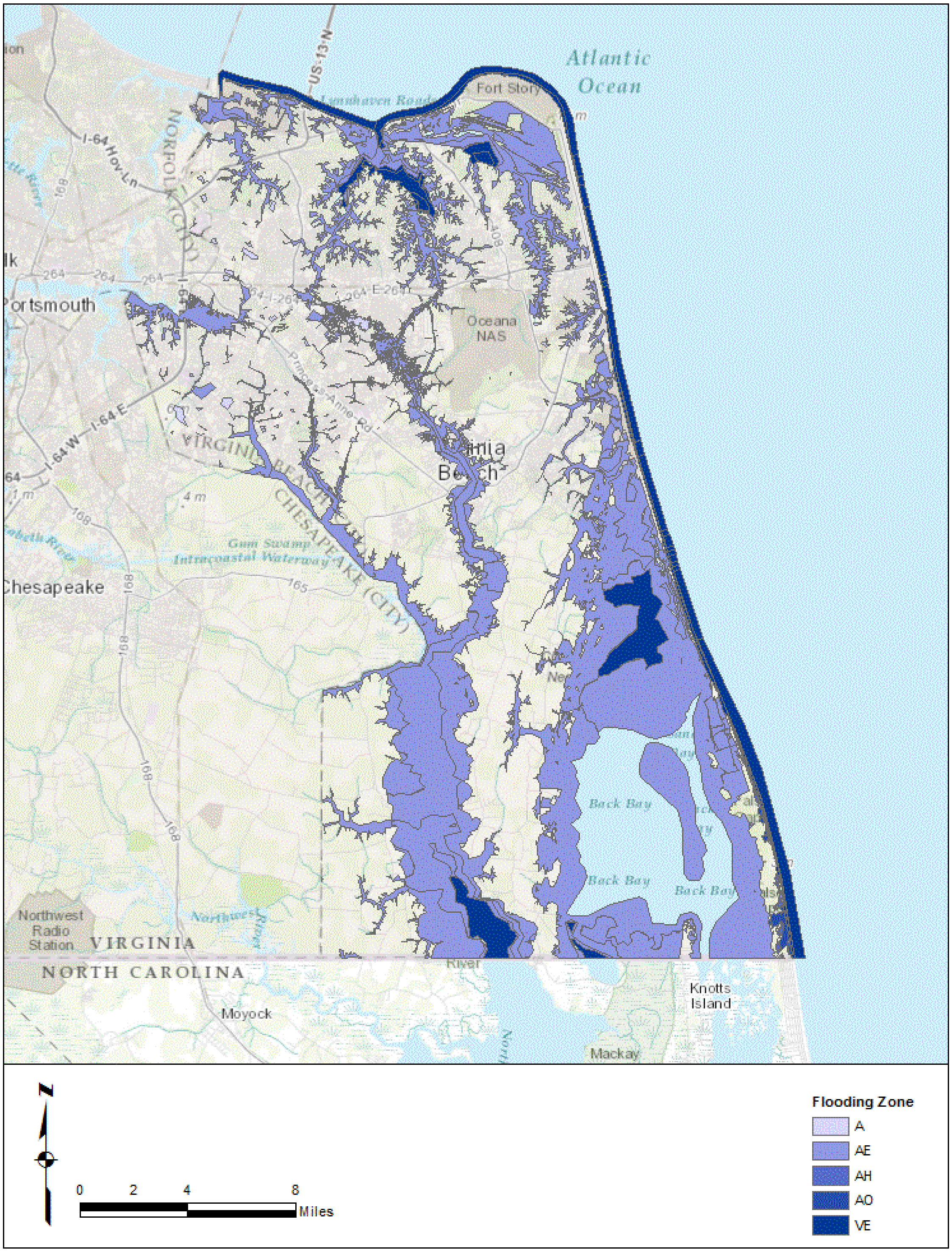
Source: *Federal Emergency Management Agency, 2016*

FIGURE 4.4: FEMA-IDENTIFIED 100-YEAR FLOOD HAZARD AREAS, NORFOLK, PORTSMOUTH



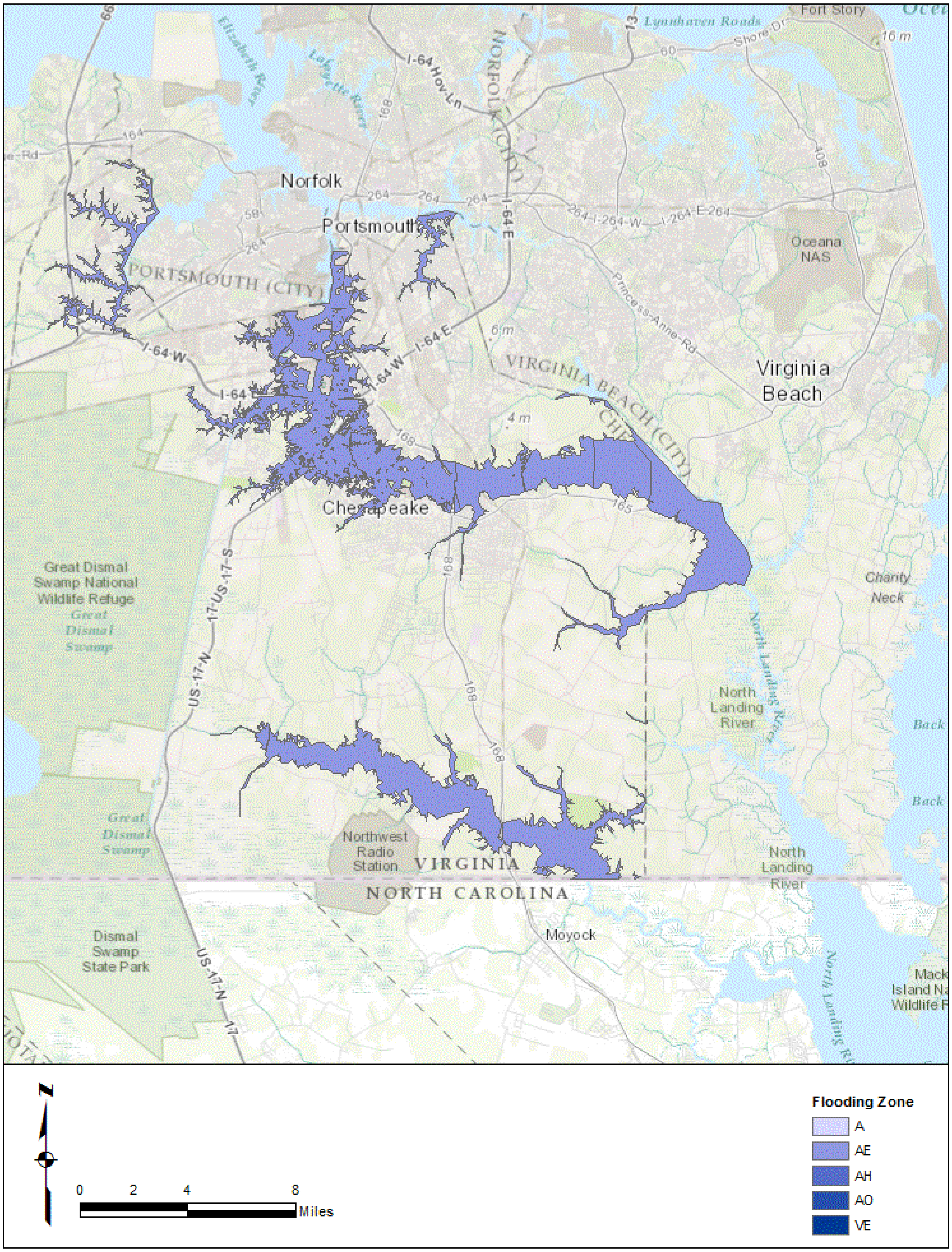
Source: Federal Emergency Management Agency, 2016

FIGURE 4.5: FEMA-IDENTIFIED 100-YEAR FLOOD HAZARD AREAS, VIRGINIA BEACH



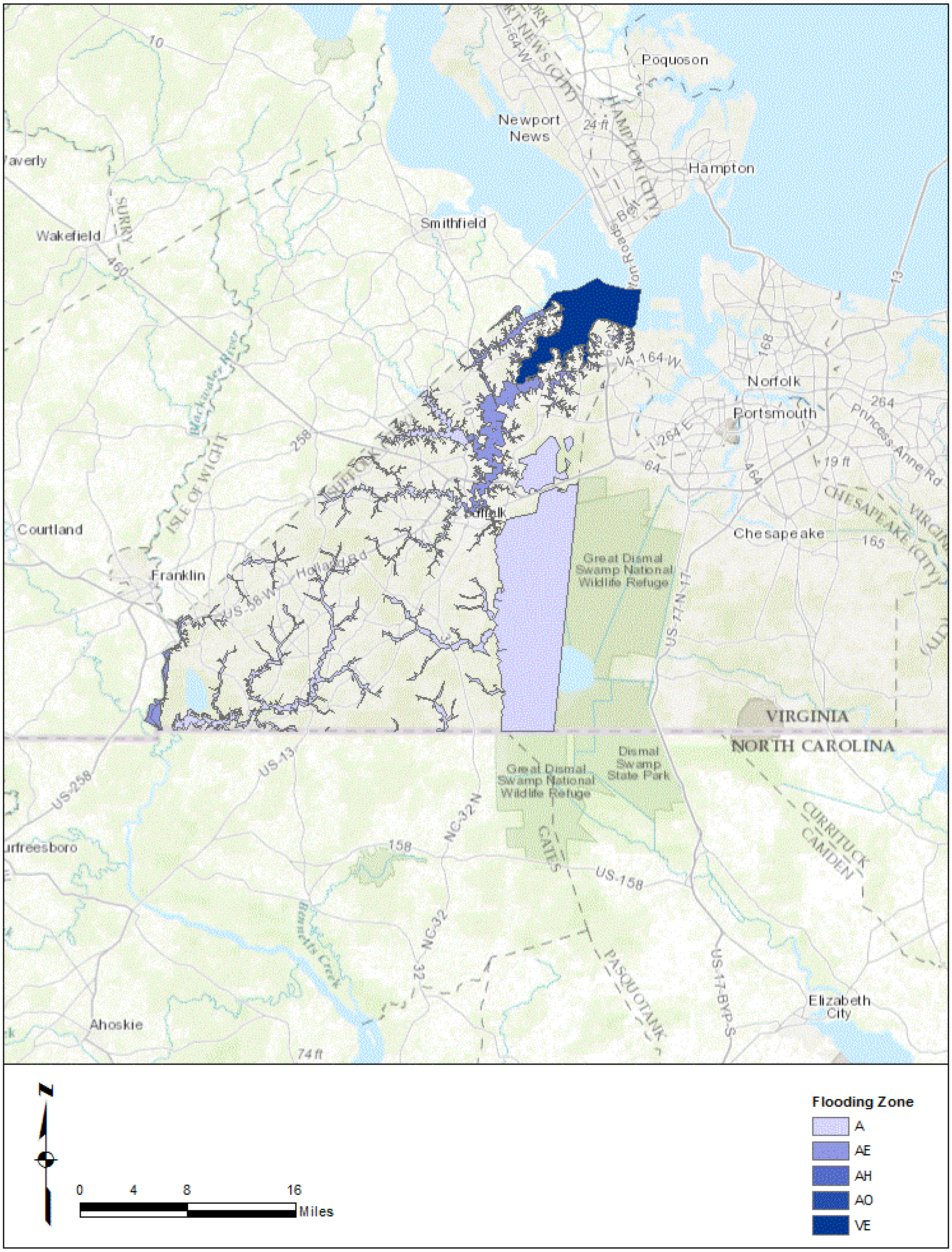
Source: Federal Emergency Management Agency, 2016

FIGURE 4.6: FEMA-IDENTIFIED 100-YEAR FLOOD HAZARD AREAS, CHESAPEAKE



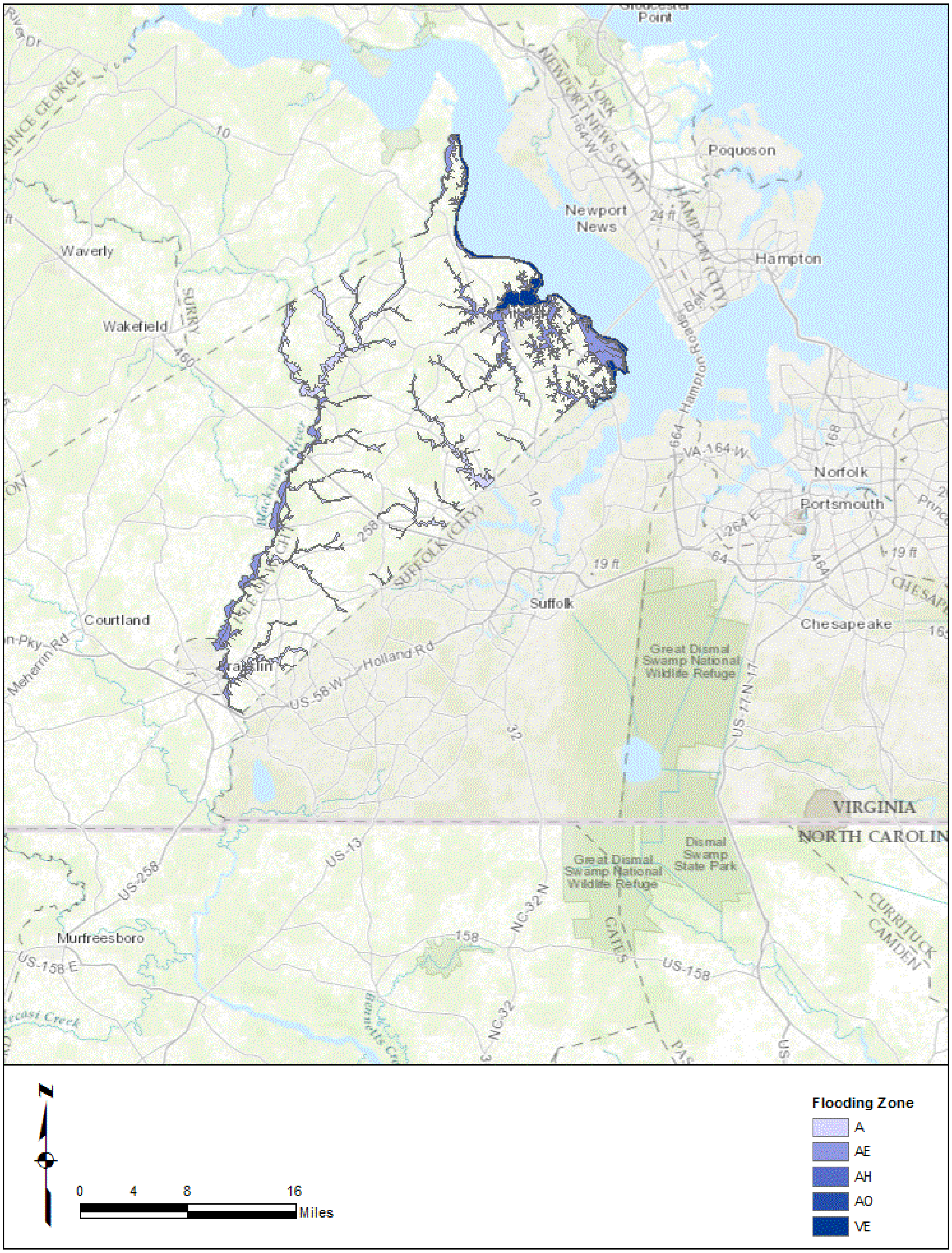
Source: Federal Emergency Management Agency, 2016

FIGURE 4.7: FEMA-IDENTIFIED 100-YEAR FLOOD HAZARD AREAS, SUFFOLK



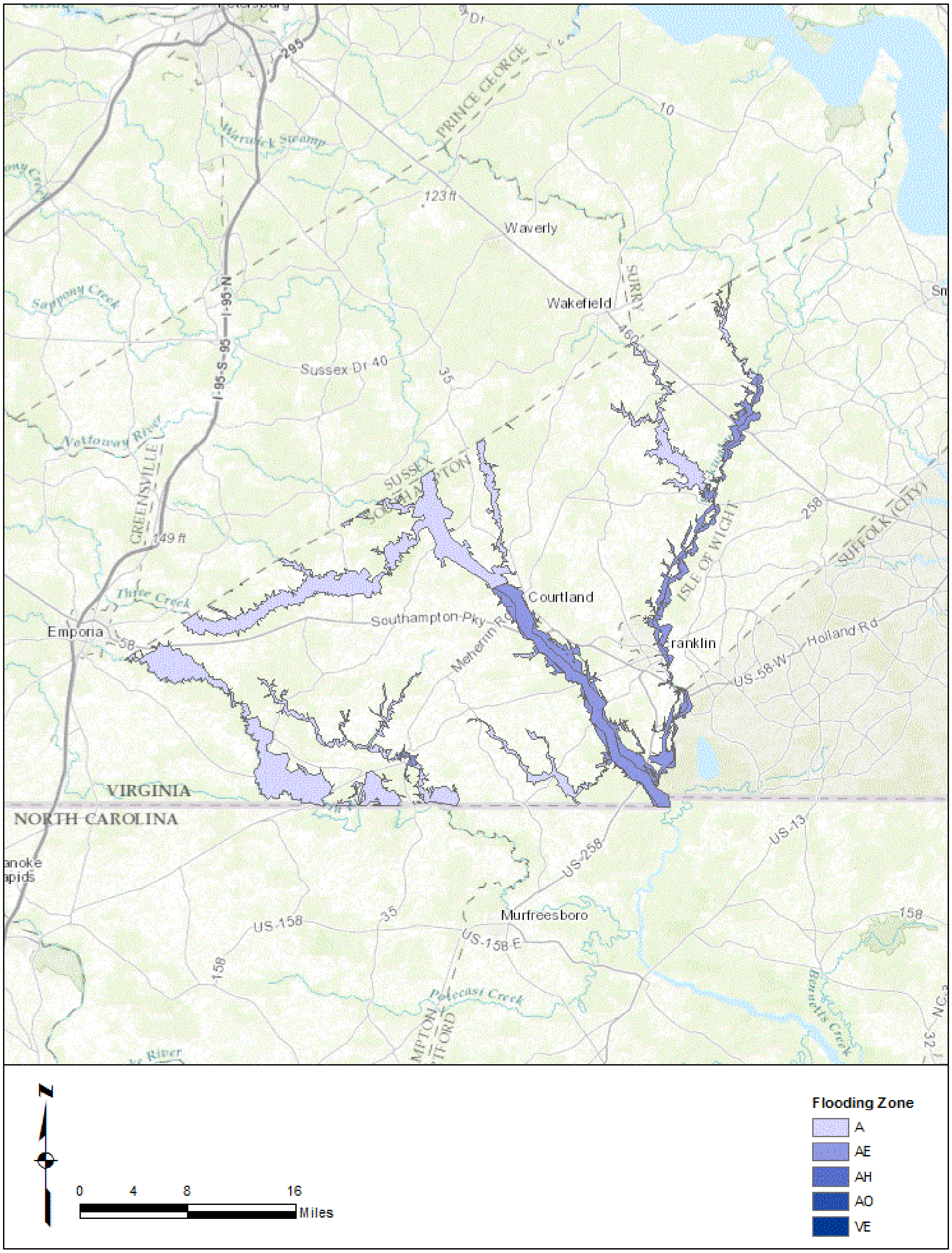
Source: Federal Emergency Management Agency, 2016

FIGURE 4.8: FEMA-IDENTIFIED 100-YEAR FLOOD HAZARD AREAS, ISLE OF WIGHT COUNTY, SMITHFIELD, WINDSOR



Source: Federal Emergency Management Agency, 2016

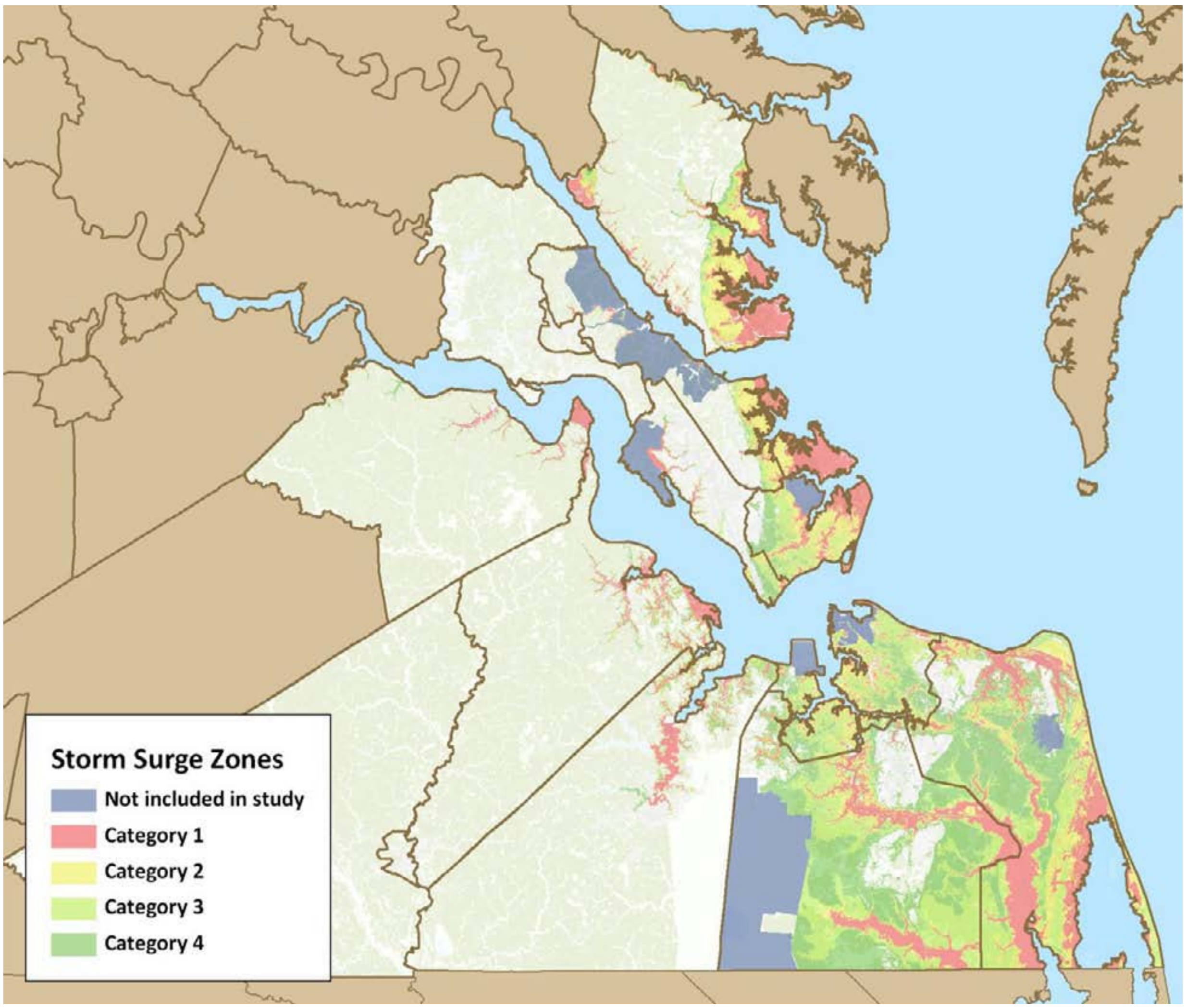
FIGURE 4.9: FEMA-IDENTIFIED 100-YEAR FLOOD HAZARD AREAS, SOUTHAMPTON COUNTY AND TOWNS, FRANKLIN



Source: Federal Emergency Management Agency, 2016

Figure 4.10 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 4.10: HAMPTON ROADS STORM SURGE ZONES



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

According to the National Inventory of Dams (NID) maintained by the U.S. Army Corps of Engineers, (USACE) there are 74 dams located in the Hampton Roads region (**Table 4.2**). The NID consists of dams meeting at least one of the following criteria;

1) High hazard classification - loss of one human life is likely if the dam fails,

2) Significant hazard classification - possible loss of human life and likely significant property or environmental destruction,

3) Equal or exceed 25 feet in height and exceed 15 acre-feet in storage,
4) Equal or exceed 50 acre-feet storage and exceed 6 feet in height.

The state regulatory agency for dams is DCR through the Dam Safety and Floodplain Management Program. **Figure 4.11** shows the location of high hazard dams in the region according to the National Inventory of Dams and DCR.

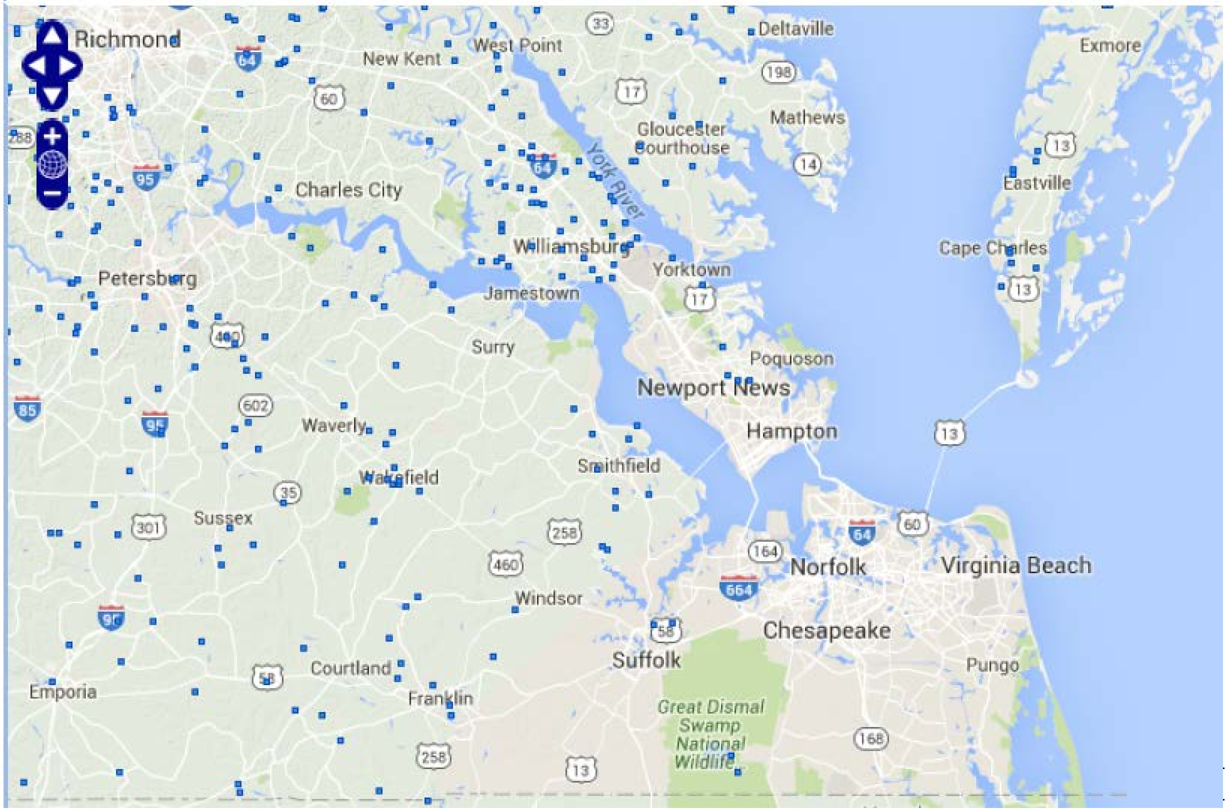
TABLE 4.2: HIGH HAZARD DAMS IN THE HAMPTON ROADS REGION

COMMUNITY	NAME OF DAM	DAM TYPE	PRIMARY PURPOSE	HEIGHT (FEET)	NORMAL STORAGE (ACRE FEET)
James City County	Ajacan Lake BMP Dam	Earth	-	24	-
James City County	Brewery Road Dam	Earth	Recreation	35	684
James City County	Cranstons Mill Pond Dam	Earth	Recreation	11	143
James City County	Deer Lake Dam	Earth	Recreation	35	71
James City County	Eastern Pond Dam (PC 106)	Earth	Irrigation	20	35.39
James City County	High Street SWM	Earth	Flood Control	28	-
James City County	Horne's Lake Dam	Earth	Recreation	14.8	32.29
James City County	Jolly Pond Dam	Earth	Recreation	10	250
James City County	Kiskiack South Dam	Earth	Recreation	25	113.2
James City County	Lake Nice	Earth	Recreation	35	301
James City County	Lake Pasbehegh Dam	Earth	Recreation	12	59
James City County	Little Creek Dam	Earth	Water Supply	67	24,600
James City County	Mirror Lakes Dam No. 1 (West)	Earth	Recreation	26.69	50
James City County	Mirror Lakes Dam No. 2	Earth	-	18	18
James City County	Nice Dam	Earth	Recreation	28	38
James City County	No. 9 Hole, Wexford Dr. SWMS	Earth	-	-	-
James City County	Perry Dam	Earth	Recreation	14	-
James City County	Rennicks Pond	Earth	Recreation	26.5	79
James City County	Scotts Pond	Earth	Recreation	16	-
James City County	Stieffen Pond	Earth	Recreation	16	-
James City County	Warburton Pond Dam	Earth	Recreation	14	-
James City County	Warehams Pond	Earth	Recreation	16	268
James City County	Wenger Dam	Earth	Recreation	19	83
James City County	Wingfield Lake Dam	Earth	Recreation	24	-
Williamsburg	Lake Matoaka Dam	Earth	Recreation	24	167
York County (location) Williamsburg (operator)	Waller Mill Dam	Earth	Recreation	40	4603
York County	Beaverdam Pond Dam	-	Water Supply	9	37
York County	Bigler Mill Pond Dam	-	Water Supply	13	145
York County	Cheatham Pond Dam	-	Recreation	9.09	196
York County	Harwood's Mill Dam	Earth	Water Supply	27	2696
York County	Jones Mill Pond Dam & Parkway	Earth	Other	26	-
York County	Lower Big Bethel Dam	-	Recreation	16	700
York County	Penniman Lake Dam	-	Recreation	11.5	183
York County	Pond 11 Dam	-	Recreation	12	38
York County	Pond 12 Dam	Earth	Recreation	13.5	36
York County	Powell Lake Dam	-	Recreation	9	17
York County	Queens Lake Dam	Earth	Recreation	12	300
York County	Roosevelt Pond Dam	-	Recreation	14	42.79
York County	Skimino Pond Dam	-	Recreation	7	15
York County	Upper Big Bethel Dam	Earth	Water Supply	27	1190
York County	Williamsburg Country Club Dam	Earth	Recreation	24	-
York County	Wormley Pond Dam	Earth	Recreation	11	-
York County	York Meadows Dam	Earth	Flood Control	15	-
Suffolk	Lake Cohoon				6,025
Suffolk	Lake Burnt Mills				7,449
Suffolk	Lake Killby				
Suffolk	Speight's Run Dam				
Suffolk	Western Branch				14,620

TABLE 4.2: HIGH HAZARD DAMS IN THE HAMPTON ROADS REGION					
COMMUNITY	NAME OF DAM	DAM TYPE	PRIMARY PURPOSE	HEIGHT (FEET)	NORMAL STORAGE (ACRE FEET)
Suffolk	Lake Meade Dam				6,372
Suffolk	Godwin's Millpond Dam				
Suffolk	C-Pond Dam				1,000
Virginia Beach	Lake Smith Dam				
Virginia Beach	Little Creek Reservoir				
Chesapeake	Lake Drummond	Gravity	-	67	22,000
Norfolk	Lake Whitehurst				
Isle of Wight County	Alemar Dam	Earth	Irrigation	17	23
Isle of Wight County	Aberdeen Dam	Earth	Irrigation	22	63
Isle of Wight County	ASB Pond	-	-	17	-
Isle of Wight County	Butlers Dam	Earth	Irrigation	21	122
Isle of Wight County	Echo Dam	Earth	Recreation	20	82
Isle of Wight County	Edwards Dam	Earth	Irrigation	23	70
Isle of Wight County	Gail Dam	Earth	Irrigation	16	30
Isle of Wight County	Jenkins Dam	Earth	Recreation	11	11
Isle of Wight County	Pond A-1 Dam	Earth	Other	20	15
Isle of Wight County	Pond B-2 Dam	Earth	Other	22	819
Isle of Wight County	Rhodes Dam	Earth	Irrigation	16	66
Isle of Wight County	Smithfield Downs Golf Course Dam	Earth	Recreation	18	15
Isle of Wight County	Smithfield Lake Dam	Earth	Recreation	19	196.34
Isle of Wight County	Tormento Dam	Earth	Irrigation	17	406
Isle of Wight County	Wrenns Dam	Earth	Recreation	14	76
Southampton County	Bishop Dam	Earth	Other	7	126
Southampton County	Camp Dam	Earth	Irrigation	17	82
Southampton County	Claud Dam	Earth	Irrigation	10	75
Southampton County	Colgate Darden Dam	Earth	Recreation	12	335
Southampton County	Cypress Cove Dam	Earth	Recreation	10	279
Southampton County	Dardens Dam (Marks)	Earth	Recreation	12	471
Southampton County	Johnson Dam	Earth	Recreation	15	746
Southampton County	McGraphs Dam	Earth	Recreation	9	81
Southampton County	Princes Dam	Earth	Irrigation	16	108
Southampton County	Ray Development Dam	Earth	Recreation	17	82
Southampton County	Rivers Dam	Earth	Recreation	11	156
Southampton County	Whitefields Dam	Earth	Recreation	14	398
Southampton County	Windbourne Dam	Earth	Recreation	15	156

Source: National Inventory of Dams, 2013 edition and personal correspondence with Robert VanLier, Virginia DCR, May 23, 2016

FIGURE 4.11: HAMPTON ROADS DAMS FROM NATIONAL INVENTORY OF DAMS



U.S. Army Corps of Engineers, National Inventory of Dams, 2013 edition
NOTE: As of 12/13/16, the NID erroneously does not contain any dams for incorporated cities in Virginia per phone conversation with Robert VanLier at DCR. DCR is requesting correction of the database for future updates.

SIGNIFICANT HISTORICAL EVENTS

Many flood events that have occurred in the region 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 region. Some of the notable flood events to impact Hampton Roads are discussed below.

The Storm of 1749 is one of the most notable storms to occur in the 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.

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.

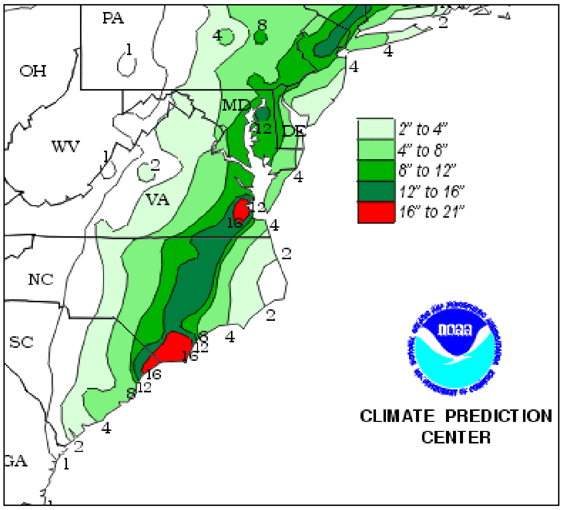
The Chesapeake-Potomac hurricane struck the region on **August 23, 1933** and created a high tide in Norfolk of 9.69 feet above Mean Lower Low Water (MLLW), a record for the area. Eighteen people were killed by this storm that also flooded downtown Norfolk and destroyed homes at Ocean View. Winds were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

Flooding of **August 13-18, 1940**, was the result of four significant rainfall events within a three-week period. During this historical flood for the region, the Blackwater River crested at 21.9 feet, approximately 10 feet above flood stage for the City of Franklin. One of the primary causes of this flood event was an unnamed tropical cyclone that meandered across the southeast United States for four days before dissipating on August 15. Rains began in earnest in Virginia on August 13 as the storm entered the state from the west. Deluges flooded locations statewide with 4.76 inches of rainfall being measured in Hampton Roads. The Meherrin River at nearby Emporia reached a flood of record stage on August 17 when the river crested at 31.5 feet, 8.5 feet above flood stage. A total of 16 deaths in Virginia and neighboring states are directly attributed to this flood event.

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.

The Ash Wednesday storm of 1962 produced very severe flooding throughout the 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 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, and approximately 13 inches to the Southampton County/City of Franklin area, and occurred 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 Suffolk, during Hurricane Floyd in 1999, Speight's Run spillway was compromised rendering Turlington Road impassable. Other dams in Suffolk were overtopped by what was reported as 8 feet of water. In western Tidewater, primary routes out-of-service due to flooding included U.S. Highway 58 near Franklin and Interstate 95 south of Petersburg to Emporia. Riverine flooding was extensive and prolonged throughout the Chowan River Basin with the Blackwater, Meherrin and Nottoway Rivers all exceeding flood stage. Water levels within the City of Franklin were estimated to be more than four feet above the previous flood of record, which occurred in August 1940, making it the new flood of record. Gage height indicated that the water reached a height of 26.27 feet on September 18, 1999. By early morning on September 16, the Blackwater River had made its way to Main Street bringing four to five feet of water to even the higher elevations of Downtown Franklin, and floodwaters continued to rise at a rate of approximately six inches per hour. Approximately 100 homes and 182 businesses were totally destroyed as a result of the flooding. Floodwaters did not begin to recede until September 21, and home and business owners were not able return to their properties and begin to evaluate their losses until September 28. The flooding was a 500-year flood of record for parts of the basin. Also, there were enormous agricultural/crop losses due to the flooding.



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

On **October 17, 1999**, a flash flood, which resulted from very heavy rainfall associated with Hurricane Irene, ranged from five to nine inches in the City of Franklin and Southampton County. The precipitation resulted in numerous flooded roads and road closures due to high water. Specific problem areas in Franklin included: a ditch along Armory Drive near the Wal-Mart Shopping Plaza where fast-moving water and drainage issues caused some road erosion; and flooding near the library caused problems along Second Avenue.

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. The magnitude of Hurricane Isabel's impact on the region was historic with rain, storm surge, and wind severely affecting many areas. Rainfall from Hurricane Isabel averaged four to seven inches over large portions of eastern North Carolina, east-central Virginia, and Maryland.

Although no damage was reported in the NCDC records, several streets in Franklin flooded as a result of precipitation associated with **Tropical Storm Ernesto** during the first four days of **September, 2006**. Ernesto strengthened throughout the day on Thursday, August 31 with maximum sustained winds reaching 70 mph. The Tropical Storm made landfall in Brunswick County, North Carolina near Long Beach at 1130 PM on Thursday, August 31. Ernesto moved north across the Coastal Plain of North Carolina on Friday, September 1, reaching southeastern Virginia as a Tropical Depression during the late afternoon on Friday. The system became extratropical late Friday evening as it moved across eastern Virginia. The Blackwater River crested at 15.61 feet according to stream gage data.

Between **October 7 and 10, 2006**, a strong low pressure system off the North Carolina coast coupled with an upper level cutoff low to dump intense rainfall across portions of southeastern Virginia and western Tidewater. Rainfall amounts in excess of 10 inches resulted in numerous road closures and moderate to major river flooding from late Friday, October 6th through Saturday, October 7th. In Franklin, the Blackwater River flooded much of downtown Franklin. Numerous businesses and residences sustained water damage, with estimates of property damage totaling approximately $4 million and crop damage estimated at $700,000. The Blackwater River crested October 10, 2006 at 22.77 feet.

Downtown Franklin during the October, 2006 flood. Source: City of Franklin photo

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 Southside Hampton Roads, including roadways which were washed out or closed. Great Bridge reported 10.75 inches of rain. Deep Creek reported 9.72 inches of rain. Very heavy rainfall ranged from five to nine inches in the City of Franklin and Southampton County. The precipitation resulted in numerous flooded roads and road closures due to high water. Fort Monroe estimated wind and water caused an estimated $2.2 million in damage to properties leased by the Fort Monroe Authority.

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 parts of the Hampton Roads region.

Table 4.3 provides information on significant flood events documented by the NCDC between 1995 and July 2015 for the study area, representing the most recent data available. These events resulted in one reported death and one reported injury, and $130,109,000 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. Bolded events in Table 4.3 are described in additional detail above.

TABLE 4.3: SIGNIFICANT FLOOD EVENTS (1995 - 2015)

LOCATION	DATE OF OCCURRENCE	TYPE OF EVENT	DEATHS/ INJURIES	PROPERTY DAMAGE	DETAILS
SOUTHAMPTON	6/11/1996	Flash Flood	0/0	-	Heavy rain in 3 hours caused road closures in the Sebrell area.
NORFOLK	6/18/1996	Flood	0/0	-	Heavy rain in 2 hours caused road closures in the Ocean View and Willoughby Spit sections of Norfolk.
VIRGINIA BEACH	6/18/1996	Flood	0/0	$10,000	Heavy rain in a few hours caused road closures in Lynnhaven and Oceanfront sections of Northern Virginia Beach.
VIRGINIA BEACH	6/20/1996	Flood	0/0	-	Heavy rain in 1 hour caused road closures in the Alanton and Oceana sections of Virginia Beach.
NORFOLK and VIRGINIA BEACH	7/18/1996	Flash Flood	0/0	-	Heavy rain in 6 hours caused road closures with people trapped in cars along the 300-400 block of East Little Creek Road and along Campostella Road. Flooding was also reported in the Kempsville area along Indian River Road and Princess Anne Road. High water was reported in the Oceanfront area along Atlantic Avenue.
CHESAPEAKE	7/18/1996	Flash Flood	0/0	-	Heavy rain in a few hours resulted in water along Bainbridge Boulevard and Freeman Avenue and a split of Interstate 64 and 264.
VIRGINIA BEACH	7/18/1996	Flash Flood	0/0	-	Heavy rain in a few hours resulted in flooding in the Kempsville area along Indian River Road and Princess Anne Road and the Oceanfront area along Atlantic Avenue.
NORFOLK	7/31/1996	Flood	0/0	-	Streets were flooded due to two storms in an afternoon.
NEWPORT NEWS, YORK/POQUOSON, NORFOLK/HAMPTON/ PORTSMOUTH, AND VIRGINIA BEACH	4/23/1997	Coastal Flood	0/0	-	Moderate coastal flooding caused tides to peak at 5.8ft above the Mean Lower Low Water especially in Willoughby Spit, Ghent, and downtown sections of Norfolk, the Old-Town section of Portsmouth, the Buckroe Beach and Grandview sections of Hampton, and the Sandbridge section of Virginia Beach. Minor coastal flooding was reported in Newport News and York county.
NORFOLK AND VIRGINIA BEACH	6/3/1997	Coastal Flood	0/0	-	Minor to moderate flooding resulted in loss of part of the boardwalk and a couple lifeguard stands in Virginia Beach and several streets flooded in downtown Portsmouth and downtown Norfolk.
VIRGINIA BEACH, YORK/POQUOSON, NORFOLK/HAMPTON/ PORTSMOUTH, AND NEWPORT NEWS	10/19/1997	Coastal Flood	0/0	-	Minor to moderate flooding resulted in streets being closed and water in a few houses in Norfolk, downtown Portsmouth, Sandbridge and Sandfiddler areas of Virginia Beach. Minor flooding was reported in Newport News and York County.
VIRGINIA BEACH, NEWPORT NEWS, NORFOLK, AND YORK	1/27/1998	Coastal Flood	0/0	$1,500,000	A Nor'easter caused high tides and moderate coastal flooding combined with gale and storm force winds. A couple houses were damaged and power outages were scattered across the Hampton Roads area.
NORFOLK, HAMPTON, PORTSMOUTH, VIRGINIA BEACH, NEWPORT NEWS, AND YORK/POQUOSON	2/4/1998	Coastal Flood	0/0	$75,000,000	A Nor'easter caused gale & storm force winds & high tides that resulted in moderate to severe coastal flooding with damage to buildings, road closures, & scattered power outages especially in Norfolk, Virginia Beach, and Hampton. Willoughby & Ocean View had the most damage.
NORFOLK,	7/24/1999	Flash	0/0		Roads were flooded including Hampton

TABLE 4.3: SIGNIFICANT FLOOD EVENTS (1995 - 2015)					
LOCATION	DATE OF OCCURRENCE	TYPE OF EVENT	DEATHS/ INJURIES	PROPERTY DAMAGE	DETAILS
CHESAPEAKE, VIRGINIA BEACH, SUFFOLK, and PORTSMOUTH		Flood		-	Boulevard. Parts on Interstate 264, Ballahack Road, and Military Highway in Chesapeake were flooded. Many other roads were flooded and impassable.
VIRGINIA BEACH, NORFOLK, CHESAPEAKE, AND PORTSMOUTH	8/14/1999	Flash Flood	0/0	-	Primary roads and underpasses were flooded including Route 13 in Chesapeake.
VIRGINIA BEACH, NORFOLK, CHESAPEAKE, SUFFOLK, AND PORTSMOUTH	9/7/1999	Flash Flood	0/0	-	A line of thunderstorms caused flooding on roads.
SUFFOLK	9/7/1999	Flash Flood	0/0	-	Road (1500 block Camp Pond Road) flooded out.
CHESAPEAKE, ISLE OF WIGHT, SUFFOLK, NORFOLK, FRANKLIN, SOUTHAMPTON, PORTSMOUTH, NEWPORT NEWS, HAMPTON, YORK, JAMES CITY, POQUOSON, AND WILLIAMSBURG	**9/15/1999**	**Flash Flood**	**0/0**	**$35,000**	**Hurricane Floyd caused heavy rain and widespread flooding and flash flooding across eastern Virginia. 12 to 18 inches of rain fell in the Tidewater region. Numerous roads were washed out and several rivers exceeded flood stage including the Chowan River Basin and the Blackwater, Meherrin, and Nottoway Rivers. There were enormous agricultural losses due to flooding.**
SUFFOLK, SOUTHHAMPTON, ISLE OF WIGHT, FRANKLIN, NORFOLK, VIRGINIA BEACH, CHESAPEAKE, PORTSMOUTH, NEWPORT NEWS, POQUOSON, YORK, AND HAMPTON	**10/17/1999**	**Flash Flood**	**0/0**	**-**	**Heavy rainfall associated with Hurricane Irene caused flooded roads and road closures.**
JAMES CITY	7/19/2000	Flash Flood	0/0	-	Heavy rain caused flooding and standing water across the intersection of Routes 30 and 60 near Toano.
HAMPTON, NEWPORT NEWS	7/24/2000	Flash Flood	0/0	$350,000	Heavy rain caused 35 residences to be evacuated due to high water on Scoggin Circle and Grimes Road in the Buckroe Beach section of Hampton. Widespread flooding of main and secondary roads was reported in Newport News.
SOUTHAMPTON, POQUOSON, AND YORK	7/24/2000	Flash Flood	0/0	-	Flooding on secondary roads and several roads washed out. Three interstate off-ramps were closed due to flooding in York.
NORFOLK	7/26/2000	Flash Flood	0/0	-	Heavy rain flooded roadways and caused closure of underpasses on Tidewater Drive in downtown Norfolk. Flooding also occurred at Chesapeake Boulevard and Chesapeake Street in the East Ocean View section of Norfolk.
SUFFOLK	7/30/2000	Flash Flood	0/0	-	Heavy rain caused flooding of Kings Fork Road in the western part of the city.
SOUTHAMPTON	8/3/2000	Flash Flood	0/0	$2,000	Heavy rain caused flooding on Route 58 near Drewryville and two minor accidents on Route 308 were due to high water.
PORTSMOUTH, AND NORFOLK	8/11/2000	Flash Flood	0/0	-	Flooding caused the closure of Interstate 264 at Frederick Boulevard. The intersections of Granby Street and

TABLE 4.3: SIGNIFICANT FLOOD EVENTS (1995 - 2015)					
LOCATION	DATE OF OCCURRENCE	TYPE OF EVENT	DEATHS/ INJURIES	PROPERTY DAMAGE	DETAILS
					Brambleton Avenue, Princess Anne Road and Monticello Avenue, and City Hall Avenue and Granby Street were all closed due to high standing water in Norfolk. Also, underpasses on Campostella Avenue, Tidewater Drive and Colley Avenue were closed due to accumulated water.
VIRGINIA BEACH	8/14/2000	Flash Flood	0/0	-	Widespread flooding caused the closure of several roads in the vicinity of Princess Anne Plaza. Sections of Rosemont Road were closed due to flooding.
SOUTHAMPTON	9/1/2000	Flash Flood	0/0	-	Several roads flooded.
NORFOLK	9/5/2000	Flash Flood	0/0	-	Heavy rain caused the side of an underpass wall to slide into the road at Granby Street and Interstate 64 resulting in road closure.
SOUTHAMPTON / FRANKLIN	9/5/2000	Flood	0/0	$3,000	The Nottoway and Blackwater Rivers flooded and caused some road closures including: Route 653 from Route 719 to Cary's Bridge, Route 619 at the intersection of Route 629, Route 614 from Route 622 to the Isle of Wight county line, and Route 651 (Indian Town Road) from Route 35 at Hancock Peanut to Route 652.
SUFFOLK AND ISLE OF WIGHT	6/16/2001	Flash Flood	0/0	-	Flooding caused one road closure near Whaleyville. Knoxville Road, Rose Drive, and numerous other secondary roads were impassable around Windsor.
NORFOLK	7/23/2001	Flash Flood	0/0	-	One car was submerged at the underpass on Colley Avenue and 21st Street and roads were covered with water.
SOUTHAMPTON	8/18/2001	Flash Flood	0/0	-	Flooding resulted in impassable roads and high water on Route 35.
HAMPTON AND NEWPORT NEWS	6/14/2002	Flash Flood	0/0	-	Streets were flooded and water was shooting out of a manhole cover.
VIRGINIA BEACH, NORFOLK, HAMPTON, AND NEWPORT NEWS	8/28/2002	Flash Flood	0/0	-	Heavy rains caused roads closures along Rosemont at the Virginia Beach Boulevard and around Kings Grant area. A car stalled in deep water. Union street and areas near City Hall and Granby were flooded in Norfolk. A section of West Mercury Boulevard and Powhatan Parkway in Hampton were closed due to high water. Roads were closed at the intersection of 27th and Buxton streets and flood barricades were in place at the City Line Apartment Complex in Newport News.
VIRGINIA BEACH AND NORFOLK	10/11/2002	Flash Flood	0/0	-	Atlantic Avenue was closed in Virginia Beach between 42nd and 65th streets due to flooding. The intersection of Tidewater Drive and Virginia Beach Boulevard in Norfolk were flooded.
NEWPORT NEWS, YORK/POQUOSON, NORFOLK/HAMPTON/ PORTSMOUTH, AND VIRGINIA BEACH	4/10/2003	Storm Surge/tide	0/0	-	Flooding occurred at high tide resulting in water in some streets portions of the Middle Peninsula and Hampton Roads.
NEWPORT NEWS AND YORK	7/19/2003	Flash Flood	0/0	-	Heavy rain caused street flooding near Leesville Mill Subdivision. Route 17 was reported closed at intersection with Route 173 due to street flooding.
NEWPORT NEWS	8/5/2003	Flash	0/0		6 families had to be evacuated due to flash

TABLE 4.3: SIGNIFICANT FLOOD EVENTS (1995 - 2015)					
LOCATION	DATE OF OCCURRENCE	TYPE OF EVENT	DEATHS/ INJURIES	PROPERTY DAMAGE	DETAILS
		Flood		-	flooding.
POQUOSON	8/17/2003	Flash Flood	0/0	-	High water occurred on Poquoson and Huggins roads, and also in Hunts Neck are and in yards.
SUFFOLK, HAMPTON, NEWPORT NEWS, NORFOLK, AND PORTSMOUTH	**9/3/2003**	**Flash Flood**	**0/0**	**-**	**Streets were flooded in northern Suffolk. Many roads closed due to high water, including 27th and Buxton Streets in Newport News and the 8000 block of Hampton Boulevard in Norfolk.**
NEWPORT NEWS AND YORK	5/19/2004	Flash Flood	0/0	-	High water on Warwick Boulevard between 36th and 50th Street and at Center and Jefferson Avenue, and underpasses along Main Street and Center Avenue. Dare Road reported closed due to high water in York.
NEWPORT NEWS	5/22/2004	Flash Flood	0/0	-	High water at Flint Drive and Tillerson Drive.
PORTSMOUTH	6/10/2004	Flash Flood	0/0	-	High water at Airline Boulevard and I-264 and at intersection of Oregon and Dakota Roads.
CHESAPEAKE	7/4/2004	Flash Flood	0/0	-	A section of Route 17 in the Great Dismal Swamp Area was washed out due to rain.
NORFOLK AND ISLE OF WIGHT	7/25/2004	Flash Flood	0/0	-	Streets were flooded in downtown Norfolk including Waterside Drive. Lawnes Creek Bridge on Route 10 near Rushmere and several other roads were reported closed due to flooding in Isle of Wight.
NORFOLK AND PORTSMOUTH	8/2/2004	Flash Flood	0/0	-	Some streets were flooded including the intersection of Park Avenue and Virginia Beach Boulevard and at the intersection of Robinhood Road and I-64 Underpass. Duke and Randolph Streets reported closed due to high water. Flooding on I-264 and Portsmouth Boulevard in Portsmouth.
CHESAPEAKE	7/13/2005	Flash Flood	0/0	-	One half mile of Murray Drive near Fentress in the Green Haven subdivision was underwater.
SUFFOLK, CHESAPEAKE, PORTSMOUTH, AND NORFOLK	8/9/2005	Flash Flood	0/0	-	College Drive and Camelia Drive flooded in Suffolk. Parts of Taylor Road were flooded in Chesapeake. Numerous roads were closed including Hampton Boulevard with vehicles flooded in Norfolk. Effingham and London Boulevard and the entrance to Route 264 at Frederick Boulevard were flooded in Portsmouth.
NORFOLK / HAMPTON / PORTSMOUTH…, NORFOLK, SUFFOLK, PORTSMOUTH, CHESAPEAKE, HAMPTON, NEWPORT NEWS, AND POQUOSON	10/8/2005	Flood	0/0	-	Street flooding reported at Hampton Boulevard and Terminal Boulevard, Granby Street and Tidewater Drive, 900 Block of East Oceanview Avenue, Virginia Beach Boulevard and Brambleton, Princess Anne and Monticello Avenue. Areas of flooding were reported along sections of Route 58, on College Drive in the College Square Section, and on Kilby Shores Drive in Suffolk. The 56th block of Cranny Brook Road, Bunch Boulevard at Dwight Avenue, Powhatan and Vahallia, Scott Drive at Westhaven, 264 West bound off ramp, and Gateway Drive were closed due to flooding in Portsmouth. Bruce Road was closed near Tyre Neck Road in Western Branch part of Chesapeake. Grimes Road and Lee Street were under water in Hampton. Buxton Avenue was closed at 25th Street in

TABLE 4.3: SIGNIFICANT FLOOD EVENTS (1995 - 2015)					
LOCATION	DATE OF OCCURRENCE	TYPE OF EVENT	DEATHS/ INJURIES	PROPERTY DAMAGE	DETAILS
					Newport News. North Lawson Road was flooded in Poquoson.
CHESAPEAKE, NORFOLK, PORTSMOUTH, SUFFOLK, AND VIRGINIA BEACH	6/14/2006	Flash Flood	0/0	-	Heavy rain from the remnants of Tropical Storm Alberto caused flash flooding and road closures and the closure of Bainbridge Boulevard near the Triple Decker Bridge in Chesapeake. Brambleton Avenue near Route 264 overpass was closed and flooding occurred at Texas Avenue in the Norvell Heights area in Norfolk. The 2000 block of Frederick Boulevard was closed due to flash flooding in Portsmouth. The 2500 block of Pruden Boulevard was closed due to flash flooding in Suffolk. Atlantic Avenue between 49th and 71st streets was closed in Virginia Beach due to flash flooding.
YORK, HAMPTON, ISLE OF WIGHT, AND NEWPORT NEWS	6/23/2006	Flood	0/0	-	High water on several roads including Main Street in Isle of Wight.
SUFFOLK, NORFOLK, VIRGINIA BEACH, CHESAPEAKE, SOUTHAMPTON, FRANKLIN, YORK, PORTSMOUTH, HAMPTON, JAMES CITY AND NEWPORT NEWS	**9/1/2006**	**Flash Flood**	**0/0**	**-**	**Numerous streets flooded with a couple feet of water including Route 600 between Routes 614 to 623 in Southampton, Route 264 ramp to Frederick Boulevard in Portsmouth, London Bridge Road and Corporate Landing Street in Virginia Beach, Route 64 at Mercury Boulevard in Hampton, Route 664 at 35th street to Jefferson Avenue in Newport News, and Route 632 in James City.**
YORK / POQUOSON	**9/1/2006**	**Coastal Flood**	**0/0**	**$1,900,000**	**Tides of 4 to 5 feet above normal caused significant property damage across portions of the Virginia Peninsula and Middle Peninsula near the Chesapeake Bay and adjacent tributaries.**
NORFOLK AND YORK	**10/6/2006**	**Coastal Flood**	**0/0**	**$200,000**	**Strong onshore winds caused moderate coastal flooding during high tide and caused road closures and power outages in western portions of the southern Chesapeake Bay.**
SOUTHAMPTON, ISLE OF WIGHT, FRANKLIN, AND JAMES CITY	**10/7/2006**	**Flash Flood**	**0/0**	**$8,050,000**	**Intense rainfall caused river flooding, road closures, and power outages in western portions of the southern Chesapeake Bay. HWY 460 was closed from Ivor to the Sussex county line. HWY 258 and parts of HWY 460 near Windsor in Isle of Wight. The Blackwater River flooded much of downtown Franklin where numerous businesses and residences sustained water damage.**
NORFOLK, YORK, CHESAPEAKE, SUFFOLK, AND VIRGINIA BEACH	11/22/2006	Coastal Flood	0/0	$225,000	Strong onshore winds caused moderate coastal flooding during high tide and caused road closures across portions of eastern and southeast Virginia including the intersection of Tidewater Drive and Brambleton Avenue and the intersection of Virginia Beach Boulevard and Tidewater Drive. The 700 block of North Main Street and East Constance Road in the 100 block between North Main and Katherine Street were closed due to high water in Suffolk.
NORFOLK AND VIRGINIA BEACH	6/26/2007	Flash Flood	0/0	-	Heavy rain caused flash flooding on roads and in underpasses including Tidewater

TABLE 4.3: SIGNIFICANT FLOOD EVENTS (1995 - 2015)					
LOCATION	DATE OF OCCURRENCE	TYPE OF EVENT	DEATHS/ INJURIES	PROPERTY DAMAGE	DETAILS
					Drive underpasses. Flooding was reported on Virginia Beach Blvd and Kempsville Road in Virginia Beach.
PORTSMOUTH AND NORFOLK	4/21/2008	Flash Flood	0/0	-	Heavy rains caused flash flooding and road closures across portions of southeast Virginia.
SUFFOLK	5/5/2009	Flash Flood	0/0	-	Isolated thunderstorm produced heavy rain which caused flash flooding across portions of Suffolk. High water was reported at the 3800 Block of Whaleyville Boulevard in Whaleyville.
SOUTHAMPTON	8/5/2009	Flash Flood	0/0	-	Isolated thunderstorms produced heavy rains which caused flash flooding across portions of Southampton county and a section of State Highway 186 was flooded and partially closed.
PORTSMOUTH, CHESAPEAKE, AND NORFOLK	8/12/2009	Flash Flood	0/0	-	Scattered thunderstorms produced heavy rain which caused flash flooding and road closures across portions of southeast Virginia. Gracie Road and State Highway 407 were flooded in Chesapeake. Westbound Route 264 at the downtown tunnel was closed from Norfolk to Portsmouth. Road was flooded at South Brambleton Road and Kimball Terrace near the Exit 11A interchange of Interstate 264 in Norfolk.
HAMPTON	8/13/2009	Flash Flood	0/0	-	Isolated thunderstorm produced heavy rain which caused flash flooding across portions of Hampton.
NEWPORT NEWS	8/14/2009	Flash Flood	0/0	-	Isolated thunderstorm produced heavy rain which caused flash flooding across portions of Newport News.
NORFOLK	8/22/2009	Flash Flood	0/0	-	Scattered thunderstorms produced heavy rain which caused flash flooding and road closures in numerous locations downtown, including the Ghent area and in the vicinity of Old Dominion University.
CHESAPEAKE, ISLE OF WIGHT, NEWPORT NEWS, NORFOLK, VIRGINIA BEACH, YORK, AND SUFFOLK	**11/12/2009**	**Coastal Flood**	**0/0**	**$38,750,000**	**A Nor'easter produced moderate to severe coastal flooding across much of eastern and southeastern Virginia causing flooding of streets, homes, and businesses. Tidal flooding took out the clubhouse north of the Godwin Bridge, and destroyed a number of piers in Suffolk. The flooding was extensive, well above what was experienced in Isabel, in the Long Creek, Lynnhaven Colony and Bay Island areas of Virginia Beach.**
CHESAPEAKE, NORFOLK, VIRGINIA BEACH, AND YORK	12/19/2009	Coastal Flood	0/0	$40,000	A coastal low pressure area produced moderate to severe coastal flooding across much of eastern and southeast Virginia and several streets, homes and businesses were flooded in low lying areas
VIRGINIA BEACH, PORTSMOUTH, AND HAMPTON	7/29/2010	Flash Flood	0/0	-	Scattered thunderstorms produced flash flooding across portions of southeast Virginia and numerous roads were flooded in north Virginia Beach, the City of Hampton, and the City of Portsmouth.
PORTSMOUTH, HAMPTON, YORK, NORFOLK, AND	9/30/2010	Flash Flood	0/0	-	Thunderstorms produced flash flooding and caused road closures including Portsmouth Boulevard, County Street, Effingham Street,

TABLE 4.3: SIGNIFICANT FLOOD EVENTS (1995 - 2015)					
LOCATION	DATE OF OCCURRENCE	TYPE OF EVENT	DEATHS/ INJURIES	PROPERTY DAMAGE	DETAILS
CHESAPEAKE,					and the Interstate 264 Exit at Effingham.
VIRGINIA BEACH, CHESAPEAKE, FRANKLIN, ISLE OF WIGHT, NORFOLK, PORTSMOUTH, SOUTHAMPTON, SUFFOLK, YORK, HAMPTON, JAMES CITY, NEWPORT NEWS, AND JAMES CITY	**8/27/2011**	**Flood**	**0/0**	**-**	**Hurricane Irene produced heavy rains which caused widespread flooding and either closed or washed out roadways. Rainfall ranged from four to twelve inches across the region.**
SOUTHAMPTON	9/9/2011	Flood	1/1	-	The driver of a vehicle drowned after his vehicle went into a swamp in Southampton county. The passenger was able to escape from the vehicle.
VIRGINIA BEACH	9/28/2011	Flash Flood	0/0	-	Scattered thunderstorms caused heavy rain which produced flash flooding and flooded Jeanna Street and Shore Drive.
ISLE OF WIGHT, NEWPORT NEWS, AND YORK	5/15/2012	Flash Flood	0/0	-	Scattered thunderstorms produced heavy rain and flash flooding resulting in flooding on several roads and high water west of Carrollton in Isle of Wight. In Newport News, flooding was reported on Interstate 64 at Jefferson Avenue. Several accidents were reported near the Patrick Henry Mall. The underpasses at Main Street and Center Avenue were flooded several feet. Winterhaven Drive had several cars floating. There was significant flooding off of Harpersville Road. There was flooding at the Virginia Living Museum. Three feet of water was reported on a road in the Coventry Subdivision in York.
NEWPORT NEWS AND HAMPTON	8/25/2012	Flash Flood	0/0	$2,000,000	Scattered thunderstorms produced heavy rain which caused flash flooding which resulted in flooding on Warwick Boulevard, Main Street, Deep Creek Road and cars were submerged on Warwick Boulevard just west of Mercury Boulevard in Newport News. An apartment building was flooded in Hampton.
HAMPTON	8/28/2012	Flash Flood	0/0	-	Scattered thunderstorms produced heavy rain which caused flash flooding. Fox Hill Road was almost impassable at Mercury Boulevard due to flooding. Other roads were closed or impassible and an apartment complex was evacuated.
SOUTHAMPTON	8/28/2012	Flood	0/0	-	Scattered thunderstorms produced heavy rain which caused flooding and road closures mainly western sections along and south of Route 58.
ISLE OF WIGHT, VIRGINIA BEACH, YORK, SUFFOLK, NEWPORT NEWS, CHESAPEAKE, NORFOLK, AND JAMES CITY	**10/28/2012**	**Coastal Flood**	**0/0**	**$2,044,000**	**Tropical Cyclone Sandy produced very strong winds which caused moderate to severe coastal flooding especially on the James River, York River, Chesapeake Bay, and at Sewells Point. Some streets were flooded in Chesapeake.**
NEWPORT NEWS, JAMES CITY, ISLE OF WIGHT, HAMPTON, CHESAPEAKE, WILLIAMSBURG,	**10/29/2012**	**Flood**	**0/0**	**-**	**Tropical Cyclone Sandy produced very strong winds which caused flooding and closed numerous roads.**

TABLE 4.3: SIGNIFICANT FLOOD EVENTS (1995 - 2015)

LOCATION	DATE OF OCCURRENCE	TYPE OF EVENT	DEATHS/ INJURIES	PROPERTY DAMAGE	DETAILS
PORTSMOUTH, SUFFOLK, YORK, VIRGINIA BEACH, AND NORFOLK					
YORK	7/21/2013	Flash Flood	0/0	-	Scattered thunderstorms produced heavy rain which caused flash flooding. Flooding was reported along Farm Road just off of Route 17. Oriana Road (Route 620) was flooded just north of Newport News Airport. Two to three inches of water was over roadway along Route 17 just south of the Coleman Bridge.
NORFOLK, PORTSMOUTH, AND CHESAPEAKE	5/16/2014	Flood	0/0	-	Heavy rain caused flooding during high tide. Numerous roads were closed due to high water. The first floor of some apartments and a couple of cars were under water in Ghent. Norfolk Public Schools experienced flooding inside some of their buildings.
VIRGINIA BEACH	7/9/2014	Flood	0/0	-	Scattered severe thunderstorms produced heavy rain which caused minor flooding on Sandbridge Road.
NORFOLK, ISLE OF WIGHT, AND PORTSMOUTH	7/10/2014	Flood	0/0	-	Scattered severe thunderstorms produced heavy rain which caused some minor flooding on Windsor Boulevard in Windsor and Elm Street in Portsmouth.
VIRGINIA BEACH	7/15/2014	Flood	0/0	-	Scattered severe thunderstorms produced heavy rain which caused some minor flooding at the intersection of Baxter Road and Princess Anne Road and on Mill Dam Road near First Colonial Road.
SUFFOLK	7/24/2014	Flash Flood	0/0	-	Scattered thunderstorms produced heavy rain which caused flash flooding on Clay Street with water flowing into homes in Suffolk. A car was partially submerged in high water in the Pleasant Hill area.
ISLE OF WIGHT, NEWPORT NEWS, PORTSMOUTH, NORFOLK, CHESAPEAKE, AND HAMPTON	9/8/2014	Flood	0/0	-	Showers and scattered thunderstorms produced locally heavy rainfall and resulted in flooding across portions of southeast Virginia. Several roads were flooded or impassable over northeast Isle of Wight county. Several roads were flooded in southern portions of Newport News, including 26th Street near Interstate 664, and Warwick Boulevard and 35th Street. Also, several streets were flooded around Mercury Boulevard. An apartment complex was evacuated in Hampton. Heavy rain closed several roads and underpasses across the region.
TOTAL			**1/1**	**$130,109,000 million**	

Source: NCDC (1995 to July, 2015 data)

PROBABILITY OF FUTURE OCCURRENCES

Flooding remains a highly likely occurrence throughout the identified flood hazard and storm surge areas of the Hampton Roads region. Smaller floods caused by heavy rains and inadequate drainage capacity will be frequent, but not as costly as the large-scale floods caused by hurricanes and coastal storms, which may occur at less frequent intervals.

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. Increased wave action contributes to the increased erosion as the wave energy attacks intertidal and upland resources.

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.

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 becomes increasingly costly. Sea level rise will threaten the longevity and effectiveness of stormwater drainage systems and other infrastructure, 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.

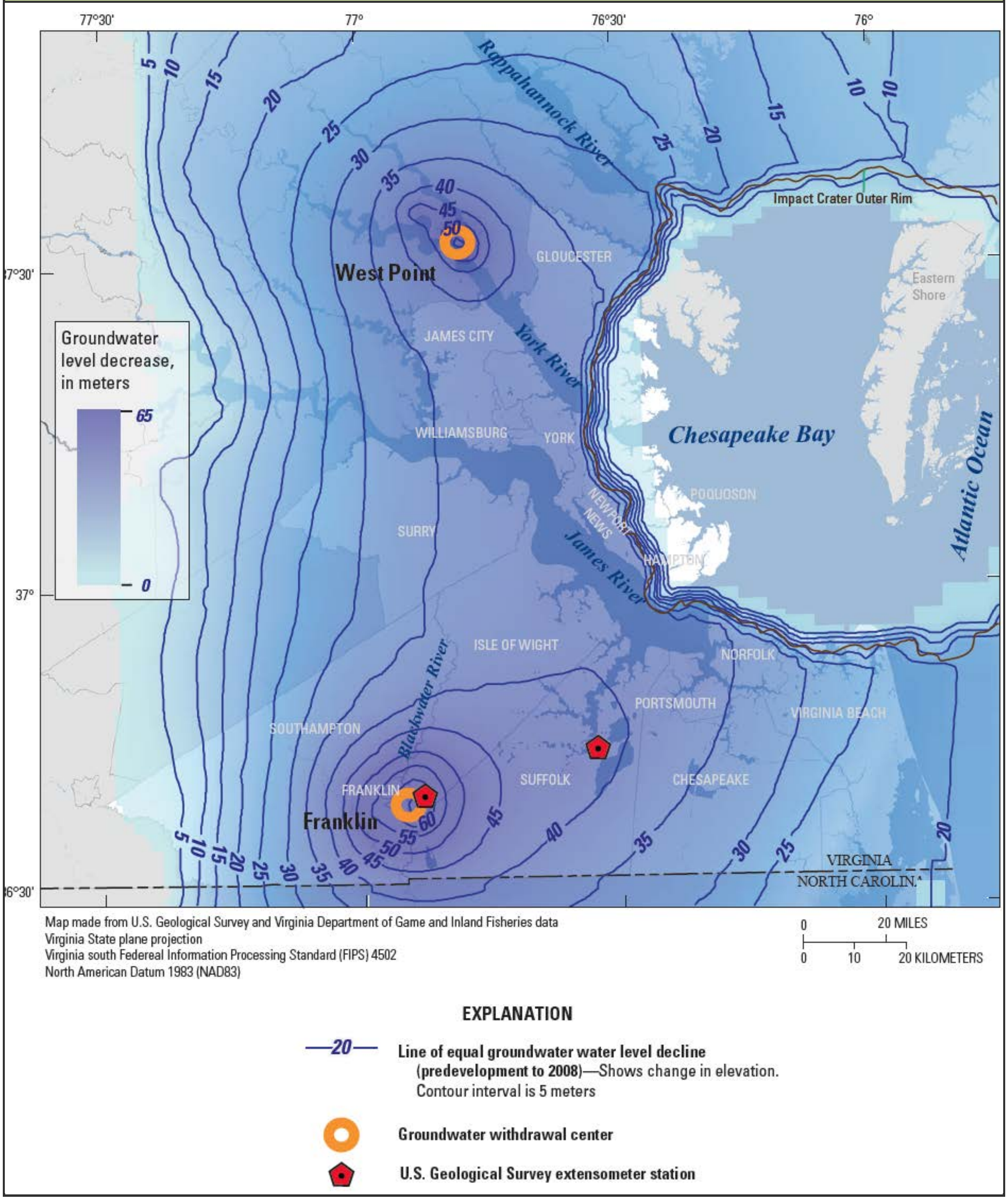
LOCATION AND SPATIAL EXTENT

According to the Old Dominion University Center for Sea Level Rise, sea level rise has a very localized spatial extent related to past development activities. Historically, many of the region's large and small waterways were filled, creating developable land upon which infrastructure, residences and businesses were constructed. Subsequently, as sea level has risen, these areas have been the first to experience the effects. Water begins to retrace ancient flow paths, flooding neighborhood streets and stormwater outfalls. The outfalls are then less capable of handling rainfall runoff because the pipes must also accommodate rising sea water. This phenomenon exacerbates and prolongs flood events.

Several factors are influencing the rates of sea level rise relative to land in 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 Hampton Roads region is experiencing both regional subsidence (along the east coast of the United States) and local subsidence, exacerbating the effects of storms. Subsidence alone can damage wetland and coastal marsh ecosystems and damage infrastructure, but when combined with sea level rise, the effects can be even more devastating.

Local subsidence is believed to be the result of settlement or compaction of subsurface layers resulting from groundwater withdrawals and glacial isostatic rebound (USGS, *Land Subsidence and Relative Sea-Level Rise in the Southern Chesapeake Bay Region*, 2013). Groundwater withdrawals in the region, primarily seen near the pumping centers of Franklin and West Point, decrease pressure and therefore water levels in the aquifer system. As a result, the aquifer system compacts and the land surface subsides. Borehole extensometers, like the one in Franklin, Virginia measure compaction or expansion of aquifer thickness. Scientists also use surface monitoring data such as that from tidal stations, geodetic surveying and remote sensing in an effort to determine how much land subsidence can be attributed to aquifer compaction. **Figure 4.12** illustrates the spatial extent of changes in groundwater level in the Hampton Roads region that are thought to contribute to land subsidence.

FIGURE 4.12: GROUNDWATER LEVEL DECREASES FROM 1900 TO 2008

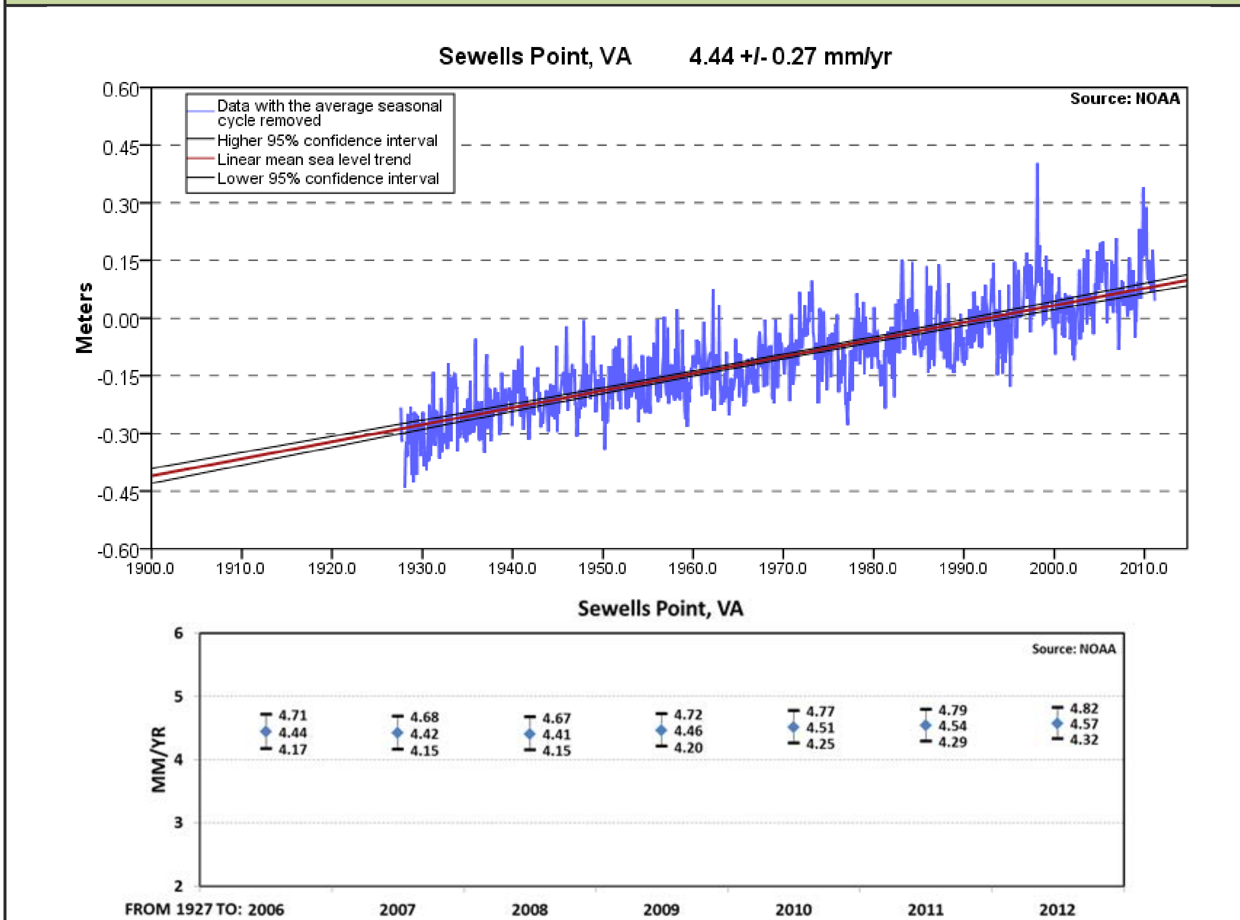


Source: USGS, *Land Subsidence and Relative Sea-Level Rise in the Southern Chesapeake Bay Region*, 2013

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

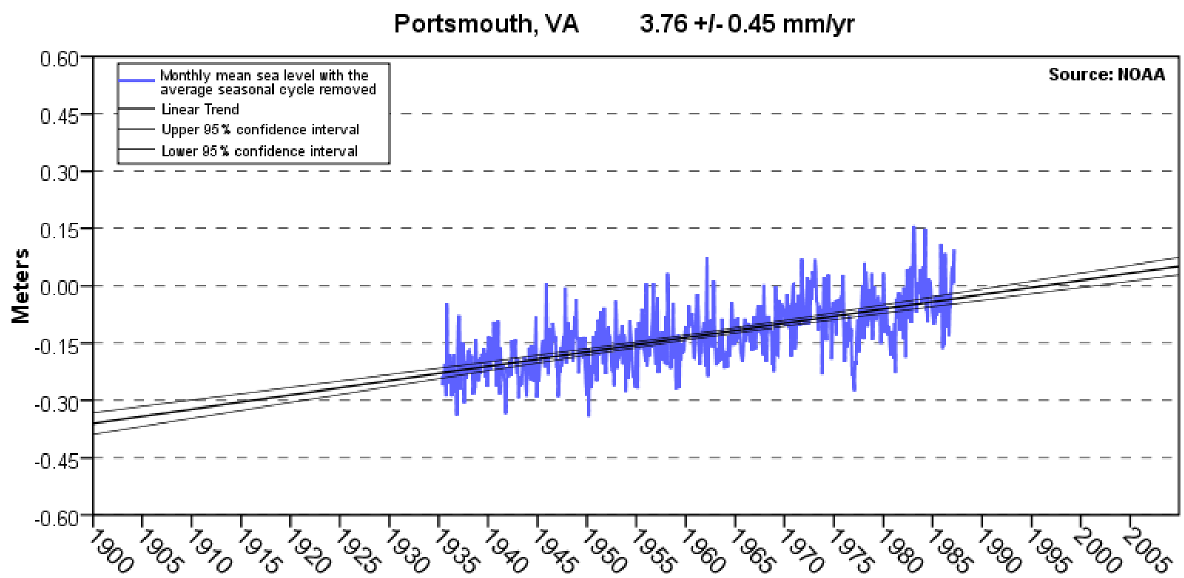
At Sewell's Point, Naval Station Norfolk, the local NOAA tide station with the longest period of record, the mean sea level trend is 4.44 millimeters/year with a 95% confidence interval of +/- 0.27 mm per year, based on monthly mean sea level data from 1927 to 2006 (**Figure 4.13**). This rate is equivalent 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 4.13: MEAN SEA LEVEL TREND, SEWELLS POINT, VIRGINIA



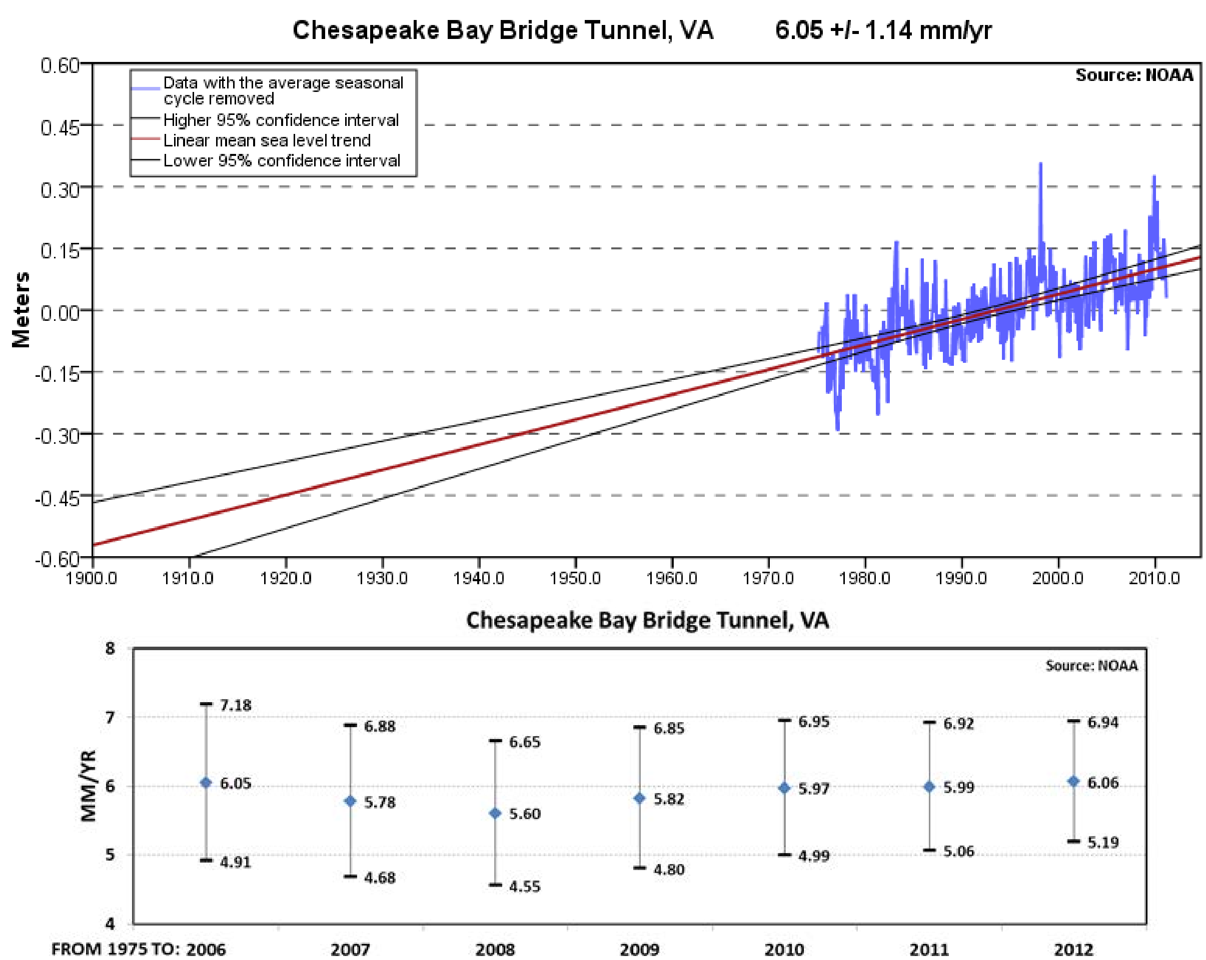
At Downtown Portsmouth, the mean sea level trend is 3.76 millimeters/year with a 95% confidence interval of +/- 0.45 mm/year based on monthly mean sea level data from 1935 to 1987 (**Figure 4.14**). This rate is equivalent to a change of 1.23 feet in 100 years.

FIGURE 4.14: MEAN SEA LEVEL TREND, PORTSMOUTH, VIRGINIA



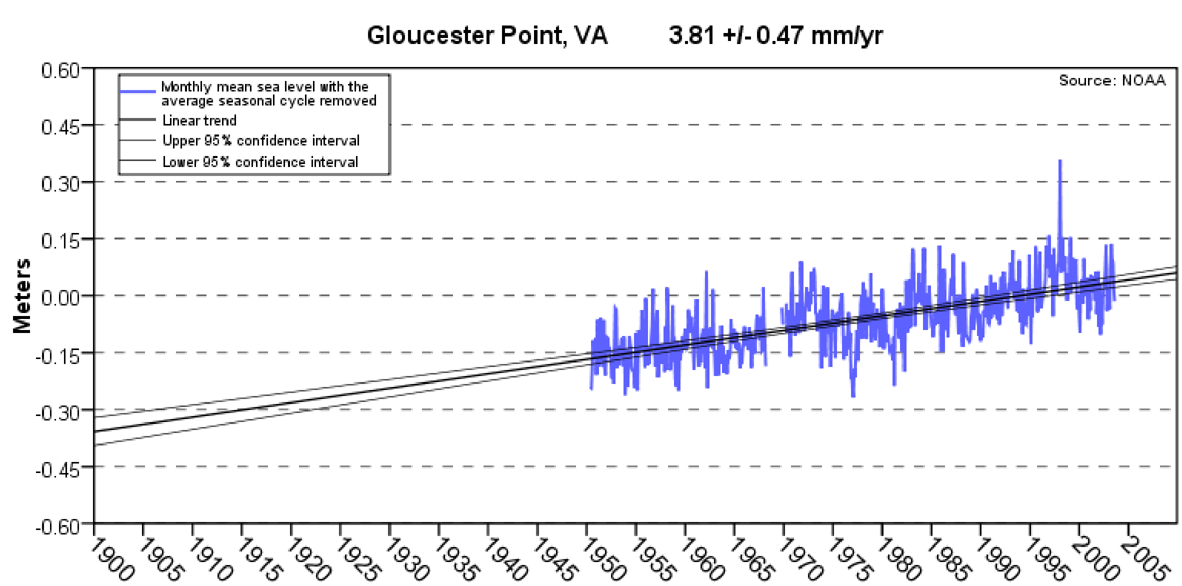
At the First Island, Chesapeake Bay Bridge Tunnel, the mean sea level trend is 6.05 millimeters/year with a 95% confidence interval of +/- 1.14 mm per year based on monthly mean sea level data from 1975 to 2006, which is equivalent to an increase of 1.98 feet in 100 years (**Figure 4.15)**. The second plot compares linear mean sea level trends and 95% confidence intervals calculated from the beginning of the station record to recent years (2006-2011). The values do not indicate the trend in each year, but the trend of the entire data period up to that year.

FIGURE 4.15: MEAN SEA LEVEL TREND, CHESAPEAKE BAY BRIDGE TUNNEL, VIRGINIA



At Gloucester Point, as shown in **Figure 4.16**, the mean sea level trend is 3.81 millimeters/year with a 95-percent confidence interval of +/- 0.47 mm/yr based on monthly mean sea level data from 1950 to 2003, which is equivalent to an increase of 1.25 feet in 100 years. Additional data since 2003 have not been analyzed as part of NOAA's program.

FIGURE 4.16: MEAN SEA LEVEL TREND, GLOUCESTER, VIRGINIA



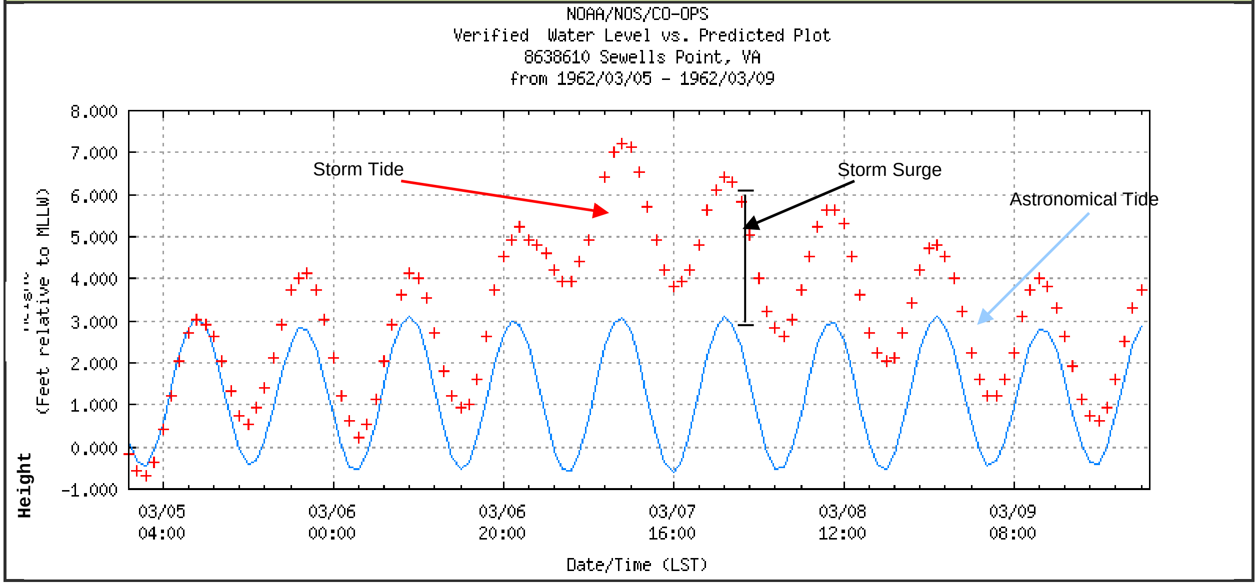
Source: NOAA, 2014

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 4.17**). 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 8 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 4.17: 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 4.4**).

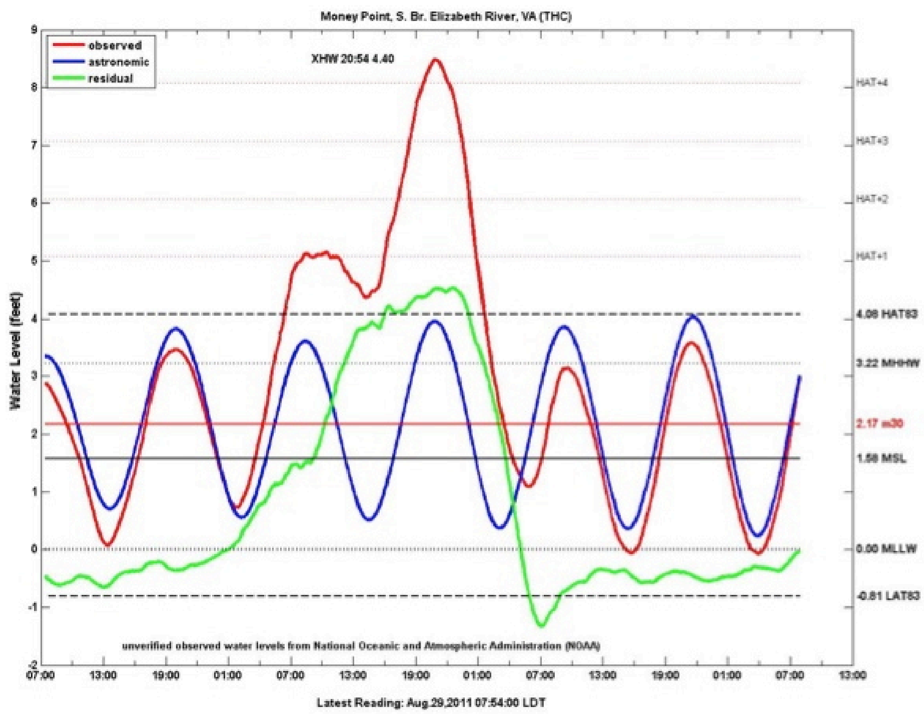
TABLE 4.4: AUGUST 1933 HURRICANE AND HURRICANE ISABEL (BOON, UNDATED)

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. (NOAA has not compiled sea level rise trend data for the Money Point gage as shown in **Figures 4.7** through **4.10** 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 that Money Point experienced the highest water levels in the area, at 4.4 feet above highest astronomical tide. **Figure 4.18** shows observed water levels (red), predicted astronomic tide (blue), and the storm surge (green).

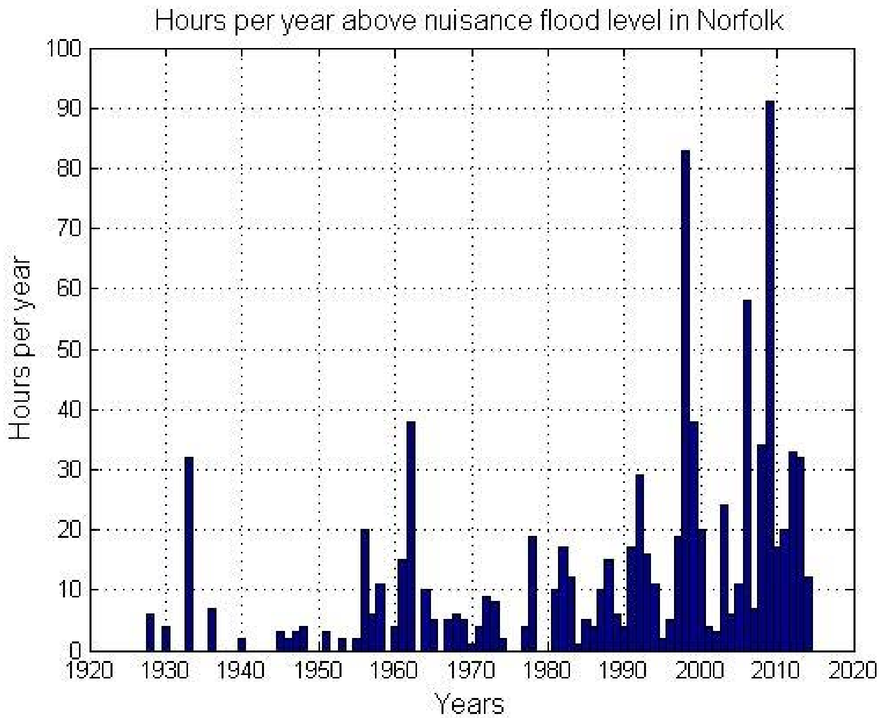
FIGURE 4.18: HURRICANE IRENE, TIDEWATCH DATA FOR MONEY POINT, VA



Source: Virginia Institute of Marine Science, 2011

The impacts of sea level rise are beginning to be felt on an almost daily basis in some parts of Hampton Roads. Old Dominion University compiled **Figure 4.19** which graphically shows the increasing problem of nuisance flooding in Norfolk.

FIGURE 4.19: NUISANCE FLOODING IN NORFOLK



Source: L. Atkinson, Old Dominion University 2014

The impacts of sea level rise are similar to the effects of flooding outlined above, but the frequency and severity of flooding can be expected to continue to increase, which has longer-term effects.

As nuisance flooding increases, Hampton Roads' population is becoming more accustomed to driving through salt-water flooded roads, cleaning out flooded buildings, and working through the impacts of each minor flood. But the longer-term economic impacts discussed above for flooding are slowly becoming more apparent. More communities must commit to long-term capital expenditures on flood mitigation and infrastructure rather than new investments in economic development, for example. More property owners must spend their wages on flood insurance, flood repair, and flood mitigation rather than on tangible goods. And the real estate market suffers when structures are subject to repetitive flooding with increasing frequency. Even nuisance flooding of crawl spaces or garages detracts from the ability of a house in a repetitive flood loss area to accrue value in the long-term. Days out of school for students locally are increasing annually due to flooding, and the impact on students and parents is sobering from an economic standpoint.

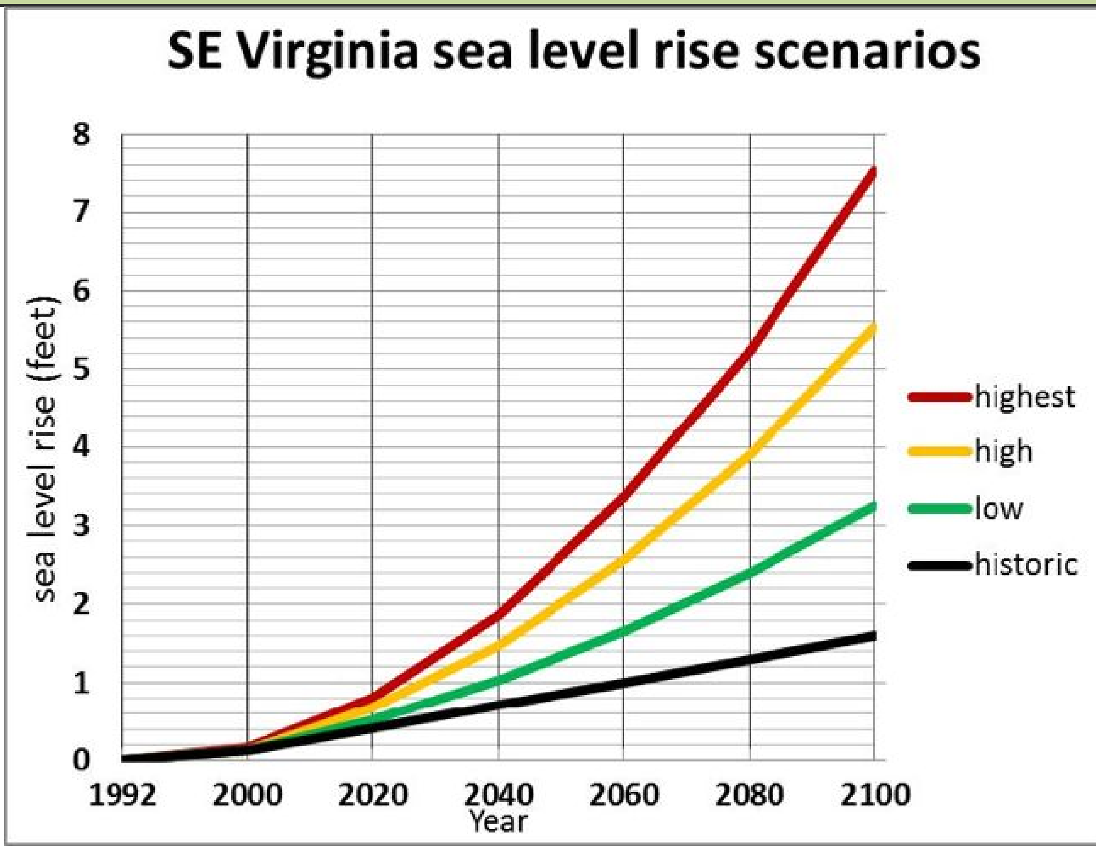
Impacts on the environment are apparent as shoreline erosion from more frequent shoreline inundation contributes to loss of trees, wetland grasses and other valuable habitats of the intertidal zone. Damage to these sensitive features is important because it could affect the important local seafood industry which relies on the intertidal zone as a fish and shellfish nursery, and because of the difficulty of recreating these habitats elsewhere. Also, eroded shorelines are more vulnerable to damage from severe flood events in the future.

Nuisance flooding in Norfolk. Source: Wetlands Watch

PROBABILITY OF FUTURE OCCURRENCE

In a report to the Virginia General Assembly in 2013 entitled *Recurrent Flooding Study for Tidewater Virginia*, VIMS presented four scenarios of sea level rise. Each scenario, as shown in **Figure 4.20** represents a possible trajectory for sea level rise in the region. The lowest, historic scenario is based on observed rates of rise and does not account for any acceleration. The low scenario incorporates some acceleration using assumptions about future greenhouse gas emission. The high scenario is based on the upper end of projections from semi-empirical models using statistical relationships in global observations of sea level and air temperature. And the highest scenario is based on consequences of global warming, ice-sheet loss and glacial melting. Each scenario was customized for conditions in southeastern Virginia, including using estimates for subsidence. The report concludes that regional planners should anticipate a 1.5-foot rise in sea level above the 1992 datum within the next 20 to 50 years (2033-2063). According to the VIMS report, “sea level rise will make it easier for the current patterns of weather events to generate damaging flood events in the future. Increases in storm intensity and/or frequency will only aggravate that circumstance.”

FIGURE 4.20: SOUTHEAST VIRGINIA SEA LEVEL RISE SCENARIOS



Source: VIMS, *Recurrent Flooding Study for Tidewater Virginia*, 2013

TROPICAL/COASTAL STORM

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[1].

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 4.5**.

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

TABLE 4.5: 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	111–129	Devastating damage will occur
4	130–156	Catastrophic damage will occur.
5	157 +	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 4.6** describes the damage that could be expected for each hurricane category.

TABLE 4.6: HURRICANE DAMAGE CLASSIFICATIONS		
STORM CATEGORY	DAMAGE LEVEL	DESCRIPTION OF DAMAGES
1	MINIMAL	Well-constructed frame homes could have damage to roofs, shingles, vinyl siding and gutters. Large branches of trees will snap and shallowly rooted trees may be toppled. Extensive damage to power lines and poles likely will result in power outages that could last a few to several days.
2	MODERATE	Well-constructed frame homes could sustain major roof and siding damage. 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.
3	EXTENSIVE	Well-built framed homes may incur major damage or removal of roof decking and gable ends. Many trees will be snapped or uprooted, blocking numerous roads. Electricity and water will be unavailable for several days to weeks after the storm passes.
4	EXTREME	Well-built framed homes can sustain severe damage with loss of most of the roof structure and/or some exterior walls. Most trees will be snapped or uprooted and power poles downed. Fallen trees and power poles will isolate residential areas. Power outages will last weeks to possibly months. Most of the area will be uninhabitable for weeks or months.
5	CATASTROPHIC	A high percentage of framed homes will be destroyed, with total roof failure and wall collapse. Fallen trees and power poles will isolate residential areas. Power outages will last for weeks to possibly months. Most of the area will be uninhabitable for weeks or months.

Source*: National Hurricane Center web site,* 2015

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.

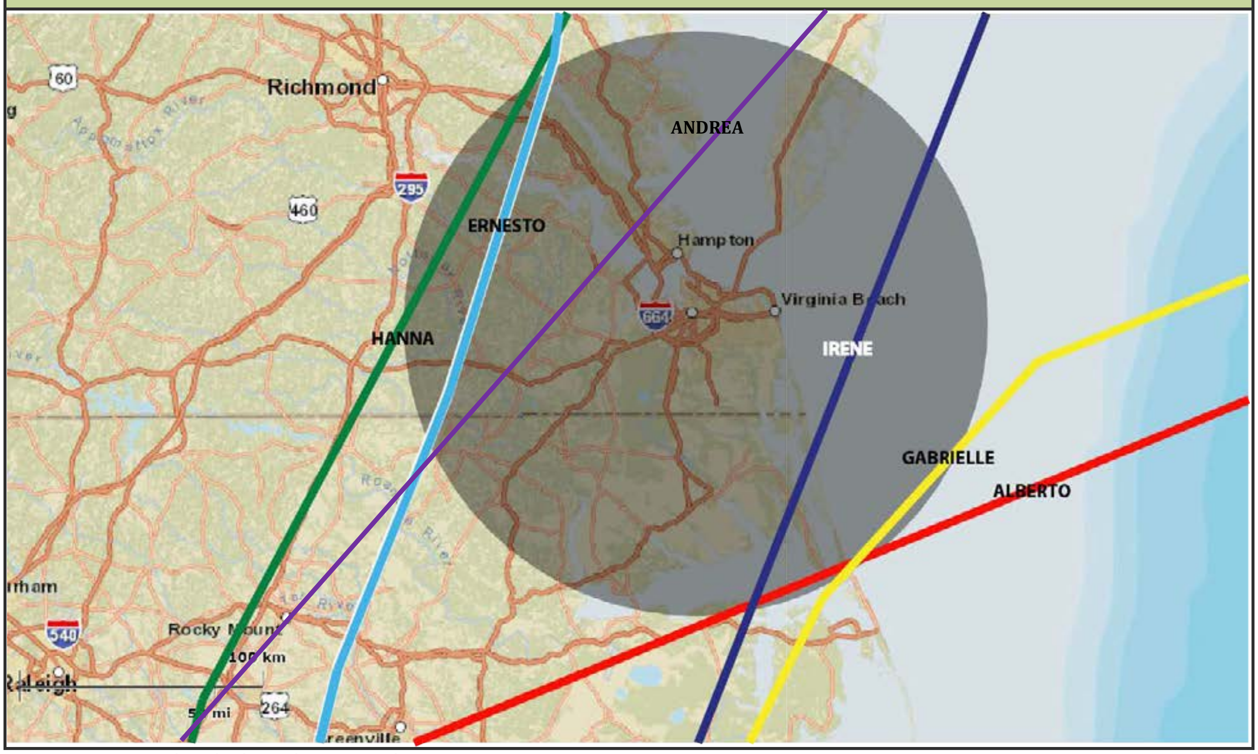
Storm surge heights and associated waves are dependent upon the shape of the continental shelf (narrow or wide) and the depth of the ocean bottom (bathymetry). A narrow shelf, or one that drops steeply from the shoreline and subsequently produces deep water close to the shoreline, tends to produce a 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. For the purposes of this report, the storm surge impacts in the region are discussed under the Flooding hazard.

LOCATION AND SPATIAL EXTENT

Hampton Roads 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.

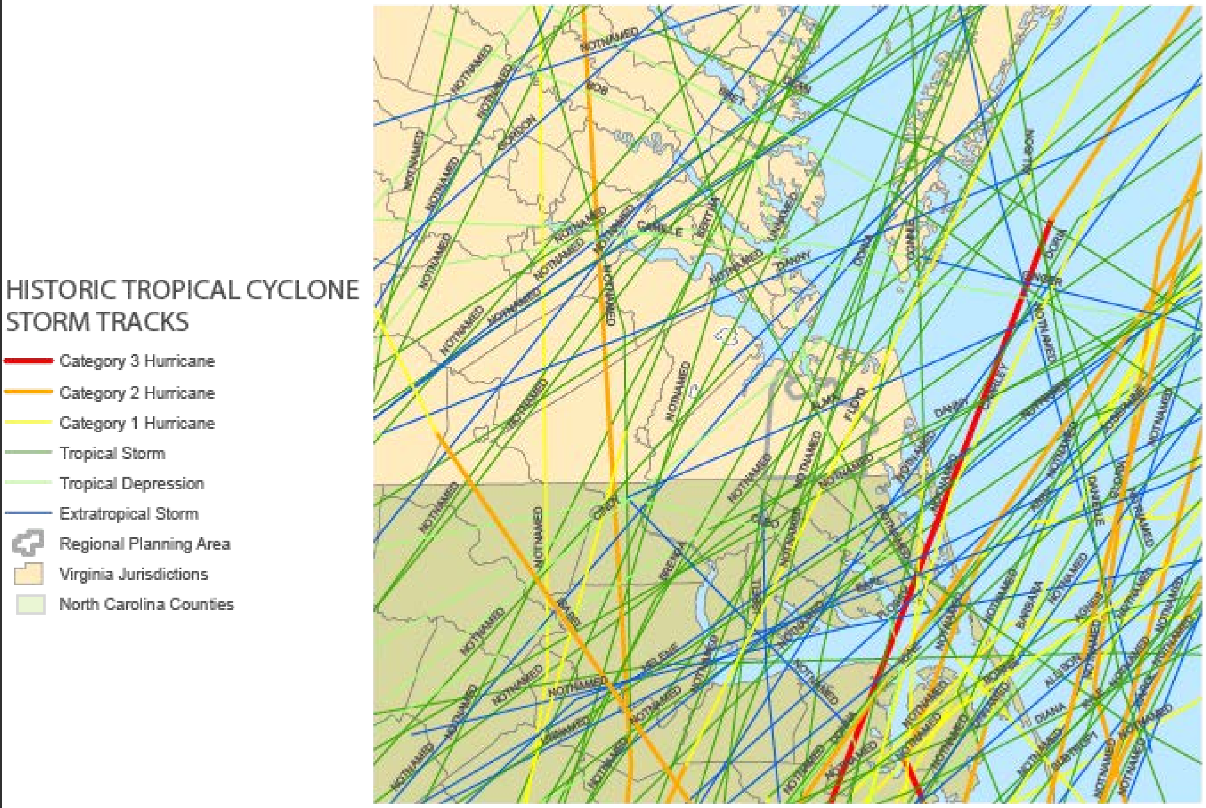
A total of 78 storms have passed within 75 miles of Hampton Roads since 1851 (**Figures 4.21 and 4.22**). Two Category 3 hurricanes passed within 75 miles of the region (unnamed storms in 1879 and 1899), eight were Category 2 hurricanes, 16 were Category 1 hurricanes and 49 were tropical storms. The remainder were tropical or extratropical depressions.

FIGURE 4.21: HISTORICAL STORM TRACKS WITHIN 75 MILES OF HAMPTON ROADS SINCE 2005



Source: NOAA Historical Hurricane Tracks.

FIGURE 4.22: HISTORICAL STORM TRACKS WITHIN 75 MILES OF HAMPTON ROADS, 1851-2005



Source: NOAA Historical Hurricane Tracks

In Hampton Roads, the negative impacts of wind from the Category 1 and 2 hurricane events the area has experienced are consistent with the damage described in Table 4.6. Wind damage in the region from events in recent memory has been marked by a large number of downed trees, damage to roofs, siding and signs, power outages of typically less than a week as a result of downed power lines and trees across lines, and wind-blown debris damage and accumulation. Downed trees can temporarily block roadways, impeding transportation; however, these blockages are typically repaired swiftly by Virginia Department of Transportation and local roadway maintenance crews. Business interruptions resulting from power outages are commonplace and many restaurants and cold storage facilities can be negatively impacted, especially by prolonged outages. Commodities such as ice and gas are in high demand to power both home and business generators. Since wind and flood events typically occur simultaneously, the combined impacts are more devastating in flood-prone areas. Roof damage from wind can subsequently result in rain damage to structures, as well. Combined storm surge and wind impacts to shorefront areas at Virginia Beach, Norfolk, and Hampton may make some homes and businesses uninhabitable for days to weeks at a time.

SIGNIFICANT HISTORICAL EVENTS

The NWS began keeping weather records on January 1, 1871. Prior to that, information on past hurricanes and tropical storms to impact the 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. 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.

Although the center of circulation for **Hurricane Hazel** in 1954 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 Cape Henry 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 Plans were 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 4.3**.

Hurricane Irene, in late August 2011, first struck the U.S. as a Category 1 hurricane in eastern North Carolina, then moved northward along the Mid-Atlantic Coast. Wind damage in coastal North Carolina, Virginia, and Maryland was moderate, with considerable damage resulting from falling trees and power lines. Irene made its final landfall as a tropical storm in the New York City area and dropped torrential rainfall in the Northeast that caused widespread flooding. Irene was the first hurricane to hit the U.S. since Ike in September 2008. Irene's landfall in eastern North Carolina and path northward were accurately predicted more than four days in advance by NOAA's National Hurricane Center, which used information from weather satellites, hurricane models, aircraft observations, and other data.

Flooding at the "Triple Decker Bridge" resulting from Hurricane Sandy.
Photo credit: City of Chesapeake

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 Hampton Roads saw little more than flooding in low-lying areas and limited wind damage, and therefore was not among declared communities.

After landfall along the northwestern coast of Florida on June 7, 2013, **Tropical Storm Andrea** moved northeastward with additional acceleration across northeastern Florida and southeastern Georgia, with the center passing over Savannah, Georgia. During this time, the storm maintained an intensity of 40 knots, with the strongest winds occurring mainly over water to the east and southeast of the center. As the cyclone moved into South Carolina, it started to merge with a baroclinic zone, which caused Andrea to become extratropical over northeastern South Carolina. The center of the post-tropical cyclone moved rapidly across eastern North Carolina and southeastern Virginia, over the Atlantic near the New Jersey coast, and across eastern Long Island to eastern Massachusetts. One traffic incident related to the storm appears to have caused one death in Virginia, but the location of the accident was not reported in the National Hurricane Center Tropical Cyclone Report on the storm.

Table 4.7 shows the historical storm tracks within 75 miles of Hampton Roads since 1851 that are the basis for **Figures 4.15 and 4.16**. While Tropical Storm Arthur in 2014 does not appear to have tracked within the search radius used for **Table 4.8** and **Figure 4.16**, the storm nonetheless produced tropical storm force winds and locally heavy rainfall across portions of southeast Virginia from late Thursday night, July 3rd into midday Friday, July 4th. Rain bands associated with Arthur produced generally one to two inches of rainfall across portions of the Virginia Beach. Back Bay reported 1.30 inches of rain. A wind gust of 47 knots was measured at Oceana Naval Air Station, and a wind gust of 43 knots was measured at

Lynnhaven. The gusts caused minor structural damage which was reported to total $5,000. Norfolk International Airport reported 1.46 inches of rain. A wind gust of 38 knots was measured at Norfolk NAS.

TABLE 4.7: HISTORICAL STORM TRACKS WITHIN 75 MILES OF HAMPTON ROADS (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
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

TABLE 4.7: HISTORICAL STORM TRACKS WITHIN 75 MILES OF HAMPTON ROADS (SINCE 1851)

DATE OF OCCURRENCE	STORM NAME	WIND SPEED (mph)	STORM CATEGORY AT LANDFALL
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
6/8/2013	ANDREA	37	EXTRATROPICAL STORM

Source: NOAA Historical Hurricane Tracks

PROBABILITY OF FUTURE OCCURRENCES

It is likely that the region will be impacted by hurricanes and tropical storms in the future. Direct impacts from hurricanes category 3 and 4 intensity are rare in Hampton Roads due to 1) historical tracks remaining offshore or impacting land before reaching Hampton Roads; and 2) cooler Atlantic Ocean water temperatures north of Cape Hatteras, which diminish a storm's ability to maintain intensity, or intensify. A Category 5 hurricane is considered implausible in Hampton Roads due to the cooler water temperatures mentioned above. 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 frequent, as storms making landfall along the North Carolina and Virginia coastlines could impact the region in any given year.

SHORELINE EROSION

BACKGROUND

Erosion is the gradual breakdown and movement of land due to both physical and chemical processes of water, wind, and general meteorological conditions. Natural, or geologic, erosion has occurred since the Earth's formation and continues at a very slow and uniform rate each year. Major storms such as hurricanes and tropical storms may cause more sudden, rapid erosion by combining heavy rainfall, high winds, heavy surf and storm surge to significantly impact river banks and the shoreline.

Erosive forces at work during the November 2009 nor'easter at Chick's Beach, Norfolk. Photo source: 1) Mark Vogan; 2) WAVY-TV 10.

As it relates to natural hazards that threaten property damage, there are two types of erosion: riverine erosion and coastal erosion. The primary concern of both riverine and coastal erosion is the gradual removal of rock, vegetation and other sediment materials from river banks, stream beds and shorelines that result in soil instability and possible damages to property and infrastructure.

The average annual erosion rate on the Atlantic coast is roughly 2 to 3 feet per year; however, erosion rates vary greatly from location to location and year to year. A study by The Heinz Center (2000), *Evaluation of Erosion Hazards*, states that over the next 60 years, erosion may claim one out of four houses within 500 feet of the U.S. shoreline. It also states that nationwide, erosion may be responsible for approximately $500 million in property loss to coastal property owners per year, including both damage to structures and loss of land. To the homeowners living within areas subject to coastal erosion, the risk posed by erosion is comparable to the risk from flooding and other natural hazard events.

In Hampton Roads, shoreline, or coastal, erosion poses the most significant threat, and is a long-term hazard that undermines waterfront homes, businesses, public facilities and infrastructure along shorelines, even rendering structures uninhabitable or unusable. Shoreline erosion is driven by a number of natural influences such as sea level rise and land subsidence, large storms such as tropical storms, nor'easters and hurricanes, storm surge, flooding and powerful ocean waves. While coastal flooding in the region is typically a short term event, shoreline erosion in Hampton Roads may best be described as a relatively slow natural process occurring over the long term, with occasional major impacts wrought by coastal storm and flooding hazards. Manmade influences such as coastal development and some shoreline stabilization projects can exacerbate shoreline erosion, even when initially intended to minimize immediate erosive effects. Many older shoreline stabilization features in Hampton Roads are vulnerable to the effects of shoreline erosion and their failure can cause subsequent catastrophic failure of parking lots, marinas, parks, garages, roads and other waterfront features. The features are not typically critical to the life, health and safety of residents, but nonetheless are costly and time-consuming to repair for both public and private entities. While not as sudden as other hazard events discussed in this plan, shoreline erosion influences the stability and condition of coastal property and beaches when other short-term hazard events occur. For example, erosive forces may undermine tree roots and revetments along a shoreline, exacerbating the effects of flooding and sea level rise.

In Hampton Roads' more vulnerable Atlantic Ocean and Chesapeake Bay shorelines, the same large waves that are capable of causing severe shoreline erosion often attract onlookers, tourists and surfers drawn to the waves' magnitude and power. Locally, fatalities then result when these people are unexpectedly caught up in the surf and strong offshore currents, or rip currents, hindering their return to shore.

LOCATION AND SPATIAL EXTENT

Shoreline erosion is a significant concern in the Hampton Roads region. According to VIMS, the Atlantic and Chesapeake Bay coasts in the region are very dynamic in terms of shoreline change and sediment transport processes. VIMS and other agencies occasionally perform studies to determine long term shoreline change patterns for various locations across the region. However, these studies are largely intended to track shoreline and dune evolution through natural and manmade alterations, and are not designed to determine erosion rates or areas of coastal erosion. While FEMA does not map erosion hazard areas, FIRMs produced by the agency do indicate the highest risk areas for coastal flooding with significant wave action (termed V zones, velocity zones, or coastal high hazard areas)[2]. For purposes of this plan, areas identified as coastal high hazard zones on the FIRM are also assumed to be at risk of shoreline, or coastal, erosion.

Another factor in accurately determining specific shoreline erosion hazard areas is the continuous implementation of shoreline reinforcement or nourishment projects completed by federal, state and local government agencies. Typically, areas of high concern with regard to long term erosion are addressed through shoreline hardening or stabilization projects, such as seawalls, breakwaters and beach sand replenishment. For example, in 2002, the Virginia Beach Erosion Control and Hurricane Protection Project protected more than six miles from the imminent hazards of shoreline erosion through sand replenishment. Many other projects have been completed in the region and still others are pending approval and/or funding[3].

This photo, taken while the Virginia Beach Erosion Control and Hurricane Protection Project was underway, shows the significant difference between the unimproved area and the area of the widened beach berm already completed. (Source: City of Virginia Beach)

HISTORICAL OCCURENCES

Shoreline erosion events typically occur in conjunction with hurricanes, tropical storms and nor'easters, so the list of "Ocean and Lake Surf" events provided from the NCDC database is not considered comprehensive (**Table 4.8**). Some of the damages listed duplicate damages shown for coastal flooding events and/or may apply to areas outside of the study area for this plan; however, the descriptive details indicate the nature of shoreline erosion damage (and fatalities) associated with this select group of events in Hampton Roads.

[2] For more information on FEMA V-zones, refer to the Flood hazard discussion within this section.
[3] In order to counter effects of coastal erosion, Virginia Beach's shoreline has been renourished annually since 1951.

TABLE 4.8: OCEAN AND LAKE SURF EVENTS (1993 - 2015)					
LOCATION	DATE	TYPE OF EVENT	DEATHS/ INJURIES	PROPERTY DAMAGE	DETAILS
Virginia Beach	8/31/1993	Heavy Surf	1/0	$0	A 15-year-old boy drowned, presumably caught in a strong undertow, as Hurricane Emily was approaching the North Carolina coast.
Isle of Wight, Norfolk, Suffolk, Virginia Beach, Portsmouth	11/17/1994	Coastal Flooding	0/0	$655,000	Strong easterly flow between Hurricane Gordon, a category 1 storm meandering 150 miles south of Cape Hatteras, and a strong anticyclone over New England, caused significant coastal flooding and damage in Sandbridge. The worst flooding occurred on the 18th, when tides were running 4 feet above normal. The heaviest damage occurred along 14th Street, where 100 feet of the fishing pier washed away. Several homes suffered minor damage, with two requiring extra work to remain in place. A 1000-foot stretch of road and several protective steel bulkheads were damaged. Seas, which were as high as 18 feet 60 miles east of the Virginia Capes, and 7 feet near the mouth of the Chesapeake Bay, forced the Naval Carrier George Washington to remain 2 miles offshore Thursday night through Friday morning. The above-normal tides caused other minor flooding in Tidewater. The Nansemond River overflowed its banks in Suffolk, causing minor flooding. High tides on the James and Pagan Rivers, caused several roads to be under water in eastern Isle of Wight County on the 17th.
Isle of Wight, Norfolk, Suffolk, Virginia Beach	12/23/1994	Coastal Flooding	0/0	$65,000	A double-structured storm system produced minor coastal flooding in the Tidewater region on the 23rd. The effects were much less than expected as the main storm moved well east of the mid-Atlantic before curling northwest into Long Island. The secondary low pressure area was significantly weaker, but still produced northeast winds of 35 to 45 mph around Tidewater. High tides of 1 to 3 feet above normal caused most of the flooding. In the Sandbridge section of Virginia Beach, a beachfront home collapsed into the sea. The combination of pounding surf and wind from flow around Hurricane Gordon in late November and this event finished off the home. In addition, a few more bulkheads were flattened. Several roads in the Tidewater area had minor flooding, including Rescue Road in Smithfield (Isle of Wight Co).
Virginia Beach	8/13/1995	Rip Current	1/0	$0	Vacationer from New York drowned after venturing too far into severe rip current conditions.

TABLE 4.8: OCEAN AND LAKE SURF EVENTS (1993 - 2015)

LOCATION	DATE	TYPE OF EVENT	DEATHS/ INJURIES	PROPERTY DAMAGE	DETAILS
Norfolk, Virginia Beach, Newport News, York County, Poquoson	4/24/1997	Coastal Flooding	0/0	$0	Moderate coastal flooding occurred across portions of the Hampton Roads area during the time of high tide April 23rd and continued into April 24th. The areas most seriously affected included the Willoughby Spit, Ghent, and downtown sections of Norfolk, the Old-Town section of Portsmouth, and Sandbridge at Virginia Beach. Tides peaked at 5.8 feet above Mean Lower Low Water (MLLW) at Sewells Point in Norfolk. Based on reports received from downtown Norfolk and the Grandview section of Hampton, tides were somewhat higher in the estuaries (Lafayette River, the Hague, the Harris and Back Rivers) draining into the Elizabeth River and Hampton Roads.
Norfolk, Virginia Beach, Portsmouth	6/3/1997	Coastal Flooding	0/0	$0	Minor to moderate flooding occurred across portions of Hampton Roads during high tide the evening of June 3rd. In Virginia Beach, officials reported part of a new boardwalk washed away and several lifeguard stands lost. Crawford Parkway in downtown Portsmouth was reported flooded and in downtown Norfolk, several streets were reported under water.
Norfolk, Virginia Beach, Portsmouth, Newport News, Poquoson	10/19/1997	Coastal Flooding	0/0	$0	Minor to moderate flooding occurred across portions of Hampton Roads during high tide Sunday, October 19th. Some minor flooding was reported in low-lying areas of Norfolk, with water in a few homes and a few streets closed. Minor flooding was also reported in downtown Portsmouth and in the Sandbridge and Sandfiddler areas of Virginia Beach. Tides peaked between 5.2 and 5.8 feet above MLLW at Sewells Point in Norfolk. Minor coastal flooding was reported in portions of Newport News and York county.
Norfolk, Virginia Beach, York County, Poquoson, Newport News	1/27/1998	Coastal Flooding	0/0	$1,500,000	A Nor'easter battered eastern Virginia on January 27th and 28th. Slow movement of the storm combined with the highest astronomical tides of the month resulted in an extended period of gale to storm force onshore winds which drove tides to 6.44 feet above MLLW at Sewells Point. Tide levels resulted in moderate coastal flooding throughout Hampton Roads. One house collapsed into the Atlantic Ocean at Sandbridge. Another home sustained severe damage. The rainfall combined with the gale and storm force winds resulted in scattered tree limbs downed across much of eastern Virginia. In addition, there were widely scattered power outages.

TABLE 4.8: OCEAN AND LAKE SURF EVENTS (1993 - 2015)					
LOCATION	DATE	TYPE OF EVENT	DEATHS/ INJURIES	PROPERTY DAMAGE	DETAILS
Norfolk, Virginia Beach, York County, Poquoson, Newport News	2/4/1998	Coastal Flooding	0/0	$75,000,000	A Nor'easter battered eastern Virginia from February 3rd through the 5th. The slow movement of the storm resulted in an extended period of gale to storm force onshore winds which drove tides to 7.0 feet above MLLW at Sewells Point. Tide levels resulted in moderate to severe coastal flooding throughout Hampton Roads. Norfolk, Virginia Beach and Hampton reported some structural damage to buildings along the bay and coast, as well as significant beach erosion. Norfolk reported main roads and intersections under 3 feet of water or greater with many roads impassable. North facing areas in Willoughby and Ocean View suffered the greatest damage. In the Chick's Beach area of Virginia Beach, 4 condominiums were undermined by the tidal flooding, and residents of those buildings had to be evacuated. Twenty-nine house fires were also reported in Norfolk as a result of flood water shorting out furnaces. The rainfall combined with the gale and storm force winds resulted in some trees downed across much of eastern Virginia. In addition, there were widely scattered power outages.
Hampton	9/18/2003	Coastal Flooding, Heavy Surf			Hurricane Isabel caused historic flooding and severe erosion in the region. In Hampton, the coastal flooding, heavy surf and wave action breached the barrier beach at Factory Point.
Virginia Beach	1/29/2005	Heavy Surf	1/1	$0	A small boat with 2 men on board was heading out of Rudee Inlet. They made it through the first set of breakers then stopped the boat. A wave overtook them and flipped the boat. One man climbed onto and stayed with the overturned boat and was rescued. He was treated for mild hypothermia and later released. The other man died of hypothermia.
York County, Poquoson	9/1/2006	Coastal Flood	0/0	$1,900,000	Tides of 4 to 5 feet above normal combined with 6 to 8 foot waves caused significant damage to homes, piers, bulkheads, boats, and marinas across portions of the Virginia Peninsula and Middle Peninsula near the Chesapeake Bay and adjacent tributaries.
Norfolk, York County, Hampton	10/6/2006	Coastal Flood	0/0	$200,000	Strong onshore winds resulted in major coastal flooding during times of high tide. Tidal departures were 2.5 to 3.5 above normal during the event. A strong low pressure system off the North Carolina coast coupled with an upper level cutoff low to dump intense rainfall across portions of southeast Virginia. Rainfall amounts in excess of 10 inches resulted in numerous road closures and moderate to major river flooding from late Friday, October 6th through Saturday, October 7th. Up to 28,000 Dominion Virginia Power customers lost power during the event.

TABLE 4.8: OCEAN AND LAKE SURF EVENTS (1993 - 2015)

LOCATION	DATE	TYPE OF EVENT	DEATHS/ INJURIES	PROPERTY DAMAGE	DETAILS
Norfolk, Chesapeake York County, Hampton	11/22 and 11/23/2006	Coastal Flood	0/0	$145,000	Strong onshore winds caused moderate coastal flooding during times of high tide. Tidal departures were about 3 feet above normal during the event. An intense low pressure system off the North Carolina coast combined with an upper level cutoff low to provide very strong winds, heavy rains, and moderate coastal flooding across portions of eastern and southeast Virginia from late November 21st into afternoon November 23rd.
Virginia Beach	5/23/2009	Rip Current	1/0	$0	A man body boarding was caught up in a rip current and pulled offshore. Officials performed CPR, but it failed to revive the man and he died.
Isle of Wight, Chesapeake, Newport News, York County, Hampton	11/12/2009	Coastal Flood	0/0	$16,200,000	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.
Norfolk, Virginia Beach, York County, Chesapeake	12/19/2009	Coastal Flood	0/0	$30,000	A strong coastal low pressure area produced moderate to severe coastal flooding across much of eastern and southeast Virginia. The peak tide height at Money Point was 6.77 feet above MLLW. Several streets, homes and businesses were flooded in low lying areas close or directly exposed to the Chesapeake Bay. The peak tide height at Yorktown was 5.32 feet above MLLW. Several streets, homes and businesses were flooded in low lying areas of the county close or directly exposed to the Chesapeake Bay.
Virginia Beach	8/25/2011	Rip Current	1/0	-	A surfer who got caught in a rip current drowned in Virginia Beach.
Virginia Beach	6/16/2012	Rip Current	1/0	-	A man was caught up in a rip current and drowned in Virginia Beach.
Chesapeake, James City County, Newport News, York County, Norfolk, Isle of Wight, Virginia Beach, Suffolk, Hampton	10/28/2012	Coastal Flood	0/0	$2,060,000	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. Water levels reached 3.5 feet to around 4.5 feet above normal adjacent to the Chesapeake Bay resulting in moderate to severe coastal flooding. Flooding of streets due to the combination of rain and storm surge was widespread during the height of the storm. However, water levels were lower than Irene in 2011.

TABLE 4.8: OCEAN AND LAKE SURF EVENTS (1993 - 2015)					
LOCATION	DATE	TYPE OF EVENT	DEATHS/ INJURIES	PROPERTY DAMAGE	DETAILS
Chesapeake, James City County, Newport News, York County, Norfolk, Isle of Wight, Virginia Beach, Suffolk, Hampton, Poquoson	10/2-3/2015	Coastal Flood	0/0	$1,000,000 (Norfolk)	Anomalously strong/nearly stationary high pressure over New England produced strong onshore winds over the Mid-Atlantic. The strength and duration of the onshore winds produced moderate coastal flooding along the Atlantic Coast and Chesapeake Bay. A tidal departure of 3 to 4 feet resulted in moderate flooding along the Chesapeake Bay.
Totals			**6/1**	**$98,755,000**	

Source: NCDC, 2015

PROBABILITY OF FUTURE OCCURENCES

Shoreline erosion over the long-term and short term will likely continue to occur in the Hampton Roads region. Shoreline erosion will be more immediate and severe during hurricanes, tropical storms and nor'easters.

TORNADO

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 200 mph. The most violent tornadoes (EF5) have rotating winds of 200 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 tens of 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	111-135
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.

Tornadoes are high-impact, low-probability hazards. The net impact of a tornado depends on the storm intensity and the vulnerability of development in its path. Because the path of each tornado is unique to each event, general descriptions of impacts in Hampton Roads can be drawn from the impacts of previous storms (see also Table 4.10 below). Communities rarely activate Emergency Operation Centers before tornadoes due to the short warning times, but after extreme events with catastrophic damage that displace a large number of residents, such activation may become necessary.

In Hampton Roads, a high intensity tornado, while unlikely, could be expected to impact almost everything within the storm's path: homes, especially those constructed prior to the use of building codes; infrastructure, especially above-ground power lines in the commercial zones and bridges throughout the region; cars and personal property; landscape elements such as trees, fences and shrubs; and even human lives. Downed trees can block roadways, impeding traffic and blocking access and egress if any of the region's thoroughfares are impacted. Manufactured homes are particularly vulnerable to damage in the event of tornadoes, as well, particularly if they were placed outside of flood zones and before building codes were in effect requiring foundation tie-downs.

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. Tracking and prior notification by the National Weather Service and local news media helps save lives locally.

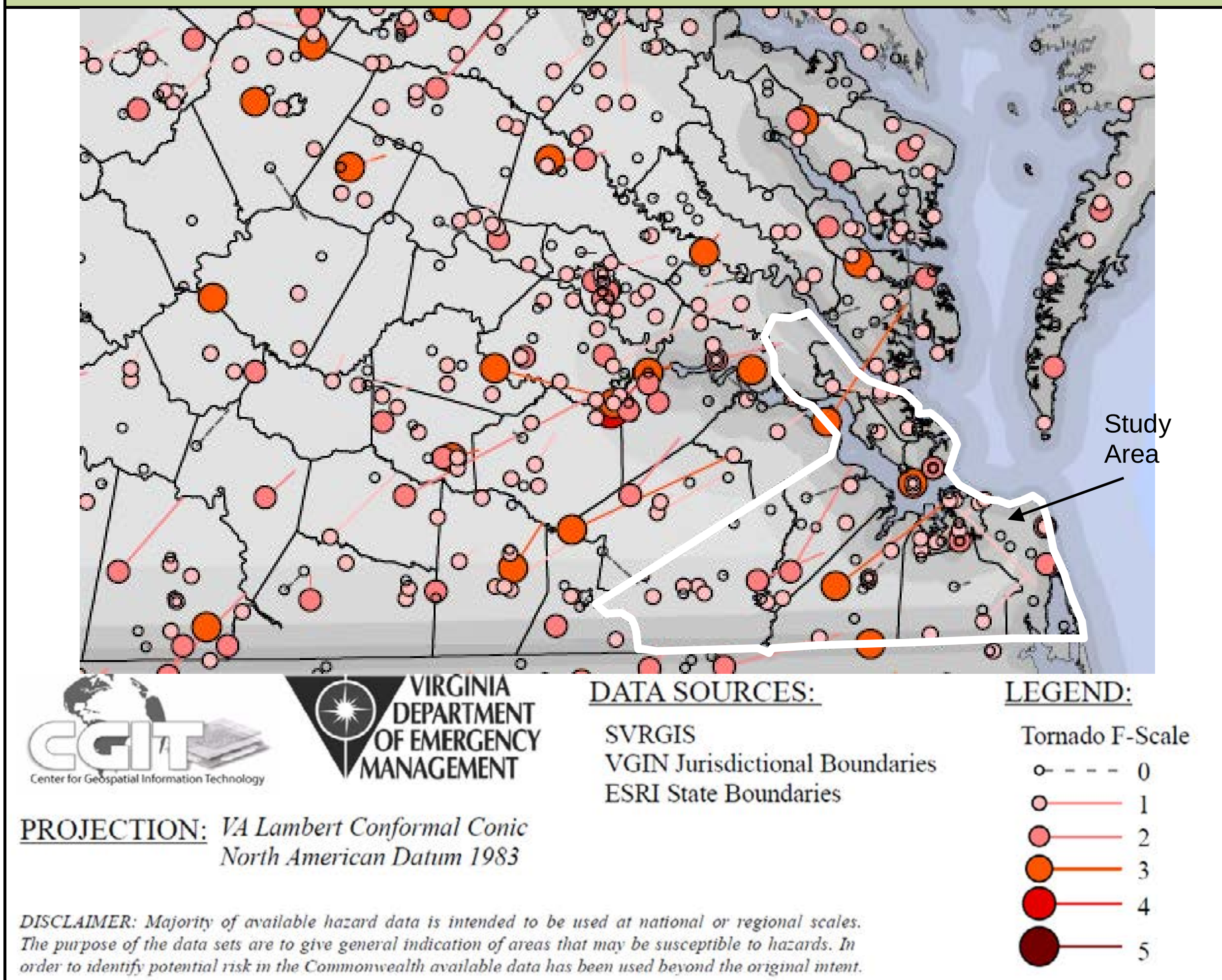
Most tornado strikes in the region have been F0 or F1 and the effects were somewhat less than as described above for severe storms. Critical damage to structures in the tornado's path is common, with indiscriminate damage to public-and privately-owned structures, some infrastructure, and downed trees that make transportation difficult. In areas adjacent to the path, minor damage, especially to roofs and windows from trees and flying debris, can also be expected. While downed trees may block transportation routes and result in power outages for some customers, these impacts are typically cleared within a few days.

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. Vulnerability of individual structures is based largely on building construction materials and standards, availability of safe rooms and advanced warning system capabilities. In cases involving intense tornadoes, the best defense against injury or death is a properly engineered safe room or tornado shelter, neither of which is standard practice in the region. Likewise, advanced warning system capabilities are limited to Reverse 911, Emergency Alert System warnings and National Weather Service weather radio broadcasts.

Figure 4.23 illustrates the approximate location where confirmed tornadoes have touched down in the region.

FIGURE 4.23: HISTORIC TORNADO TOUCHDOWNS AND TRACKS: 1950-2011



Source: *Commonwealth of Virginia Hazard Mitigation Plan 2013*

SIGNIFICANT HISTORICAL EVENTS

Hampton Roads has experienced 35 days with reported damaging tornadoes since 1995. The tornadoes occurring since 1995 had strengths up to EF3. Damage estimates for these tornadoes exceed $41.56 million. **Table 4.10** lists historical tornadoes that touched down in the study area (NCDC Website).

TABLE 4.10: TORNADOES (1995 - 2015)

LOCATION	DATE OF OCCURRENCE	MAGNITUDE	DEATHS/ INJURIES	PROPERTY DAMAGE	DETAILS
ISLE OF WIGHT	7/12/1996	F1	0	$25,000	Small tornado damaged 10-15 homes and several trees in Moorfield subdivision of Smithfield.
YORK	7/12/1996	F1	0	$15,000	Tornado cut a 2-mile-long path across part of Naval Weapons Station Yorktown. Numerous trees, homes and cars were damaged.
HAMPTON	9/4/1996	F0	0	$1,000	Weather personnel at Langley Air Force Base observed a small tornado about 1/2 mile north-northwest of their building. Minor damage to a few vehicles and tops of trees occurred.
CHESAPEAKE	7/24/1997	F1	0	$400,000	Tornado had a track of approximately 1 mile and was an estimated 50 yards in width.
NORFOLK	7/24/1997	F1	0	$400,000	Tornado path started in south Norfolk just south of Poindexter Street on Guerriere Street. The tornado then continued north-northeast into the Berkley Avenue Industrial Park before crossing into the southern portion of Norfolk and lifting after causing damage on Roseclair and Joyce Streets. One business, a car wash was destroyed, and six sustained major roof damage. One home was damaged in Chesapeake, with damage to a couple of additional structures in the Roseclair and Joyce Street areas of Norfolk.
NORFOLK	7/24/1997	F0	0	$100,000	Tornado first touched down west of Route 460 between Liberty Street and Indian River Road. The tornado tracked north-northeast across Indian River Road and across the eastern branch of the Elizabeth River before lifting east of Harbor Park and south of I-264. Minor damage to several structures, mostly residential.
CHESAPEAKE	4/9/1998	F0	0	$25,000	Tornado with speeds of 60-70mph in Chesapeake. Damage was seen just south of intersection of Dominion Boulevard and Great Bridge Boulevard. Several trees were downed/topped in the Riverwalk Subdivision. Damage to a couple of homes as a result of trees falling on them. Tornado moved east-northeast to just northwest of intersection of Volvo Parkway and Kempsville Road. Several trees were downed/topped in this area as well, with a couple of homes damaged by falling trees/limbs. Tornado appeared to remain just above ground, with all structural damage resulting from falling trees/limbs.
HAMPTON	9/4/1999	F2	0/6	$7,720,000	Tornado touchdown in the city of Hampton. Extensive structural damage in a 3 block area. Three apartment complexes and an assisted living facility condemned. Two additional apartment complexes partially

TABLE 4.10: TORNADOES (1995 - 2015)

LOCATION	DATE OF OCCURRENCE	MAGNITUDE	DEATHS/ INJURIES	PROPERTY DAMAGE	DETAILS
					condemned. Many roofs were lifted off buildings and as many as 800 vehicles were reported damaged. This tornado formed in area ahead of tropical storm Dennis.
VIRGINIA BEACH	7/24/2000	F0	0	$20,000	A waterspout that formed over Back Bay came ashore at Campbell Landing Road and destroyed 20’ x 30’ foot outbuilding before dissipating. Many trees were blown down; camper shells and lawn furniture were tossed across neighborhood.
SUFFOLK	5/21/2001	F0	0	$25,000	Tornado occurred in 5000 block of Manning Road. Several small outbuildings destroyed including 30’ wooden shed.
SUFFOLK	6/1/2001	F1	0	$15,000	Tornado touched down near Jackson Road. Tornado became a funnel cloud and then touched down again just south of Sleepy Hole Road and passed through Sleepy Hole Golf Club. Tornado continued north northeast through Chatham Woods with extensive damage along Burning Tree Lane.
NEWPORT NEWS	8/11/2001	F0	0	$50,000	Weak tornado damaged a couple of mobile homes and produced minor damage at townhouse complex near Fort Eustis.
SUFFOLK	2/22/2003	F0	0	$25,000	Several 50-60 foot trees were pushed over into houses. Numerous tree trunks were twisted and tops sheared off.
SOUTHAMPTON	5/9/2003	F0	0	$10,000	Damage to trees and outbuildings, and minor damage to home by a tornado in northwest Southampton County.
YORK	8/7/2003	F1	0	$20,000	Tornado damage occurred near Victory Boulevard and Running Man Trail, with about a dozen trees down. Damage to 4 houses from trees snapping off and falling on the homes.
VIRGINIA BEACH	8/8/2003	F0	0	$5,000	Tornado briefly touched down with minor damage reported at Salem Crossing Shopping Center.
NORFOLK	9/18/2003	F0	0	-	Brief tornado occurred in association with Isabel. No damage reported.
SOUTHAMPTON COUNTY	6/25/2004	F1	0	$2,000	F1 tornado downed numerous large trees in a swamp.
SUFFOLK	6/25/2004	F1	0	$2,000	F1 tornado downed numerous trees near intersection of Route 660 and Route 668.
SUFFOLK	6/25/2004	F0	0	$2,000	F0 tornado damage to trees on Cypress Chapel Road in Whaleyville.
CHESAPEAKE	8/14/2004	F0	0	$5,000	Tornado associated with Tropical Storm Charley damaged a fence and downed trees.
JAMES CITY COUNTY	8/30/2004	F0	0	$5,000	F0 tornado downed or damaged several trees.
JAMES CITY COUNTY	8/30/2004	F0	0	$5,000	F0 tornado downed or damaged several trees near Drummonds Field Subdivision and the James River.
POQUOSON	8/30/2004	F0	0	$5,000	F0 tornado downed trees on River Road and Wythe Creek Road.
HAMPTON	8/30/2004	F0	0	$5,000	F0 tornado damaged a shed and trees on Hall Road.
YORK COUNTY	8/30/2004	F0	0	$10,000	F0 tornado downed trees and damaged roofs at Pinewood Drive and Highway 134.
YORK COUNTY	8/30/2004	F0	0	$10,000	F0 tornado blew roof off of garage and damaged trees.

TABLE 4.10: TORNADOES (1995 - 2015)

LOCATION	DATE OF OCCURRENCE	MAGNITUDE	DEATHS/ INJURIES	PROPERTY DAMAGE	DETAILS
SOUTHAMPTON	7/2/2005	F0	0	-	F0 tornado touched down near Freemans Pond Road then crossed Route 460.
SOUTHAMPTON	7/8/2005	F1	0	$2,000	F1 tornado caused damage near Old Belfield Road.
VIRGINIA BEACH	7/14/2005	F0	0	$2,000	Brief tornado touchdown caused minor damage to golf practice facility and downed tree limbs near Dam Neck Road and Holland Road.
JAMES CITY	1/11/2006	F1	0/2	$20,000	F1 tornado caused intermittent damage at Jamestown Beach Campground and Foxfield subdivision. One trailer and pop-up camper were destroyed at campground and caused minor injuries to two occupants. Two townhomes suffered minor roof and siding damage in subdivision.
PORTSMOUTH	8/11/2006	F0	0	-	Waterspout near the mouth of the James River came on shore near Churchland High School. No damage or injuries were reported.
HAMPTON	8/11/2006	F0	0	-	Waterspout near mouth of the James River came on shore just south of Beach Road in Grandview section of Hampton.
SUFFOLK	4/28/2008	EF3	0/200	$30,000,000	A tornado touched down with damage first noted about 2 miles northeast of Lummis. The tornado crossed Route 58, downing trees as it moved northeast. The tornado strengthened just south of the intersection of Route 10 and Route 58, where it damaged several homes and an elementary school as well as downing numerous trees. The intense tornado crossed Route 58 again and then Route 10 before hitting the Freedom Plaza shopping center where it destroyed a strip mall and tossed around numerous cars. One car was impaled into a building adjacent to the strip mall. Thereafter, the tornado moved into 2 subdivisions east and northeast of Obici Hospital. Many homes were damaged with at least a dozen completely destroyed. The tornado then continued into Driver where it damaged a number of homes and businesses and downed numerous trees. The tornado then appeared to lift just north of Driver, although amateur video and pictures suggested that the tornado maintained close contact with the ground as it tracked northeast across northern portions of Portsmouth to the Norfolk Naval Air Station.
SOUTHAMPTON COUNTY	4/28/2008	EF0	0	$5,000	A brief tornado touched down about a half mile east of Capron off Highway 58 near Douglas Drive. Several trees were downed or snapped off.
PORTSMOUTH	4/28/2008	EF1	0	$60,000	The tornado moved from northeast Suffolk across northern portions of Portsmouth. The tornado maintained close contact with the ground and downed several trees and produced some structural damage. While in Suffolk, the tornado was rated as EF3, but in Portsmouth it was rated as EF1.
NORFOLK	4/28/2008	EF1	0	$100,000	The tornado maintained close contact with the ground as it moved from northern Portsmouth to the Norfolk Naval Air Station.

TABLE 4.10: TORNADOES (1995 - 2015)					
LOCATION	DATE OF OCCURRENCE	MAGNITUDE	DEATHS/ INJURIES	PROPERTY DAMAGE	DETAILS
					The tornado damaged vehicles and a building at Pier 2, and numerous trees were blown down or snapped off. The tornado remained rated as EF1 from northern Portsmouth to the Norfolk Naval Air Station.
JAMES CITY COUNTY	4/28/2008	EF0	0	$200,000	A brief tornado touched down in James City county about 6 miles northwest of Jamestown. Several trees were uprooted or snapped off, and there was some minor damage to homes in the area.
ISLE OF WIGHT	4/28/2008	EF1	0	$184,000	A tornado touched down near Carrsville in southern Isle of Wight county. The tornado damaged eleven homes and six agricultural buildings along Harvest Drive and Eleys Lane.
FRANKLIN	9/26/2008	EF0	0	-	Brief tornado touchdown in an open field near S.P. Morton Elementary School. No damage reported.
ISLE OF WIGHT	4/20/2009	EF0	0	$5,000	EF0 tornado tracked along nearly 8-mile track from near Raynor east-northeast to approximately one mile northwest of Smithfield.
CHESAPEAKE	5/4/2009	EF0	0	$10,000	EF0 tornado touched down in Great Bridge section south of Cedar Road between Shillelagh Road and Battlefield Boulevard.
SOUTHAMPTON COUNTY	10/27/2010	EF0	0	$50,000	An EF0 tornado destroyed a carport, overturned a shed and downed several trees. Debris was scattered toward northeast about 100 yards.
SOUTHAMPTON COUNTY	4/16/2011	EF1	0	$30,000	Brief tornado touched down in southwest Southampton County. Numerous trees were snapped off and a few structures were damaged. The most significant damage was to a farm equipment shelter and a roof on a home.
JAMES CITY COUNTY	4/16/2011	EF3	0	$50,000	Tornado tracked from Surry County into Kingsmill section of James City County. Tornado tracked from James City County into York County.
YORK COUNTY	4/16/2011	EF3	0	$15,000	The tornado mainly affected the Yorktown Naval Weapons Station.
ISLE OF WIGHT COUNTY	4/16/2011	EF2	0	$300,000	Tornado damage was along a nearly continuous 20-mile damage path from east of Walters to just southwest of Smithfield. More than 2 dozen homes were damaged. Farm equipment was picked up and tossed around on several farms.
VIRGINIA BEACH	8/27/2011	EF0	0	$150,000	Weak tornado (EF0) severely damaged a home on Sandpiper Road. Minor damage to one other home.
HAMPTON	6/1/2012	EF1	0	$1,000,000	Tornado began on James River just east of Monitor Merrimac Bridge Tunnel. Its track went over Chesapeake Avenue, through downtown Hampton to Hampton Yacht Club before moving across Mercury Boulevard, then dissipating over the Chesapeake Bay.
ISLE OF WIGHT	1/11/2014	EF0	0	$40,000	The tornado touched down on Bob White Road just north of Woodland Drive, then continued northeast about 2 miles nearly paralleling Woodland Drive before lifting near Quaker Road in Isle of Wight. The tornado touched down just north of Route 10, then continued northeast into Mogarts

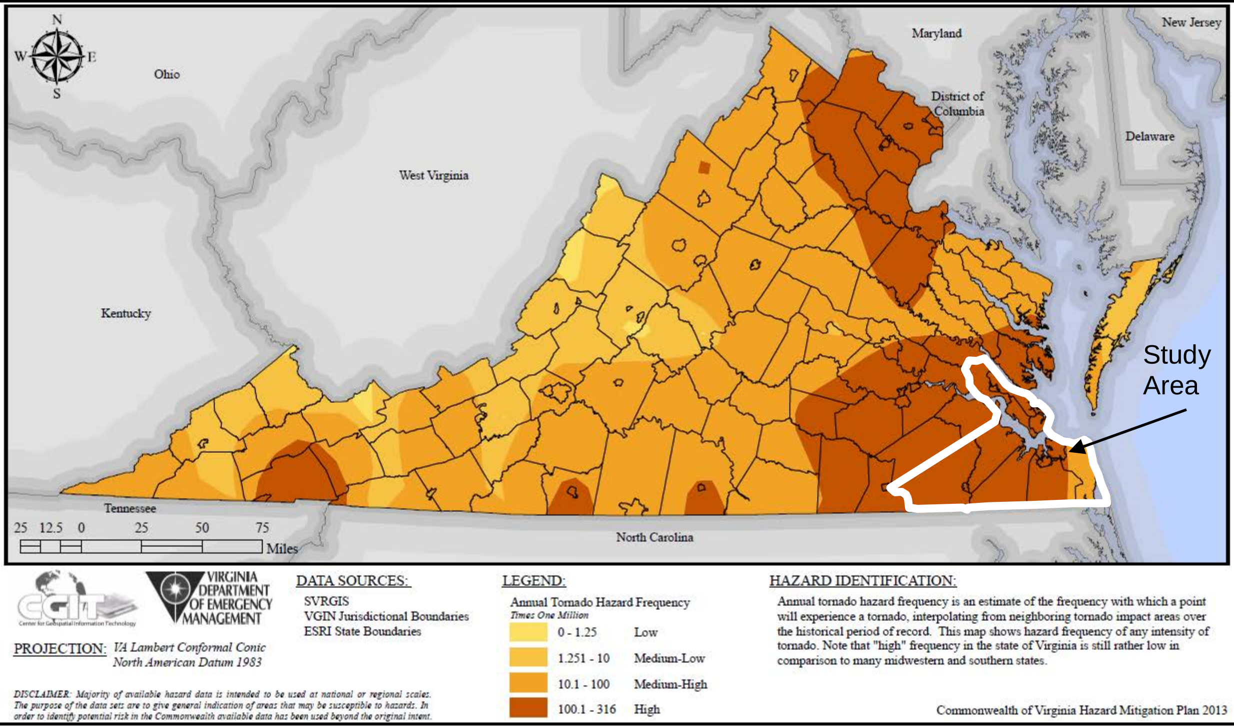
TABLE 4.10: TORNADOES (1995 - 2015)					
LOCATION	**DATE OF OCCURRENCE**	**MAGNITUDE**	**DEATHS/ INJURIES**	**PROPERTY DAMAGE**	**DETAILS**
					Beach area. Tornado was on the ground about 1.4 miles before dissipating over James River.
HAMPTON	1/11/2014	EF0	0	$100,000	Tornado touched down near Routten Road and Cabell Lane where around 50 trees were snapped and homes had 10 to 20 percent of their roof shingles blown off. The tornado traveled east northeast damaging the roof of Fox Hill Central Methodist Church and completely ripping roof off of the City of Hampton school maintenance compound on Windmill Point Road. Tornado moved to Canal Road snapping trees, damaging residential rooftops and blowing out windows of a car. Tornado continued on to completely destroy the Fox Hill Athletic Association Building on Grundland Drive, before ending at the Grandview Nature Preserve.
VIRGINIA BEACH	7/4/2014	EF0	0	$25,000	A brief EF-0 tornado associated with a squall from Hurricane Arthur touched down near Lynnwood in Virginia Beach. Numerous trees were snapped and uprooted along Lynndale Road and Kline Drive.
NORFOLK	7/4/2014	EF0	0	$5,000	Tornado touched down near the Forest Lawn Cemetery in Norfolk.
VIRGINIA BEACH	7/10/2014	EF0	0/10	$300,000	A weak tornado caused significant damage to a home from the roof being blown off. There was also damage to several other structures including a school gymnasium. A large pool window was blown out.
TOTAL			**0/218**	**$41.56 million**	

Source: NCDC, July 2015

PROBABILITY OF FUTURE OCCURRENCES

According to the *Commonwealth of Virginia Hazard Mitigation Plan 2013*, VDEM documented statewide annual tornado frequency and annual significant tornado hazard frequency. Hampton Roads, as shown in **Figure 4.24**, 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.

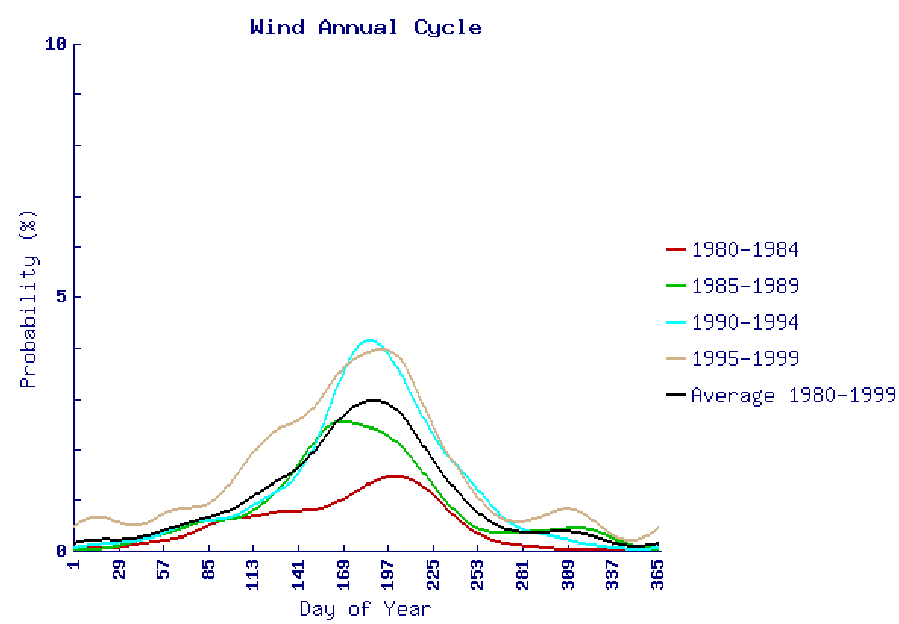
FIGURE 4.24: HISTORICAL TORNADO HAZARD FREQUENCY



Source: *Commonwealth of Virginia Hazard Mitigation Plan 2013*

A tornado wind event could occur in Hampton Roads 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 the region (**Figure 4.25**) below.

FIGURE 4.25: ANNUAL WIND CYCLE



Source: National Severe Storm Labs

WINTER STORMS

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.

In Hampton Roads, winter storms typically 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. Ice storms have also occurred in the region, when freezing rain falls and freezes immediately upon impact.

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

Communications and power in the region can be disrupted for days, and even small accumulations of ice may cause extreme hazards to motorists and pedestrians. Perhaps one of the most common impacts of winter storms in the region is vehicle accidents and stranded, disabled vehicles. Unaccustomed to driving in snow and ice much of the year, drivers attempt to drive at normal speeds despite deteriorated road conditions. Lacking the large fleets of snowplows of some counties and municipalities further north, the region's secondary roads are not cleared as often or as quickly, and roads may remain unplowed or untreated for many days. This impacts special needs populations and others who may become housebound by severe winter storms. Most of the airports in the region also shut down for some time until the runways can be cleared.

Recent winter storms in the region have caused severe economic disruption with lengthy school and business closures, damage to vehicles and reduced community services for extended periods. In agricultural portions of the study area such as Southampton County, freezing temperatures may affect agricultural production, depending on when the event occurs relative to the growing periods of certain crops. Nor'easters often cause winter storms in the region, so the impacts of coastal flooding and shoreline erosion are also associated with winter storm events.

The Northeast Snowfall Impact Scale (NESIS) developed by the NWS characterizes and ranks high-impact 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

SIGNIFICANT HISTORICAL EVENTS

According to the NCDC, Hampton Roads has experienced 23 significant winter storm events including snow and ice storms, since 1995 (**Table 4.12**). These events account for $20.15 million in reported 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 most significant winter storms to impact the region in the twentieth century are discussed below.

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.

TABLE 4.12: WINTER STORM AND NOR'EASTER ACTIVITY (1995 - 2015)

DATE OF OCCURRENCE	TYPE OF EVENT	PROPERTY DAMAGE	DETAILS
1/6/1996	Winter Storm	$25,000	No description available. NESIS Category 5, Extreme.
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. Snow developed on the back side of the storm with snow accumulations across Tidewater ranging from 4 to 8 inches.
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 to near the Newport News area. Snow briefly fell heavily after midnight, creating hazardous driving conditions.

TABLE 4.12: WINTER STORM AND NOR'EASTER ACTIVITY (1995 - 2015)			
DATE OF OCCURRENCE	TYPE OF EVENT	PROPERTY DAMAGE	DETAILS
1/25/2000	Winter Storm	$70,000	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. Winds gusting over 50 mph created some blowing snow in the late afternoon and evening hours. Eighty-four automobile accidents were reported during the storm in Virginia Beach alone. Portions of Interstate 264 were closed. Moderate beach erosion was experienced, especially in the Sandbridge area. Blowing sand closed portions of Sandfiddler Road. The U.S. Coast Guard rescued four crew members of a vessel four miles west of Cape Charles when their craft was caught in dangerously rough seas. NESIS Category 2, Significant.
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 in Suffolk, Franklin and Isle of Wight County.
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.
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. Some schools in the area were closed Thursday due to slippery road conditions.
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.
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, Crippling.
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.

TABLE 4.12: WINTER STORM AND NOR'EASTER ACTIVITY (1995 - 2015)			
DATE OF OCCURRENCE	TYPE OF EVENT	PROPERTY DAMAGE	DETAILS
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.
12/26/2004	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.
1/30/2010	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.
12/25/2010	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 region. Chesapeake reported 13.0 inches of snow. NESIS Category 3, Major.
1/21/2014	Winter Storm	$0	Coastal low pressure intensifying off the Mid Atlantic Coast produced a widespread two to five inches of snowfall from the Virginia Piedmont to the Virginia Eastern Shore. NESIS Category 1, Notable.
1/28/2014	Winter Storm	$0	Coastal low pressure intensifying off the Mid Atlantic Coast produced widespread snowfall ranging from two to ten inches of snowfall from the Virginia Piedmont to the Virginia Eastern Shore. Highest snowfall amounts were over southeast Virginia.
2/16/2015	Winter Storm	$0	Low pressure moving from the Southern Plains east northeast and off the Mid Atlantic Coast produced between four inches and nine inches of snow across central, south central and eastern Virginia from Monday afternoon, February 16th through early Tuesday morning, February 17th.
2/26/2015	Winter Storm	$0	Intensifying low pressure tracking from the Gulf of Mexico northeast and off the southeast and Mid Atlantic coast produced between three inches and nine inches of snow across eastern and southeast Virginia from late Wednesday night, February 25th into midday Thursday, February 26th.
23 Events		**$20,145,000**	

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 the region 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 4.13**.

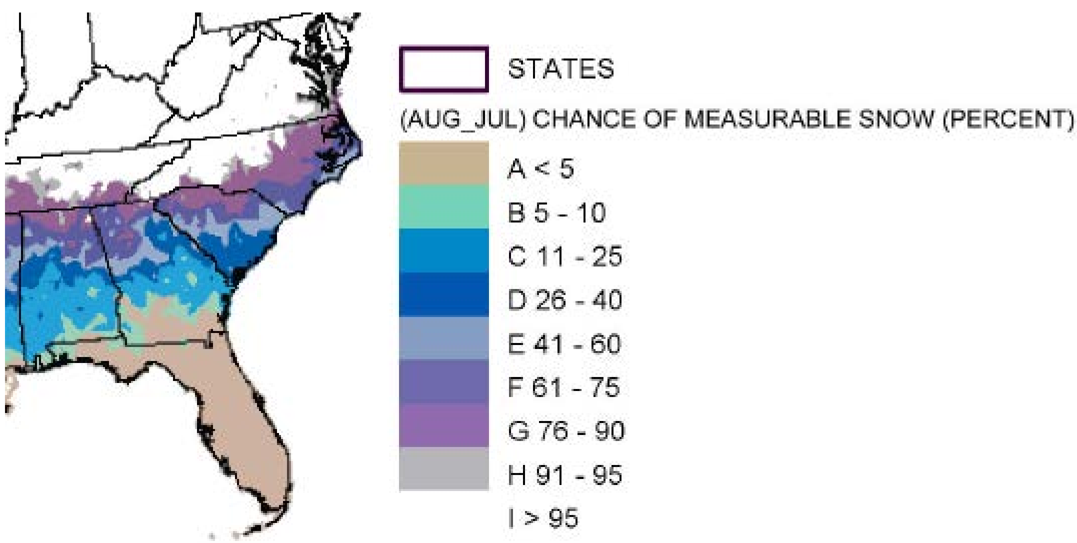
TABLE 4.13: PROBABILITY OF RECEIVING A MEASURABLE SNOWFALL

JURISDICTION	ANNUAL PROBABILITY	WINTER PROBABILITY	SPRING PROBABILITY	FALL PROBABILITY
Isle of Wight	83.3%	94.1%	25.0%	4.0%
Norfolk	89.8%	88.7%	36.4%	5.5%
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 4.26 provides graphic evidence that the chance of snow annually is close to or equal to 100 percent in the rest of the study area.

FIGURE 4.26: CHANCE OF MEASURABLE SNOWFALL IN SOUTHEAST UNITED STATES (%)



Source: NC State University, Climate Education web page: http://climate.ncsu.edu/edu/k12/.SEPrecip

Figure 4.27 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 the region:

- 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 4.27: AVERAGE NUMBER OF DAYS WITH AT LEAST THREE INCHES OF SNOW

Source: Commonwealth of Virginia Hazard Mitigation Plan 2013

EARTHQUAKE

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

Most property damage and earthquake-related deaths are caused by the failure and collapse of structures due to ground shaking. The level of damage depends upon the amplitude and duration of the shaking, which are directly related to the earthquake size, distance from the fault, site and regional geology.

Most earthquakes are caused by the release of stresses accumulated as a result of the rupture of rocks along opposing fault planes in the Earth’s outer crust. These fault planes are typically found along borders of the Earth's 10 tectonic plates. These plate borders generally follow the outlines of the continents, with the North American plate following the continental border with the Pacific Ocean in the west, but following the mid-Atlantic trench in the east. Earthquakes occurring in the mid-Atlantic trench usually pose little danger to humans.

The areas of greatest tectonic instability occur at the perimeters of the slowly moving plates, as these locations are subjected to the greatest strains from plates traveling in opposite directions and at different speeds. Deformation along plate boundaries causes strain in the rock and the consequent buildup of stored energy. When the built-up stress exceeds the rocks' strength, a rupture occurs. The rock on both sides of the fracture is snapped, releasing the stored energy and producing seismic waves, generating an earthquake.

Earthquakes are measured in terms of their magnitude and intensity. Magnitude is measured using the Richter scale, an open-ended logarithmic scale that describes the energy release of an earthquake through a measure of shock wave amplitude (see **Table 4.14**). Each unit increase in magnitude on the Richter scale corresponds to a 10-fold increase in wave amplitude, or a 32-fold increase in energy. Intensity is most commonly measured using the Modified Mercalli Intensity (MMI) Scale based on direct and indirect measurements of seismic effects. The scale levels are typically described using Roman numerals, with a I corresponding to imperceptible (instrumental) events, IV corresponding to moderate (felt by people awake), to XII for catastrophic (total destruction). A detailed description of the Modified Mercalli Intensity Scale of earthquake intensity and its correspondence to the Richter scale is given in **Table 4.15**.

TABLE 4.14: RICHTER SCALE

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

Source: United States Geological Survey

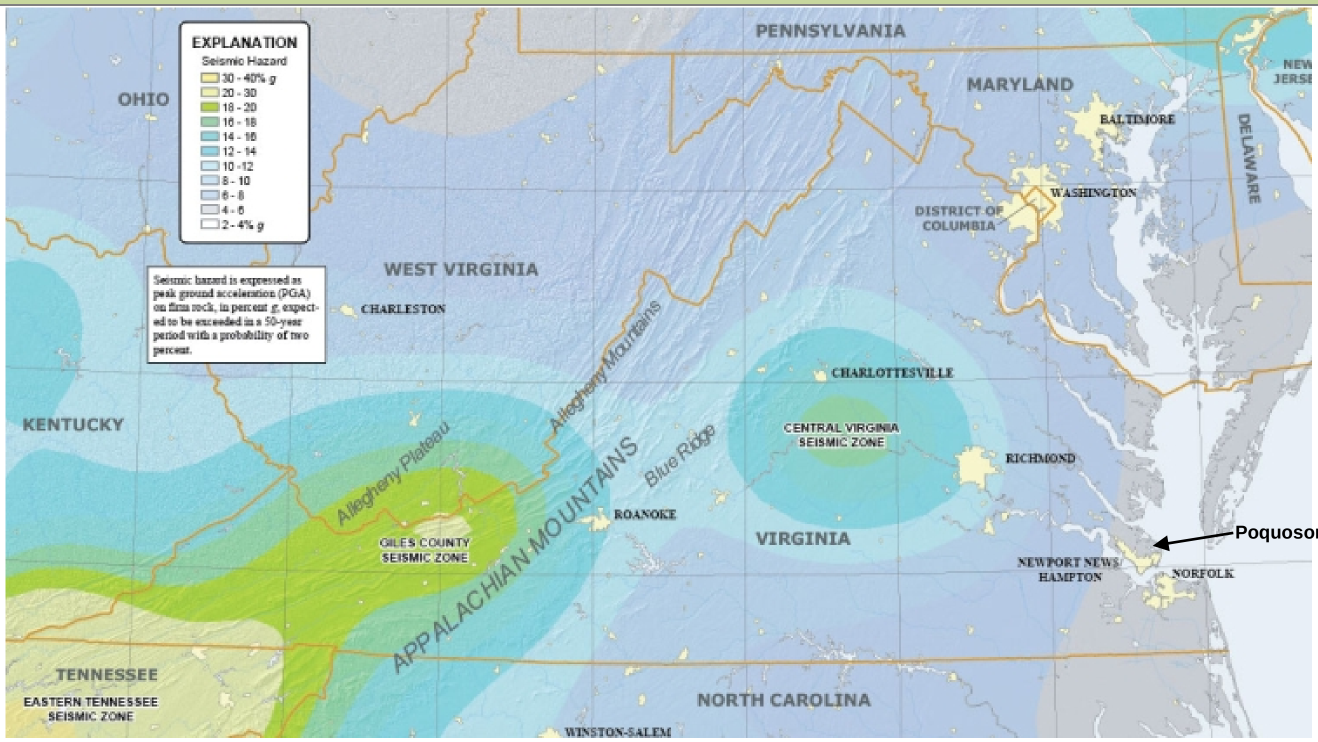
TABLE 4.15: MODIFIED MERCALLI INTENSITY SCALE FOR EARTHQUAKES

SCALE	INTENSITY	DESCRIPTION OF EFFECTS	CORRESPONDING RICHTER SCALE MAGNITUDE
I	Instrumental	Detected only on seismographs	
II	Feeble	Some people feel it	<4.2
III	Slight	Felt by people resting; like a truck rumbling by	
IV	Moderate	Felt by people walking	
V	Slightly Strong	Sleepers awake; church bells ring	<4.8
VI	Strong	Trees sway; suspended objects swing, objects fall off shelves	<5.4
VII	Very Strong	Mild Alarm; walls crack; plaster falls	<6.1
VIII	Destructive	Moving cars uncontrollable; masonry fractures, poorly constructed buildings damaged	
IX	Ruinous	Some houses collapse; ground cracks; pipes break open	<6.9
X	Disastrous	Ground cracks profusely; many buildings destroyed; liquefaction and landslides widespread	<7.3
XI	Very Disastrous	Most buildings and bridges collapse; roads, railways, pipes and cables destroyed; general triggering of other hazards	<8.1
XII	Catastrophic	Total destruction; trees fall; ground rises and falls in waves	>8.1

Source: United States Geological Survey

Hampton Roads is in an area that could feel the effects of earthquakes in the Central Virginia Seismic Zone (see **Figure 4.28**), an area of frequent, yet very weak, earthquake activity located to the southwest of Charlottesville, at the New Madrid Fault in Missouri and at the Charleston Fault in South Carolina. During the last 200 years, both the New Madrid Fault and the Charleston Fault have generated earthquakes measuring greater than 8 on the Richter scale.

FIGURE 4.28: CENTRAL VIRGINIA SEISMIC ZONE



Source: Virginia Department of Mines Minerals and Energy, web site, 2014

Earthquakes in the central and eastern U.S., although less frequent than in the western U.S., are typically felt over a much broader region. East of the Rockies, an earthquake can be felt over an area as much as ten times larger than a similar magnitude earthquake on the west coast. A magnitude 4.0 eastern U.S. earthquake typically can be felt at many places as far as 60 miles from where it occurred, and it infrequently causes damage near its source. A magnitude 5.5 eastern U.S. earthquake usually can be felt as far as 300 miles from where it occurred, and sometimes causes damage out to 25 miles.

Earthquakes everywhere occur on faults within bedrock, usually several miles deep. Most bedrock beneath central Virginia was assembled as continents collided to form a supercontinent about 500-300 million years ago, raising the Appalachian Mountains. Most of the rest of the bedrock formed when the supercontinent rifted apart about 200 million years ago to form what are now the northeastern U.S., the Atlantic Ocean, and Europe.

At well-studied plate boundaries like the San Andreas fault system in California, often scientists can determine the name of the specific fault that is responsible for an earthquake. In contrast, east of the Rocky Mountains this is rarely the case. The Central Virginia seismic zone is far from the nearest plate boundaries, which are in the center of the Atlantic Ocean and in the Caribbean Sea. The seismic zone is laced with known faults but numerous smaller or deeply buried faults remain undetected. Even the known faults are poorly located at earthquake depths. Accordingly, few, if any, earthquakes in the seismic zone can be linked to named faults. It is difficult to determine if a known fault is still active and could slip and cause an earthquake. As in most other areas east of the Rockies, the best guide to earthquake hazards in the seismic zone is the earthquakes themselves.

Historical data is supportive of the low risk assessment. Since 1774, there have been only three earthquake epicenters within 65 miles of Hampton Roads, one on the Delmarva Peninsula and two in the Hampton Roads area. Only minor structural damage as a result of these earthquakes has been reported in the region. Impacts of a severe, unlikely earthquake centered in Hampton Roads are unknown based on the historical record, but could be extrapolated from damage experienced in Louisa County during the August 2011 quake described below. Damage to local structures would likely be severe because buildings in the region are not typically designed to withstand high magnitude quakes. Underground infrastructure damage is also expected to be severe and could cause long-term power, water and sewer service interruptions in the region. Likewise damage to bridges, tunnels and roads could disrupt transportation routes for much of the population.

On Tuesday afternoon, August 23, 2011, an earthquake with a moment magnitude of 5.8 occurred about 7 miles southwest of Mineral, Virginia, which is near Lake Anna in Louisa County. The earthquake was widely felt, with felt reports received from people as far away as Detroit, Atlanta, Boston, Toronto, and Montreal. Dozens of aftershocks up to magnitude 4.5 have been recorded, including a magnitude 4.2 aftershock approximately six hours after the main shock and a magnitude 4.5 aftershock about a day and a half later. The *Washington Post* reported that the two Dominion Virginia Power nuclear plants in North Anna, Va., 10 miles from the epicenter, shut down automatically when the quake hit. They lost power from the grid and switched to four diesel generators. Damage was greatest in Louisa County and several minor injuries occurred. Structural damage to buildings was significant in cities throughout central and eastern Virginia and Washington D.C., including damage to the Washington Monument and the Washington National Cathedral. Officials at Fort Monroe, in Hampton, Virginia, also reported some minor structural damage as a result of the quake.

The *Daily Press* and *Virginian-Pilot* newspapers reported a minor, but relatively rare, earthquake with its epicenter on the Peninsula August 3, 1995. According to the *Virginian-Pilot*, the quake measured 2.6 on the Richter scale. The Virginia Tech Seismological Observatory detected the quake with instrumentation in Goochland County west of Richmond, and in Blacksburg. The quake was centered under the York River near York River State Park. According to the *Daily Press*, people at Camp Peary in York County reported feeling the quake.

The Virginia Tech Seismological Observatory provides additional information on more recent events in Virginia, including a magnitude 4.0 shock that occurred on August 17, 1984. The epicenter was approximately 15 miles to the southeast of Charlottesville. The quake was felt from Washington, DC to the North Carolina border and from Staunton to Norfolk.

A magnitude 3.2 earthquake occurred Saturday, September 22, 2001, with the epicenter near Shadwell, just east of Charlottesville. The focal depth was within a few kilometers of the surface, and this produced a strong acoustic signal that local officials attributed to an aircraft in transonic flight. In fact, such explosive sounds are frequently associated with shallow earthquakes in eastern North America. Unlike the situation in California, the rocks in the upper few kilometers of the Earth's crust in the east are extremely efficient transmitters of high frequency seismic energy, and a proportion of this energy is converted to ordinary sound waves when the seismic waves reach the Earth's surface.

Earthquakes of significant magnitude are unlikely occurrences for Hampton Roads, though the proximity of the region to the Charleston Fault could increase the possibility of feeling some impact of a large earthquake if it were to occur along that fault line.

WILDFIRES

BACKGROUND

A wildfire is any fire occurring in a wildland area (i.e., grassland, forest, brush land) except for fire under prescription.[4] 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.

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)

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, tornadoes and lightning) 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.

The impacts of wildfire in the Hampton Roads region are both economic and environmental. From an economic perspective, fires destroy most homes, businesses and infrastructure in their path. The population displacement and subsequent rebuilding consumes valuable resources of private and public entities. Communities in the region spend significant capital funds both fighting wildfires and training staff, and preparing equipment and infrastructure to fight wildfire. Wildfire also endangers the lives and safety of firefighters and citizens. Loss of life is a possible impact of severe wildfire in the region, although the lack of mountainous terrain makes escape somewhat easier.

The region's air, water and soil environments are all altered by wildfire, and even wildfire in adjacent regions. Dense smoke and the fine particles and gases inside the smoke pose a risk to human health. Smoke irritates the eyes and respiratory system and can cause bronchitis or aggravate heart or lung disease even for residents hundreds of miles downwind. Wildfires raise the temperature of forest soils and potentially wipe away organic value of the soil. And although soils do eventually recover, the impact on watersheds in the interim can be detrimental to the region's water bodies. Burned organic matter in soils may negatively affect infiltration and percolation making soil surfaces water repellant. If water is

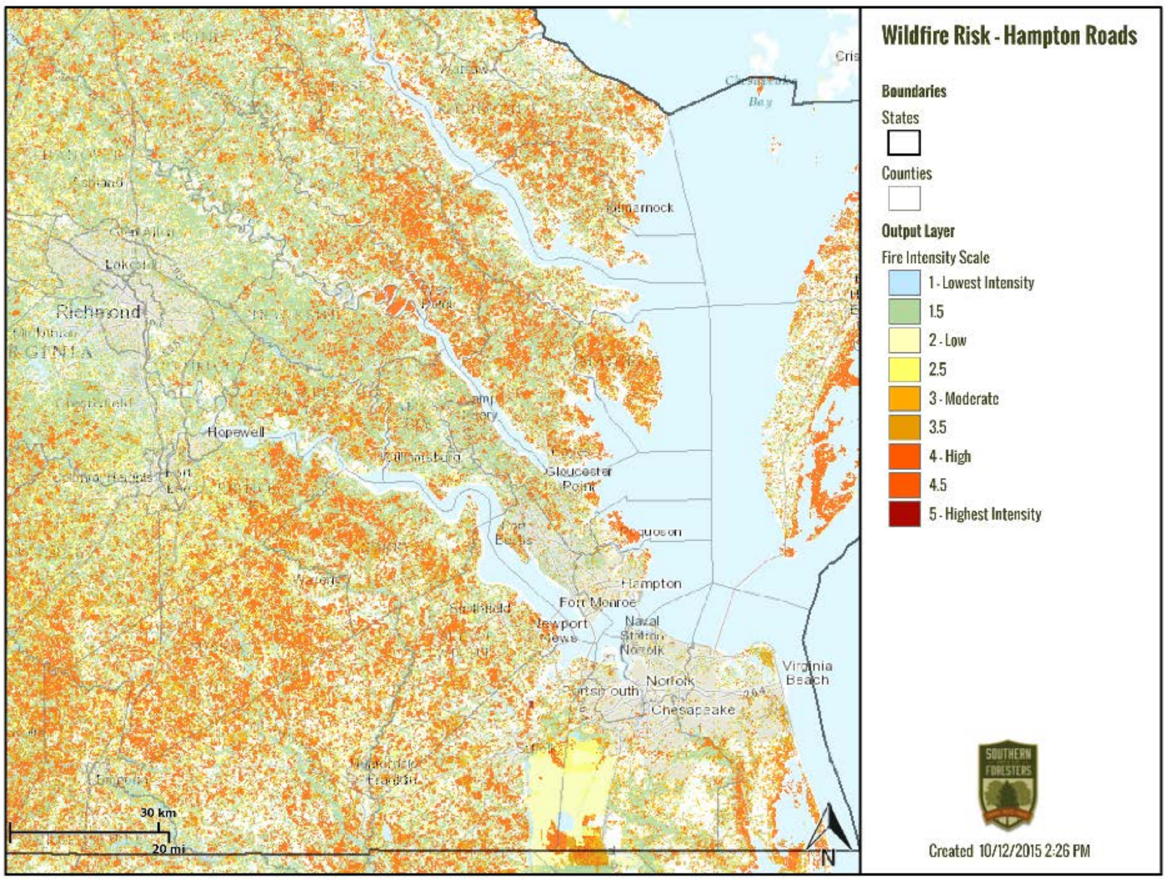
[4] Prescription burning, or "controlled burn," undertaken by land management agencies is the process of igniting fires under selected conditions, in accordance with strict parameters.

unable to infiltrate, runoff quantity increases and infiltration to groundwater decreases. Both of these factors may negatively impact water quality downstream.

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. The data are now part of the Southern Foresters web site at www.southernwildfirerisk.com that serves as a portal for data from several southern states. While this assessment of wildfire risk 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 the region, as shown in **Figure 4.29**. 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.

FIGURE 4.29: WILDFIRE THREAT



Source: Southern Foresters, 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.

SIGNIFICANT HISTORICAL EVENTS

According to VDOF records, the agency responded to 39 events between 2010 and 2013, the most recent year for which data were available. 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 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 4.16** shows damages from wildfire events in the region between 2002 and 2013, the latest year for which data are available.

TABLE 4.16: HAMPTON ROADS WILDFIRE OCCURRENCES (2002-2013)

YEAR	FREQUENCY	ACRES DAMAGED	COST OF DAMAGE ($)	VALUE OF RESOURCES PROTECTED ($)
2002	72	592	$89,800	$4,718,200
2003	9	42	$1,600	$0
2004	19	26	$50	$500,000
2005	19	130	$750	$1,370,000
2006	41	298	$69,950	$7,315,000
2007	40	188	$600	$1,950,000
2008	31	141	$500	$0
2009	12	46.5	not provided	not provided
2010-2013	39	496	not provided	not provided

Source: Virginia Department of Forestry, 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 cities of Chesapeake and Suffolk:

- 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 4.17**.

On August 4, 2011, lighting struck and ignited much of the dead trees and brush that remained from the 2008 fire. Aided by a drought that had dried plants and the soil, the Lateral West fire steadily grew. This fire produced dense smoke as the peat soil burned (**Figure 4.30**). Shortly after the fire started, Hurricane Irene dumped 12 inches of rain in 24 hours, but that did not put out the fire which burned for another two and a half months.

FIGURE 4.30: GREAT DISMAL SWAMP LATERAL WEST FIRE, 2011

Source: NASA Satellite, 2011

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 4.17: 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.
2011 Lateral West Fire	Largest fire in recent history sparked by lightning on August 4. Burned for 111 days and consumed 6,300 acres.

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 region, 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.

DROUGHT

BACKGROUND

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)

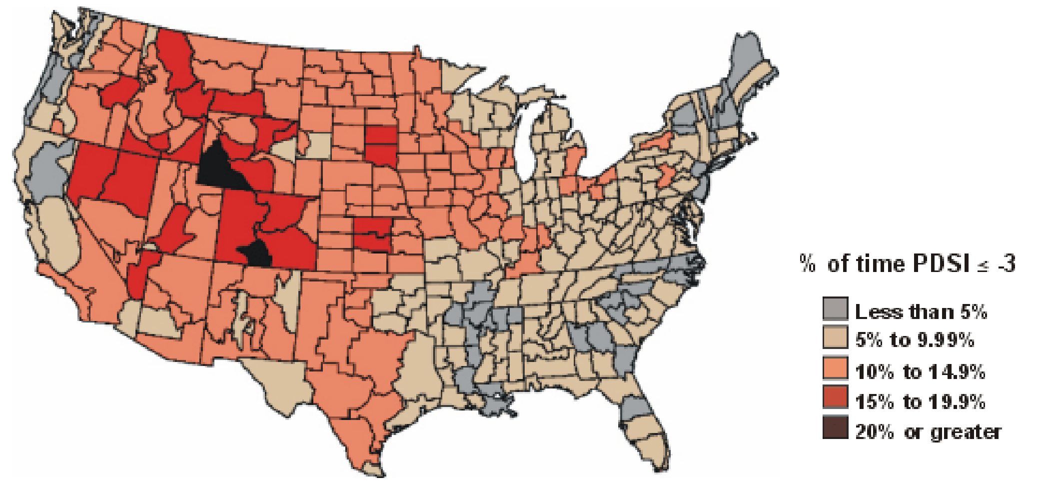
Drought is a natural climatic condition caused by an extended period of limited rainfall beyond that which occurs naturally in a broad geographic area. High temperatures, high winds and low humidity can worsen drought conditions, and make areas more susceptible to wildfire. Human demands and actions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

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.

In Hampton Roads, droughts can have economic, environmental and social impacts. Economic impacts include loss of income for farmers dependent on crop harvests, especially in the western portion of the region, irrigation costs for farms and gardens, higher costs of feed and water for farm animals, and impacts to farm supply businesses such as tractor sales. Wildfire resulting from drought can impact timberland. Water utilities may have additional costs to treat and provide limited water supplies, and food prices in general may be driven higher. Environmental impacts in the region may include loss or destruction of fish and wildlife habitat, and lack of food or drinking water for wild animals and resultant disease in those populations, migration of wildlife, and poor soil quality which may lead to soil erosion. Social impacts may result from changes in lifestyle associated with chronic drought and associated water restrictions. Severe drought often causes anxiety or depression about economic effects of drought in farming communities, health problems related to poor water quality and fewer recreational activities if drought continues and water supplies are curtailed.

Figure 4.31 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, the Eastern United States has historically not seen as many significant long-term droughts as the Central and Western regions of the country.

FIGURE 4.31: 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 4.31**, Virginia is in a zone representing 5 percent to 9.99 percent 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 the Hampton Roads region. 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. Agricultural areas in Chesapeake, Isle of Wight County, James City County, York County and Southampton County are more likely to be impacted by drought, especially in the early stages. As water restrictions are put in place as a result of acute water shortages, impacts on urban consumers increase (use restrictions, drinking water supply effects and saltwater intrusion).

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 2 instances of drought to impact the Southside Hampton Roads region (**Table 4.18**). 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 4.18: OCCURRENCES OF DROUGHT (1993 - 2016)

LOCATION	DATE OF OCCURRENCE	DETAILS
17 jurisdictions, including Isle of Wight	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.
20 jurisdictions, including Isle of Wight, James City County, Williamsburg, and Suffolk	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. Damages reported in the study area were $9.2 million.
Hampton Roads	10/1/2000	Although not technically a drought, much of eastern Virginia experienced extremely dry conditions during the month of October. Norfolk International Airport also received only .01 inches of precipitation during the month. This was the driest month ever recorded at Norfolk. A very wet summer prevented a more hazardous fire situation than would normally be experienced under such dry conditions. However, several small brush fires were reported over the region. Crops also were able to withstand the lack of rainfall due to a very wet summertime. No damages reported.

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.

August, 2002: Drought

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 sixty 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. In 2005, Isle of Wight County sought federal disaster drought aid because of drought conditions effecting crop production.

September, 2007: Drought

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.

Summer, 2008: Hydrologic Drought
Low stream flow in summer 2008 resulted in severe hydrologic drought.

Summer, 2010: Drought
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. Crop yields were well below average with particular emphasis on corn and soybeans.

PROBABILITY OF FUTURE OCCURRENCES

Based on current and seasonal outlook drought maps available through the National Drought Mitigation Center, Hampton Roads is not currently in an area of abnormally dry conditions as of November 2016. Based on past events, the Hampton Roads region could possibly experience recurring drought conditions when precipitation falls below normal for extended periods of time.

EXTREME HEAT

BACKGROUND

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.

In Hampton Roads, humid conditions resulting from maritime air masses may also add to the discomfort of high temperatures. Health risks to residents in the region exposed to extreme heat include dehydration, heat cramps, fainting, heat exhaustion and heat stroke. According to the NWS, heat is the leading weather-related killer in the United States, although no deaths have been reported for the historical events described below. 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, Hampton Roads is uniformly exposed to this hazard and the spatial extent of that impact is potentially large. Extreme heat typically does not cause significant damage to the built environment. Summertime temperatures in Hampton Roads region can easily climb into the high 90 to low 100 degree Fahrenheit range with high humidity rates. Coastal areas may experience slightly (1 to 2 degrees) lower temperatures at some times as a result of late day sea breezes or lower water temperatures, depending on the season.

SIGNIFICANT HISTORICAL EVENTS

While temperature extremes occur fairly frequently in the region, the NCDC has only recorded three extreme temperature events recorded that have impacted the region as shown below. The committee acknowledges that there have been other, unrecorded extreme heat events during the period since 1950; however, records on these events are not available from the communities and were not reported through the NCDC or 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.

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.

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.

PROBABILITY OF FUTURE OCCURRENCES

It is highly likely that the Hampton Roads region will experience periods of extreme heat in the future.

HAZARDOUS MATERIAL INCIDENTS

BACKGROUND

Hazardous material (HAZMAT) incidents can apply to fixed facilities as well as mobile, transportation-related accidents in the air, by rail, on the Nation's highways and on the water. Approximately 6,774 HAZMAT events occur each year, 5,517 of which are highway incidents, 991 are railroad incidents and 266 are due to other causes (FEMA, 1997). In essence, HAZMAT incidents consist of solid, liquid and/or gaseous contaminants that are released from fixed or mobile containers, whether by accident or by design, as with a terrorist attack. A HAZMAT incident can last hours to days, while some chemicals can be corrosive or otherwise damaging over longer periods of time. In addition to the primary release, explosions and/or fires can result from a release, and contaminants can be extended beyond the initial area by persons, vehicles, water, wind and wildlife.

City of Portsmouth Hazardous Materials Response Team. (Source: City of Portsmouth)

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

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

Hazardous material incidents may include chemical agents, or compounds with unique chemical properties that can produce lethal or damaging effects in humans, animals and plants. Chemical agents can exist as solids, liquids or gases depending on temperature and pressure. Most chemical agents are liquid and can be introduced into an unprotected population relatively easily using aerosol generators, explosive devices, breaking containers or other forms of covert dissemination. Dispersed as an aerosol, chemical agents have their greatest potential for inflicting mass casualties. Chemical agents can have an immediate effect or a delayed effect of several hours to several days, and are broadly categorized as lethal or incapacitating. Fortunately, the compounds are difficult to deliver in lethal concentrations, difficult to produce, and dissipate rapidly outdoors.

Shippers are relying more heavily on other types of transportation to move hazardous materials. The Department of Transportation reported that the use of trucks and water carriers had climbed sharply between 1997 and 2002. The volume of hazardous materials shipped by trucks increased 21 percent to 1.16 billion tons by 2002, while the amount carried by rail rose 7 percent to 109 million tons. During that period, the volume of hazardous material moving by water climbed 36 percent to 228 million tons, according to the department's Bureau of Transportation Statistics. Between 2002 and 2007, truck and rail shipments of hazardous materials again increased by 3 percent and 19 percent, respectively; but, water shipment volume decreased by 34 percent to 150 million tons, which is below the 1997 volume carried by water.

In Hampton Roads, the negative impacts of hazardous materials incidents are dependent on the nature of the materials involved. While each chemical transported locally has unique qualities, there are generally three types of impacts: 1) economic, 2) environmental and 3) life/safety impacts to residents and first responders.

Economic impacts are likely greatest from potential large-scale incidents involving the port of Hampton Roads. Incidents that may result in port closure are unlikely, but even an event that blocks the port or a portion of the port for some period of time would have dire impacts on the port's ability to move commodities in or out of the entire region by train, ship or truck. Large spills or large fires have consequently high costs associated with response, control and cleanup. While local governments may only absorb some of those costs, economic costs to other industries would occur. Local emergency planners are especially aware of flammable crude oil transports in the York County portion of the planning area. Recent derailments involving this commodity, such as the one in Lynchburg in 2015, are high profile events as they often involve large spills and large fires.

Lesser, but still significant, economic impacts from hazardous materials incidents in the region could include the costs of litigation to resolve large spills, traffic control problems and lost time and wages for travelers impacted by roadway spills or incidents, and the impacts of corrosives such as sodium hydroxide on bridge and roadway infrastructure. In cases where evacuations are necessary to protect human life and safety, lost wages can be significant. For example, a natural gas leak in a downtown business district could result in evacuation of downtown businesses and shut down transportation routes. Derailment of a single train carrying hazardous materials shuts down the rail line to other trains for a long period of time, as well, which has economic consequences for numerous carriers, suppliers and buyers.

As intermodal transportation from overseas increases through the region, shipping through the port is growing and that increases highway traffic and rail traffic. The potential economic costs of hazardous materials incidents are, consequently, increasing in the region.

There are potential impacts to the health and safety of residents and travelers through Hampton Roads, as well. Response personnel are trained to respond in a variety of situations, but can nonetheless be exposed to harmful vapors or come into contact with hazardous chemicals. There is a potential for large-scale evacuations of businesses and residents if raw chemicals are released into the air or water under certain conditions that could endanger human health.

Environmental impacts of highest concern in Hampton Roads include the results of spills of petroleum products into the region's waterways. The region's emergency managers have contingency plans in place with the U.S. Coast Guard and others, and conduct regular training and exercises to prevent and then control further damage or secondary damage from fire or contaminant(s) spreading to sensitive environmental areas and critical infrastructure. However, a spill could still impact water quality, aquatic life and valuable wetlands along the shoreline. There is also a potential for hazardous materials incidents along roadways or railroads to impact groundwater with subsequent well water impacts for residents. Local emergency managers also noted the region's valuable migratory bird corridors, which could potentially be impacted by airborne contaminants, and the occurrence of illegal dumping which contributes hazardous materials to waterways, floodplains, wetlands, and forests without the benefit of appropriate response and cleanup.

LOCATION AND SPATIAL EXTENT

The Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA) was created to increase public awareness of the existence of hazardous materials in the community. The Act is a freestanding title in the Superfund Amendments and Reauthorization Act of 1986 (SARA), and requires certain facility owners/operators to routinely report the presence, quantity, and releases of hazardous materials at their facility. The Act also provides an avenue in which this information can be disseminated to the public, as well as requiring state and local governments to undertake planning measures to respond to emergencies involving those materials.

As a result, each community in Hampton Roads has identified a Local Emergency Planning Committee (LEPC) to take on the responsibilities of hazardous materials planning. These plans reside with the Emergency Coordinator of the community and provide detailed outlines of hazardous materials response and identification. Key components of the plans include the following that address the location and spatial extent of hazardous materials within the community:

- Identification of routes that are used for transportation of extremely hazardous materials, types of hazardous materials and facility locations of the materials; and,
- Identification of critical facilities which have additional risk due to proximity of transportation routes or fixed facilities.

HISTORICAL OCCURRENCES

The Federal Railroad Administration, Office of Safety Analysis, maintains accident reports for railroad accidents with damages greater than $8,500. In Hampton Roads, there have been 22 accidents involving hazardous materials since 1998. The worst accident was in Suffolk in 2006, when one rail car suffered $18,212 of damage and 7 people had to be evacuated. Of the 22 accidents in the past decade, 6 rail cars carrying hazardous materials were damaged, and there was no record of hazardous materials being released.

There have been 454 documented HAZMAT events in Hampton Roads since 1998 (**Table 4.19**), based on information from the U.S. Department of Transportation, Pipeline and Hazardous Materials Safety Administration, Office of Hazardous Materials Safety Incidents Report Database. There were no fatalities, and 15 injuries associated with these events, and a total of $1,104,153 damage. The worst event was in 2013 in Norfolk, when 4,500 gallons of ferric chloride spilled on the highway, causing $340,000 damages.

TABLE 4.19: HAZARDOUS MATERIALS INCIDENTS (1998 – 2015)

Community	Date	Mode of Transport & Injuries	Quantity Released	Commodity	Damages
Branchville (Southampton Co.)	11/21/2007	Highway	0.00cf	LPG	$10,706
Courtland (Southampton Co.)	1/11/2004	Highway	0.00g	Sodium Hydroxide	$0
Chesapeake	5/12/1998	Highway	0.50g	Hydrogen Peroxide	$335
Chesapeake	6/19/1998	Highway	0.13g	Paint	$0
Chesapeake	6/22/1998	Highway	0.25g	Acetone	$403
Chesapeake	8/10/1998	Highway	15.00g	Compounds, Cleaning Liquid	$0
Chesapeake	10/16/1998	Rail	1.00g	Ethanol	$0
Chesapeake	11/25/1998	Highway	50.00g	Diesel Fuel	$100,050
Chesapeake	12/1/1998	Highway	0.05g	Hydrogen Peroxide & Peroxyacetic Acid Mixtures	$465
Chesapeake	12/14/1998	Highway	55.00g	Flammable Liquid	$85
Chesapeake	2/12/1999	Highway	4.00g	Potassium Hydroxide	$500
Chesapeake	9/29/1999	Highway	1.00lb	Resourcinol	$0
Chesapeake	11/8/1999	Highway	5.00lb	Sodium Nitrate	$460
Chesapeake	1/13/2000	Highway	3.00g	Disinfectants, Liquid, Corrosive	$375
Chesapeake	5/18/2000	Rail	1.00g	Sodium Hydroxide	$0

TABLE 4.19: HAZARDOUS MATERIALS INCIDENTS (1998 – 2015)					
Community	**Date**	**Mode of Transport & Injuries**	**Quantity Released**	**Commodity**	**Damages**
Chesapeake	8/11/2000	Highway	0.06g	Hydrochloric Acid	$0
Chesapeake	9/6/2000	Rail	1.00g	Diethyl Ether	$0
Chesapeake	11/7/2000	Highway	5.00lb	Oxidizing Solid, Corrosive	$1,010
Chesapeake	12/5/2000	Highway	3.00g	Toluene	$100
Chesapeake	1/2/2001	Highway	0.02g	Trichloroethylene	$85
Chesapeake	1/26/2001	Highway	125.00g	Gasohol	$2,620
Chesapeake	4/2/2001	Highway	2.00g	Chloroform	$0
Chesapeake	6/19/2001	Rail	5.00g	Carbmate Pesticides	$7,500
Chesapeake	7/5/2001	Rail	1.00g	Flammable Liquids	$0
Chesapeake	7/17/2001	Rail	1.00g	Corrosive Liquid, Acidic, Organic	$0
Chesapeake	10/15/2001	Highway	0.19g	Caustic Alkali Liquids	$525
Chesapeake	10/30/2001	Highway	0.25g	Hydrofluoric Acid Solution	$315
Chesapeake	2/11/2002	Highway	25.00g	Gas Oil	$0
Chesapeake	2/12/2002	Highway	1.50g	Combustible Liquid	$100
Chesapeake	6/26/2002	Highway	5.00g	Environmentally Hazardous Substances, Liquid	$20
Chesapeake	9/20/2002	Highway	3.00g	Toluene	$400
Chesapeake	9/24/2002	Highway	5.00g	Petroleum Distillates	$370
Chesapeake	5/5/2003	Highway	5.00g	Flammable Liquids	$475
Chesapeake	6/30/2003	Highway	5.00g	Caustic Alkali Liquids	$475
Chesapeake	6/30/2003	Highway	1.00g	Hydrochloric Acid Solution	$400
Chesapeake	7/10/2003	Highway	0.02g	Trimethylhexamethylendiamines	$365
Chesapeake	7/15/2003	Highway	0.03g	Ethyl Chloride	$525
Chesapeake	9/16/2003	Highway	15.00g	Flammable Liquid	$0
Chesapeake	9/23/2003	Highway	5.00g	Ammonia Solution	$100
Chesapeake	10/31/2003	Highway	200.00g	Styrene Monomer	$0
Chesapeake	11/20/2003	Highway	0.01g	Oxidizing Liquid	$365
Chesapeake	11/23/2003	Highway	3,000.00g	Diesel Fuel	$119,500
Chesapeake	12/16/2003	Highway	1.00lb	Environmentally Hazardous Substances, Solid	$175
Chesapeake	12/26/2003	Rail	1.00g	Environmentally Hazardous Substances, Liquid	$0
Chesapeake	2/19/2004	Rail	1.00g	Combustible Liquid	$0
Chesapeake	2/23/2004	Rail	25.00g	Environmentally Hazardous Substances, Liquid	$1,500
Chesapeake	4/08/2004	Highway	0.06g	Paint	$500
Chesapeake	5/10/2004	Highway	0.25g	Corrosive Liquid, Basic, Organic	$525
Chesapeake	6/7/2004	Highway	1.00lb	Environmentally Hazardous Substances, Solid	$385

TABLE 4.19: HAZARDOUS MATERIALS INCIDENTS (1998 – 2015)

Community	Date	Mode of Transport & Injuries	Quantity Released	Commodity	Damages
Chesapeake	7/20/2004	Rail	1.00g	Petroleum Distillates	$1,000
Chesapeake	9/20/2004	Rail	8.00lb	Corrosive Solids	$1,000
Chesapeake	3/22/2005	Highway	0.50g	Paint	$0
Chesapeake	4/13/2005	Highway	16.00lb	Batteries	$0
Chesapeake	5/3/2005	Highway	10.00 lb	Fire Extinguishers	$0
Chesapeake	5/6/2005	Highway	60.00 lb	Life-saving Appliances	$0
Chesapeake	8/11/2005	Highway	0.25g	Sodium Hydroxide	$0
Chesapeake	3/27/2006	Highway	1.00g	Paint	$0
Chesapeake	5/2/2006	Highway	0.04cf	Carbon Dioxide	$0
Chesapeake	7/12/2006	Highway	0.50g	Paint	$0
Chesapeake	9/6/2006	Highway	0.02g	Paint	$0
Chesapeake	10/3/2006	Highway	1.00g	Paint	$0
Chesapeake	11/3/2006	Rail	0.06g	Environmentally Hazardous Substances, Liquid	$0
Chesapeake	2/9/2007	Highway	0.66g	Sulfuric Acid	$0
Chesapeake	9/25/2007	Rail	0.06g	Amines, Liquid, Corrosive	$0
Chesapeake	10/16/2007	Highway	1.00g	Corrosive Liquid, Basic, Inorganic	$0
Chesapeake	10/17/2007	Highway	3.00g	Hydrochloric Acid	$0
Chesapeake	10/29/2007	Highway	2.00 lb	Flammable Solids, Organic	$0
Chesapeake	11/16/2007	Highway	0.09g	Tetrahydrofuran	$0
Chesapeake	4/1/2008	Highway	0.25g	Paint	$0
Chesapeake	4/4/2008	Highway	2.00g	Paint	$0
Chesapeake	6/16/2008	Highway	15.00g	Gasoline	$5,050
Chesapeake	3/10/2009	Highway	1.06g	Flammable Liquids	$0
Chesapeake	9/11/2009	Highway	5.00g	Flammable Liquids	$650
Chesapeake	12/31/2009	Highway	0.13g	Sodium Hydroxide	$0
Chesapeake	5/17/2010	Highway	3.00g	Corrosive Liquid, Acidic, Organic	$2,881
Chesapeake	9/9/2010	Highway	0.13g	Paint	$0
Chesapeake	10/1/2010	Highway	0.53g	Sodium Hydroxide	$0
Chesapeake	11/8/2010	Highway	0.04g	Paint	$0
Chesapeake	5/16/2011	Highway	0.03g	Paint	$0
Chesapeake	11/21/2011	Highway	0.13 lb	Organic Peroxide, Type F, Solid	$0
Chesapeake	2/23/2012	Highway	1.50g	Paint	$0
Chesapeake	6/22/2012	Highway	1.00g	Paint	$0
Chesapeake	7/19/2012	Highway	4.00g	Paint	$0

TABLE 4.19: HAZARDOUS MATERIALS INCIDENTS (1998 – 2015)					
Community	**Date**	**Mode of Transport & Injuries**	**Quantity Released**	**Commodity**	**Damages**
Chesapeake	8/27/2012	Highway	40.00g	Aryl Sulfonic Acids	$4,000
Chesapeake	11/26/2012	Highway	1.00g	Paint	$0
Chesapeake	8/22/2013	Highway	30.00g	Fuel Oil (NO. 1, 2, 4, 5, or 6)	$7,327
Chesapeake	9/29/2014	Highway	0.02g	Organic Peroxide Type D, Liquid	$0
Franklin	1/5/1998	Highway	0.02g	Phosphorous Trichloride	$0
Franklin	3/2/1999	Highway	40.00 lb	Calcium Hypochlorite, Hydrated Mixtures	$2,850
Franklin	3/23/2000	Highway	150.00g	Hypochlorite Solutions	$638
Franklin	8/17/2001	Highway	1.00g	Hydrogen Peroxide	$200
Franklin	4/8/2002	Highway	0.07g	Phosphorus Trichloride	$0
Franklin	8/27/2002	Highway	0.06g	Phosphorus Trichloride	$0
Franklin	5/27/2005	Rail	2.00g	Elevated Temperature Liquid, N.O.S.	$0
Franklin	1/13/2007	Rail	1.00g	Flammable Liquid	$0
Hampton	9/4/1999	Highway	25.00g	Potassium Hydroxide	$500
Hampton	9/22/2003	Highway	15.00g	Gasoline	$6,000
Hampton	6/22/2004	Highway	35.00gg	Gasoline	$1,550
Hampton	8/12/2004	Highway	1.00g	Flammable Liquids	$20
Hampton	4/02/2014	Highway	50.00g	Potassium Hydroxide	$0
Hampton	7/14/2014	Highway	5.00g	Gasoline	$1,384
Newport News	1/29/1998	Highway	0.26g	Methyl Tert-Butyl Ether	$0
Newport News	3/4/1998	Highway	0.25g	Methyl Ethyl Ketone	$0
Newport News	4/1/1998	Highway	0.75g	Corrosive Liquids	$160
Newport News	4/23/1998	Highway	0.02g	Hydrochloric Acid	$0
Newport News	5/4/1998	Highway	0.25g	Sulfuric Acid	$0
Newport News	5/12/1998	Highway	0.01g	Sulfuric Acid	$0
Newport News	5/20/1998	Highway	0.00g	Sulfuric Acid	$0
Newport News	5/27/1998	Air	0.01g	Formaldehyde	$0
Newport News	6/15/1998	Highway	0.05g	Phosphoric Acid	$145
Newport News	6/15/1998	Highway	0.25g	Phosphoric Acid	$0
Newport News	7/21/1998	Highway	0.25g	Ammonia Solution	$178
Newport News	8/4/1998	Highway	0.06g	Sodium Hydroxide	$0
Newport News	8/17/1998	Highway	1.06g	Tetrahydrofuran	$0
Newport News	9/2/1998	Highway	0.01g	Sodium Hydroxide	$0
Newport News	9/16/1998	Highway	5.00g	Sulfuric Acid	$5
Newport News	9/22/1998	Highway	0.26g	Methanol	$0

TABLE 4.19: HAZARDOUS MATERIALS INCIDENTS (1998 – 2015)					
Community	**Date**	**Mode of Transport & Injuries**	**Quantity Released**	**Commodity**	**Damages**
Newport News	10/14/1998	Highway	0.06g	Heptanes	$0
Newport News	11/11/1998	Highway	0.38g	Aerosols, Poison, Packing Group III	$310
Newport News	4/2/1990	Highway	0.06g	Terpene Hydrocarbons	$0
Newport News	9/30/2003	Highway	10.00g	Diesel Fuel	$10
Newport News	8/22/2005	Highway	0.13g	Flammable Liquids	$0
Newport News	10/06/2005	Highway	0.01g	Paint	$0
Newport News	12/15/2005	Highway	1.50 lb	Fire Extinguishers	$0
Newport News	3/29/2006	Highway	0.00	Radioactive Material	$0
Newport News	4/3/2007	Highway	0.05g	Hydrochloric Acid Solution, Inhibited	$0
Newport News	4/17/2007	Highway	1.00lb	Fire Extinguishers	$0
Newport News	8/18/2008	Highway	0.01g	Corrosive Liquids	$0
Newport News	9/4/2009	Highway	1,100.00g	Diesel Fuel	$2,750
Newport News	4/28/2011	Highway	0.06g	Petroleum Distillates	$0
Newport News	7/12/2011	Highway	0.13g	Alcohols	$0
Newport News	10/15/2012	Highway	0.25gg	Paint	$0
Newport News	6/17/2013	Air	0	Carbon Dioxide, Solid or Dry Ice	$0
Newport News	4/16/2015	Highway	15.00g	Environmentally Hazardous Substances, Liquid	$0
Norfolk	1/21/1998	Highway	1.00g	Isopropanol	$125
Norfolk	1/27/1998	Highway	0.25g	Sodium Hydroxide Solution	$0
Norfolk	2/3/1998	Highway	0.75g	Corrosive Liquid Basic Inorganic	$0
Norfolk	2/3/1998	Highway	0.75g	Corrosive Liquid Basic Inorganic	$0
Norfolk	2/25/1998	Highway	0.13g	Flammable Liquids	$125
Norfolk	3/4/1998	Rail		Combustible Liquid	$0
Norfolk	3/4/1998	Highway	0.02g	Styrene Monomer Inhibited	$0
Norfolk	3/26/1998	Highway	0.02g	Corrosive Liquids	$0
Norfolk	4/6/1998	Highway	5.00g	Petroleum Distillates	$125
Norfolk	4/7/1998	Highway	0.02g	Xylenes	$0
Norfolk	5/8/1998	Highway, 1 injury	0.25g	Flammable Liquids	$0
Norfolk	5/29/1998	Highway	0.75g	Flammable Liquids	$0
Norfolk	6/1/1998	Highway	0.25g	Petroleum Distillates	$0
Norfolk	6/10/1998	Highway	0.75g	Hypochlorite Solutions	$125
Norfolk	7/21/1998	Air	2.20 lb	Fire Extinguishers	$0
Norfolk	7/23/1998	Air	0.04g	Paint	$0
Norfolk	8/11/1998	Highway	0.06g	Potassium Hydroxide Solution	$125

TABLE 4.19: HAZARDOUS MATERIALS INCIDENTS (1998 – 2015)					
Community	**Date**	**Mode of Transport & Injuries**	**Quantity Released**	**Commodity**	**Damages**
Norfolk	8/11/1998	Highway	0.13g	Corrosive Liquid Acidic Inorganic	$125
Norfolk	8/11/1998	Highway	0.03g	Flammable Liquids	$125
Norfolk	8/12/1998	Highway	0.06g	Corrosive Liquid Acidic Organic	$125
Norfolk	8/27/1998	Highway	2.00g	Alkylamines	$125
Norfolk	9/10/1998	Highway	5.00g	Combustible Liquid	$100
Norfolk	9/29/1998	Highway	0.75g	Compound Cleaning Liquid	$125
Norfolk	9/30/1998	Highway	0.50g	Corrosive Liquids	$125
Norfolk	11/16/1998	Highway	0.02g	Corrosive Liquid Basic Organic	$0
Norfolk	12/10/1998	Air	0.12g	Corrosive Liquids	$0
Norfolk	1/7/1999	Highway	1.00g	Adhesives	$25
Norfolk	2/1/1999	Highway	0.08g	Toxic Liquid Inorganic	$0
Norfolk	2/8/1999	Highway	0.13g	Corrosive Liquids	$3
Norfolk	2/10/1999	Highway	0.25g	Corrosive Liquid Basic Inorganic	$20
Norfolk	2/12/1999	Highway	0.50g	Isopropanol	$125
Norfolk	3/24/1999	Highway	2.00g	Styrene Monomer Inhibited	$0
Norfolk	5/28/1999	Highway	1.00g	Flammable Liquids	$5
Norfolk	7/23/1999	Highway	1.50g	Phosphoric Acid	$125
Norfolk	7/29/1999	Highway	0.31g	Potassium Hydroxide Solution	$125
Norfolk	8/27/1999	Highway	1.00lb	Sodium Fluorosilicate	$1,483
Norfolk	9/7/1999	Air	0.02g	ISOPROPANOL or ISOPROPYL ALCOHOL	$0
Norfolk	10/27/1999	Highway	0.50g	Corrosive Liquid Basic Inorganic	$5
Norfolk	11/12/1999	Highway	2.00g	Fuel Oil No. 1 2 4 5 Or 6	$0
Norfolk	11/18/1999	Highway	0.07g	Isopropanol	$125
Norfolk	1/4/2000	Air	0.09g	Aerosols Flammable	$0
Norfolk	3/8/2000	Highway	0.06g	Compound Cleaning Liquid	$1
Norfolk	4/21/2000	Highway	0.01g	Coating Solution	$125
Norfolk	5/1/2000	Highway	0.50g	Phosphoric Acid	$125
Norfolk	5/2/2000	Highway	0.50g	Phosphoric Acid	$125
Norfolk	5/2/2000	Highway	1.50g	Battery Fluid Acid	$125
Norfolk	5/3/2000	Highway	25.00g	Corrosive Liquid Basic Inorganic	$1,300
Norfolk	6/21/2000	Highway	0.63g	Carbon Dioxide	$250
Norfolk	6/21/2000	Highway	0.63g	Carbon Dioxide	$250
Norfolk	8/11/2000	Highway	200.00g	Fuel Oil No. 1 2 4 5 Or 6	$200
Norfolk	11/3/2000	Air	0.01g	Toxic Liquids Organic	$0

TABLE 4.19: HAZARDOUS MATERIALS INCIDENTS (1998 – 2015)					
Community	**Date**	**Mode of Transport & Injuries**	**Quantity Released**	**Commodity**	**Damages**
Norfolk	11/20/2000	Highway		Caustic Alkali Liquids	$0
Norfolk	11/22/2000	Highway	1.00g	Regulated Medical Waste	$10
Norfolk	3/13/2001	Highway	18.00g	Gasoline	$4,023
Norfolk	9/20/2001	Highway	50.00g	Gasoline	$3,655
Norfolk	10/10/2001	Highway	3.00g	Sodium Hydroxide Solution	$0
Norfolk	12/19/2001	Air	0.03g	Perfumery Products	$0
Norfolk	1/24/2002	Highway	1.00g	Fuel Oil (No. 1 2 4 5 Or 6)	$1
Norfolk	2/20/2002	Air	0.01g	Flammable Liquids	$0
Norfolk	3/11/2002	Highway	0.00g	Sulfuric Acid	$300
Norfolk	6/20/2002	Rail	1.00g	Flammable Liquids	$0
Norfolk	6/22/2002	Air	1.00 lb	Consumer Commodity	$10
Norfolk	12/19/2002	Highway	1.00g	Corrosive Liquids	$0
Norfolk	8/8/2003	Highway	0.02g	Sodium Hydroxide Solution	$0
Norfolk	8/17/2004	Rail	1.00g	Environmentally Hazmat	$0
Norfolk	1/15/2005	Water	25.00g	Toxic Liquids Corrosive Organic	$0
Norfolk	2/19/2005	Highway	0.06g	Flammable Liquids	$0
Norfolk	2/23/2005	Water		Aerosols Non-Flammable	$0
Norfolk	3/24/2005	Highway	3.00g	Diesel Fuel	$0
Norfolk	5/2/2005	Highway	100.00gg	Fuel Oil Diesel	$0
Norfolk	7/28/2005	Highway	0.13g	Flammable Liquids	$0
Norfolk	8/9/2005	Highway	20.00g	Gasoline	$0
Norfolk	4/24/2006	Highway	0.02g	Hydrogen Peroxide	$0
Norfolk	11/15/2006	Highway	75.00g	Sodium Hydroxide Solution	$0
Norfolk	4/6/2007	Highway	1.00g	Corrosive Liquid Basic Inorganic	$0
Norfolk	4/12/2007	Highway	0.04g	Corrosive Liquids Toxic	$0
Norfolk	6/7/2007	Highway	1.00g	Sulfuric Acid	$0
Norfolk	7/27/2007	Highway	150.00g	Sodium Hydroxide Solution	$16,550
Norfolk	8/30/2007	Highway	0.02g	Sodium Hydroxide Solution	$0
Norfolk	1/24/2008	Highway	0.13g	Paint	$0
Norfolk	6/23/2008	Rail	1.00g	Isopropanol	$2,000
Norfolk	10/16/2008	Highway	0.06g	Paint	$0
Norfolk	2/23/2009	Highway	0.16g	Isopropanol	$0
Norfolk	5/5/2009	Highway	0.08g	Corrosive Liquid Basic Organic	$0
Norfolk	7/15/2009	Highway	0.26g	Nitric Acid	$0
Norfolk	8/18/2009	Air	0.00	Cartridges Small Arms	$0

TABLE 4.19: HAZARDOUS MATERIALS INCIDENTS (1998 – 2015)					
Community	**Date**	**Mode of Transport & Injuries**	**Quantity Released**	**Commodity**	**Damages**
Norfolk	5/2/2010	Water	0.53g	Corrosive Liquid Acidic Inorganic	$4,000
Norfolk	10/10/2010	Water	5.00g	Cadmium Compounds	$11,000
Norfolk	2/14/2011	Highway	0.13g	Ethyl Alcohol	$0
Norfolk	3/20/2011	Air	14.99 lb	Fire Extinguishers	$0
Norfolk	5/8/2011	Air	0.00g	Oxygen	$0
Norfolk	7/11/2011	Highway	18.00 lb	Fire Extinguishers	$0
Norfolk	7/13/2011	Highway	0.17g	Methanol	$0
Norfolk	8/17/2011	Water, 8 injuries	5.00g	2-Dimethylaminoethyl Acrylate	$7,956
Norfolk	9/11/2011	Air	0.13g		$0
Norfolk	1/16/2012	Highway	1.00g	Sulfuric Acid	$0
Norfolk	2/14/2012	Highway	0.26g	Paint	$0
Norfolk	11/15/2012	Highway	16.00 lb	Batteries	$5,000
Norfolk	7/15/2013	Highway	25.00g	Hydrochloric Acid	$0
Norfolk	9/13/2013	Highway	4,500.0g0	Ferric Chloride	$340,000
Norfolk	5/9/2014	Highway	0.24g	Paint	$0
Norfolk	9/29/2014	Highway	0.00	Carbon Dioxide, Solid or Dry Ice	$0
Norfolk	7/17/2015	Highway	5.00g	Diethyl Sulfide	$0
Portsmouth	4/2/1998	Highway	15.00g	Ethylene Glycol Diethyl Ether	$500
Portsmouth	3/19/1999	Highway	400.00g	Dimethyl ethanolamine	$100,000
Portsmouth	9/20/1999	Highway	2.00g	Aluminum Chloride Solution	$0
Portsmouth	11/1/1999	Highway	30.00g	Sulfuric Acid	$30
Portsmouth	12/10/1999	Highway, 1 injury	1.00g	Sulfuric Acid	$1
Portsmouth	2/17/2000	Highway	0.08gg	Formaldehyde Solutions	$0
Portsmouth	8/4/2000	Highway	5.00g	Printing Ink Flammable	$0
Portsmouth	8/15/2001	Highway	1.00g	Resin	$0
Portsmouth	1/31/2002	Highway	0.25g	Chloroform	$500
Portsmouth	3/7/2002	Highway	0.06g	Organic Peroxide Type B Liquid	$0
Portsmouth	2/12/2003	Highway	5.00g	Fuel Aviation Turbine Engine	$18
Portsmouth	3/25/2003	Highway	2.00g	Fuel Aviation Turbine Engine	$9
Portsmouth	9/4/2003	Highway	1.00g	Gasoline	$10
Portsmouth	11/13/2003	Highway	0.20g	Butyl Acetates	$70
Portsmouth	12/12/2003	Highway	5.00g	Compound Cleaning Liquid	$0
Portsmouth	1/5/2004	Highway	15.00g	Fuel Aviation Turbine Engine	$52
Portsmouth	2/22/2005	Highway	10.00g	Paint	$8,100

TABLE 4.19: HAZARDOUS MATERIALS INCIDENTS (1998 – 2015)					
Community	**Date**	**Mode of Transport & Injuries**	**Quantity Released**	**Commodity**	**Damages**
Portsmouth	10/20/2005	Highway	7.50g	Helium Refrigerated Liquid	$0
Portsmouth	10/24/2005	Highway	100.00g	Paint Related Material	$0
Portsmouth	4/26/2007	Highway	0.04g	Corrosive Liquids Toxic	$0
Portsmouth	5/12/2007	Highway	25.00g	Hydrochloric Acid Solution	$0
Portsmouth	5/15/2007	Highway	10.00g	Gasoline	$4,030
Portsmouth	7/12/2007	Highway	1.00g	Paint	$0
Portsmouth	8/8/2007	Highway	0.50g	Paint	$0
Portsmouth	10/24/2007	Highway	0.25g	Paint	$0
Portsmouth	2/11/2008	Highway	0.05g	Paint	$0
Portsmouth	6/27/2008	Highway	0.25g	Paint	$0
Portsmouth	7/3/2008	Highway	0.25g	Hydrogen Peroxide	$0
Portsmouth	8/21/2008	Highway	0.13g	Paint	$0
Portsmouth	9/26/2008	Highway	10.00g	Environmentally Hazmat	$0
Portsmouth	10/24/2008	Highway	0.02g	Amines Liquid Corrosive	$0
Portsmouth	3/26/2009	Rail	0.00	Air Bag Inflators	$0
Portsmouth	8/13/2009	Highway	1.00g	Hydrochloric Acid Solution	$0
Portsmouth	9/17/2009	Highway	0.50g	Corrosive Liquid Basic Organic	$0
Portsmouth	9/28/2009	Highway	1.00g	Paint	$0
Portsmouth	4/28/2010	Highway	0.06g	Corrosive Liquid Acidic Organic	$0
Portsmouth	9/10/2010	Highway	3.00g	Corrosive Liquid Acidic Organic	$0
Portsmouth	1/4/2011	Highway	500.00g	Sulfuric Acid	$5,373
Portsmouth	2/28/2012	Highway, 1 injury	200.00g	Sodium Hydroxide	$0
Portsmouth	8/14/2012	Highway	0.00	Compressed Gas	$0
Portsmouth	10/7/2012	Highway	0.05g	Corrosive Liquid, Basic, Inorganic	$0
Portsmouth	5/9/2013	Highway	5.00g	Paint Related Material	$0
Portsmouth	9/26/2013	Highway	5.00g	Corrosive Liquid, Basic, Inorganic	$0
Portsmouth	10/31/2013	Highway	0.00g	Sulfuric Acid	$0
Smithfield (Isle of Wight Co.)	2/7/2012	Highway	800.00g	Diesel Fuel	$221,000
Suffolk	8/10/1999	Highway	3.00g	Formaldehyde Solutions	$500
Suffolk	8/6/2000	Highway	233.13g	Chlorine	$0
Suffolk	1/8/2001	Highway	10.00cf	Ammonia Anhydrous Liquefied	$40,012
Suffolk	4/17/2001	Highway	75.00g	Fuel Oil No. 1 2 4 5 Or 6	$3,936
Suffolk	8/20/2001	Highway	1287.10g	Methanol	$0
Suffolk	1/27/2002	Highway	7700.00g	Gasoline	$220,500

TABLE 4.19: HAZARDOUS MATERIALS INCIDENTS (1998 – 2015)					
Community	**Date**	**Mode of Transport & Injuries**	**Quantity Released**	**Commodity**	**Damages**
Suffolk	9/30/2002	Rail	2.00g	Acrylic Acid Inhibited	$0
Suffolk	11/20/2005	Highway	4.01cf	Liquefied Petroleum Gas	$21,030
Suffolk	3/16/2006	Rail	0.00g	Sodium Hydroxide Solution	$7,000
Suffolk	10/31/2006	Highway, 2 injuries	20.00g	Petroleum Gases Liquefied	$0
Suffolk	10/2/2009	Highway	5.00g	Hypochlorite Solutions	$0
Suffolk	9/21/2011	Highway	0.10g	Organic Peroxide Type D, Liquid	$0
Virginia Beach	2/11/1998	Highway	4.00g	Potassium Hydroxide Solution	$100
Virginia Beach	4/13/1998	Highway	0.75 lb	Carbamate Pesticides Solid Toxic	$400
Virginia Beach	8/12/1998	Air	0.03g	Gasoline	$0
Virginia Beach	12/7/1998	Air		Gasoline	$0
Virginia Beach	2/22/1999	Highway	20.00g	Fuel Aviation Turbine Engine	$670
Virginia Beach	5/11/1999	Highway	0.01g	Hydrochloric Acid Solution	$250
Virginia Beach	5/19/1999	Air	0.79g	Paint	$0
Virginia Beach	6/17/1999	Air, 1 injury		Styrene Monomer Inhibited	$0
Virginia Beach	7/9/1999	Highway	0.06g	Hydrochloric Acid Solution	$330
Virginia Beach	7/29/1999	Highway	0.06g	Hydrochloric Acid Solution	$220
Virginia Beach	8/9/1999	Highway	0.50g	Hydrochloric Acid Solution	$120
Virginia Beach	8/31/1999	Highway	0.06g	Organic Peroxide Type B Liquid	$220
Virginia Beach	11/5/1999	Highway	1.00 lb	Sodium Hydrosulfide	$145
Virginia Beach	12/9/1999	Highway	1.50g	Toxic Liquids Organic	$225
Virginia Beach	1/30/2000	Air	5.28g	Resin	$0
Virginia Beach	4/27/2000	Highway	0.50g	Corrosive Liquids	$150
Virginia Beach	8/21/2000	Highway	0.25g	Organic Peroxide Type of Liquid	$100
Virginia Beach	10/4/2000	Highway	0.05g	Corrosive Liquids Toxic	$140
Virginia Beach	12/27/2000	Highway	0.02g	Flammable Liquids	$350
Virginia Beach	2/26/2001	Highway	0.50g	Compound Cleaning Liquid	$200
Virginia Beach	6/18/2001	Highway	0.02g	Organic Peroxide Type of Liquid	$300
Virginia Beach	7/23/2001	Highway	0.50g	Adhesives	$200
Virginia Beach	7/24/2001	Highway	0.03g	Caustic Alkali Liquids	$1
Virginia Beach	10/5/2001	Highway		Dichloromethane	$2,550
Virginia Beach	12/19/2001	Air	0.26g	Fuel Aviation Turbine Engine	$0
Virginia Beach	2/17/2002	Highway, 1 injury	0.07cf	Petroleum Gases Liquefied	$0
Virginia Beach	2/20/2002	Highway	0.02g	Carbamate Pesticides Liquid Toxic	$80
Virginia Beach	3/7/2002	Highway	0.02g	Organophosphorus Pesticides	$200

TABLE 4.19: HAZARDOUS MATERIALS INCIDENTS (1998 – 2015)					
Community	**Date**	**Mode of Transport & Injuries**	**Quantity Released**	**Commodity**	**Damages**
Virginia Beach	3/14/2002	Highway	1.00g	Corrosive Liquid Basic Inorganic	$70
Virginia Beach	4/3/2002	Highway	0.50g	Amines Liquid Corrosive	$200
Virginia Beach	4/16/2002	Highway	0.03g	Ammonia Solutions	$225
Virginia Beach	5/13/2002	Highway	0.02g	Toxic Liquids Organic	$240
Virginia Beach	7/12/2002	Highway	1.00 lb	Organophosphorus Pesticides	$1,550
Virginia Beach	8/6/2002	Highway	0.13g	RESIN SOLUTION Flammable	$100
Virginia Beach	6/25/2003	Highway	5.00g	Compound Cleaning Liquid	$185
Virginia Beach	8/8/2003	Highway	0.50g	Petroleum Gases Liquefied	$33,500
Virginia Beach	12/2/2003	Highway	0.05g	Petroleum Distillates	$105
Virginia Beach	12/8/2003	Highway	0.08g	Gas Oil	$120
Virginia Beach	1/6/2004	Highway	0.19 lb	Resorcinol	$0
Virginia Beach	2/19/2004	Highway	0.02g	Isopropanol	$105
Virginia Beach	3/1/2004	Highway	0.50g	Hydrochloric Acid Solution	$195
Virginia Beach	3/19/2004	Highway	4.00g	Environmentally Hazmat	$145
Virginia Beach	3/29/2004	Highway	0.38 lb	Resorcinol	$0
Virginia Beach	8/18/2004	Highway	30.00 lb	Fire Extinguishers	$135
Virginia Beach	11/11/2004	Highway	0.05g	Organic Peroxide Type D Liquid	$1
Virginia Beach	12/8/2004	Highway	0.02g	Corrosive Liquids	$125
Virginia Beach	12/9/2004	Highway	0.26g	Corrosive Liquid Acidic Organic	$105
Virginia Beach	1/31/2005	Highway	2.00 lb	Calcium Hypochlorite Hydrated	$0
Virginia Beach	3/10/2005	Highway	0.09g	Paint	$0
Virginia Beach	4/15/2005	Highway	0.13g	Paint	$0
Virginia Beach	8/22/2005	Highway	0.03g	Toluene	$0
Virginia Beach	9/12/2005	Highway	0.01g	Flammable Liquids	$0
Virginia Beach	9/12/2005	Highway	1.00g	Paint	$0
Virginia Beach	9/23/2005	Highway	1.00g	Paint	$0
Virginia Beach	10/19/2005	Highway	0.75g	Paint	$0
Virginia Beach	11/1/2005	Highway	0.06g	Compound Cleaning Liquid	$0
Virginia Beach	3/20/2006	Highway	1.00g	Paint	$0
Virginia Beach	5/22/2006	Highway	0.50g	Amines Liquid Corrosive	$0
Virginia Beach	6/2/2006	Highway	0.06g	Corrosive Liquid Acidic Inorganic	$0
Virginia Beach	6/27/2006	Highway	0.13g	Methanol	$0
Virginia Beach	7/13/2006	Highway	0.06 lb	Fire Extinguishers	$0
Virginia Beach	7/28/2006	Highway	0.05g	Corrosive Liquids	$0
Virginia Beach	9/21/2006	Highway	12.83cf	Liquefied Petroleum Gas	$0

TABLE 4.19: HAZARDOUS MATERIALS INCIDENTS (1998 – 2015)					
Community	**Date**	**Mode of Transport & Injuries**	**Quantity Released**	**Commodity**	**Damages**
Virginia Beach	9/29/2006	Highway	0.25g	Heptanes	$0
Virginia Beach	10/17/2006	Highway	1.50 lb	Consumer Commodity	$0
Virginia Beach	2/22/2007	Highway	0.09g	Potassium Hydroxide Solution	$0
Virginia Beach	3/22/2007	Highway	0.26g	Flammable Liquids	$0
Virginia Beach	4/19/2007	Highway	0.25g	Corrosive Liquids	$0
Virginia Beach	4/24/2007	Highway	1.00g	Acetic Acid Glacial	$0
Virginia Beach	5/24/2007	Highway	1.00 lb	Fire Extinguishers	$0
Virginia Beach	6/15/2007	Highway	0.50 lb	Fire Extinguishers	$0
Virginia Beach	8/21/2007	Highway	0.13g	Paint	$0
Virginia Beach	10/19/2007	Highway	0.27g	Aerosols Non-Flammable	$0
Virginia Beach	12/4/2007	Highway	0.38 lb	Batteries Wet Filled	$0
Virginia Beach	4/9/2008	Highway	0.06g	Paint	$0
Virginia Beach	4/24/2008	Highway	0.31 lb	Fire Extinguishers	$0
Virginia Beach	6/26/2008	Highway	0.13g	Petroleum Gases Liquefied	$0
Virginia Beach	9/3/2008	Highway	0.09g	Corrosive Liquid Acidic Organic	$0
Virginia Beach	9/4/2008	Highway	1.00g	Paint	$0
Virginia Beach	9/29/2008	Highway	0.00	Aerosols Flammable	$0
Virginia Beach	10/9/2008	Air	0.02g	Corrosive Liquids	$0
Virginia Beach	10/15/2008	Highway	2.00 lb	Consumer Commodity	$0
Virginia Beach	10/29/2008	Highway	0.13g	Ethanol (Ethyl Alcohol)	$0
Virginia Beach	11/6/2008	Highway	1.00 lb	Paint	$0
Virginia Beach	3/11/2009	Highway	0.19 lb	Consumer Commodity	$0
Virginia Beach	4/2/2009	Highway	1.63 lb	Consumer Commodity	$0
Virginia Beach	6/21/2009	Highway	15.00g	Gasoline	$10,050
Virginia Beach	6/24/2009	Highway	0.14g	Paint Related Material	$0
Virginia Beach	7/7/2009	Highway	0.08g	Corrosive Liquids	$0
Virginia Beach	9/2/2009	Air	0.26g	Paint	$0
Virginia Beach	9/3/2009	Highway	1.00g	Paint Related Material	$0
Virginia Beach	10/6/2009	Highway	0.53g	Sodium Hydroxide Solution	$0
Virginia Beach	10/19/2009	Highway	0.14g	Aerosols Flammable	$0
Virginia Beach	10/22/2009	Highway	0.08g	Paint	$0
Virginia Beach	12/10/2009	Highway	0.05g	Consumer Commodity	$0
Virginia Beach	12/18/2009	Highway	5.00g	Alcohols	$0
Virginia Beach	12/18/2009	Air	0.03g	Biological Substance Category B	$0
Virginia Beach	3/2/2010	Highway	0.63g	Isopropyl Alcohol	$0

TABLE 4.19: HAZARDOUS MATERIALS INCIDENTS (1998 – 2015)					
Community	**Date**	**Mode of Transport & Injuries**	**Quantity Released**	**Commodity**	**Damages**
Virginia Beach	3/10/2010	Highway	0.31 lb	Fire Extinguishers	$0
Virginia Beach	3/10/2010	Highway	0.02g	Paint Related Material	$0
Virginia Beach	3/15/2010	Highway	0.03g	Methyl Ethyl Ketone	$0
Virginia Beach	3/24/2010	Highway	0.03g	Amines Liquid Corrosive	$0
Virginia Beach	4/19/2010	Highway	0.50 lb	Fire Extinguishers	$0
Virginia Beach	5/7/2010	Highway	0.04g	Aerosols Flammable	$0
Virginia Beach	5/12/2010	Highway	0.50g	Coating Solution	$0
Virginia Beach	5/24/2010	Highway	0.00g	Consumer Commodity	$0
Virginia Beach	5/24/2010	Highway	0.13g	Hydrochloric Acid Solution	$0
Virginia Beach	5/28/2010	Highway	0.02g	Paint Related Material	$0
Virginia Beach	6/15/2010	Highway	0.02g	Organophosphorus Pesticides	$0
Virginia Beach	7/2/2010	Highway	0.01g	Paint	$0
Virginia Beach	7/9/2010	Air	0.13g	Corrosive Liquids	$0
Virginia Beach	7/26/2010	Air	0.14g	Aerosols Flammable	$0
Virginia Beach	8/17/2010	Highway	1.00g	Caustic Soda Solution	$0
Virginia Beach	9/20/2010	Highway	0.23g	Ethyl Methyl Ketone	$0
Virginia Beach	3/18/2011	Highway	0.08g	Corrosive Liquids	$0
Virginia Beach	7/1/2011	Highway	0.13g	Paint Related Material	$0
Virginia Beach	7/11/2011	Highway	0.09g	Aerosols, Poison, Packing Group III	$0
Virginia Beach	8/12/2011	Highway	0.38g	Amines Liquid, Corrosive	$0
Virginia Beach	8/15/2011	Highway	1.00g	Paint Related Material	$0
Virginia Beach	9/7/2011	Highway	0.25g	Hydrogen Peroxide	$0
Virginia Beach	9/23/2011	Highway	2.00g	Paint Related Material	$0
Virginia Beach	11/1/2011	Highway	20.00g	Coating Solution	$0
Virginia Beach	11/16/2011	Air	0.01g	Dangerous Goods in Machinery	$0
Virginia Beach	11/21/2011	Highway	358.00g	Diesel Fuel	$6,450
Virginia Beach	12/20/2011	Air	0.08g	Dangerous Goods in Machinery	$0
Virginia Beach	1/16/2012	Highway	3.25g	Chloroform	$0
Virginia Beach	2/9/2012	Highway	0.01g	Resin Solution, Flammable	$0
Virginia Beach	3/6/2012	Highway	0.25g	Paint Related Material	$0
Virginia Beach	3/12/2012	Highway	0.25g	Isopropyl Alcohol	$0
Virginia Beach	4/5/2012	Highway	0.02g	Isopropanol	$0
Virginia Beach	4/16/2012	Highway	2.00g	Hydrochloric Acid	$0
Virginia Beach	5/14/2012	Air	0.07g		$0
Virginia Beach	5/16/2012	Highway	0.04g	Corrosive Liquid, Acidic,	$0

TABLE 4.19: HAZARDOUS MATERIALS INCIDENTS (1998 – 2015)					
Community	**Date**	**Mode of Transport & Injuries**	**Quantity Released**	**Commodity**	**Damages**
				Inorganic	
Virginia Beach	8/28/2012	Highway	0.02g	Paint	$0
Virginia Beach	9/20/2012	Air	0.06g		$0
Virginia Beach	1/16/2013	Highway	0.25g	Flammable Liquids	$0
Virginia Beach	3/15/2013	Highway	0.31g	Aerosols, Flammable	$0
Virginia Beach	4/23/2013	Highway	2.00g	Paint Related Material	$0
Virginia Beach	7/23/2013	Highway	1.00g	Paint Related Material	$0
Virginia Beach	9/13/2013	Highway	0.50g	Paint Related Material	$0
Virginia Beach	10/25/2013	Highway	1.00 lb	Smokeless Powder for Small Arms	$0
Virginia Beach	11/23/2013	Air	0.07cf	Carbon Dioxide	$0
Virginia Beach	4/11/2014	Highway	0.25g	Compounds, Tree Killing, Liquid	$0
Virginia Beach	5/30/2014	Highway	1.00g	Resin Solution, Flammable	$0
Virginia Beach	6/6/2014	Highway	0.04g	Flammable Liquids, Toxic	$0
Virginia Beach	6/24/2014	Highway	1.00g	Corrosive Liquid, Basic, Inorganic	$0
Virginia Beach	7/31/2014	Highway	1.00g	Acetone	$0
Virginia Beach	8/5/2014	Air	0.13g	Paint	$0
Virginia Beach	11/13/2014	Highway	1.00g	Denatured Alcohol	$0
Virginia Beach	11/25/2014	Highway	0.09g	Hydrogen Peroxide and Peroxyacetic Acid Mixtures	$0
Virginia Beach	5/12/2015	Highway	0.00g	Corrosive Liquid, Basic, Inorganic	$0
Virginia Beach	7/8/2015	Highway	1.25g	Flammable Liquids	$0
Virginia Beach	7/16/2015	Highway	2.67cf	LPG	$0
Virginia Beach	7/20/2015	Highway	0.00g	Corrosive Liquid, Acidic, Inorganic	$0
Williamsburg	4/27/2001	Highway	475.00g	Gasoline	$6,000
Williamsburg	2/18/2003	Highway	1.00g	Paint Related Material	$50
Williamsburg	9/26/2008	Highway	15.00g	Gasoline	$795
Yorktown (York Co.)	8/4/2006	Highway	25.00g	Fuel Oil (NO. 1, 2, 4, 5, or 6)	$0
Yorktown (York Co.)	1/31/2014	Highway	160.00 lb	Environmentally Hazardous Substances, Solid	$0
Totals		15 injuries			$1,104,153

Source: U.S. Department of Transportation, 2015

PROBABILITY OF FUTURE OCCURRENCES

Future occurrences of HAZMAT incidents, accidents or issues within Hampton Roads are considered to be highly likely.

VULNERABILITY ASSESSMENT

2017 UPDATE

Each of the hazards was reviewed and updated to reflect both the revised information obtained for the updated *Hazard Identification and Analysis* section and the most recent modeling and data collection, primarily for flood. Discussion of vulnerability to Sea Level Rise and Land Subsidence has been updated using the region's most well-regarded sources. All hazard names were edited to provide consistency with the *Hazard Identification and Analysis*. **Table 5.1** was updated with new Hazards U.S. Multi-Hazard (HAZUS-MH) exposure data. **Tables 5.2, 5.3 and 5.4** were updated with more recent NFIP data, **Table 5.5** was created based on newly designated repetitive flood loss areas, and **Table 5.6** contains updated vulnerability data from new HAZUS modeling runs. A revised system of ranking the hazards was added as well. The tables at the end of the section regarding Conclusions on Hazard Risk were all updated. All figures were updated to reflect current conditions.

INTRODUCTION

The *Vulnerability Assessment* section builds on the information provided in the *Hazard Identification and Analysis* section 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
- TROPICAL/COASTAL STORM
- SHORELINE EROSION
- TORNADO
- WINTER STORM
- EARTHQUAKE
- WILDFIRE
- DROUGHT
- EXTREME HEAT
- HAZARDOUS MATERIALS INCIDENT

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 somewhat ***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.

QUANTITATIVE METHODOLOGY

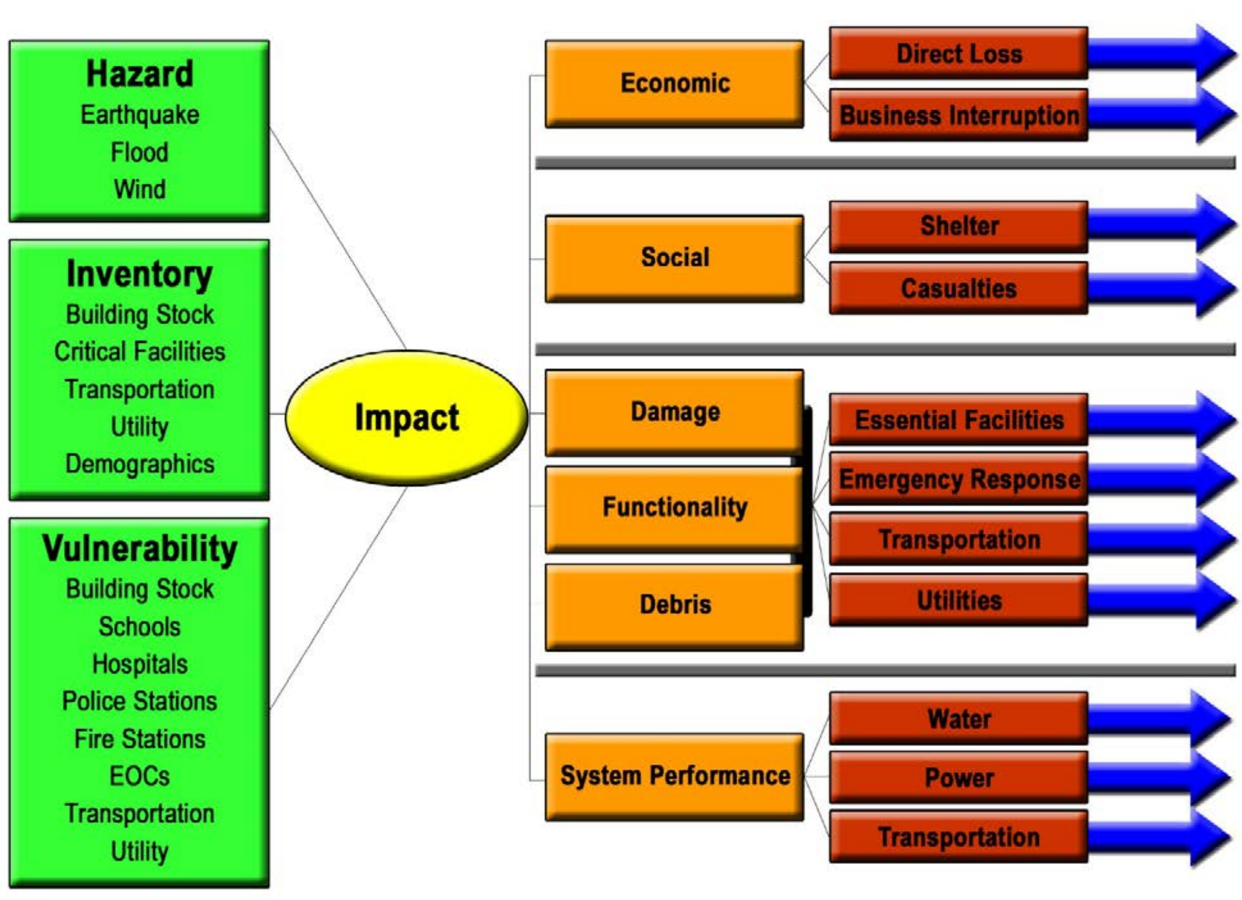
The quantitative assessment involved the use of the most recent version of Hazards U.S. Multi-Hazard software, a geographic information system (GIS)-based loss estimation tool available from FEMA, along with a statistical risk assessment methodology for hazards outside the scope of HAZUS-MH. For the 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 three of the hazards addressed in this section: flooding, tropical/coastal storm winds, and earthquake. For each of these hazards, HAZUS-MH was used to generate probabilistic "worst case scenario" events to show the extent of potential damages. Both earthquake and wind were modeled using HAZUS Level 1 and flood was modeled using HAZUS Level 2.

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 in previous plans, this method was applied to generate potential loss estimates. The approach was based on the same principles as HAZUS-MH, but did not rely on readily available automated software. Historical data were compiled for each hazard to relate occurrence patterns with existing hazard models. Statistical evaluations were then applied in combination with engineering modeling to develop damage functions that generate annualized losses.

The use of the statistical risk assessment methodology was used in previous plans to provide a determination of estimated annualized loss[1] for several hazards. However, in recent years, the historical data from which these conclusions were made have become less reliable. For example, damages for wildfire were not reported for the two most recent reporting periods, and the communities reviewing the

[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.

historical damage data from the NCDC expressed concern that the damages were severely underestimated. Until more reliable historical damage data can be provided, a more qualitative methodology for examining historical losses and making conclusions about future risk was needed as shown below.

Despite the shortcomings of certain historical data, this analysis included collection of and updates to relevant GIS data from local, state and national sources. These sources include each community's GIS Department, FEMA, Virginia Department of Forestry (VDOF), and NOAA. Once all data were acquired, GIS was used to demonstrate and spatially analyze risks to people, public buildings and infrastructure. 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 Hampton Roads is based on committee member dot voting to indicate their priorities for mitigation spending. The members present at the first planning meetings on October 21, 22 and 23, 2015, 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 5.15** at the end of this section. Communities were reminded of a full range of hazards based on the hazards included in the previous mitigation actions for the region, including: flood, sea level rise, tropical storm, severe thunderstorm, tsunami, urban fire, winter storm/nor'easter, drought, dam failure, tornado, extreme heat, earthquake, wildfire, erosion, sinkhole, mosquito diseases, hazardous materials incidents, terrorism, biological threats, radiological threats, and pandemic flu. Although this list is not a comprehensive list of all hazards that may ever impact the region, the resultant hazards summarized in this section were determined by committee members to be the necessary hazards for the purposes of determining mitigation actions.

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 the planning committee. 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 region provided planning committee members 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 region 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 each jurisdiction.

OVERVIEW OF VULNERABILITY

GENERAL ASSET INVENTORY

The total dollar exposure of buildings within the study area is estimated to be almost $197 billion. This figure is based on an estimated 560,000 buildings located throughout the region based on the HAZUS default inventory (**Table 5.1**). The data provide an estimate of the aggregated replacement value for the region's assets and indicate that at least 60 percent of the structures are of wood construction.

TABLE 5.1: EXPOSURE OF THE BUILT ENVIRONMENT

SUBREGION	COMMUNITY	BUILDING INVENTORY BY TYPE OF CONSTRUCTION			
		WOOD	MANUFACTURED HOMES	MASONRY, CONCRETE, STEEL	TOTAL
Peninsula	Hampton	$9,417,390,000	$35,354,000	$5,869,377,000	$15,322,121,000
	Newport News	$12,025,853,000	$95,133,000	$8,591,073,000	$20,712,059,000
	Poquoson	$1,170,328,000	$7,518,000	$505,595,000	$1,683,441,000
	Williamsburg	$897,152,000	$0	$1,031,132,000	$1,928,284,000
	James City County	$6,443,669,000	$62,242,000	$3,528,137,000	$10,034,048,000
	York County	$6,115,462,000	$16,293,000	$3,085,417,000	$9,217,172,000
Southside	Norfolk	$14,220,270,000	$28,826,000	$14,923,791,000	$29,172,887,000
	Portsmouth	$6,249,290,000	$14,733,000	$4,002,116,000	$10,266,139,000
	Suffolk	$6,245,529,000	$48,297,000	$3,368,659,000	$9,662,485,000
	Virginia Beach	$35,038,833,000	$77,650,000	$19,926,533,000	$55,043,016,000
	Chesapeake	$17,095,310,000	$93,252,000	$9,501,654,000	$26,690,216,000
Western Tidewater	Isle of Wight County	$2,730,967,000	$83,702,000	$1,565,721,000	$4,380,390,000
	Franklin	$504,056,000	$0	$407,347,000	$911,403,000
	Southampton County	$1,088,809,000	$50,583,000	$656,343,000	$1,795,735,000
TOTAL		**$119,242,918,000**	**$613,583,000**	**$76,962,895,000**	**$196,819,396,000**

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 typically 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 the region; however, for the HAZUS modeling performed for this risk analysis, each community provided their own list of what they consider essential facilities:

- 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

Table 5.2 shows the results of a simple overlay analysis of the essential facilities that are located in the 100-year floodplain, 500-year floodplain, and the Storm Surge Zone for a Category 3 hurricane.

TABLE 5.2: CRITICAL FACILITIES LOCATED IN HAZARD AREAS

SUBREGION	COMMUNITY	100-YEAR FLOODPLAIN	500-YEAR FLOODPLAIN	STORM SURGE ZONE (CATEGORY 3 STORM)
Peninsula	Hampton	3	7	24
	Newport News	2	0	4
	Poquoson	3	3	0
	Williamsburg	0	0	0
	James City County	7	0	0
	York County	7	10	2
Southside	Norfolk	9	5	47
	Portsmouth	2	3	8
	Suffolk	2	0	4
	Virginia Beach	26 (2 V Zone)	14	65
	Chesapeake	4	3	20
Western Tidewater	Isle of Wight County	0	0	0
	Franklin	1	0	0
	Southampton County	4	8	0
REGION TOTAL		**70**	**53**	**174**

FLOODING

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.

As described in detail in the *Hazard Identification and Analysis* section, the NCDC has records for 87 significant flood events in the past 20 years (1995 to 2015) for the region, amounting to approximately $130 million 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 region. Historically, Hampton Roads is vulnerable to the flood hazard and flood events, which occur on a frequent basis.

NFIP STATISTICS AND REPETITIVE LOSS PROPERTIES

Table 5.3 provides basic background information regarding the number of flood insurance policies and the value of those policies for NFIP-participating communities in the study area. As shown in Table 5.3, the communities in the Hampton Roads region joined the NFIP throughout the 1970s, 1980s and into the 1990s. In order to join the NFIP, each participating jurisdiction is required to adopt and enforce its own floodplain management ordinance. As a result, structures built after joining the NFIP are assumed to be less vulnerable to flood hazards than those built prior to joining, assuming other environmental conditions remain constant.

TABLE 5.3: NFIP DATA FOR PARTICIPATING COMMUNITIES					
SUBREGION	COMMUNITY	NFIP ENTRY DATE	CURRENT EFFECTIVE FIRM DATE	CURRENT NUMBER OF NFIP POLICIES	INSURANCE IN-FORCE
Peninsula	Hampton	1/15/1971	8/16/2011	11,076	$2,752,401,900
	Newport News	5/2/1977	12/9/2014	2,515	$627,732,100
	Poquoson	5/16/1977	12/16/2014	3,310	$877,069,600
	Williamsburg	11/20/1981	9/28/2007	47	$11,971,100
	James City County	2/6/1991	12/16/2015	1,006	$275,598,300
	York County	12/16/1988	1/16/2015	3,394	$980,284,400
Southside	Norfolk	8/1/1979	12/16/2014	12,324	$3,203,123,000
	Portsmouth	7/2/1971	8/3/2015	3,618	$884,828,100
	Suffolk	11/16/1990	8/3/2015	943	$280,794,800
	Virginia Beach	4/23/1971	1/16/2015	24,200	$6,453,533,800
	Chesapeake	2/2/1977	12/16/2014	8,841	$2,383,084,100
Western Tidewater	Isle of Wight County	8/19/1991	9/4/2002	397	$116,904,100
	Smithfield	12/5/1990	9/4/2002	108	$32,979,900
	Windsor	8/1/1990	9/4/2002	6	$1,204,000
	Franklin	8/15/1980	9/4/2002	148	$39,465,400
	Southampton County	12/15/1982	9/4/2002	127	$26,582,600
	Boykins	4/1/1982	9/4/2002	7	$1,901,500
	Branchville	3/30/1979	9/4/2002	0	$0
	Courtland	7/5/1982	9/4/2002	20	$5,822,600
	Ivor	11/4/2002	No Special Flood Hazard Area	1	$350,000
Totals				**72,088**	**$18,955,631,300**

Source: NFIP Policy Statistics as of April 30, 2015 (not cumulative)

Reducing the number of repetitive loss (RL) properties insured by the NFIP is a nationwide emphasis of FEMA. An RL is defined as any insurable building for which two or more claims of more than $1,000 were paid by the NFIP within any rolling 10-year period, since 1978. A repetitive loss property may or may not be currently insured by the NFIP. An RL property may or may not be currently insured by the NFIP. Per data provided by the Virginia Department of Conservation and Recreation in June 2015, a total of 4,514 RL properties as defined by the NFIP have been identified within the study area communities. These 4,514 properties have experienced a total of $239 million individual insured losses for the structure and contents combined. The average payment for each qualifying claim was $19,190. There are 4,408 residential properties (98 percent) and 106 non-residential properties on the list.

The NFIP also designates severe repetitive losses (SRL) in a community. As defined by the Flood Insurance Reform Act of 2004, SRLs are 1- to 4-family residences that have had four or more claims of more than $5,000 or at least two claims that cumulatively exceed the building's value. The Act created new funding mechanisms to help mitigate flood damage for these properties. The study area communities have 319 SRL properties identified by the NFIP, with a total of 1,713 losses. Total payments for these 319 properties were over $42 million. **Table 5.4** provides summary details for the communities with regard to each community's repetitive losses.

TABLE 5.4: NFIP REPETITIVE LOSS PROPERTIES

REGION	COMMUNITY	REPETITIVE FLOOD LOSSES			
		NUMBER OF PROPERTIES	VALUE OF LOSSES	NUMBER OF LOSSES	AVERAGE PAYMENT PER CLAIM
Peninsula	Hampton	936	$48,166,174	2541	$18,956
		SEVERE REPETITIVE FLOOD LOSSES			
		70	$10,407,881	365	$28,515
	Newport News	121	$13,037,268	294	$44,344
		SEVERE REPETITIVE FLOOD LOSSES			
		3	$189,943	11	$17,268
	Poquoson	971	$42,927,508	2375	$18,075
		SEVERE REPETITIVE FLOOD LOSSES			
		25	$3,033,475	117	$25,927
	Williamsburg	4*	$104,271	9	$11,586
	James City County	35	$2,345,563	95	$24,690
		SEVERE REPETITIVE FLOOD LOSSES			
		2	$146,768	8	$18,346
	York County	236	$15,330,549	560	$27,376
		SEVERE REPETITIVE FLOOD LOSSES			
		11	$1,772,861	50	$35,457
Southside	Norfolk	958	$48,354,230	2837	$17,044
		SEVERE REPETITIVE FLOOD LOSSES			
		93	$12,251,484	516	$23,743
	Portsmouth	229	$10,009,951	631	$15,864
		SEVERE REPETITIVE FLOOD LOSSES			
		16	$2,070,120	86	$24,071
	Suffolk	17	$2,285,818	50	$45,716
	Virginia Beach	574	$34,205,856	1768	$19,347
		SEVERE REPETITIVE FLOOD LOSSES			
		62	$8,673,919	361	$24,027
	Chesapeake	395	$19,611,525	1214	$16,154
		SEVERE REPETITIVE FLOOD LOSSES			
		37	$3,523,288	199	$17,705
Western Tidewater	Isle of Wight County	23	$1,584,416	60	$26,407
	Smithfield	3	$71,418	7	$10,203
	Franklin	6	$686,165	12	$57,180
	Southampton County	9	$557,595	19	$29,347
Totals		4,514	$239,206,889	12,465	19190
		SEVERE REPETITIVE FLOOD LOSSES			
		319	$42,069,739	1,713	24559

** Williamsburg officials have conducted additional research into these data and contend the data do not represent a pattern of repetitive flooding.*
Sources: FEMA and NFIP (as of July 2015)

Figures 5.2 through 5.9 contain maps of the region's repetitive loss areas. Each designated area was identified by referencing maps of all historical NFIP flood claims, NFIP RL lists, the SRL list, a Digital

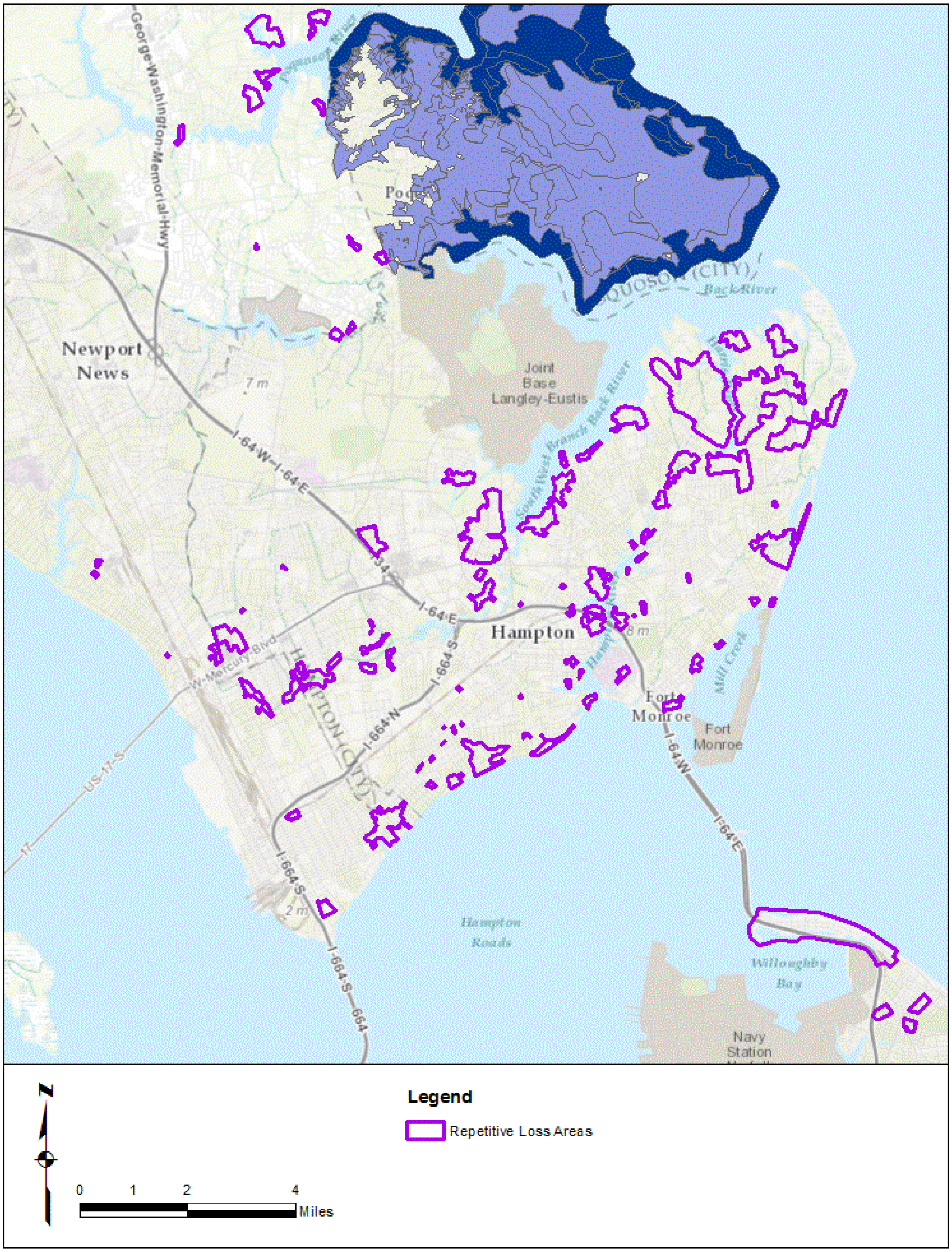
Elevation Model (DEM)-based depth grid of the 100-year floodplain, and the HAZUS results regarding predicted flood damages from a 100-year flood for individual structures. As shown in **Table 5.5**, There are 4,514 properties on FEMA's repetitive loss list and an additional 55,179 parcels identified as being within those repetitive loss areas. Other structures near the ones listed by the NFIP may have been uninsured during the floods, may have had single flood insurance claims, or may have had multiple claims under different policies that the claims system did not recognize as being the same repetitively flooded address.

TABLE 5.5: REPETITIVE FLOOD LOSS AREA DETAILS

REGION	COMMUNITY	REPETITIVE FLOOD LOSS AREAS		
		NUMBER OF RL AREAS	NUMBER OF PROPERTIES OR BUILDINGS	SOURCES OF FLOODING
Peninsula	Hampton	71	8,940	Low-lying land along the banks of tidal rivers and creeks are regularly inundated by nor'easters and tropical storms. Newmarket Creek overflows banks during coastal storms and heavy rains. Wind driven storm tides drive water into smaller tributaries and flood low-lying areas. Along Chesapeake Bay, wind and wave velocity, coastal flooding and overwash during coastal storms causes damage.
	Newport News	24	1,113	Low-lying land along the banks of tidal rivers and creeks are regularly inundated by nor'easters and tropical storms. Newmarket Creek overflows banks during coastal storms and heavy rains. Wind driven storm tides drive water into smaller tributaries and flood low-lying areas. Along James River, wind and wave velocity, coastal flooding and overwash during coastal storms causes damage.
	Poquoson	1	4,810	Low-lying land along the banks of tidal rivers and creeks are regularly inundated by nor'easters and tropical storms.
	James City County	10	643	Low-lying land along the banks of tidal rivers and creeks are regularly inundated by nor'easters and tropical storms. Stormwater drainage from heavy rains cause flooding in some riverine watersheds.
	York County	15	3,323	Low-lying land along the banks of tidal rivers and creeks are regularly inundated by nor'easters and tropical storms.
Southside	Norfolk	89	11,933	Low-lying land along the banks of tidal rivers and creeks are regularly inundated by nor'easters and tropical storms. Stormwater drainage from heavy rains cause flooding in some riverine watersheds. Tidal inundation of stormwater system increases flooding in some neighborhoods.
	Portsmouth	25 maps	1,974	Low-lying land along the banks of tidal rivers and creeks are regularly inundated by nor'easters and tropical storms. Stormwater drainage from heavy rains cause flooding in some riverine watersheds. Tidal inundation of stormwater system increases flooding in some neighborhoods. Seawall damaged.
	Suffolk	12	81	Low-lying land along the banks of tidal rivers and creeks are regularly inundated by nor'easters and tropical storms.
	Virginia Beach	6	18,939	Low-lying land along the banks of tidal rivers and creeks are regularly inundated by nor'easters and tropical storms. Stormwater drainage from heavy rains cause flooding in some riverine watersheds. Tidal inundation of stormwater system increases flooding in some neighborhoods.

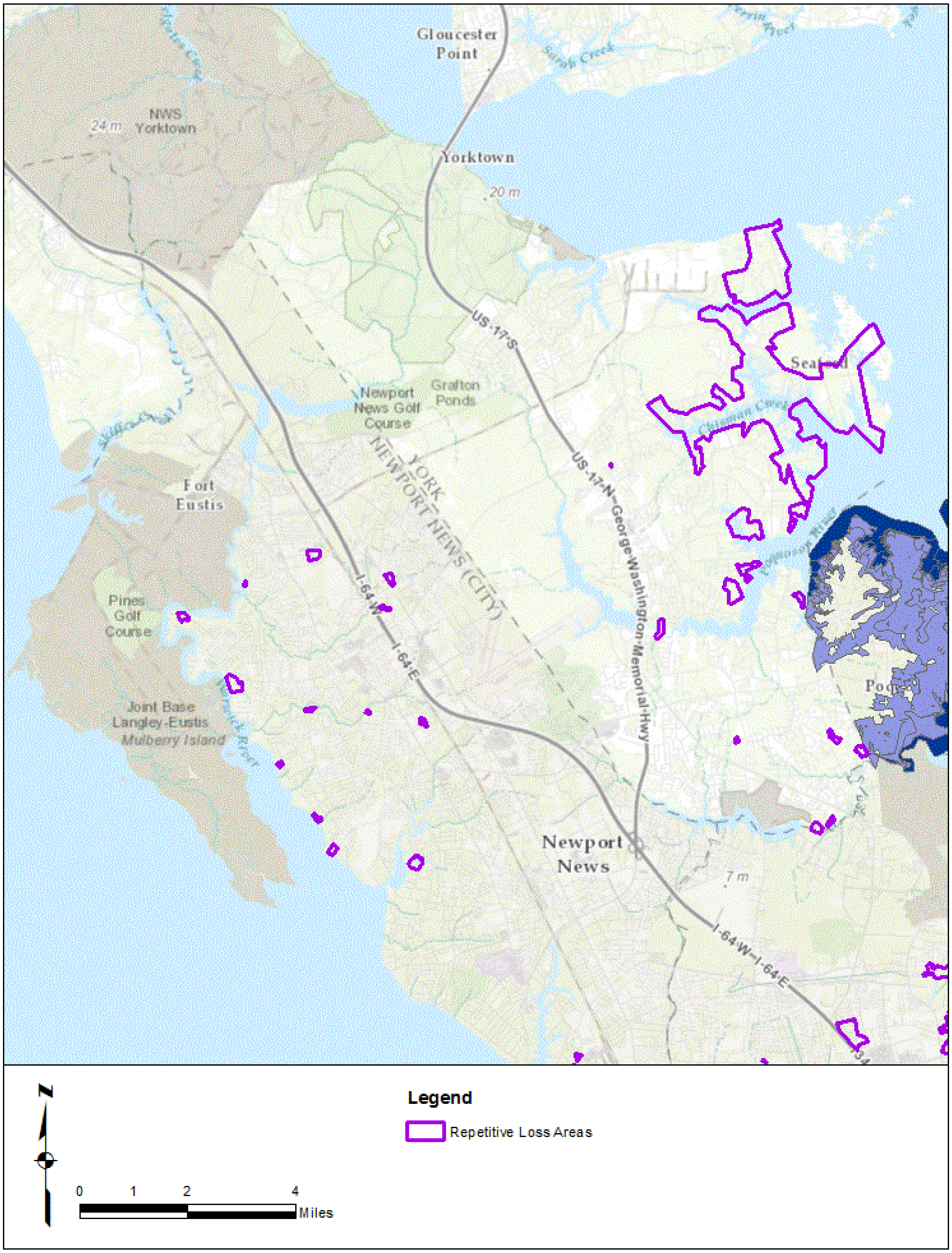
TABLE 5.5: REPETITIVE FLOOD LOSS AREA DETAILS				
REGION	COMMUNITY	REPETITIVE FLOOD LOSS AREAS		
		NUMBER OF RL AREAS	NUMBER OF PROPERTIES OR BUILDINGS	SOURCES OF FLOODING
	Chesapeake	47	3,011	Low-lying land along the banks of tidal rivers and creeks are regularly inundated by nor'easters and tropical storms. Flat terrain hinders stormwater
Western Tidewater	Isle of Wight County	13	151	Low-lying land along the banks of tidal rivers and creeks are regularly inundated by nor'easters and tropical storms.
	Smithfield	1	45	Low-lying land along the banks of tidal rivers and creeks are regularly inundated by nor'easters and tropical storms.
	Franklin	2	462	Blackwater River overflows its banks and tributary banks as a result of heavy rain in the upper parts of the watershed causing severe flooding in the downtown area.
	Southampton County	4	74	The Blackwater and Nottoway River systems overflow their banks as a result of heavy rain in the watershed, causing pockets of flooding especially where tributaries flow into main rivers.
Totals		320	55,499	

FIGURE 5.2: NFIP REPETITIVE FLOOD LOSS AREAS, LOWER PENINSULA



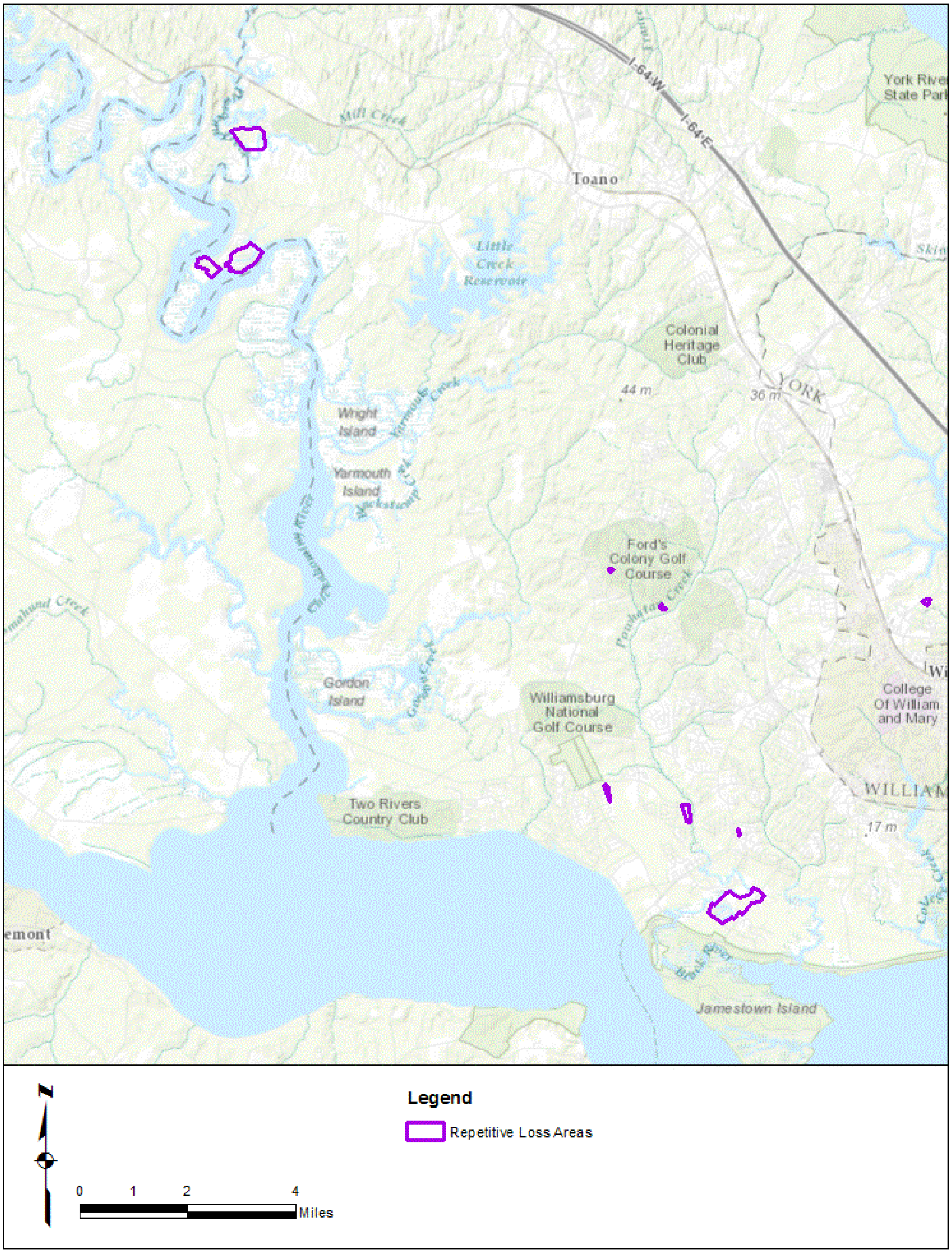
**Poquoson designated entire SFHA as repetitive loss area*
Source: VDEM, 2015 data

FIGURE 5.3: NFIP REPETITIVE FLOOD LOSS AREAS, MIDDLE PENINSULA



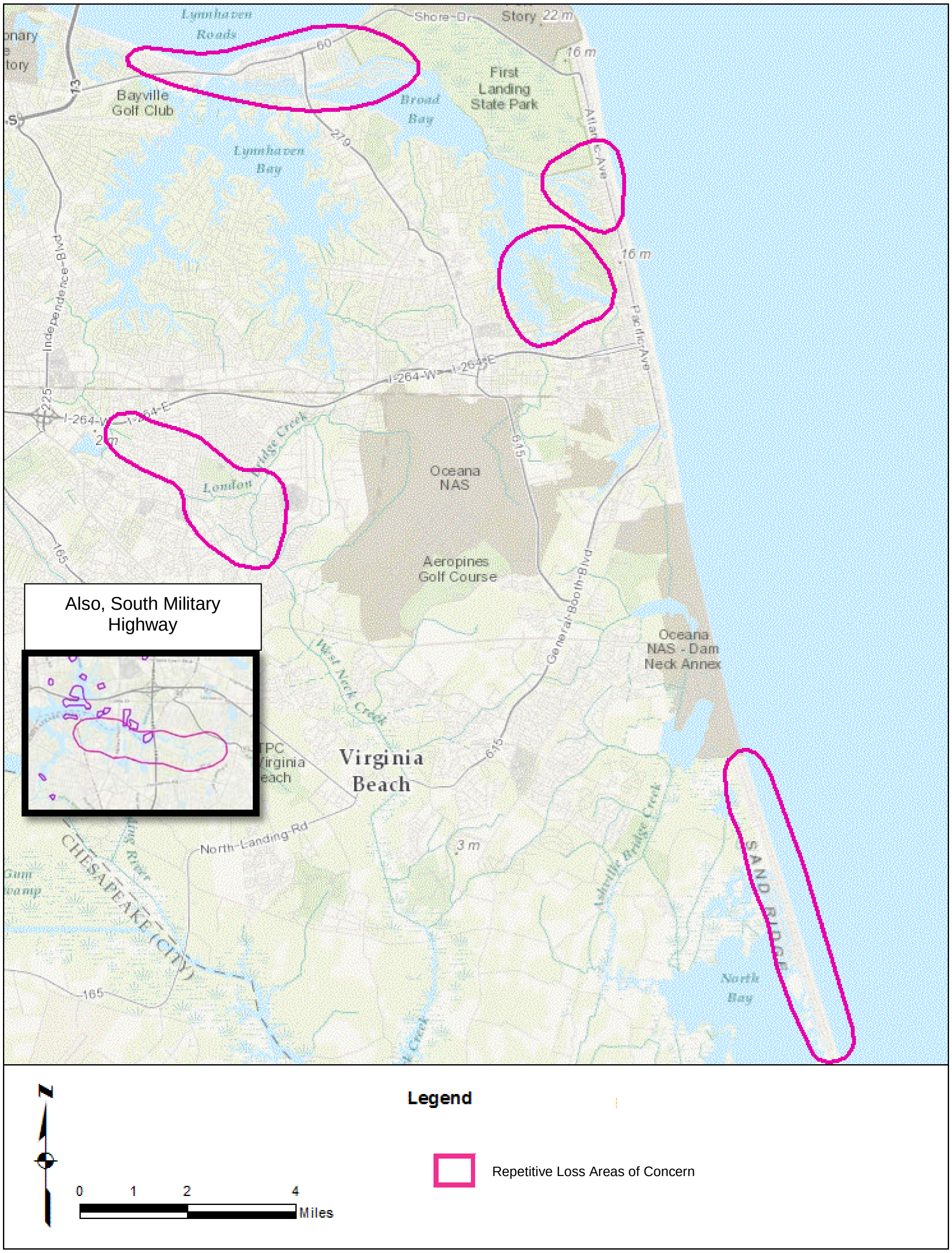
Source: *VDEM, 2015 data*

FIGURE 5.4: NFIP REPETITIVE FLOOD LOSS AREAS, UPPER PENINSULA



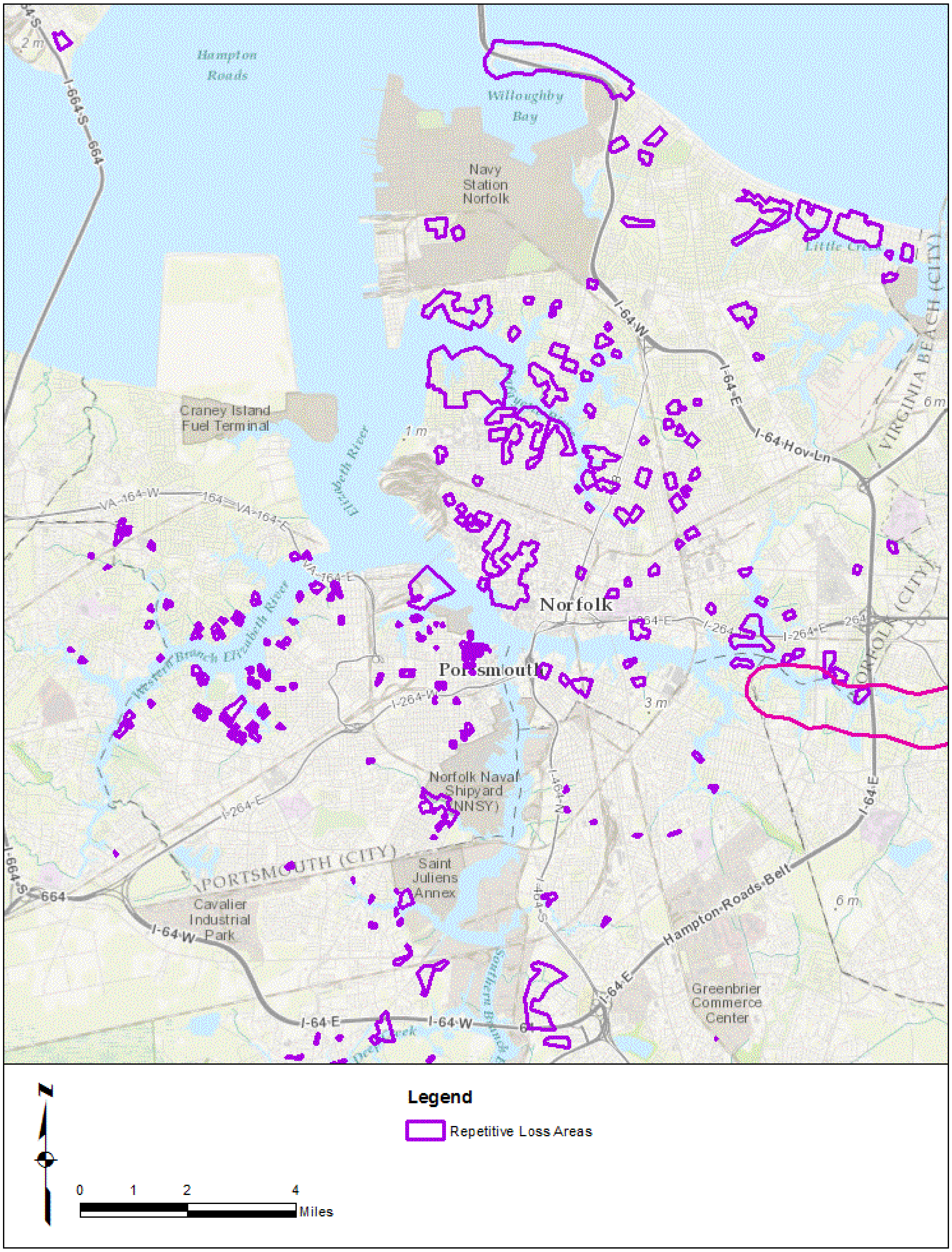
Source: VDEM, 2015 data

FIGURE 5.5: NFIP REPETITIVE FLOOD LOSS AREAS OF CONCERN, VIRGINIA BEACH



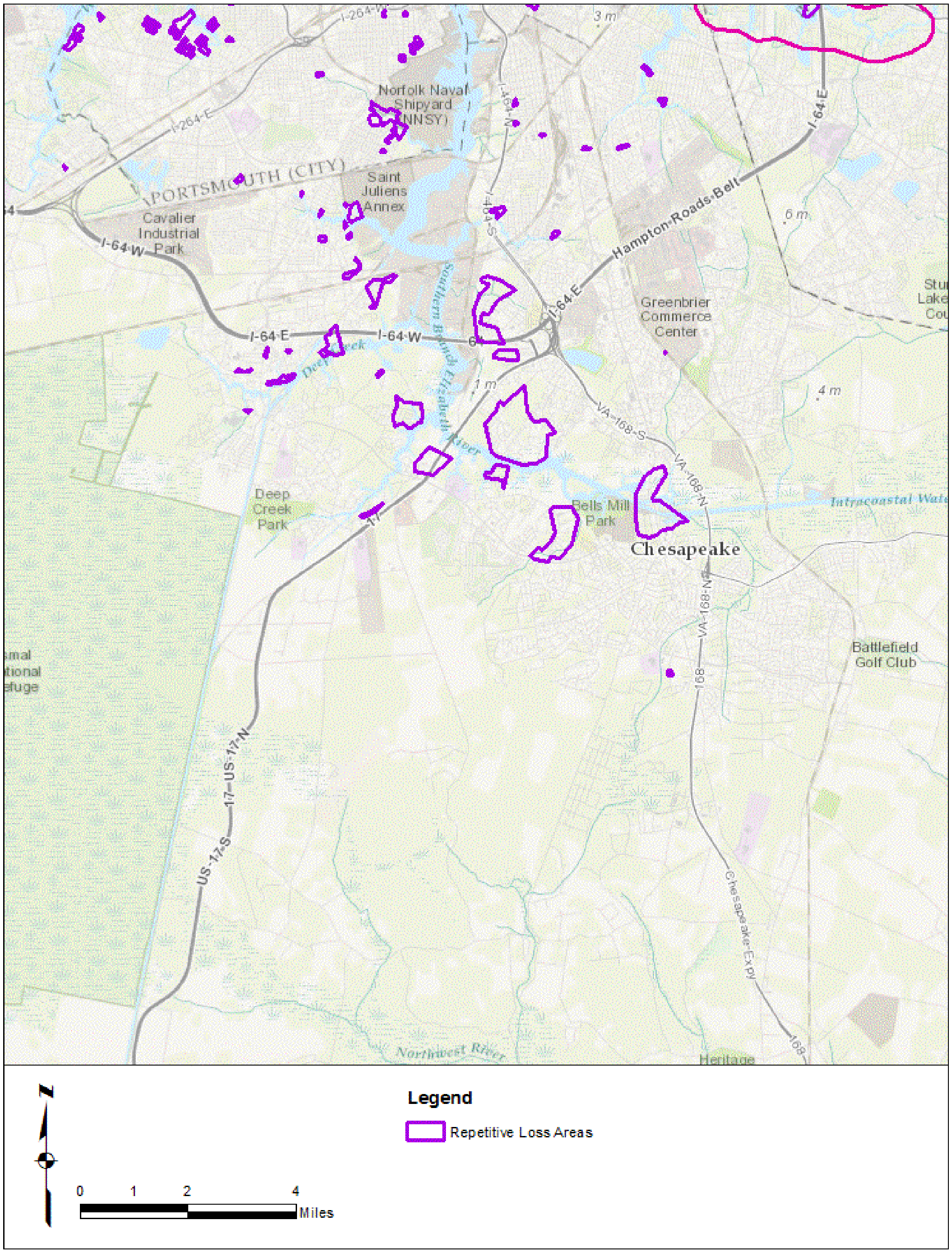
Source: VDEM, 2015 data

FIGURE 5.6: NFIP REPETITIVE FLOOD LOSS AREAS, NORFOLK, PORTSMOUTH



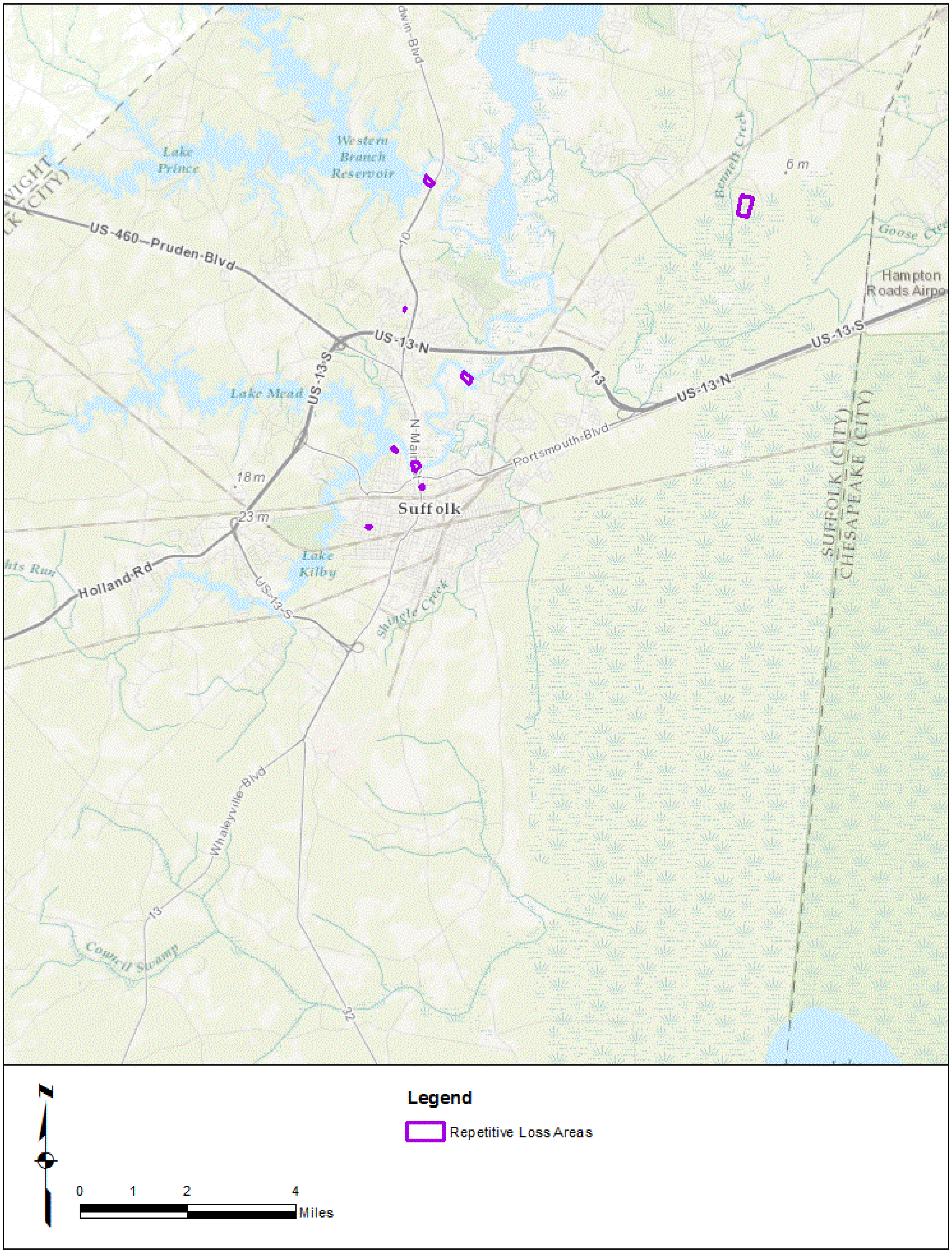
Source: *VDEM, 2015 data*

FIGURE 5.7: NFIP REPETITIVE FLOOD LOSS AREAS, CHESAPEAKE



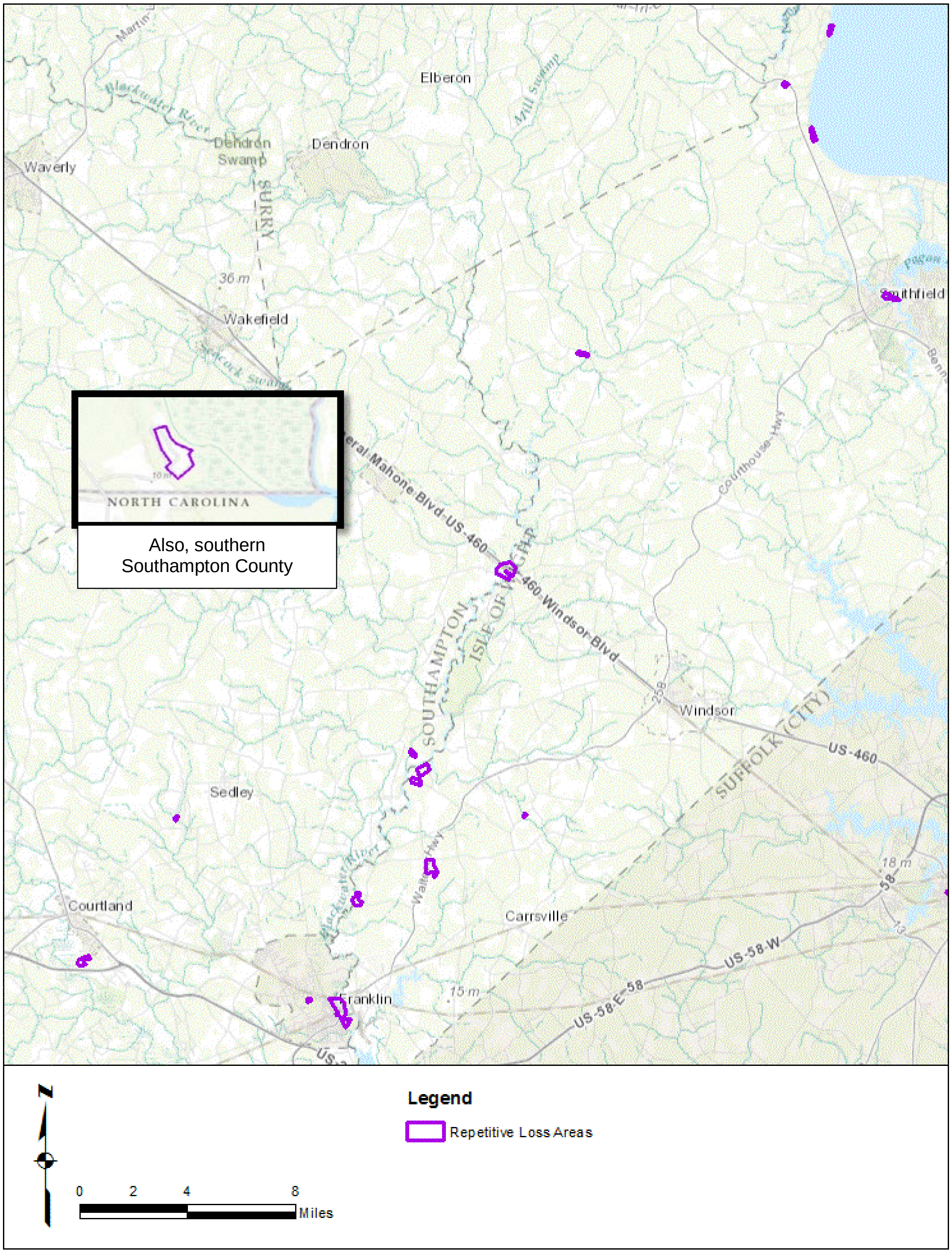
Source: VDEM, 2015 data

FIGURE 5.8: NFIP REPETITIVE FLOOD LOSS AREAS, SUFFOLK



Source: VDEM, 2015 data

FIGURE 5.9: NFIP REPETITIVE FLOOD LOSS AREAS, ISLE OF WIGHT, SMITHFIELD, SOUTHAMPTON COUNTY, FRANKLIN



Source: VDEM, 2015 data

ESTIMATES OF POTENTIAL LOSSES

For the updated flood vulnerability analysis, participating communities were asked to share as much information as possible about individual structures in their communities, including:

- Elevation Certificate data or lowest floor elevation;
- address;
- year built;
- number of stories;
- building cost;
- content cost;
- building type;
- square footage;
- construction class;
- foundation type; and/or
- occupancy/use code.

As part of the flood hazard vulnerability assessments, analysts used the datasets provided by each community to construct the necessary base datasets required by HAZUS to conduct a detailed, Level 2 hazard assessment. The following highlights the data source and processing methodology for each of the input datasets required by HAZUS:

Digital Elevation Model (DEM)
The DEM used for the HAZUS analysis was developed by the Hampton Roads Planning District Commission by combining three separate LiDAR-derived DEMs. The three datasets were acquired between 2010 and 2014. Together, the datasets provide coverage for all of the Hampton Roads Planning District:

1) Isle of Wight County, James City County, Suffolk, and Williamsburg (2010)
2) Franklin and Southampton County (2012)
3) Chesapeake, Hampton, Newport News, Norfolk, Poquoson, Portsmouth, Virginia Beach, and York County (2014)

The individual datasets were mosaicked together in ArcGIS, with priority given to the most recent and most accurate datasets. The original DEMs did not have the same horizontal resolution, so as part of the merging process they were each resampled to a resolution of five feet. The coordinate system for the DEM is NAD 1983 HARN State Plane Virginia South, and the vertical datum is the North American Vertical Datum of 1988.

Flood Hazard Data and Depth Rasters
Geospatial analysts obtained the most recent effective Digital Flood Insurance Rate Map databases from the FEMA Map Service Center for the region. The 100-year floodplain boundary and associated Base Flood Elevations (BFE) were used as the flooding source input to HAZUS for calculating the loss estimations.

User Defined Facilities (Building Data)
Each community provided building data in the form of either parcels, building footprints or address points. The datasets were inconsistent across the communities, but from each dataset, analysts were able to determine the basic structural attributes (i.e. value, foundation type, occupancy class, etc.) required by HAZUS to perform a loss estimation.

First Floor Elevations (FFE)
Each structure was assigned a relative FFE according to the guidelines listed in the HAZUS Flood Model Technical Manual. These values were neither surveyed nor field verified, but were instead algorithmic estimates provided by HAZUS. For example, a structure with a slab-on-grade foundation would have a FFE of 1 foot above Highest Adjacent Grade (HAG) and a crawl space foundation would have a FFE of 3 feet over HAG. This data input is identified as a potential area for increasing the accuracy of the model output in future updates to the plan. By collecting and using real-world data on FFEs, the model will provide more accurate results for individual structures.

Using the DEM, depth rasters and building data listed above, a building level 100-year flood vulnerability analysis was conducted for each flood-prone community. HAZUS uses the associated 100-year depth at each structure and compares that to the assigned FFE to determine the predicted depth of flooding at each structure. Then, using depth damage curves, HAZUS determines the building and content damage percentage for each structure, which corresponds to a dollar figure based on the assessed value of each structure.

Table 5.6 provides a detailed listing of the number of structures expected to be damaged, and the dollar losses predicted. In previous HAZUS runs for these regional hazard mitigation plans, the flood vulnerability results were run using HAZUS Level 1 which combines or estimates damages at the Census tract level – there is no building level analysis so the results are predictably greater than with HAZUS Level 2. As expected, the vulnerability analysis summarized in Table 5.6 shows a reduction over previous Level 1 analyses, but many committee members expressed concern that the results are perhaps too low and do not accurately reflect the conditions experienced after Hurricane Isabel, which resembled a 100-year frequency flood event in many parts of Hampton Roads. The key data missing are the exact FFE for flood-prone structures, which would greatly improve the accuracy of the estimated vulnerability.

TABLE 5.6: HAZUS FLOOD DAMAGE VULNERABILITY RESULTS

SUBREGION	COMMUNITY	NUMBER OF BUILDINGS MODERATELY DAMAGED (15-49% OF VALUE)	NUMBER OF BUILDINGS SUB-STANTIALLY DAMAGED	BUILDING LOSSES	CONTENT LOSSES	INVENTORY LOSSES
Peninsula	Hampton	1,696	0	$66,454,685	$36,858,927	$5,537,339
	Newport News	463	8	$49,965,691	$102,837,473	$48,883,533
	Poquoson	1,088	12	$39,310,852	$19,174,311	$539,678
	Williamsburg	2 structures in Special Flood Hazard Area (SFHA); no damage predicted.				
	James City County	20	0	$1,453,197	$473,439	$0
	York County	146	0	$109,911,650	$204,923,596	$211,317,219
Southside	Norfolk	1,154	0	$81,875,507	$99,171,200	$28,227,113
	Portsmouth	94	5	$14,015,336	$20,583,938	$30,098,433
	Suffolk	5	0	$190,938	$447,274	$503,228
	Virginia Beach	356	0	$19,861,960	$20,552,564	$3,542,009
	Chesapeake	1,260	0	$73,665,489	$50,414,821	$14,776,711
Western Tidewater	Isle of Wight County	17	0	$4,068,078	$8,694,919	$7,975,198
	Smithfield	9	0	$4,424,147	$14,472,143	$15,873,322
	Windsor	0	0	$0	$0	$0
	Franklin	75	0	$7,174,366	$21,436,438	$19,024,847
	Southampton County	88	3	$4,253,048	$3,928,022	$2,017,067
	Boykins	2	0	$12,283	$6,432	$0
	Branchville	0	0	$0	$0	$0
	Capron	0	0	$0	$0	$0
	Courtland	0	0	$66,830	$24,427	$0
	Ivor	0	0	$0	$0	$0
	Newsoms	0	0	$0	$0	$0
Totals		6,473	28	**$476,704,057**	**$603,999,924**	**$388,315,697**

Sources: HAZUS-MH

Clearly, much of the Hampton Roads region is susceptible to costly damage resulting from flood events and Figures 4.1 through 4.10 indicate where the flood risk is highest. The lower Peninsula (Hampton and Poquoson) and developed areas of Southside (Norfolk, Virginia Beach, Chesapeake and Portsmouth) have the highest numbers of repetitive losses and highest predicted number of structures expected to be damaged in a 100-year flood event based on the HAZUS data. Hampton, Poquoson, Norfolk and Chesapeake all have more than 1,000 structures that are highly vulnerable to the 100-year flood event, and these areas are likely the most vulnerable in the region. York County has fewer structures susceptible, but the value of those structures is higher, so the vulnerability is consequently higher. The repetitive flood loss areas shown in Figures 5.2 through 5.9 indicate where within each community the flood damage has historically been highest and can be expected to continue into the future without large-scale mitigation measures to reduce flood vulnerability.

FUTURE VULNERABILITY AND LAND USE

Future vulnerability will be determined, in part, by local officials. Flood hazard and SLOSH maps are available to indicate what areas of the region are most vulnerable to these hazards. These planning tools are 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. Additional discussion of actions these communities have taken to reduce future flood vulnerability is provided in Section 6, the Capability Assessment.

SEA LEVEL RISE AND LAND SUBSIDENCE

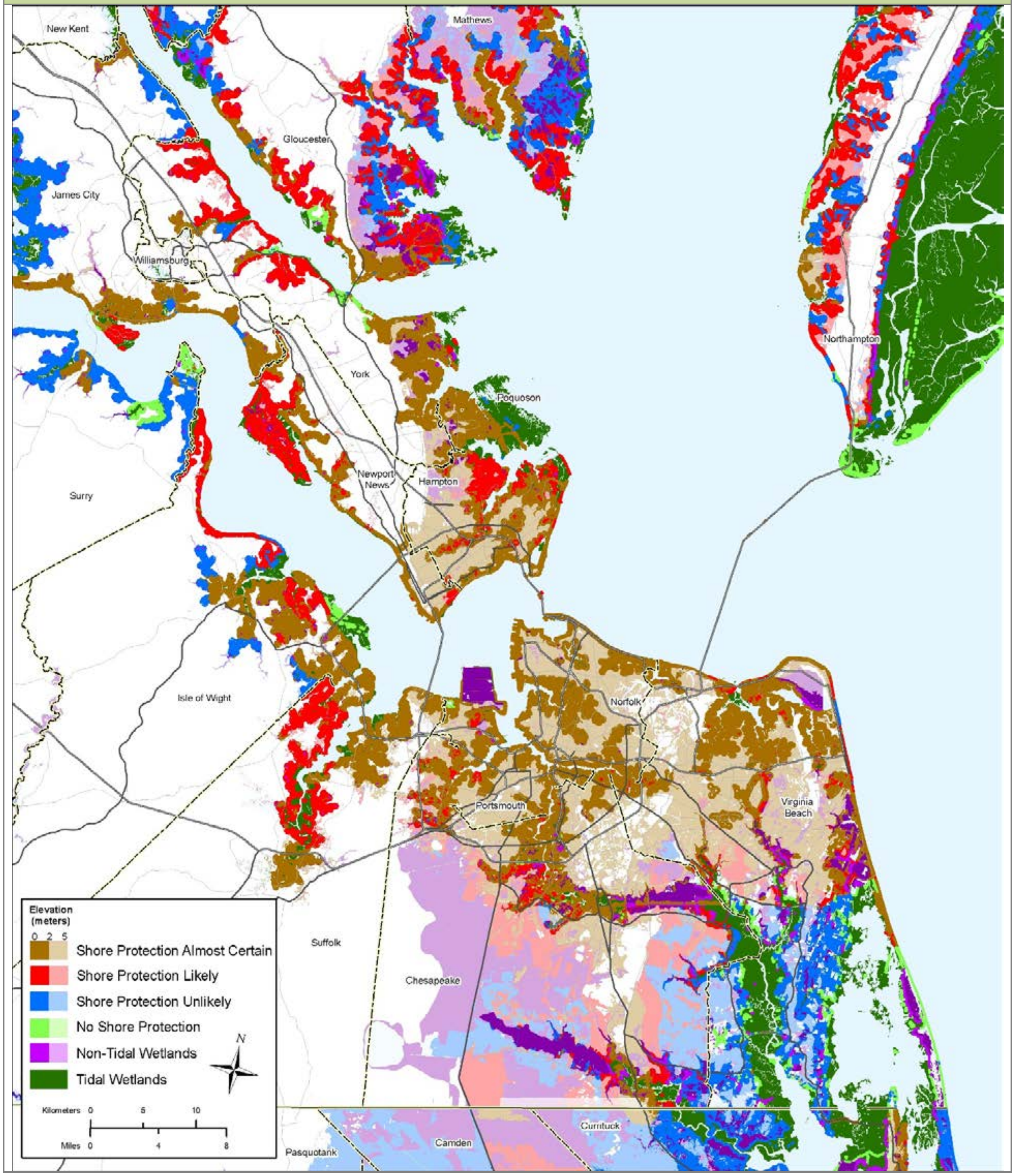
Historical evidence shows that much of the Hampton Roads region is already experiencing some degree of sea level rise. As discussed in the *Hazard Identification and Analysis* section, data from Sewells Point at the Norfolk Naval Base indicate that sea level in the past 70 years has risen at a rate of approximately 4.44 millimeters per year and sea level rise at that rate is expected to continue and possibly accelerate. Vulnerability to sea level rise can be looked at in terms of economic losses resulting from future flood event damages, and by examining expectations for future land use and development patterns and highlighting what infrastructure and real estate will potentially be affected by rising tides. In both cases, this analysis assumes somewhat static conditions with regard to flood mitigation capabilities. A changing regulatory climate, development pressure, or economic conditions could dramatically affect the impact of sea level rise.

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. Regional experience over the past 50 years 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 can 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 address rising sea level by creating maps that depict the likely response given current practices and policies. The maps divide coastal low lands in the coastal communities into four categories: developed (shore protection almost certain), intermediate (shore protection likely), undeveloped (shore protection unlikely), and conservation (no shore protection) (**Figure 5.10**). More detailed maps for each community along the vulnerable coast are available through the VIMS Center for Coastal Resources management web site at:
http://ccrm.vims.edu/climate_change/slr_maps/index.html.

FIGURE 5.10: SEA LEVEL RISE PLANNING MAPS



Source: *Environmental Research Letters*, 2009

One methodology for estimating average annual losses expected from sea level rise is supported by FEMA. The agency issued a report to Congress documenting the estimated impact of relative sea level rise on the Flood Insurance Rate Maps, *Projected Impact of Relative Sea Level Rise on the National Flood Insurance Program*, FEMA, October 1991, http://papers.risingsea.net/Flood-Insurance.html. 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% increase resulting from a 3-foot rise by 2100.

The lack of detailed elevation information for the existing pre-FIRM and post-FIRM building inventory in much of Hampton Roads further 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. 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 currently implementing and enforcing freeboard requirements, and many base flood elevations recently changed as a result of a restudy of coastal areas. The obsolescence of buildings is not accounted for in the FEMA predictions; presumably, 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.

If communities are in need of more detailed annualized estimates for the economic impacts of sea level rise in the future, to include impacts to infrastructure and individual structures, two primary data needs must be addressed:

1. Lowest floor elevations for structures in and near the existing SFHA. Side-scan LIDAR methods have been developed that can quickly collect the data needed.
2. HAZUS Level 2 or Level 3 analysis for multi- frequency flood events and flood depths to provide sufficient results for annualization.

The costs associated with these data needs are significant and communities should individually weigh whether the detailed estimates would then significantly alter their selection of mitigation measures to address sea level rise. The use of limited funds to implement mitigation measures to prevent damage must be contrasted with whether additional study of the impacts is necessary to acquire new funds or convince the public or elected officials of the need for action.

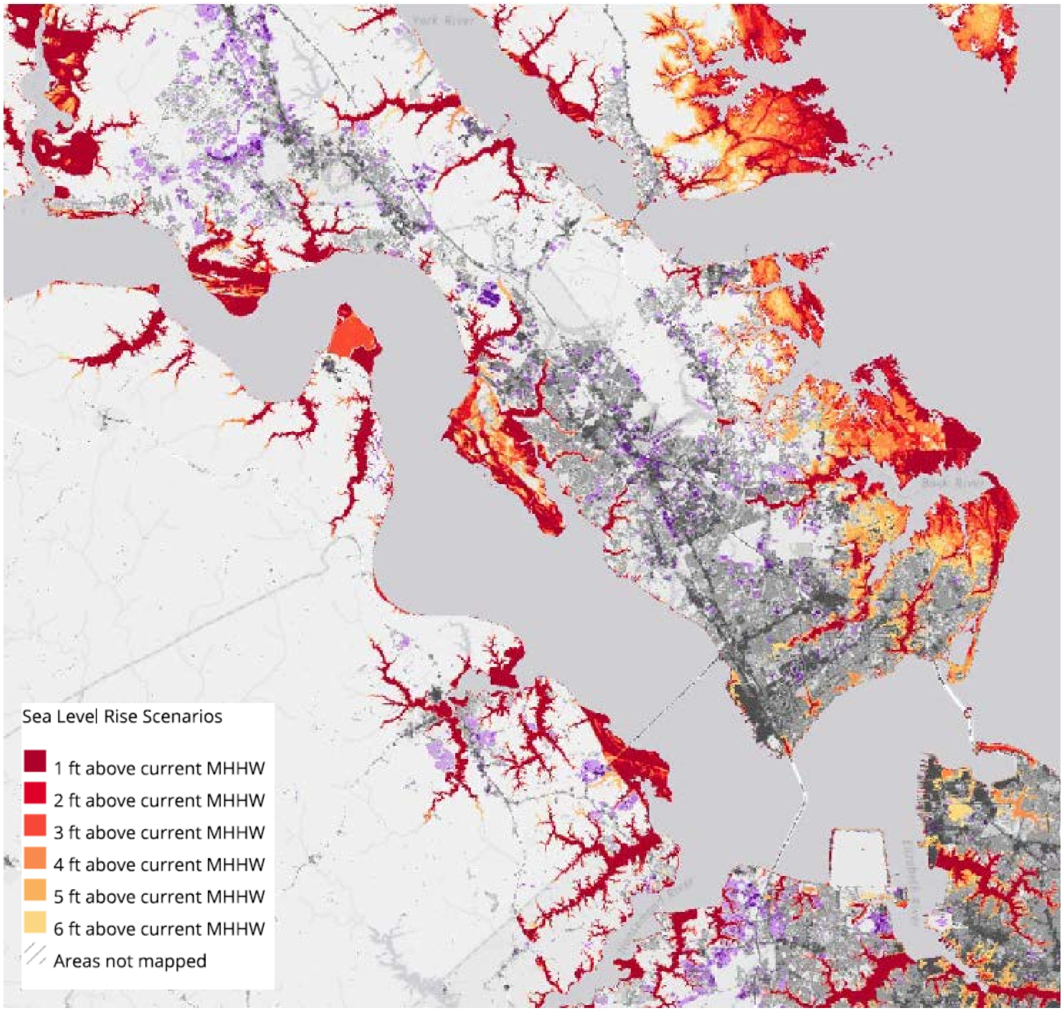
FUTURE VULNERABILITY AND LAND USE

The NOAA Coastal Flood Exposure Mapper tool (http://www.coast.noaa.gov/floodexposure/#/map) uses recent land cover data to show where areas being developed may be impacted by varying levels of sea level rise. This tool can help provide planners with information needed to focus sea level rise mitigation efforts geographically. Summary maps are shown for each Hampton Roads subregion in **Figures 5.11 through 5.16**.

FIGURE 5.11: DEVELOPMENT PATTERNS, PENINSULA

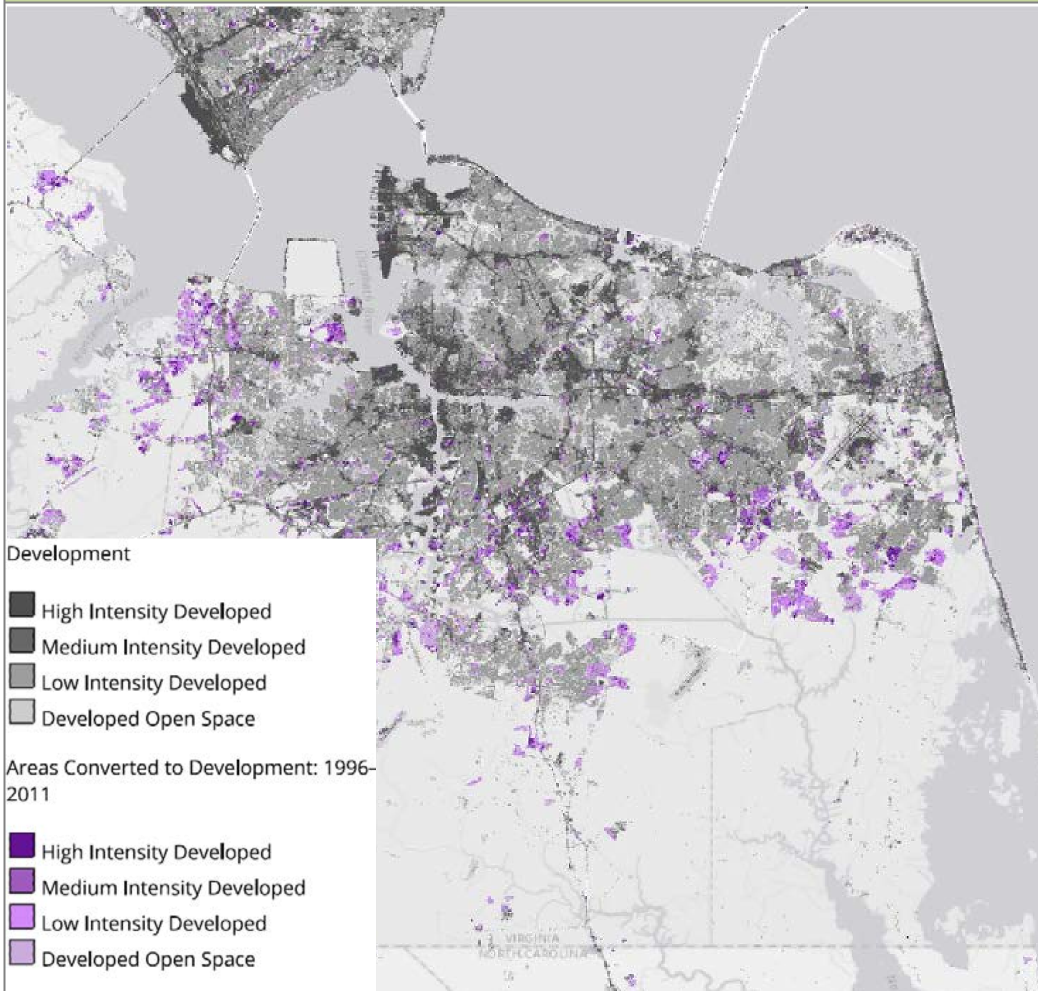
Source: NOAA Coastal Flood Exposure Mapper

FIGURE 5.12: SEA LEVEL RISE SCENARIOS, PENINSULA



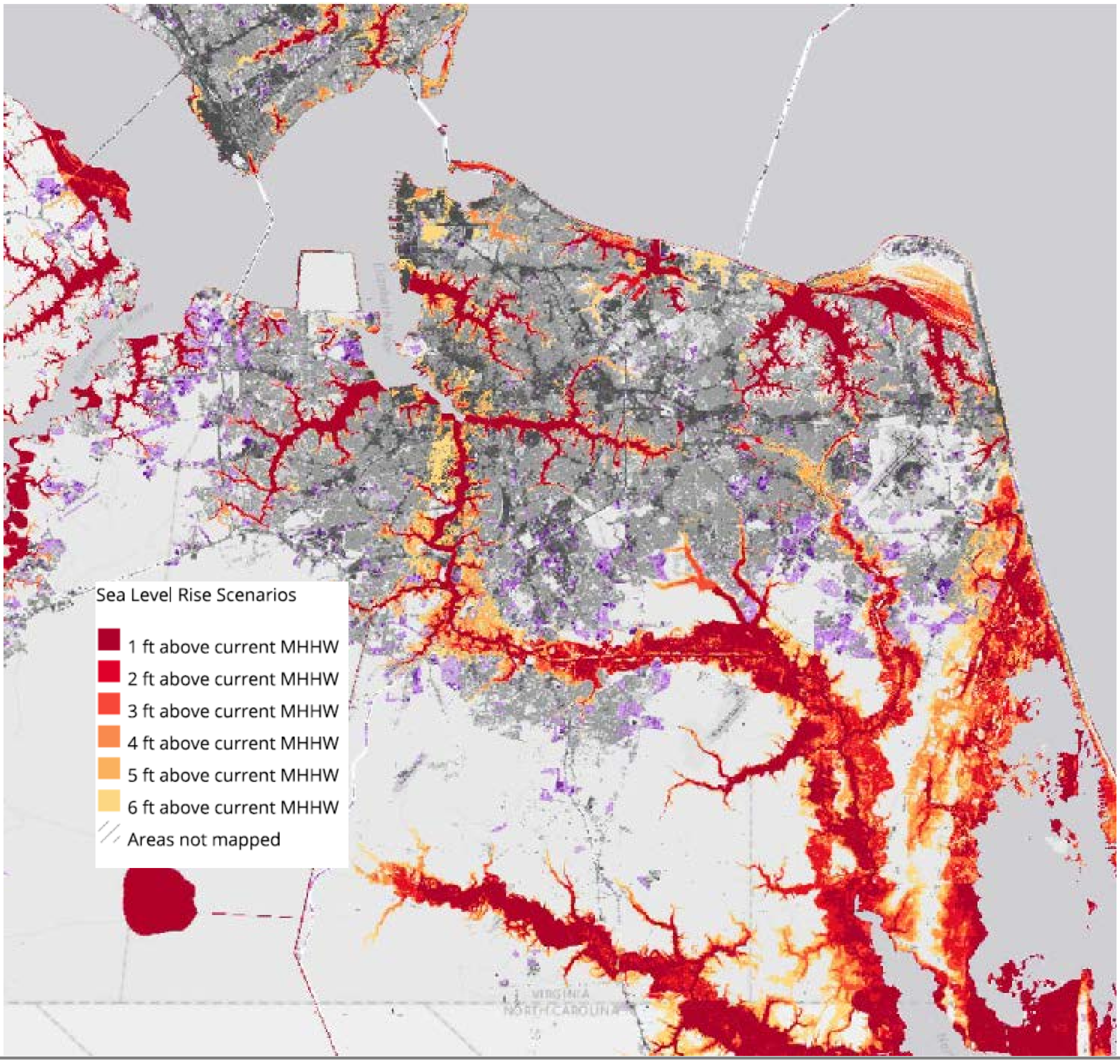
Source: NOAA Coastal Flood Exposure Mapper

FIGURE 5.13: DEVELOPMENT PATTERNS, SOUTHSIDE



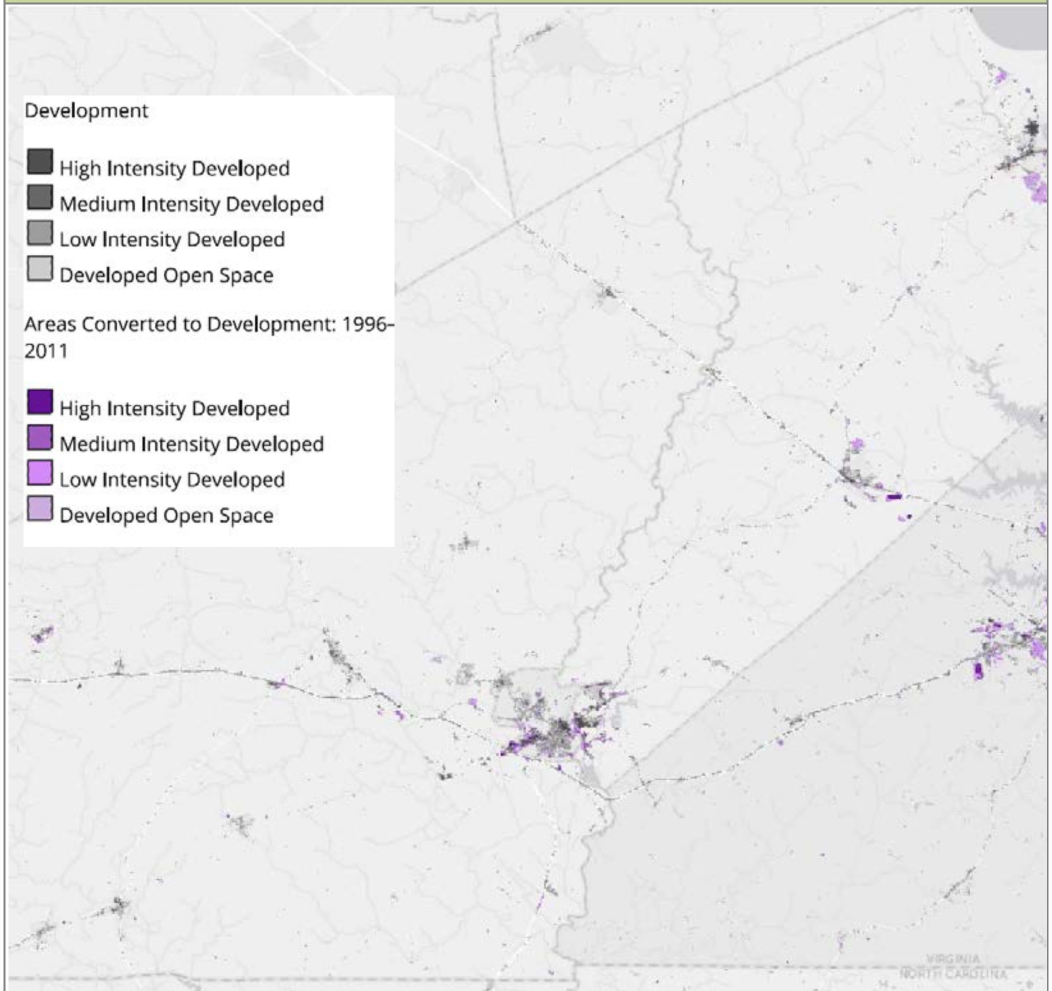
Source: NOAA Coastal Flood Exposure Mapper

FIGURE 5.14: SEA LEVEL RISE SCENARIOS, SOUTHSIDE



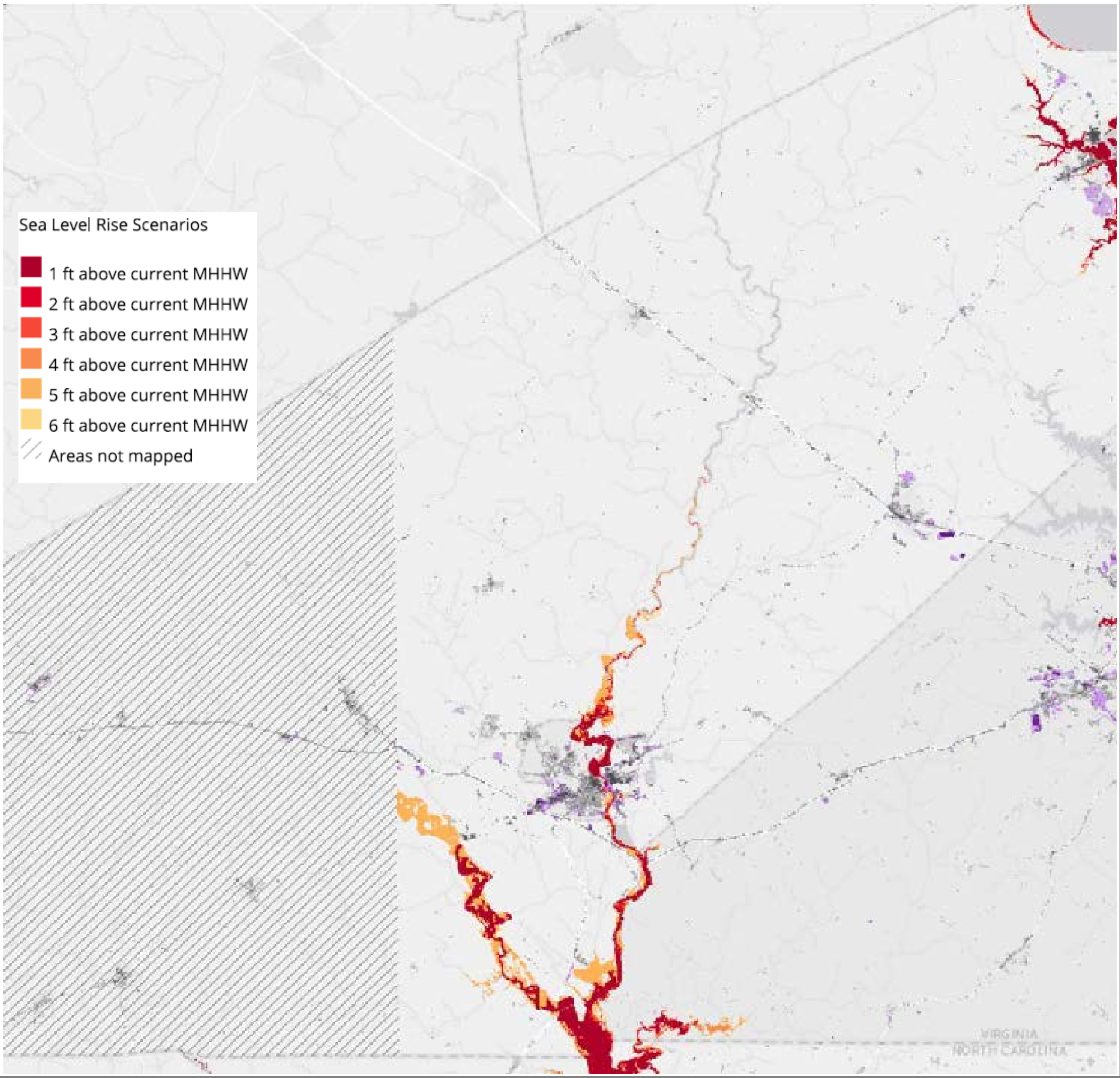
Source: NOAA Coastal Flood Exposure Mapper

FIGURE 5.15: DEVELOPMENT PATTERNS, WESTERN TIDEWATER



Source: NOAA Coastal Flood Exposure Mapper

FIGURE 5.16: SEA LEVEL RISE SCENARIOS, WESTERN TIDEWATER



Source: NOAA Coastal Flood Exposure Mapper

In a 2012 report entitled *Climate Change in Hampton Roads, Phase III: Sea Level Rise in Hampton Roads, Virginia,* HRPDC compiled maps and data to document those areas of the region that are exposed to one meter of sea level rise above spring high tide **(Figure 5.17)**. **Table 5.7** summarizes the report's findings, which highlight over $8.3 billion of vulnerability or exposure in the built environment. Norfolk, Virginia Beach and Chesapeake are the Hampton Roads communities with the highest population exposed to sea level rise. Hampton is fourth on the list and even has a larger number of housing units exposed than Chesapeake. Poquoson is a smaller community, but with a very high percentage of its land area and population exposed, the City must deal with the increasing vulnerability on a very frequent basis. The exposure to sea level rise is lowest in the western part of the study area, including Southampton County and Franklin, where sea level rise may cause some moderate changes in river levels, but is not expected to have the dramatic impacts on homes, roads and businesses that it will in the eastern portion of the study area.

TABLE 5.7: EXPOSURE TO ONE METER SEA LEVEL RISE ABOVE SPRING HIGH TIDE (MIDDLE ESTIMATE)

SUBREGION	COMMUNITY	LAND AREA (square miles)	POPULATION	HOUSING UNITS	ROADS (total miles)	BUSINESSES
Peninsula	Hampton	12.6	14,066	6,011	97.0	263
	Newport News	9.5	4,321	1,896	8.3	28
	Poquoson	11.8	6,770	2,597	38.7	115
	Williamsburg	0.2	275	137	0.1	0
	James City County	14.9	1,796	835	4.5	12
	York County	11.0	5,483	2,195	34.6	64
Southside	Norfolk	6.5	24,715	8,955	75.5	532
	Portsmouth	7.0	4,655	2,089	17.5	127
	Suffolk	14.4	4,691	1,715	4.7	21
	Virginia Beach	58.0	21,160	10,051	66.9	389
	Chesapeake	32.4	15,983	5,731	65.2	380
Western Tidewater	Isle of Wight County	13.4	3,046	1,263	2.0	16
	Franklin	0.6	74	33	0.1	0
	Southampton County	7.8	149	64	2.0	1
TOTALS		**200.1**	**107,184**	**43,572**	**417.1**	**1,948**

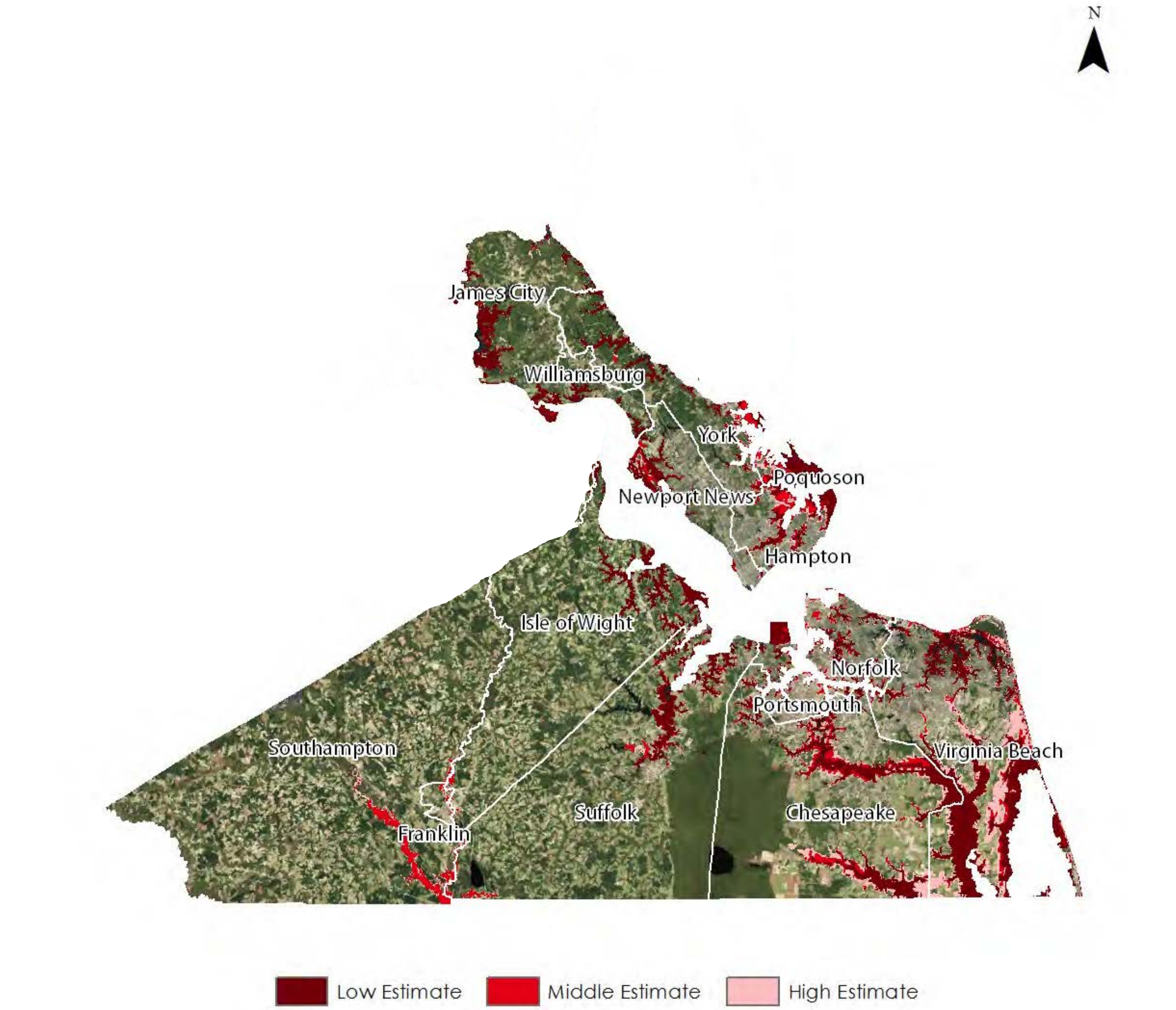
Source: *Climate Change in Hampton Roads, Phase III: Sea Level Rise in Hampton Roads, Virginia.* HRPDC, July 2012.

In addition to the 2012 HRPDC study cited above, the Old Dominion University Center for Sea Level Rise has spearheaded several significant research projects in the scientific community regarding sea level rise. With regard to vulnerability, the Center's web site provides the following compelling data points regarding the region's vulnerability to sea level rise:

- Military Impact: Norfolk Naval Base is home to 14 World War II era piers that are experiencing significant maintenance issues due to the rising sea levels that have occurred since they were built. These piers are being replaced over time, at a cost of $35-40 million per pier, according to the Department of Defense.
- Municipal Impacts: The Virginia Beach-Norfolk Metropolitan Statistical Area ranks 10th in the world in value of assets exposed to increased flooding from relative level rise, according to an analysis by RMS (a catastrophe modeling company). The City of Virginia Beach could lose about 45,000 acres from water inundation, assuming 4 foot of relative sea level rise without considering storm surge effects or sea level rise adaptation measures. Hampton Roads is rated second only to New Orleans as the most vulnerable area to relative sea level rise in the country. Ron Williams Jr., Assistant City Manager of Norfolk, has estimated that the city will need a total investment of $1 billion in the coming decades, including $600 million to overhaul and replace current city infrastructure.
- Economic Impacts: According to a recent study by the Hampton Roads Planning District Commission (HRPDC), costs from three feet of sea-level rise in the Hampton Roads region are

expected to range between $12 billion and $87 billion. According to the Virginia Governor's Commission on Climate Change in 2008, "The continued affordability and availability of insurance for Virginia's landowners is a concern as our climate changes. These effects are already being felt in Coastal Virginia. The frequency and severity of storms in the future are expected to exceed those of the past, and the insurance industry may not have the ability to handle several concurrent events."

FIGURE 5.17: AREAS EXPOSED TO ONE METER OF SEA LEVEL RISE ABOVE SPRING HIGH TIDE



Disclaimer: This map is for informational purposes only. Areas depicted as vulnerable are based on estimates only and should not be construed as being in imminent danger of inundation. The analysis depicted does not account for flood protection or control infrastructure. This map should not be used in place of official FEMA flood insurance rate maps. Users agree to hold harmless and blameless the Hampton Roads Planning District Commission and its representatives and its agents for any liability associated with the use of this map.

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

TROPICAL/COASTAL STORM

Historical evidence shows that Hampton Roads is vulnerable to damaging storm-force winds, whether associated with coastal storms like nor'easters, or tropical storms such as hurricanes. 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 similarly impact the region.

ESTIMATES OF POTENTIAL LOSSES

Detailed loss estimates for the wind damage associated with the tropical storm hazard were developed based on probabilistic scenarios using HAZUS-MH (Level 1 analysis). **Table 5.8** shows estimates of potential building damage for the 100-year return period, and annualized total losses. In summary, the region may be susceptible to an estimated total of approximately $1.19 billion in building damages from a 100-year wind event.

TABLE 5.8: ESTIMATES OF POTENTIAL BUILDING DAMAGE – WIND ONLY

SUBREGION	COMMUNITY	BUILDING DAMAGE	CONTENTS & INVENTORY DAMAGE	TOTAL*	ANNUALIZED TOTAL LOSSES
Peninsula	Hampton	$91,781,000	$42,021,000	$138,514,000	$7,265,000
	Newport News	$53,985,000	$10,663,000	$68,841,000	$5,035,000
	Poquoson	$9,575,000	$3,971,000	$13,874,000	$670,000
	Williamsburg	$1,366,000	$392,000	$1,766,000	$236,000
	James City County	$10,477,000	$3,944,000	$14,428,000	$1,841,000
	York County	$35,966,000	$18,024,000	$55,067,000	$2,997,000
Southside	Norfolk	$168,291,000	$28,515,000	$213,399,000	$10,494,000
	Portsmouth	$48,722,000	$8,960,000	$61,573,000	$3,824,000
	Suffolk	$23,969,000	$6,293,000	$31,191,000	$3,031,000
	Virginia Beach	$579,495,000	$190,242,000	$815,974,000	$37,078,000
	Chesapeake	$160,748,000	$55,549,000	$224,879,000	$12,459,000
Western Tidewater	Isle of Wight County	$8,008,000	$2,592,000	$10,789,000	$1,174,000
	Franklin	$381,000	$110,000	$491,000	$207,000
	Southampton County	$650,000	$268,000	$919,000	$437,000
Totals		**$1,193,414,000**	**$371,544,000**	**$1,651,705,000**	**$86,748,000**

* Also includes income losses from relocation, lost wages, and lost rental income.

Source: HAZUS-MH

Based on the data in Table 5.8, Virginia Beach, Chesapeake and Norfolk have the highest annualized total losses from wind associated with a 100-year wind event. These communities are also the most vulnerable for flood, so these 3 communities are considered the most vulnerable to the combined wind and flooding effects of Tropical Storms. Hampton and Newport News are also very vulnerable to wind effects from the 100-year wind event. Franklin, Williamsburg and Southampton County are significantly further inland and are less likely to experience the devastating impacts of the remainder of Hampton Roads. Franklin has annualized wind-related damages of only $207,000; a small portion of the $37 million calculated for Virginia Beach.

HAZUS-MH was also used to produce building damage estimates based on percentage of damage (by damage state) for the 100-year return period (**Table 5.9**).

TABLE 5.9: NUMBER OF BUILDINGS DAMAGED, BY DAMAGE STATE[2] - 100-YEAR WIND EVENT

OCCUPANCY TYPE	MINOR	MODERATE	SEVERE	DESTRUCTION
Residential	29,180	3,407	70	68
Commercial	1,214	204	20	0
Industrial	307	45	8	0
Other	287	36	5	1
TOTAL	**30,988**	**3,692**	**103**	**69**

Source: HAZUS-MH

FUTURE VULNERABILITY AND LAND USE

All future structures built in Hampton Roads 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. The State's Uniform Statewide Building Code continues to reduce vulnerability of newly constructed buildings to the wind hazard.

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

SHORELINE EROSION

As documented in the *Hazard Identification and Analysis* section, the Hampton Roads region is vulnerable to the long term effects of shoreline erosion. Coastal erosion remains a significant hazard of concern that must continue to be addressed through sustained shoreline management practices. To date, existing strategies for shoreline hardening and the implementation of numerous replenishment projects have been successful in minimizing major coastal erosion losses within parts of the planning region.

ESTIMATES OF POTENTIAL LOSSES

It is difficult to determine the amount of property or the number of structures that are vulnerable to the erosion hazard. The jurisdictions in the region have demonstrated, through past projects such as the Virginia Beach Erosion Control and Hurricane Protection Project that they are willing to take on projects to protect coastal residences and commercial buildings in the hazard zone.

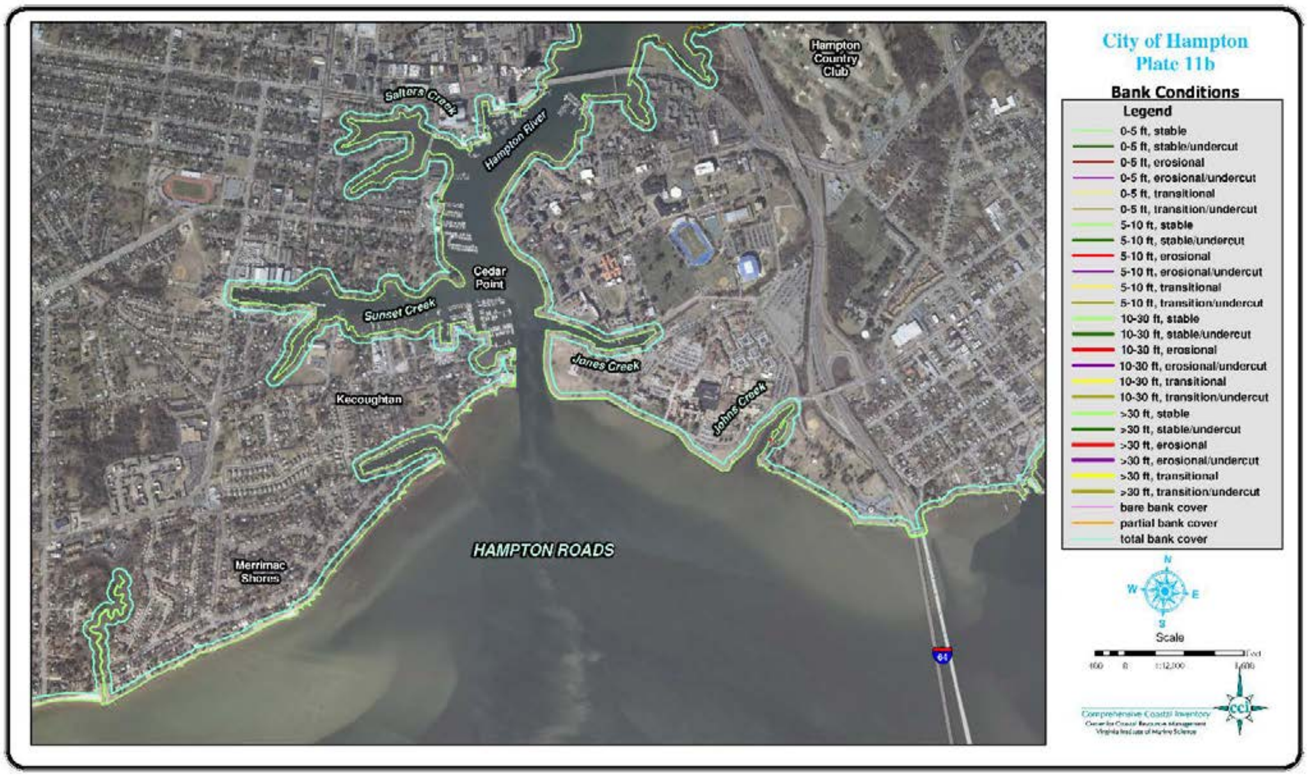
The Comprehensive Coastal Inventory Program (CCI) at VIMS has created a new GIS shoreline database to develop revised Shoreline Situation Reports (SSR) for cities and counties in the region. SSRs were developed by VIMS in the 1970s, and are available online at: http://ccrm.vims.edu/gis_data_maps/index.html. These reports have been the foundation for shoreline management planning in the region for more than 30 years. CCI has developed new protocols for collecting, disseminating, and reporting data relevant to shoreline management issues today. New SSRs are currently available online at: http://ccrm.vims.edu/gis_data_maps/shoreline_inventories/. Southampton County and Franklin are not included in the Chesapeake Bay Shoreline Inventory project.

The data inventory developed for the new SSRs is based on a three-tiered shoreline assessment approach. In most cases this assessment characterizes conditions that can be observed from high resolution imagery. A small boat navigating along the shoreline was used to verify the remotely sensed data and collect features that could not be ascertained from the imagery. The three tiered shoreline assessment approach divides the shore zone into three regions: 1) the immediate riparian zone, evaluated for land use; 2) the bank, evaluated for height, stability, cover and natural protection; and 3) the shoreline, describing the presence of shoreline structures for shore protection and recreational purposes. Final prepared maps are available online at the site noted above. Although the maps alone do not indicate potential loss from erosion, they provide areas for future study and indicate where shoreline structure protection is currently in place to protect against coastal erosion.

Figure 5.18 provides a sample of the maps available in the SSR for the City of Hampton.

The Atlantic Ocean shorelines in Virginia Beach and Norfolk are the most vulnerable areas of Hampton Roads with regard to coastal shoreline erosion. The fetch for tropical storms and nor'easters is sufficient to create wind-driven waves that cause significant damage on a regular basis as shown in Table 4.8. The Chesapeake Bay shorelines of Hampton, Poquoson and Norfolk are also susceptible to wind-driven wave action that causes coastal shoreline erosion. The James River and York River are deep and wide enough to cause some shoreline erosion in Suffolk, Isle of Wight, Newport News, York County and James City County. Riverine erosion in Franklin and Southampton County, while not as dangerous to people and homes, creates limited vulnerability to infrastructure.

FIGURE 5.18: BANK CONDITIONS, HAMPTON RIVER



FUTURE VULNERABILITY AND LAND USE

It is difficult to assess future vulnerability and land use in regard to this hazard. Generally speaking, future vulnerability will depend greatly on appropriate local site planning and permitting, as well as each community's approach to sea level rise and associated flooding problems.

TORNADO

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

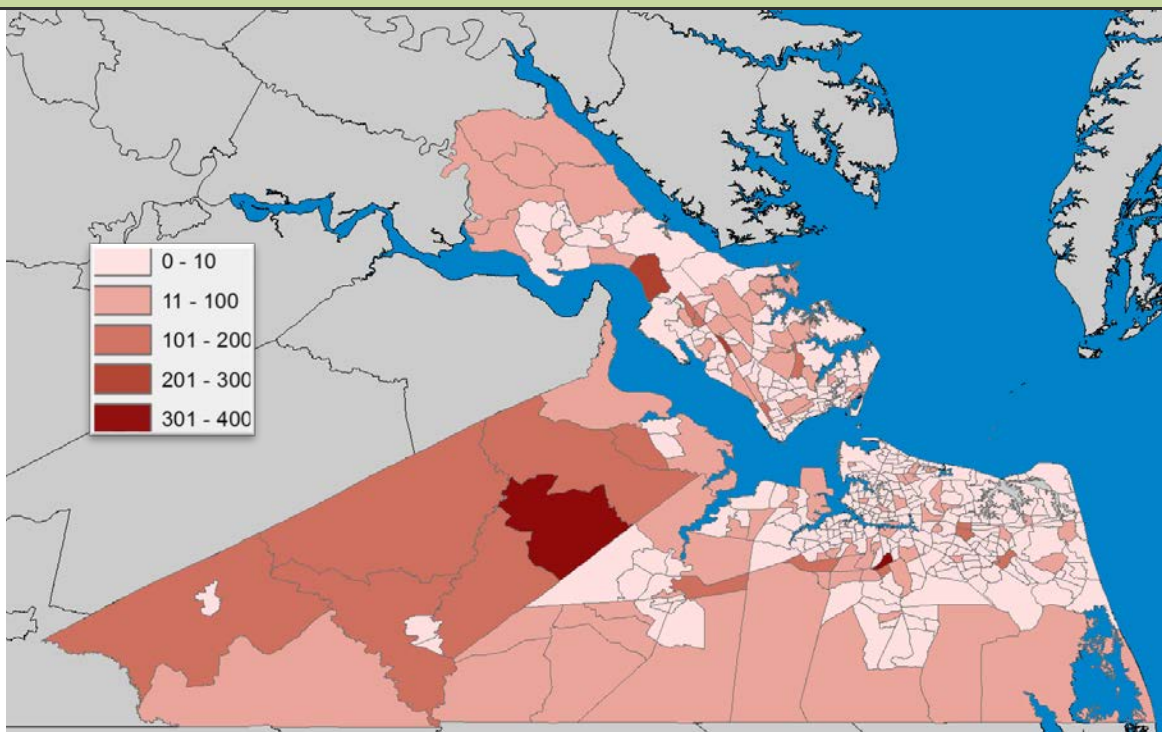
ESTIMATES OF POTENTIAL LOSSES

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 $197 billion for all buildings and contents within the region is considered to be exposed and could potentially be impacted on some level by the tornado hazard.

Low-intensity tornadoes may not completely destroy a well-constructed building, although even the most well-constructed buildings are vulnerable to the effects of a more intense (F2 or higher) tornado. The statewide building code provides a reasonable level of protection for newly constructed buildings, while structures built before the code went into effect are most vulnerable to damage.

Because manufactured homes are particularly vulnerable to damage from tornadoes, HAZUS was used to show geographic concentrations of manufactured homes in the study area. **Figure 5.19** is a map showing the number of manufactured homes by Census tract from the 2010 Census data generated by HAZUS.

FIGURE 5.19: NUMBER OF MANUFACTURED HOMES BY CENSUS TRACT



Source: HAZUS-MH and 2010 U.S. Census

Based on historic property damages for the 21-year period between 1995 and 2015 as shown in *Section 4, Hazard Identification and Risk Analysis*, there were 54 tornado events with an annualized loss estimate of $2.1 million and annual probability of 2.7% percent.

While Figure 4.24, Historical Tornado Hazard Frequency, and Figure 5.19, Number of Manufactured Homes by Census Tract are useful for seeing where tornadoes have historically struck and where they could potentially damage a specific type of structure, the figures do not show measured differences in vulnerability among study area communities. As tornadoes are driven by larger scale air masses and storm systems and these storm systems affect the Hampton Roads region uniformly, the region's vulnerability to tornadoes is quite uniform. The population concentrations in the urbanized areas of the Peninsula and Southside Hampton Roads may experience more damage as a result of a similar event in the more rural areas of Southampton County or Isle of Wight County, for example, but the vulnerability to tornado strike is uniform throughout the study area.

FUTURE VULNERABILITY AND LAND USE

All future structures built in Hampton Roads are likely to be exposed to the tornado hazard.

WINTER STORM

Historical evidence shows that the Hampton Roads region 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 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 $197 billion for all buildings and contents within the region is considered to be exposed and could potentially be impacted by the winter storm hazard. Based on historic property damages for the past 20 years (1996 to 2015), an annualized loss estimate of $959,000 and annual probability of 100% was generated for the winter storm hazard. 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 combine metropolitan regional damages.

Structures built prior to Virginia's statewide building code are somewhat more vulnerable to damage from severe winter storms where snow and ice may accumulate on rooftops, especially if snow loads were not accounted for in the original structure design.

Because manufactured or mobile homes are also very susceptible to damage of roof collapse or additional damage due to their design features, HAZUS was used to show geographic concentrations of manufactured homes in the study area. **Figure 5.19** is a map showing manufactured homes by Census tract from the 2010 Census data generated by HAZUS.

Due to the consistency in the study area's basic geographic characteristics, winter storms can be expected to affect Hampton Roads' communities in a similar way. However, warm ocean currents offshore of Virginia Beach can occasionally diminish the effects of winter storms on the communities adjacent to larger bodies of water, including Virginia Beach, Norfolk, Hampton, and Poquoson. Temperature differences of a few degrees in these eastern communities can cause faster melting of snow and ice, and may result in a "snow line" that bisects the study area into areas of snow versus areas of rain associated with eastward moving systems. Such differences can result in dramatically different storm impacts in the study area.

FUTURE VULNERABILITY AND LAND USE

Because of the geographic location, all future structures built in Hampton Roads are likely to be exposed to the winter storm hazard and may experience damage not accounted for in the estimated losses presented in this section.

EARTHQUAKE

The annual probability of an earthquake epicenter within 65 miles of Hampton Roads is estimated at less than 1% based on historical data. While the probability of an earthquake occurrence is relatively low, moderate losses, should a significant earthquake event occur, are possible.

ESTIMATES OF POTENTIAL LOSSES

Table 5.10 provides generalized building damage estimates by jurisdiction for the 1,000-year return period based on probabilistic scenarios using HAZUS-MH.

TABLE 5.10: ESTIMATES OF POTENTIAL BUILDING DAMAGE – EARTHQUAKE WITH 1,000-YEAR RETURN PERIOD

SUBREGION	COMMUNITY	BUILDING DAMAGE	NON-STRUCTURAL, CONTENTS & INVENTORY DAMAGE	TOTAL*
Peninsula	Hampton	$4,614,000	$4,664,000	$20,172,000
	Newport News	$6,840,000	$7,658,000	$31,661,000
	Poquoson	$535,000	$355,000	$2,097,000
	Williamsburg	$825,000	$1,200,000	$4,409,000
	James City County	$4,396,000	$3,799,000	$19,609,000
	York County	$3,167,000	$2,610,000	$13,386,000
Southside	Norfolk	$8,393,000	$18,849,000	$36,396,000
	Portsmouth	$2,906,000	$6,632,000	$12,771,000
	Suffolk	$3,067,000	$6,868,000	$12,617,000
	Virginia Beach	$13,530,000	$27,488,000	$53,882,000
	Chesapeake	$7,246,000	$15,124,000	$28,734,000
Western Tidewater	Isle of Wight County	$1,587,000	$3,705,000	$6,576,000
	Franklin	$337,000	$481,000	$1,706,000
	Southampton County	$780,000	$685,000	$3,314,000
Totals		**$58,223,000**	**$100,118,000**	**$247,330,000**

* Also includes income losses from relocation, lost wages, and lost rental income.
Source: HAZUS-MH

HAZUS-MH (Level 1 analysis) was also used to produce building damage estimates based on percentage of damage (by damage state) for the 1,000-year return period (**Table 5.11**). According to the HAZUS-MH model assumptions, there should be no building damage from the 100-year earthquake event.

TABLE 5.11: ESTIMATES OF POTENTIAL BUILDINGS DAMAGED BY DAMAGE STATE[3]– EARTHQUAKE WITH 1,000-YEAR RETURN PERIOD			
SLIGHT	**MODERATE**	**EXTENSIVE**	**COMPLETE**
10,723	3,092	367	33

Source: HAZUS-MH

Due to the consistency in the geographic characteristics and soils of the study area, earthquakes are expected to affect the Hampton Roads region communities in a similar manner.

FUTURE VULNERABILITY AND LAND USE

All future structures built in Hampton Roads will be vulnerable to seismic events to a limited degree, and may also experience damage not accounted for in the estimated losses presented in this section.

[3] For more detailed description of the four damage states, please refer to the *HAZUS-MH User Manual* for the Earthquake Model.

WILDFIRE

Historical data indicate that the Hampton Roads region of Virginia is vulnerable to wildfire, particularly in the western portion of the study area. Figure 4.29 provides a graphical overview of wildfire vulnerability in the region.

ESTIMATES OF POTENTIAL LOSSES

As shown in the *Hazard Identification and Analysis* section, VDOF documented an average of 26 wildfire events per year between 2002 and 2013, with total property damages of $163,250 reported for the 231 events between 2002 and 2008. Annualized losses for state-response wildfires are, therefore, estimated to be $27,208.

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. Wildland Urban Interface (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.

The Southern Group of State Foresters has created an online portal for wildfire risk assessment at http://www.southernwildfirerisk.com/map/index/public. The portal provides mapping to help determine future vulnerability to WUI fire in Hampton Roads and to provide planners a sense of where fire mitigation should be focused for the best reduction in vulnerability. Community Protection Zones (CPZs) with both primary and secondary levels of importance are depicted in **Figures 5.20 through 5.22**. The zones are based on an analysis of the “Where People Live” housing density data and surrounding fire behavior potential. Primary CPZs reflect areas with a predefined housing density appropriate to the region. Rate of Spread data is used to determine the areas of concern around populated areas that are within a 2-hour fire spread distance. This is referred to as the Secondary CPZ.

The online portal for wildfire risk assessment also allows users to highlight a neighborhood or street and determine the wildfire characteristics of that area, such as the Wildfire Urban Interface Risk Index, the wildfire ignition density and the fire intensity scale.

The CPZs in the Hampton Roads area, where wildfire vulnerability is highest, are clustered in the lower Peninsula (Hampton, Newport News and Poquoson), James City County, Suffolk, and north Chesapeake. There are sporadic pockets of vulnerability scattered through eastern Isle of Wight County, parts of Virginia Beach, Norfolk and Portsmouth that make these areas perhaps slightly less vulnerable. The Great Dismal Swamp is not mapped as part of this effort as it is Federal land, but there is also high risk of wildfire in that region actively managed by the Great Dismal Swamp Fire Program.

FIGURE 5.20: COMMUNITY PROTECTION ZONES FOR WILDFIRE, PENINSULA

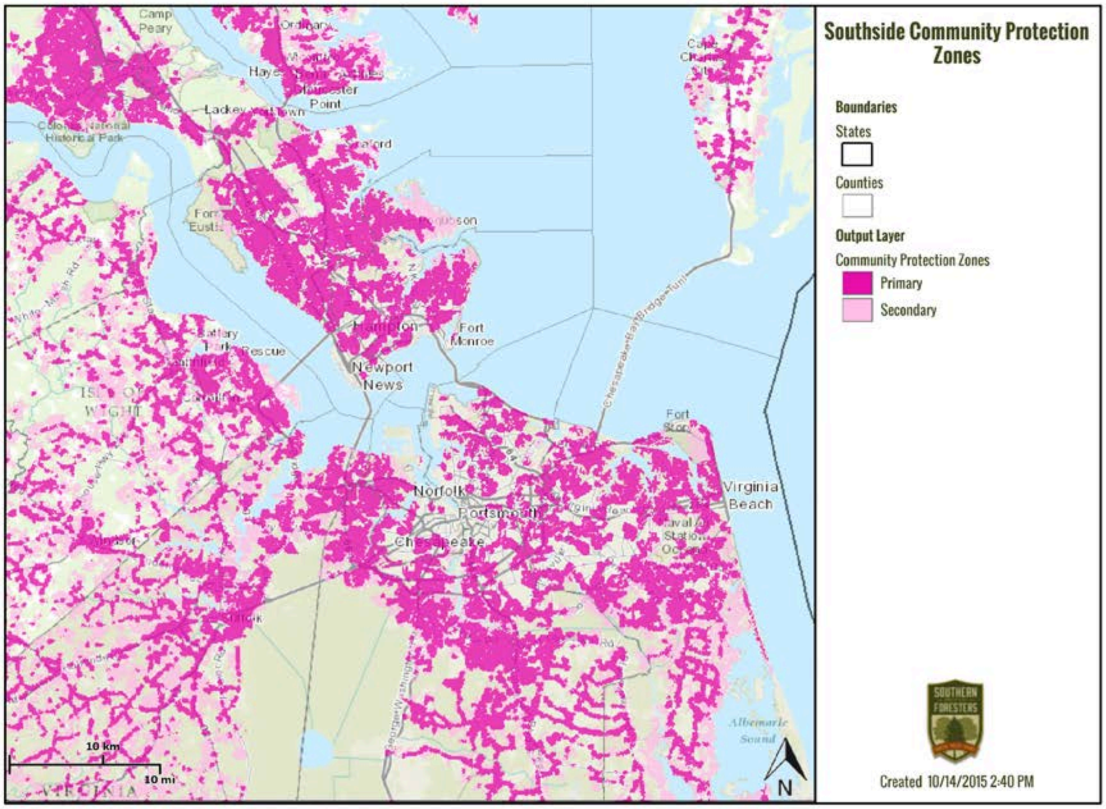


FIGURE 5.21: COMMUNITY PROTECTION ZONES FOR WILDFIRE, SOUTHSIDE

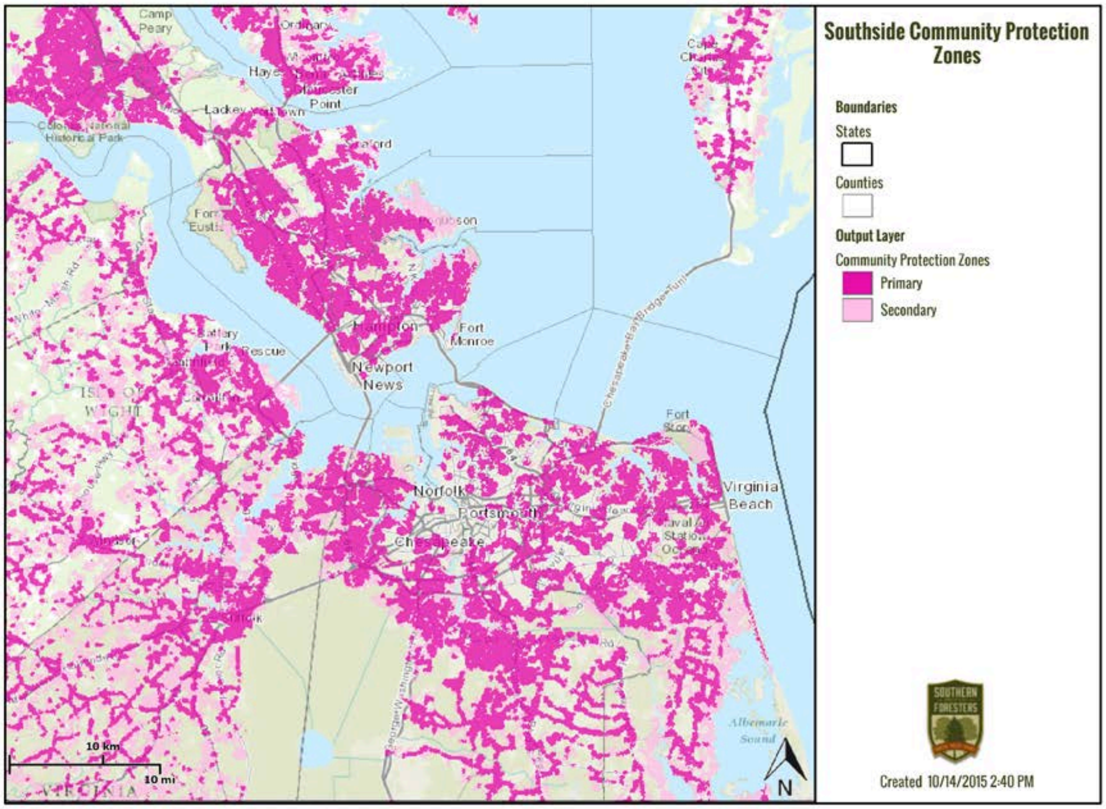
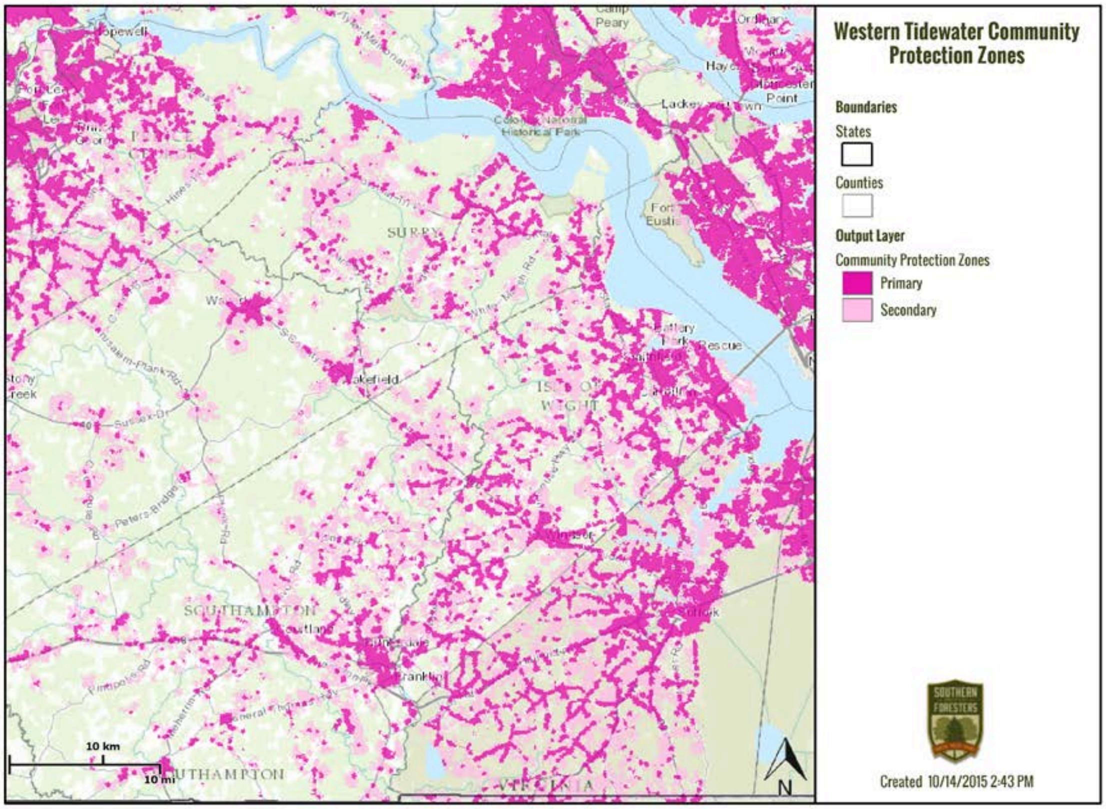


FIGURE 5.22: COMMUNITY PROTECTION ZONES FOR WILDFIRE, WESTERN TIDEWATER



DROUGHTS

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 Hampton Roads region 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. In 2006, this plan included an annualized drought loss estimate of $2,215,839 for Isle of Wight County, Suffolk and Virginia Beach; however, the methodology regarding how this loss estimate was developed is not clear. Annualized damages appear to have been based on changes in total harvested cropland; however, losses in harvested cropland or the market value of crops cannot be attributed entirely to drought or other weather-related conditions, especially in rural parts of the planning area that are rapidly developing. Data on drought damages from the NCDC are incomplete and, when available, apply to a very large area including jurisdictions outside of the planning region. As a result, the estimation of annualized damages due to drought was discontinued in previous updates.

Table 5.12 provides a time series of data regarding the total harvested cropland, irrigated land, market value of crops, and percent of non-irrigated land from 2002, 2007 and 2012. Due to a lack of agricultural information, data for many of the cities and towns are not provided.

TABLE 5.12: AGRICULTURAL DATA RELATED TO DROUGHT VULNERABILITY						
JURISDICTION	2002		2007		2012	
	TOTAL HARVESTED CROPLAND (acres)	MARKET VALUE OF CROPS ($1,000)	TOTAL HARVESTED CROPLAND (acres)	MARKET VALUE OF CROPS ($1,000)	TOTAL HARVESTED CROPLAND (acres)	MARKET VALUE OF CROPS ($1,000)
James City County	5,258	$2,032	2,367	$1,469	2,698	$1,565
York County	211	$2,607	Withheld	Withheld	Withheld	$2,076
Suffolk	53,954	$35,745	51,203	$51,271	49,693	$58,963
Virginia Beach	21,609	$7,716	20,258	$12,570	20,814	$16,803
Chesapeake	53,188	$33,056	41,391	$30,956	36,269	Withheld
Isle of Wight County	49,373	$13,458	48,230	$13,798	47,868	$33,025
Southampton County	83,449	$21,912	79,449	$27,500	87,902	$67,002
TOTAL	267,042	$116,526	242,898	$137,564	245,244	$179,434

Source: U.S. Department of Agriculture Farm and Ranch Irrigation Survey (2016)

The geography of the study area makes the Hampton Roads region uniformly vulnerable to the effects of drought. However, the impacts would vary across the region with impacts to agriculture and the agricultural economy primarily in Southampton County, as well as James City County, York County, Suffolk, Virginia Beach, Chesapeake, and Isle of Wight County. Social impacts to water utility customers in the cities of Hampton Roads would be more likely during a chronic, prolonged drought that results in water restrictions.

FUTURE VULNERABILITY AND LAND USE

According the USDA Farm and Ranch Irrigation Survey data from 2002 through 2012, the total harvested cropland in Hampton Roads farming communities decreased 9-percent from 2002 to 2007, and then increased again slightly (less than 1-percent) between 2007 and 2012. This is somewhat consistent with the area's largest farming county, Southampton County, which experienced a decrease of 4-percent in the first period and an increase of 10-percent in the later period. These rates may be indicative of past and future changes in land use which may be peripherally related to long-term drought conditions, although the long period between data collection makes it difficult to draw useful conclusions.

EXTREME HEAT

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 or health impacts are a greater concern with extreme heat than is property damage.

Hampton Roads is uniformly vulnerable to the effects of extreme heat, with occasional relief to eastern communities such as Virginia Beach, Norfolk, Hampton and Poquoson brought by sea breezes and cooler ocean temperatures that may moderate temperature extremes by a couple of degrees.

FUTURE VULNERABILITY AND LAND USE

All future structures built in the Hampton Roads region 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.

HAZARDOUS MATERIALS INCIDENTS

ESTIMATES OF POTENTIAL LOSSES

Based on information provided in the *Hazard Identification and Analysis* section, the Hampton Roads region experiences an average of 25 hazardous materials incidents per year with only minor damages (generally less than $10,000 per year) reported. **Table 5.13** shows hazardous materials incidents from 1998 to 2015 in Hampton Roads region (according to the U.S. Department of Transportation) that contribute to an annualized loss estimate of $81,152.

TABLE 5.13: ANNUALIZED LOSSES FOR HAZARDOUS MATERIALS INCIDENTS

SUBREGION	COMMUNITY	NUMBER OF EVENTS	PROPERTY DAMAGE	AVERAGE ANNUAL NUMBER OF EVENTS	ANNUALIZED LOSS
Peninsula	Hampton	6	$9,454	0.35	$556
	Newport News	34	$3,558	2.00	$209
	Poquoson	0	$0	0.00	$0
	Williamsburg	3	$6,845	0.18	$403
	James City County	0	$0	0.00	$0
	York County	2	$0	0.12	$0
Southside	Norfolk	103	$400,522	6.06	$23,560
	Portsmouth	44	$118,693	2.59	$6,982
	Suffolk	12	$292,978	0.71	$17,234
	Virginia Beach	154	$60,557	9.06	$3,562
	Chesapeake	86	$251,589	5.06	$14,799
Western Tidewater	Isle of Wight County	1	$221,000	0.06	$13,000
	Franklin	8	$3,688	0.47	$217
	Southampton County	2	$10,706	0.12	$630

U.S. Department of Transportation, 2015

SOCIAL VULNERABILITY

At-risk populations were estimated using the proximity of structures located within certain ranges of high-risk railway corridors. Potential at-risk structures (populations), as shown in **Table 5.14**, are presented for each jurisdiction.

TABLE 5.14: POTENTIALLY AT-RISK STRUCTURES FOR HAZARDOUS MATERIALS INCIDENTS				
SUBREGION	COMMUNITY	STRUCTURES WITHIN 0.1 MILE OF RAILROAD	STRUCTURES WITHIN 0.25 MILE OF RAILROAD	STRUCTURES WITHIN 1 MILE OF RAILROAD
Peninsula	Hampton	1,940	6,277	34,001
	Newport News	4,625	15,121	55,258
	Poquoson	0	0	0
	Williamsburg	491	2,239	5,601
	James City County	1,387	3,529	11,770
	York County	773	1,739	6,362
Southside	Norfolk	7,297	21,634	61,470
	Portsmouth	3,592	10,841	40,017
	Suffolk	6,223	15,126	33,980
	Virginia Beach	3,337	9,687	47,747
	Chesapeake	8,777	23,074	65,051
Western Tidewater	Isle of Wight County	917	1,532	2,969
	Franklin	1,312	2,993	5,805
	Southampton County	1,885	3,763	7,332
Total Structures		13,118	114,562	357,864
Total Estimated Population*		33,451	292,133	912,553

* Rough estimated based on average household size of 2.55 persons per household for Virginia Beach-Norfolk-Newport News, VA-NC Metro Area in *2010 U.S. Census.*
Source: GIS data analysis of local structure data.

Although railroads are not the only transportation method that contribute to hazardous materials incidents, and myriad other constantly changing factors such as vehicle/train speed, weather conditions, number of vehicles/trains in motion, and operator error can cause accidents, railroad incidents vividly highlight surrounding population vulnerabilities. Table 5.14 indicates that the communities in the study area with the lowest vulnerability to hazardous materials incidents based on proximity to railroads are Poquoson, Isle of Wight County, Williamsburg, York County and Franklin. Norfolk, Chesapeake and, to a lesser degree, Suffolk and Newport News have the largest number of structures near the railroads, and thus a higher population is vulnerable to impacts.

FUTURE VULNERABILITY AND LAND USE

Future land use and zoning of structural development as discussed in previous subsections are expected to have less impact on future vulnerability than the protection of human life through administration of proper emergency notification and evacuation planning with regard to potential hazardous material incidents.

CONCLUSIONS ON HAZARD RISK

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

Table 5.15 summarizes the degree of risk assigned to each category for all identified hazards in the region based on the application of the voting tool fully introduced in Methodologies Used, Qualitative Methodology at the beginning of this section. Assigned risk levels were based on historical and anecdotal data, as well as input from committee members.

TABLE 5.15: SUMMARY OF QUALITATIVE ASSESSMENT

HAZARD	MITIGATION PRIORITY RANKING
Flooding	$27,925,000
Tropical/Coastal Storm	$25,775,000
Hazardous Materials Incident	$4,800,000
Tornado	$2,925,000
Winter Storm	$2,500,000
Sea Level Rise & Land Subsidence	$2,100,000
Shoreline Erosion	$1,350,000
Earthquake	$1,150,000
Wildfire	$450,000
Drought	$0
Extreme Heat	$0

Source: Mitigation Committee Meeting results

The conclusions drawn from the assessments, combined with final determinations and discussion from the committee, were inserted into three categories for a final summary of hazard risk for the region based on High, Moderate, Low, or Negligible designations (**Table 5.16**). It should be noted that although some hazards are classified as posing Low risk, their occurrence is still possible.

TABLE 5.16: CONCLUSIONS ON HAZARD RISK FOR HAMPTON ROADS	
CRITICAL HAZARD - HIGH RISK	FLOODING TROPICAL/COASTAL STORM
CRITICAL HAZARD - MODERATE RISK	SEA LEVEL RISE AND LAND SUBSIDENCE TORNADO WINTER STORM HAZARDOUS MATERIALS INCIDENT
NONCRITICAL HAZARD - LOW RISK	SHORELINE EROSION EARTHQUAKE WILDFIRE
NEGLIGIBLE	DROUGHT EXTREME HEAT

CAPABILITY ASSESSMENT

2017 UPDATE

Section 6 was updated to combine capabilities of all communities based on the existing plans and updated information collected from interviews, phone calls, and committee work during the update process. The following major changes were incorporated:

1) All tables were updated to reflect new information;
2) Mitigation actions completed by communities and their methods of integrating hazard mitigation principles across plans and departments was summarized; and,
3) A brief section detailing regional capabilities in conjunction with the Hampton Roads Planning District Commission, and state coastal zone management capabilities was updated.

INTRODUCTION

This section of the Plan discusses the capability of Hampton Roads communities 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
- INTEGRATING MITIGATION INTO COMMUNITY LIFE

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 Hampton Roads' community capabilities, the planning committee 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. The matrix of capability indicators has been built by the consultant over several years of gathering capability information, and on review of numerous documents relating factors that impact community capability. Other indicators included information related to each community'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 2017 update, the planning committee was asked to review and provide feedback on: the existing plan's capability assessment, and a presentation at the second meeting of the planning subcommittee. The presentation included information on possible 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 each 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 Hampton Roads, 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. A "C" indicates that the item is in place for a town jurisdiction, but is maintained and administered by the County.

TABLE 6.1: RELEVANT PLANS, ORDINANCES, AND PROGRAMS

COMMUNITY	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 (feet freeboard)	Zoning Ordinance	Subdivision Ordinance	Unified Development Ordinance	Post-disaster Redevelopment Plan	Building and Fire Code	NFIP	NFIP Community Rating System
PENINSULA																						
Hampton	✓	✓			✓	✓	✓	✓		✓	✓	✓	✓		✓(3)	✓	✓			✓	✓	✓
Newport News	✓	✓		✓	✓	✓	✓	✓		✓		✓	✓	✓	✓(2)	✓	✓			✓	✓	✓
Poquoson	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓			✓(3)	✓	✓			✓	✓	✓
Williamsburg	✓	✓			✓	✓	✓	✓		✓	✓	✓	✓		✓	✓	✓			✓	✓	
James City County	✓	✓			✓	✓	✓	✓	✓	✓		✓			✓(2)	✓	✓			✓	✓	✓
York County	✓	✓			✓	✓	✓	✓	✓	✓		✓			✓(3)	✓	✓			✓	✓	✓
SOUTHSIDE																						
Norfolk	✓	✓			✓	✓	✓	✓		✓		✓		✓	✓(3)	✓	✓			✓	✓	✓
Portsmouth	✓	✓	✓		✓	✓	✓	✓		✓	✓	✓	✓	✓	✓(3)	✓	✓			✓	✓	✓
Suffolk	✓	✓		✓	✓	✓	✓	✓		✓		✓	✓	✓	✓	✓	✓			✓	✓	
Virginia Beach	✓	✓		✓	✓	✓	✓	✓		✓		✓	✓	✓	✓(2)	✓	✓			✓	✓	
Chesapeake	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓(1.5)	✓	✓			✓	✓	✓
WESTERN TIDEWATER																						
Isle of Wight County	✓	✓			✓	✓	✓	✓	✓	✓		✓	✓	✓	✓(1.5)	✓	✓			✓	✓	
Smithfield	✓	✓			✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	
Windsor	✓	✓			✓		✓	✓		✓		✓			✓	✓	✓			✓	✓	
Franklin	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓(2)	✓	✓		✓	✓	✓	
Southampton County	✓	✓		✓	✓	✓	✓	✓				✓			✓(1.5)	✓	✓			✓	✓	
Boykins	✓	✓				C	C	C					✓		✓	✓	✓			✓	✓	
Branchville	✓	✓				C	C	C					✓		✓	✓	✓			✓	✓	
Capron	✓	✓				C	C	C					✓			✓	✓			✓		
Courtland	✓	✓				C	C	C					✓		✓	✓	✓			✓	✓	
Ivor	✓	✓				C	C	C					✓		✓	✓	✓			✓	✓	
Newsoms	✓	✓				C	C	C					✓			✓	✓			✓		

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. 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.

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.

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

- Virginia Department of Emergency Management (VDEM) assists local governments with plan development and revisions by offering the following services:
  - Issuing update notification at both 1 year and 6 months;
  - Conducting a plan review, as requested;
  - Facilitating plan review meetings; and,
  - Developing plan templates through collaboration with local partners
- In December 2015, VDEM released *2015 Report on the Status of Emergency Response Plans and Preparedness Efforts in the Commonwealth*. According to the report, 98-percent of Virginia localities have current local emergency operations plans. Virginia was accredited for the third time in a row by the Emergency Management Assessment Program (EMAP). Recommendations from the report included implementing statwide disaster planning software to digitize all EOPs to increase efficiency and coordination between agencies and localities, and using common operating picture (COP) tools to provide situational awareness to state leaders in real-time.

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.

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.

- The Virginia plan for radiological emergencies is available online at: http://www.vaemergency.gov/webfm_send/522/COVEOP_2012_HSA_1_Radiological_Emergency_Respsponse.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).

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.

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.

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.

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 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.

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 2012 version of the International Building Code and International Fire Code were adopted by the Commonwealth of Virginia and are in effect in Hampton Roads since 2014.

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.

Detailed information on each community's NFIP participation history and current map status are provided in Sections 5 and 6: **Table 5.3** summarizes NFIP participation for Hampton Roads communities, along with general NFIP policy data, while **Tables 5.4** and **5.5** provide the repetitive flood losses; and **Table 6.1** provides information on freeboard requirements. Each of the communities that participates in the NFIP has designated a floodplain manager in their floodplain management ordinance and each community in the NFIP has created a very specific Mitigation Action in the Mitigation Action Plan in Section 7 that addresses actions they will consider in the near-term to address their commitment to continuing their participation in the NFIP. Noteworthy accomplishments in floodplain management are also found at the end of this section, broken out by community. **Table 6.2** provides additional summary information on how the NFIP is managed in each of the participating communities in Hampton Roads, and notes specific actions or programs of interest in each community, especially with regard to their flood ordinances which are typically zoning overlay ordinances.

TABLE 6.2: NFIP MANAGEMENT IN PARTICIPATING COMMUNITIES

SUBREGION	COMMUNITY	Designated Floodplain Manager/Agency	CFM on Staff?	Notes on Floodplain Management Ordinance and Administration
Peninsula	Hampton	Water Resources Engineer	Yes, 4	The City last updated their ordinance 2014 and included 3 feet of freeboard in the SFHA and 1.5 feet of freeboard outside the SFHA. Most ordinance administration is by Community Development or Public Works. The CBPA protects natural and beneficial functions of floodplains in some areas. ECs are maintained in digital format.
	Newport News	Cartographic Specialist	Yes, 2 in Engineering and 1 in Emergency Management	Ordinance was updated in 2014 and requires 2 feet freeboard. Codes Compliance maintains ECs and performs inspections of floodplain construction.
	Poquoson	Building Official	Yes	Last updated in 2014, the City's ordinance has many higher standards, including coastal A Zone, and freeboard of 3 feet. The ordinance is administered by the Building Official within the Permit Office.
	Williamsburg	Zoning Administrator	No	The City last updated their ordinance in 2015, adopting the State's model ordinance, with 2 feet of freeboard for nonresidential structures and 18 inches for residential structures. The narrow floodplains of Williamsburg do not lend themselves to development pressure; the ordinance is administered as a zoning ordinance by the Zoning Administrator.

TABLE 6.2: NFIP MANAGEMENT IN PARTICIPATING COMMUNITIES				
SUBREGION	**COMMUNITY**	**Designated Floodplain Manager/Agency**	**CFM on Staff?**	**Notes on Floodplain Management Ordinance and Administration**
	James City County	Proffer Administrator	Yes	The ordinance is contained in the Zoning Ordinance and was last updated in 2015 to include 2 feet of freeboard, and many prohibited uses in the SFHA such as manufactured homes, storage/transport of hazardous materials. It also has higher standards for fill. Community Development office administers the ordinance.
	York County	Chief of Stormwater Programs	Yes	The ordinance is contained in the Zoning Ordinance and requires 3 feet of freeboard for residential structures and an additional foot of freeboard for structures in the Coastal A Zone.
Southside	Norfolk	Floodplain Administrator (Planning)	Yes	Revisions to ordinance approved 2014 with several higher standards, including 3 feet freeboard, and coastal A zone regulation to V Zone standards. City has robust flood mitigation program, CRS program and ordinance administration system through City Planning, Building Safety and the Development Services Center.
	Portsmouth	Environmental Manager	Yes	Zoning related inquiries and information regarding floodplains is handled by the Department of Neighborhood Advancement. The City has a robust flood mitigation program and CRS program. Last updated in 2015, the ordinance requires 3 feet freeboard and V Zones requirements for coastal A Zone structures.
	Suffolk	Director of Planning and Zoning	No	The floodplain management ordinance was updated in 2015. Flood damage is tied to the assessor's record for properties. High water mark data is collected along the Nansemond River at North Main Street. The City does not maintain ECs digitally.
	Virginia Beach	Public Works Director	Yes, but not required by ordinance. 2 in Planning, 2 in Public Works, 1 in Emergency Management	The City ordinance requires 2 feet of freeboard. The ordinance had a major rewrite in 2013 and it includes several higher standards, including compensatory fill in some areas, and no new residential structures on lots created after October 23, 2001. 38% of the SFHA is protected as open space. Lowest floor data for new structures is recorded in online permit record and EC is attached to Certificate of Occupancy. USCG installing 10 tide gauges with real time data to be publicly available. City has a Southern Rivers watershed buffer and the CBPA buffers which help protect natural and beneficial functions of floodplain.
	Chesapeake	Director of Development and Permits	Yes	Ordinance was updated in 2014 and includes 1.5 feet of freeboard. The City maintains ECs digitally.
Western Tidewater	Isle of Wight County	Director of Planning and Zoning	Yes	The County has freeboard of 1.5 feet required by ordinance, has no freeboard outside the SFHA, and is working on joining the CRS.

TABLE 6.2: NFIP MANAGEMENT IN PARTICIPATING COMMUNITIES				
SUBREGION	**COMMUNITY**	**Designated Floodplain Manager/Agency**	**CFM on Staff?**	**Notes on Floodplain Management Ordinance and Administration**
	Smithfield	Town Manager	No	Ordinance does not require freeboard and is administered by Planning, Engineering & Public Works.
	Windsor	Planning and Zoning Department	No	Ordinance does not require freeboard and is administered by Planning and Zoning Department.
	Franklin	Director of Community Development	Yes	The City has freeboard of 2 feet. Ordinance was updated in early 2016. City routinely considers higher standards and the impact when updating ordinance. The Comprehensive Plan promotes a greenway along the Blackwater River and zoning protects open space along the river. The City is considering joining the CRS. Online maintenance of ECs is under development. The Downtown area has a Flood Recovery Plan.
	Southampton County	Director of Community Development	Yes	The County recently adopted the State Model Floodplain Ordinance and included 1.5 feet of freeboard. Residential structures are required to have large, front-yard-type, setbacks along waterfront, rather than smaller rear yard setbacks as is typical not along waterfront. Comprehensive Plan encourages conservation easements/ag and forestal districts and reforestation of clear-cut properties as well as a number of environmental goals to protect waterways and wetlands, Nottoway and Blackwater Rivers are part of State Scenic River program, limiting development that visually impacts rivers, thereby helping limit development in the floodplain.
	Boykins	Mayor	No	Ordinance requirements administered by town staff, as required, although the towns are exploring an MOU for County administration.
	Branchville	Unknown	No	Ordinance requirements administered by town staff, as required, although the towns are exploring an MOU for County administration.
	Courtland	Mayor	No	Ordinance requirements administered by town staff, as required, although the towns are exploring an MOU for County administration.
	Ivor	Clerk	No	Ordinance requirements administered by town staff, as required, although the towns are exploring an MOU for County administration.

An additional indicator of floodplain management capability is participation in the CRS. The CRS is an incentive program that encourages communities to undertake defined flood mitigation activities that go above and 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. Every 500 points accumulated is equal to a 5% reduction in flood insurance premiums.

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.

- As of October 2015, there were six communities in the study area participating in the Community Rating System: Hampton (Class 8); James City County (Class 7); Norfolk (Class 9); Poquoson (Class 8); Portsmouth (Class 9); and York County (Class 8). Being in the CRS shows continued compliance with the NFIP on the part of these communities.

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 Portsmouth is the only community in the study area that adopts a separate floodplain management plan, but the community 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.

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.

- Virginia Department of Environmental Quality (DEQ) is the lead agency for developing and implementing statewide stormwater management and nonpoint source pollution control programs to protect the Commonwealth's water quality and quantity. Currently, three laws apply to land disturbance activity in Virginia: the Stormwater Management Act (§ 62.1-44.15:24 et seq.), Erosion and Sediment Control Law (§ 62.1-44.15:51 et seq.), and Chesapeake Bay Preservation Act (§ 62.1-44.15:67 et seq.). These laws evolved at different times, have been administered by different agencies throughout the years, and created three distinct regulatory programs with varying requirements. At the request of the Chairs of the Virginia House and Senate Natural

Resources committees, DEQ pulled together a group of stakeholders to consider ways to streamline and possibly combine these programs. The goal is to make the requirements clearer, more consistent and more “user-friendly”, while continuing to ensure the protection of the Commonwealth’s water quality. The Department asked representatives of all affected constituencies to take part in this important effort – including local governments, the development community, environmental organizations, agriculture, and others.

- Local governments in Virginia are required to administer the stormwater management laws and regulations promulgated by the State through local ordinances.

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 available personnel resources, whether through consultants or collaborators with community government. **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

COMMUNITY	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
PENINSULA										
Hampton	✓	✓	✓	✓	✓			✓	✓	✓
Newport News	✓	✓	✓	✓	✓			✓	✓	✓
Poquoson	✓	✓	✓	✓	✓		✓			✓
Williamsburg	✓	✓	✓	✓	✓			✓	✓	✓
James City County	✓	✓	✓	✓	✓			✓	✓	
York County	✓	✓	✓	✓	✓				✓	
SOUTHSIDE										
Norfolk	✓	✓	✓	✓	✓				✓	✓
Portsmouth	✓	✓	✓	✓	✓	✓		✓	✓	✓
Suffolk	✓	✓	✓	✓				✓	✓	✓
Virginia Beach	✓	✓	✓	✓	✓	✓		✓	✓	
Chesapeake	✓	✓	✓	✓	✓	✓			✓	✓
Franklin	✓	✓	✓	✓	✓			✓	✓	
WESTERN TIDEWATER										
Isle of Wight County	✓	✓	✓	✓					✓	
Smithfield	✓	✓	✓	✓					✓	
Windsor										
Southampton County	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Boykins		✓								
Branchville										
Capron										
Courtland	✓	✓								
Ivor										
Newsoms										

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.

TABLE 6.5: FISCAL CAPABILITY									
COMMUNITY	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
PENINSULA									
Hampton	✓	✓	✓	✓		✓		✓	✓
Newport News	✓	✓			✓	✓			✓
Poquoson	✓	✓				✓		✓	✓
Williamsburg	✓	✓		✓	✓			✓	✓
James City County	✓	✓							✓
York County	✓	✓							✓
SOUTHSIDE									
Norfolk	✓	✓		✓	✓	✓			✓
Portsmouth	✓	✓			✓	✓		✓	✓
Suffolk	✓	✓	✓	✓	✓		✓	✓	✓
Virginia Beach	✓	✓	✓		✓	✓	✓	✓	✓
Chesapeake	✓	✓			✓	✓	✓	✓	✓
WESTERN TIDEWATER									
Isle of Wight County	✓	✓		✓	✓			✓	✓
Smithfield	✓	✓			✓		✓		✓
Windsor	✓	✓					✓		✓
Franklin	✓	✓	✓	✓	✓				✓
Southampton County	✓	✓		✓	✓			✓	✓
Boykins		✓						✓	
Branchville		✓						✓	
Capron		✓			✓			✓	
Courtland		✓			✓			✓	
Ivor		✓			✓			✓	
Newsoms		✓						✓	

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.

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. The committee 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					
COMMUNITY	Planning and Regulatory Capability	Administrative and Technical Capability	Fiscal Capability	Political Capability	Overall Capability
PENINSULA					
Hampton	H	H	M	M	M
Newport News	H	H	M	H	H
Poquoson	H	H	M	M	H
Williamsburg	H	H	H	H	H
James City County	H	H	M	H	H
York County	H	H	M	H	H
SOUTHSIDE					
Norfolk	M	H	M	H	M
Portsmouth	M	M	L	M	M
Suffolk	M	H	M	L	M
Virginia Beach	M	H	M	L	M
Chesapeake	H	H	M	M	H
WESTERN TIDEWATER					
Isle of Wight County	H	M	M	M	M
Smithfield	L	L	L	M	L
Windsor	L	L	L	L	L
Franklin	M	M	L	M	M
Southampton County	M	M	L	M	M
Boykins	L	L	L	M	L
Branchville	L	L	L	M	L
Capron	L	L	L	M	L
Courtland	M	M	L	M	M
Ivor	L	L	L	M	L
Newsoms	L	L	L	M	L

INTEGRATING MITIGATION MEASURES INTO COMMUNITY LIFE

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.

While the notes below are not an exhaustive list of all mitigation actions taken in the region, they do provide a summary of very recent mitigation measures undertaken by communities in Hampton Roads and describe how many of the communities have integrated their mitigation strategies into other planning mechanisms. Additionally, as noted in the *National Mitigation Framework*, the aspects of leadership, collaboration, partnership building and education/skill building have been shown in the following notes whenever possible.

Regional Activities

- Prepared grant application for hazard mitigation plan update that combines 7 existing plans into 1 large regional plan. Updated plan will streamline the list of hazards to align more closely with the State Hazard Mitigation Plan.
- The All-Hazards Advisory Committee (AHAC) was formed in 2015 to bring together mitigation practitioners from each of the HRPDC communities. This group is helping the PDC administer the mitigation planning contract among other tasks.
- Coastal Virginia CRS Users' Group meets every other month to review best practices of other communities and stay up to date on floodplain management and CRS issues. Consulting hazard mitigation planners for the HRPDC updated the group on how to create and update mitigation capability analyses at spring 2015 meeting.
- Each community's comprehensive plan, Old Dominion University/VIMS/HRPDC recent publications on sea level rise, and the State Hazard Mitigation Plan were used and will continue to be used to carefully update the goals and objectives in the HMP to align with existing plan goals at the State and regional levels.
- Each community strives to include mitigation planning committee members who were also involved in the comprehensive planning process. This helps ensure consistency across planning documents. Since there are 14 comprehensive plans to consider during this HMP update, it is expected that common themes can be found that will help focus the HMP goals and objectives in a manner consistent with the 14 comprehensive plans.

City of Hampton

- The City's Fire Department Public Educator has added more hazards to her 4th grade fire presentation.
- The 2011 Hazard Mitigation Plan, especially HIRA information, was integrated into City's 2014 Emergency Operations Plan update.
- Hampton and Newport News applied for and received a hazard mitigation grant to add a generator to Hines Middle School, which is one of the shelters in the City's MOU with Newport News.
- Hampton received a State Homeland Security Grant in 2014 to add specialized items for sheltering children, such as highchairs and pack and plays.
- As a result of a previous HMP action to evaluate/review options for more effective public warning systems to upgrading/replace existing reverse 911 system, in 2013 Hampton switched to Everbridge which provides more options for alerting the public. This system is also integrated with the system being used by VDEM.
- HMP action to educate elected officials and residents on the importance of the NFIP has resulted in a multi-agency effort to provide flood insurance brochures at all outreach events. The

importance of flood insurance is in the City's general presentation that is given to the public on emergency management.

- A high priority action in the HMP was to support mitigation of priority flood-prone structures through promotion of acquisition/demolition, elevation and flood proofing of non-residential projects where feasible using FEMA hazard mitigation grant programs where appropriate. The City has hired new staff to implement grants and has several on going home elevation projects, including:
    - Severe Repetitive Loss Grant Program 2012 – Project is to elevate 4 SRL residences
    - DR-4024 (Disaster mitigation funding from Hurricane Irene) – Project is to elevate 8 flood prone residences (7 on RL list)
    - DR-4042 (Disaster mitigation funding from Mineral, VA earthquake) – Project is to elevate 8 flood prone residences (6 SRL, 1 RL)
    - FMA 2013 (Flood Mitigation Assistance Grant Program) – 2 Projects to elevate 10 SRL residences
- The City has implemented a revolving loan fund for residential elevation projects. The revolving loan program is up and running. It is the only program of its kind, in Virginia, for residents to apply for low-interest loans to help with qualifying mitigation projects. This project is supported by the Office of Emergency Management, Hampton Redevelopment and Housing Authority, and Old Point National Bank. Hampton would like to assist other localities in setting up a similar program.
- Mitigation action to provide NOAA weather radios to high risk populations was funded and completed with weather radios provided to residents that live in mobile homes in Hampton in April 2015.
- HMP mitigation action to evaluate the relocation of Hampton City Schools Maintenance Building was implemented by chance when the building was destroyed by a tornado that hit Hampton on January 11, 2014. The building was not rebuilt.

City of Newport News

- The Comprehensive Plan update process during the summer of 2015 examined goals, objectives, and actions from the previous HMP. Many of the same planning teams will be involved in both updates.
- The emphasis on floodplain management through ordinance administration in the HMP resulted in flood ordinance changes in 2014 that included adoption of freeboard.
- Certified Floodplain Managers, a professional certification program administered by the Association of State Floodplain Managers, increased in number across at least 2 departments and they participate in hazard mitigation planning on a regular basis.
- The City Watch program was expanded to include post-disaster messages as a result of a careful capability analysis.
- The City formed a Generator Committee to address needs in the City identified during hazard mitigation capability review.
- A mitigation action in the previous plan recommended developing a natural hazards school curriculum. Existing Fire Department programs were expanded to address this need.
- The previous HMP identified City Line apartments as a high hazard area and some retrofits were made to the complex's HVAC system. Additional flood protection measures for this and an adjacent housing complex are being pursued in conjunction with the City of Hampton, U.S. Department of Housing and Urban Development and other State and Federal agency partners.

City of Poquoson

- The City has inserted a Capital Improvement Plan (CIP) line item for tree trimming as reflected in the mitigation actions in the HMP, and is pursuing installation of hurricane shutters on the front of City Hall through similar measures.
- In partnership with Hampton, the two cities hired a shared grants administrator specifically to pursue funding for mitigation actions identified for sea level rise and flood mitigation.
- As part of CRS program, City is forming a Program for Public Information (PPI). A regional PPI is under consideration by several adjacent communities.

City of Williamsburg

- The City has and maintains StormReady designation and has discussed pursuit of the designation with the College of William and Mary, as well.
- The stormwater program has started a series of inter-departmental training sessions to help other City staff who are out in neighborhoods to recognize problems associated with drainage maintenance, including waste dumping, improper use of drains and proper notification of problems. Drainage system maintenance is a medium priority action in the HMP and this innovative method for addressing maintenance problems has been well-received in by the Fire Department.
- Shelter generator maintenance program called for in the HMP has been implemented through the CIP, with a regular maintenance budget and real-time monitoring software included.
- Strengthening the GIS capability was a medium priority in the last two HMPs. The City has now hired a part-time person and hazard-related GIS data gathering has been accomplished, including verification of hydrant locations and identification/mapping of critical structures and infrastructure.
- Mitigation action in HMP called for exploring feasibility of a Disaster-Resistant University plan with the College of William & Mary. The university did their own plan in 2013.

James City County

- Repetitive flood loss data is reviewed annually as part of the County's participation in the CRS, or when the data is made available. This action is included in the Hazard Mitigation Plan but is also part of the County's plan to address flood mitigation through the CRS.
- Two major theme parks in the County, Busch Gardens and Water Country, received StormReady designation through NOAA.

York County

- A mitigation action in the Hazard Mitigation Plan suggests evaluating sustainability and safety of critical facilities. The county's ongoing plan for generator replacement is now tied to the CIP.
- York County, Newport News and Newport News Waterworks work jointly on forest management at the Waterworks-owned property. Fire trails are regularly maintained.
- Part of staff responsibilities include making information/speakers available to business for contingency planning as needed, or as requested. This is a mitigation action identified in the Hazard Mitigation Plan and reflected in day-to-day operations.
- The County adopted 3 feet of freeboard for structures built or substantially improved in flood hazard areas. Freeboard was recommended as an action in the hazard mitigation plan.
- Comprehensive Plan adopted in 2013 echoes several of the hazards included in the previous hazard mitigation plan, and proposes Implementation Strategies to address them in great detail. The shoreline erosion strategies will continue to be referenced, or included directly, in the 2017 update to the Hazard Mitigation Plan.

City of Norfolk

- Updated Comprehensive Plan was adopted March 26, 2013, and was recognized as an example of content and metrics to include in a comprehensive plan. The plan was also recognized for its inclusion of sea level rise, flooding and mitigation actions as part of the metrics.
- As a result of a previous mitigation action plan strategy to expand existing notification systems, several City departments have come together to expand the City's ability to notify the public. Sources include real-time updates the web page, email distribution lists, Facebook and Twitter.
- The City continues to update the flooding awareness webpage, accessible from the homepage. A cross-departmental Flood Awareness Committee was formed, and also provides quarterly updates to citizens as well as to the professional community regarding the City's progress on flood mitigation as well as providing an opportunity for dialogue for all interested stakeholders.
- The City is part of the Rockefeller Foundation RE.invest Initiative which explores ways the private sector can be engaged to enhance flood protection in some older areas of Norfolk with a history

of flooding. The city is currently reviewing a report of actions and deliverables from the RE.invest group.

- The city is recognized as part of the initial cohort of the 100 Resilient Cities. Also funded by the Rockefeller Foundation, the program provides access to a worldwide network and knowledge base that will be able to identify additional strategies to help the City be more resilient to physical, social, and economic threats. As a result, the city has appointed a Chief Resiliency Officer.
- As a result of a previous mitigation action plan strategy, City and Norfolk Public Schools have funded and are in the design phase of multiple school replacements throughout Norfolk. These new facilities will replace older facilities that do not meet current requirements for stormwater management and, in some cases, elevation for flood protection. New structures will meet these requirements and provide safer emergency shelters in times of need.
- Public Works has completed improvements to Brambleton Avenue that provide better access and egress to Sentara Norfolk General Hospital and Eastern Virginia Medical College during storm and flooding events.
- After a storm or flooding event occurs, properties that have received damage are mapped using GIS as part of the damage assessment reporting. Damage assessment training is provided each spring for staff that inspect properties after events.
- The city uses a new data tracking software of storm events (STORM) for live input of information from the public that is used to provide guidance to city staff regarding where problems exist during storm events.
- Revisions to the Zoning Ordinance were approved and implemented on January 1, 2014. These revisions allow for development to be more resilient to flood damage. These changes are expected to help lower the city's CRS classification and further reduce flood insurance premiums for property owners in the city.
- The city has acquired Everbridge, calling it Norfolk Alert, to alert property owners in flood-prone areas of need for evacuation or other short-term actions ahead of, during or after events.
- The City's GIS department development a tool termed the Tidal Inundation Tracking Application for Norfolk (TITAN) that shows potential flooding based on current tide projections or other hypothetical scenarios.

City of Portsmouth

- In addition to HMP, Portsmouth has a Floodplain Management Plan that is updated on a 5-year cycle, just before the hazard mitigation plan. Plans are slightly redundant, but serve different purposes. The FMP will be consulted as the HMP is updated through 2016 to avoid conflicts and echo priorities for flood mitigation.
- Flood Information Pamphlets are distributed by several City departments, including recently to all rental units as inspections are completed, and at the public counters in Planning and Inspections. Originally developed for CRS and repetitive loss mailings, pamphlets have an expanded purpose and audience in recent years.
- Staff created a "flood speakers bureau" for Civic Leagues and has attended 4 civic/neighborhood meetings to speak.
- Floodplain Management function was transferred to the Department of Neighborhood Advancement in August 2013. New web page was created in 2014.
- Emergency evacuation plan was a priority in the previous mitigation plan. Action on this item is strategically on hold in order to use new LIDAR data received in August 2014. First step is creating a list of flood prone streets and then routing evacuation. Fire Department, Engineering and Public Works are all involved in listing flood-prone streets. USACE is also involved.
- Staff training on the NFIP is a priority in the HMP. Staff provided training to City Council and Planning Commission on BW '12 and other NFIP legislative changes to increase knowledge and allow integration of NFIP information in City planning strategies.
- Identifying and funding drainage improvements and protecting water/sewer infrastructure from flooding is a high priority in the HMP and FMP. Work has been coordinated between several departments and an outside engineering firm, and funded through capital improvements planning. New stormwater lines are being replaced with larger lines and outfalls are getting flood gates.

New and retrofitted pump stations can be quickly connected to generators or auxiliary pump connections.

- GIS is being used to map flood-prone properties that store hazardous materials as identified by the Fire Department. This inter-departmental use of funds was a priority in the FMP. This action increases the City's ability to identify capability gaps with regard to fire and flood as compounding hazards.
- While not complete, an interdepartmental effort to help special needs homes develop emergency operations plans is underway. This priority of the FMP will tie together several existing plans for flood, emergency operations and outreach/warning.
- Many plans and actions by the City are becoming dependent on an agreed-upon rate of sea level rise for a specific time period. Using the VIMS study and efforts by ODU, Portsmouth has settled on a rate of 7 feet of sea level rise by 2100. This is a subtle, but important accomplishment for moving several plans and projects forward.

City of Suffolk

- Information from the 2011 HMP was incorporated into the 2015 Revision of the City of Suffolk Emergency Operations Plan and into the 2015 revision to the City of Suffolk Hazardous Materials Response Plan.
- Flood hazard risk and vulnerability information was considered for the City's 2035 Comprehensive Plan and the recent FIRM updates.
- As a result of a previous mitigation action plan strategy, a FIRM viewer and a Hurricane Surge Viewer are in place on the City's Emergency Management website in the "Flooding" tab. A PDF document also resides there for users who are not comfortable with mapping programs.
- Suffolk OEM answers email and phone requests for address-specific flood data. Personalized maps can either be generated in the office or during community outreach events.
- Hurricane/tropical storm/flood safety talks are delivered upon request to church, civic and community groups.
- Hurricane/flooding preparedness brochures are placed at local libraries, the visitor's center and other public buildings around the city.

City of Virginia Beach

- Together with the AHAC, the City is considering working toward a regional recovery framework. This is an offshoot of the City's mitigation action regarding developing a regional MOU for recovery and mitigation.
- The 2015 Comprehensive Plan update references the hazard mitigation plan update process. The timing did not facilitate inclusion of the existing mitigation actions because those actions were updated immediately thereafter during the update. The Sustainability Plan references the Hazard Mitigation Plan content in the appendices, echoes the goals and objectives of the Hazard Mitigation Plan, and contains a flood component to address the interrelationship of flood mitigation and sustainability.
- The ComIT Data Center relocation mitigation action has not occurred, but the City has used the recommendation from the plan to push for generator/battery backup and consolidation of data centers as a first step. Relocation of the center will be changed to a high priority action due to the increasing recognition of the importance of this action to City operations.
- The City changed floodplain management ordinance to adopt two feet of freeboard for structures built or substantially improved in flood hazard areas.
- City is aggressively tackling enforcement issues in floodplains.
- City is integrating floodplain management more widely into other community actions such as the preliminary development review process which includes flood mitigation recommendations early in the process and the formation of the City Manager's Sea Level Rise/Flooding Work Group.
- Although the Hazard Mitigation Plan is not referenced per se in the annual CIP, projects are included that reflect mitigation actions from the plan on a regular basis. One example was the relocation and rebuilding of the City's Animal Control Facility. Another example is the complete replacement of the public safety communication hardware and the 6-year spending/replacement plan that is reflected in each CIP.

- Public information, particularly regarding floodplain management, has been redesigned on the City's web site and the site references and includes information from the HIRA in the Hazard Mitigation Plan.
- CERT curriculum was revised to include damage assessment and storm preparation advice as a result of mitigation actions and hazard information included in the Hazard Mitigation Plan.
- The City's Urban Forestry Management Plan, a component of the Comprehensive Plan, was published in 2014 and includes strategies for better management of dunes and landscaping in V Zones. The plan is expressly tied to the Sustainability Plan, the city's stormwater management regulations, the Strategic Growth Area Plans, and the Outdoors Plan, and includes a reference to Sea Level Rise as a threat to tree cover in the City.
- The City recognizes the importance of sand management strategies for maintaining beaches, like Sandbridge, and plans to use the HMP update process to reinforce the importance of ongoing actions that are being implemented through other planning mechanisms.

City of Chesapeake

- Chesapeake has attained a Class 8 rating in the CRS program, qualifying all Chesapeake residents for a 10 percent discount in flood insurance premiums, due to its continued vigilance in floodplain management, open space policies, public outreach in flood issues, and acquisition, demolition and elevation of severe repetitive flood loss properties through various grant programs.
- The City has expanded its ability to notify the public of potential flood hazards by using Everbridge, which is a part of Chesapeake Alert. Additionally, Emergency Management has coordinated with our Public Information offices and Public Works to provide the public with real-time updates via its City webpage, Facebook and Twitter.
- Chesapeake provides continued information on flood-related issues, including the NFIP, via the City's home web page and the Emergency Management web page.
- The City of Chesapeake has acquired $7,515,092.00 in FMA grant funds over the past seven years to acquire and demolish 25 and elevate five severe repetitive loss structures.
- The City has committed in its CIP the following:
  - $1.5 million for public works infrastructure system replacement and upgrade in the South Norfolk/Liberty Street area to protect and enhance drainage for this flood-prone area.
  - $5 million to a five-year public works project that increases resiliency in the South Norfolk/Oakdale area and the city is in the conceptual stage of a drainage improvement project totaling $800,000 in the South Norfolk/Portlock area, which will be under construction in 2016.
  - All projects are designed for Best Management Practices, designed to collect storm water runoff, reduce soil erosion and remove pollutants. The outcome will be to substantially alleviate the repetitive flood problems in that area, to build social and physical resiliency for the low- to moderate-income population, and to encourage economic resiliency through infrastructure that encourages and supports economic revitalization in the South Norfolk area, an area that is on the upswing.
  - The South Norfolk target area will also see increased resiliency from a Chesapeake/ Hampton Roads Sanitation District (HRSD) project. $8 million will be spent in the South Norfolk to replace the 100-year old wastewater transmission lines. HRSD is an award-winning, industry leader at the national, state, and local levels in protecting public health and the waterways, and the regional wastewater treatment agency that treats water for Chesapeake and other localities in Hampton Roads.
  - Chesapeake has budgeted $7 million for the Bainbridge Boulevard corridor five-year public utilities project. The City's dedication to building resiliency for its citizens and to businesses is typified in this project that will improve resiliency by decreasing risk associated with flooding's effect on the public utilities. By burying utilities along that the Bainbridge Boulevard corridor, the city will eliminate the risk of utility interruption created during floods. This will create a more resilient infrastructure that will generate greater social and economic benefits in the South Norfolk low- to moderate-income community.

Improved infrastructure is an asset in building economic revitalization, as well as in improving utility service to residents during tidal flooding and/or heavy rains, including rains from hurricanes.

- Chesapeake begins its hazard mitigation planning through the Natural Event Mitigation Advisory Committee (NEMAC). NEMAC is a citizen/city staff advisory committee appointed by City Council to advise it on all hazards and report yearly on progress in mitigation and resiliency. NEMAC's 8 citizens (who form the quorum) is supported by 9 city department representatives, with each department representing a part of mitigation problems and solutions. NEMAC meets 6 times a year to plan for hazards, to make recommendations for improvements in the Hazard Mitigation Plan (HMP) to increase resiliency, and to provide oversight on accomplishing the actions recommended in the HMP. One particular resiliency improvement overseen by the NEMAC was providing guidance to include sea level rise and land subsidence in the 2014 HMP as a Critical Hazard-Moderate Risk.

Isle of Wight County

- As a result of a mitigation action in the HMP, staff have been cleared to move forward with CRS application-related activities.
- Comprehensive Plan updates in the region have included resource conservation areas. Sea level rise continues to be a consideration for future planning efforts.
- Stormwater drainage in floodprone areas has been identified as a local hazard and related action to implement a drainage plan is being acted upon through implementation of a stormwater master plan in development.
- Flooding of access roads identified as a problem in the HIRA. Virginia Department of Transportation (VDOT) owns and maintains all roadways in the county. County has recently added a transportation planner/VDOT liaison to staff to help with coordination of issues like this. Similarly, an extra fueling station for county vehicles was needed and recently installed in conjunction with the new volunteer rescue squad building.

City of Franklin

- Southampton County and the City of Franklin implemented a "shared services" Community Development Department recently that had the effect of reducing costs, increasing available services, and increasing efficiencies, including sharing a Building Official who is also a CFM.

Southampton County

- The draft Comprehensive Plan is expected to be adopted in June 2015. The plan includes many hazard identification and risk assessment elements from the previous HMP in Chapter 7, Environment. There is information on storm tracks, flooding/floodplains, wetlands, and repetitive flood loss areas in the county and towns. Implementation strategies in the comprehensive plan were also coordinated with the mitigation actions in the previous HMP.
- CFM training for staff was indicated as a high priority in the previous HMP. The County and the City of Franklin implemented a "shared services" Community Development Department recently that had the effect of reducing costs, increasing available services, and increasing efficiencies, including sharing a Building Official who is also a CFM.
- Two additional staff in the Franklin/Southampton Community Development Department are working to become CFMs in calendar year 2015.

Town of Boykins

- An acquisition project on Spring Garden Street is complete with the exception of 1 vacant home. Boykins Volunteer Fire Department acquired and cleared the remaining structures.
- Identified as a problem flooding area in the HIRA, the town has done what they can to clean out Tarrara Creek. Private property owners have removed beaver dams and other impediments.
- The mayor is going to put a flyer on each door in town reminding people to sign up for the county's reverse 911. He'll mention it at town council meetings and put it on the town's updated website, which he will ask the county to link to from the county site.

Town of Newsoms

- Drainage improvements to eliminate standing water in yards and drainage ditches as identified in a 2011 stormwater study were targeted as a high priority in the previous HMP. Town procured a grant in 2012 to evaluate storm drainage and recommend improvements. Preliminary engineering report was completed. Town applied for Community Development Block Grant (CDBG) and, as part of the application, also completed a preliminary housing assessment in 2013. The grant was denied, but the Town will seek additional funding sources.

Regional Capabilities

The communities of Southside Hampton Roads are part of HRPDC, one of 21 Planning District Commissions in the Commonwealth of Virginia. 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 VIMS. 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 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

2017 UPDATE

Section 7 was updated to reflect the Co4mmittee's work to update the Goals and Objectives. 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 reviewed, completed actions were deleted; and, new mitigation actions were revised and added as directed by Committee members.

INTRODUCTION

This section of the Plan provides the "blueprint" for Hampton Roads to become less vulnerable to natural hazards. It is based on the general consensus of the Committee 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 region 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 when possible, 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 set of 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*, committee members considered their overall hazard risk and capability to mitigate natural hazards, in addition to the mitigation goals. The prioritization of 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 Hampton Roads Hazard Mitigation Plan were crafted as part of three facilitated discussions and brainstorming sessions with committee members (see Section 2: *Planning Process*). As part of the 2017 update, the planning consultant reviewed the goals and objectives of the six plans being combined. Similar goals and objectives were grouped and assessed initially by the consultant to find the best representative language in each category. This set of combined goals and objectives was then presented at the first of three regional meetings to dissect and review, with live editing of the document taking place during each of the three meetings to reflect participants' current goals and objectives.

The groups reassessed each goal word for word, reprioritized the list, and edited overall for brevity. The original combination document ("Previous Plan Goals and Objectives") and updated ("2017 Goals and Objectives") goals are provided in **Table 7.1** below, with notes about the discussion leading to the changes. The committee also reviewed and considered the regional mitigation goals expressed in several other documents as shown in Section 2. Each of the following goal statements represent a broad target to achieve through implementation of specific *Mitigation Action Plans*.

TABLE 7.1: UPDATED GOALS AND OBJECTIVES

PREVIOUS PLAN GOALS AND OBJECTIVES*	2017 GOALS AND OBJECTIVES
Goal 1: Increase community resiliency/sustainability/ by reducing vulnerability to (all/high risk/natural) hazards. *Objective 1.1: Reduce hazard-related losses to the built environment.* 1.1.1: Implement structural and nonstructural mitigation measures to protect existing development; focus on repetitive flood loss property protection. 1.1.2: Protect future development. 1.1.3: Provide protection and access/egress for critical public and private utilities, facilities and services (also, bridges, utilities and evacuation routes). 1.1.4: Ensure continuity of government operations. *Objective 1.2: Reduce hazard-related impacts on lives.* 1.2.1: Use multi-objective approaches that achieve other community goals such as preservation of natural areas, open space, or energy-efficiency. *Objective 1.3: Increase staff capability in Floodplain and Emergency Management.*	**Goal 1: Increase community resiliency by reducing vulnerability to hazards.** *Objective 1.1: Reduce damage to repetitively flooded properties* *Objective 1.2: Protect existing and future development* *Objective 1.3: Protect critical facilities/infrastructure* *Objective 1.4: Maintain government services throughout hazard events* *Objective 1.5: Reduce hazard-related impacts on daily routines* *Objective 1.6: Preserve and enhance benefits of natural areas* **Why the Change?** These statements are more concise with a very clear focus on the ways in which resiliency can lead to reduced vulnerability. The shortened statements work better for the variety of communities involved in the plan and their unique blend of hazards.

TABLE 7.1: UPDATED GOALS AND OBJECTIVES	
PREVIOUS PLAN GOALS AND OBJECTIVES*	**2017 GOALS AND OBJECTIVES**
Goal 2: Increase public awareness of vulnerability to high risk hazards and mitigation tools. *Objective 2.1: Provide information to residents/citizens, businesses and schoolchildren about hazards.* 2.1.1: Encourage property owners to assume responsibility for protection. 2.1.2: Promote flood insurance as a property protection measure. 2.1.3: Highlight mitigation successes.	**Goal 2: Educate the public about hazard vulnerabilities and ways to reduce risk** *Objective 2.1: Encourage property owners to assume responsibility for reducing vulnerability* **Why the Change?** The groups agreed that government has a responsibility for implementing this goal, but that an additional way to educate is to help and encourage property owners to take appropriate mitigation actions on their own.
Goal 3: Integrate mitigation concepts into local and regional government actions *Objective 3.1: Institutionalize risk reduction principles into the community's daily activities, processes and functions.* *Objective 3.2: Integrate hazard information with environmental protection programs and other community planning initiatives.* *Objective 3.3: Unify local, regional and state planning efforts.* 3.3.1: Include separate section of regional actions in this and future hazard mitigation plans. *Objective 3.4: Improve hazard data collection and mapping.*	**Goal 3: Strengthen and develop partnerships for mitigating hazard impacts** *Objective 3.1: Integrate mitigation concepts into local and regional government plans, policies and actions* *Objective 3.2: Improve and standardize hazard data collection and mapping* *Objective 3.3: Leverage shared resources in pursuit of funding for hazard mitigation projects* *Objective 3.4: Develop partnerships among local, regional, national, and international organizations* **Why the Change?** Local emphasis on mitigation partnerships is timely. Those partnerships can happen inter-departmentally, within community government, or between government agencies across local and state boundaries. This goal better states the partnership angle and then objectives break down different ways in which the goal could be accomplished.
Goal 4: Maximize use of state, federal, local, private funds available for mitigation. *Objective 4.1: Analyze and establish additional cost-share opportunities.* *Objective 4.2: Minimize repeat community expenditures for incident response.*	**GOAL DELETED** **Why the Change?** This goal was a rather apparent goal of all local governments and was quite broad for this plan. New Objective 3.3 better captures the intent of this original Goal 4 as it pertains to mitigation.

* The goals and objectives in this column represent a blending of goals and objectives from the six existing plans being combined into this 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 Hampton Roads' *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, committee 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 as it applies to Hampton Roads.

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

2016 Committee Discussion: Prevention activities have been implemented in the past in Hampton Roads, are ongoing, and will continue to be included in this and future mitigation action plans. Many communities will mitigate flood damage through planning and zoning actions, such as amendments to their floodplain management ordinances which are viewed as very effective mitigation tools locally. Most communities in the region are continually updating zoning ordinances, especially for flood zones. The statewide building code is viewed as a rather static mitigation tool; it has components that mitigate especially for wind and flood, but is not a product that local governments exert a great deal of influence upon regularly. Open space preservation strategies are contained in most of the regional comprehensive plans, including Newport News, and will be added to several in upcoming revisions. In York County and several other communities, open space preservation is also addressed in subdivision regulations. Franklin has taken recent action to promote cluster development outside of flood hazard areas and create conservation and recreation districts along riverbanks. Several communities, including Hampton, Newport News and Southampton County, have recently integrated information from their existing hazard mitigation plans into Comprehensive Plan revisions. Stormwater management regulations and drainage system maintenance rules promulgated at the state level are viewed as quite robust and not in need of additional local action at this time; in addition, VDOT performs much of the drainage system maintenance in the Wester Tidewater region. Similarly, the state's Chesapeake Bay Act regulations governing shoreline setbacks are enforced locally, but not promulgated locally. Capital improvements programming is seen as a useful tool in the implementation of high priority mitigation activities across the participating communities.

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

2016 Committee Discussion: Property protection measures have been implemented in the past in the region and across the state, and are ongoing primarily through HMGP projects. These measures will continue to be included in this and future mitigation action plans, although Virginia Beach and Poquoson will not do property acquisition due to difficulties with this approach in previous projects. Acquisition is preferred over elevation for Isle of Wight County and a large-scale acquisition project in Newport News is ongoing. Relocation of flood-prone structures is not a high priority in the Western Tidewater region, and is not a preferred alternative in the more built-out municipalities on the Peninsula and Southside. Building elevation projects, critical facilities protection, and floodproofing/retrofitting are popular alternatives with the region's emergency managers, and many communities continually seek ways to increase insurance coverage for vulnerable property owners. Although costly, elevation of a wastewater treatment plant near Franklin is under consideration by both Franklin and Southampton County officials. The Community Rating System and related activities encompass and highlight several property protection measures ongoing in the participating communities. The committee decided to continue acquisition, relocation, and elevation measures for repetitively flooded properties, including critical facilities retrofits, in the Mitigation Action Plan, but did not act on any measures specifically for safe rooms or shatter-resistant glass as tornadoes are not a high risk critical hazard. Some communities in Western Tidewater have had discussions about providing safe rooms in designated areas, but no action was taken for this plan. Existing building code requirements are seen as sufficient with regard to wind and tornado protection; however, hurricane shutters and shatter-resistant glass may be an option for critical facility or emergency shelter retrofits as necessary. Many of the study area communities have installed or are considering installation of back-up generators for specific critical facilities, and this will be reflected in the MAP. With regard to insurance, some communities in Western Tidewater have produced community flyers regarding the importance of having insurance coverage on structures, and the counties participate in the Virginia Association of Counties Group Self-Insurance Risk Pool, a member-owned program that provides equitable rates with stable prices for long-term budgeting purposes.

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

2016 Committee Discussion: Natural resource protection measures remain commonly-used 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 Hampton Road's critical hazards are floodplain protection, erosion and sediment control, wetland preservation, and watershed management. Several communities in Western Tidewater discussed the fact that they did a lot of land acquisition after Isabel and Floyd and feel like that measure is no longer a high priority under consideration, and others indicated the cost of flood-prone land acquisition is often prohibitive for their local governments. Several rivers in the study area are designated scenic rivers and that designation has positively impacted watershed management efforts. Forest and vegetation management were discussed and determined to be low priority items at this time, although changes in risk or vulnerability for wildfire may change this thinking in the future. Beach and dune preservation is another state-promulgated program that requires permitting for impacts. Several communities decided to continue floodplain protection measures and land acquisition in the Mitigation Action Plan, but did not act specifically on other natural resource protection measures as those are considered to be sufficiently addressed through state regulations. Invasive species control is an important habitat preservation technique used, especially in Isle of Wight County within a 200-acre park containing both wetlands and floodplains. York County has a rare and endangered species overlay in the zoning ordinance, as well as an overlay zone for protection of historic or significant archaeological sites. Slope stabilization is not seen as a particularly high priority need in the study area, although individual projects have been implemented in the past, such as a bridge replacement in Franklin and cliff stabilization at a park along the James River at Fort Boykins. Smithfield recently spent $3 million on historic property preservation on the Pagan River to protect a valuable historic asset; additional projects may be under consideration but were not thought to be tied to hazard mitigation at this time.

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

2016 Committee Discussion: New large-scale reservoirs are not under consideration at this time in the region. Dam regulations at the state level are considered sufficient and communities are not considering additional regulation; many physical upgrades to existing dams are underway as a result of recent changes in these regulations, including raising and strengthening of the Newport News Waterworks reservoir. "Dutch dialogs", or conversations with Dutch engineers regarding successful flood mitigation structures overseas, are ongoing for several Hampton Roads communities as they explore ways to protect their built environment from sea level rise. In Newport News, Norfolk and Portsmouth, deteriorating seawalls are under consideration for replacement with increased levels of protection. Virginia Beach, Norfolk and Hampton have ongoing beach nourishment programs to provide flood protection and recreation amenities, and this will be reflected in MAP actions for those communities. Other structural protection measures are in place and must be maintained by the communities or private owners. Channel modifications, diversions, and detention/retention, such as tide gates, backflow preventers and stream restoration, have been effective in reducing flood hazards in some areas of the region and will remain viable mitigation actions in the future, especially for reducing the effects of floods and sea level rise. Stream restoration was recently included as a BMP in the State's BMP clearinghouse and some committee members believe that this may result in this method being considered and possibly used more in the future. Isle of Wight County is implementing some watershed management measures through installation of larger BMPs. Dry hydrants, and smoke testing of sanitary sewers, and the stormwater management preventive maintenance schedule are potential structural projects, with dry hydrants particularly important in wildfire control in the western parts of the study area. The committee did not foresee need for new high-cost mitigation actions such as dams, levees or reservoirs in this 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

2016 Committee Discussion: Traditional riverine warning systems are inappropriate for some of the region’s flood hazards, but a system of citizen and institutional tidal gage monitoring provides limited input to community emergency planners for specific watersheds in the region. Hampton and Newport News have flood gages with alerts along Newmarket Creek. Flood warning systems in Southampton County and Franklin are implemented and effective and Isle of Wight County recently switched to a more robust system. Several communities have recently implemented Everbridge unified critical communications software to deliver messages to targeted audiences, and most communities have some form of reverse 911. Evacuation planning is aided at the regional and state levels, but local planners use many tools to continually manage and improve the program; several are now considering more use of sheltering in place or the use of central evacuation locations. VDEM, through a Hurricane Evacuation Workgroup, is currently updating the hurricane evacuation study with a particular focus on including and coordinating with the media. Evacuation and sheltering plans for vulnerable populations are a high priority for the region’s emergency planners at this time, and Western Tidewater planners continue to work with NC officials regarding Outer Banks evacuation routes that traverse the region. Sandbagging for flood protection is generally considered helpful, but local governments are not involved in helping property owners sandbag, with the exception of Franklin where a recent new rule allows downtown business owners to get sand and bags from the City. Individual property owners may decide to sandbag for protection, but this is not an action committee members want to include in the MAP, as longer-term retrofit protection methods are deemed preferable. Adding generator electrical circuits to support jail operations during power outages was discussed and included in the MAP for Chesapeake. This activity is both an Emergency Services action and a Property Protection measure. Some communities, such as Poquoson, Newport News, and York County, have installed shutters for wind protection on Emergency Operations Centers. Committee members in Western Tidewater discussed battery backups for stoplights, but indicated that in their region, such a measure would require assistance and cooperation with VDOT to implement.

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

2016 Committee Discussion: Public education activities are a particular focus of emergency planners in the region and are ongoing, particularly through existing web sites and several CRS-related activities. Speaker series and demonstration events, such as hurricane awareness events, are supported by several of the local governments throughout the year, but may not rise to the importance of being included in the MAP for each of these communities. For example, Franklin and Southampton County Planning Commissions share responsibility for manning a booth at the county fair each year. Hampton participates in the Home Expo and Emergency Preparedness Day annually, and York County has a Safety Town Program each summer. The groups considered ways to improve upon these programs in the MAP moving forward and many adopted a mitigation action to implement a Plan for Public Information (PPI) as discussed in the CRS User's Manual. FEMA, working with the U.S. Army Corps of Engineers, has recently revised many of the Flood Insurance Rate Maps for the region as ongoing coastal studies are completed. Additional hazard mapping was discussed and some communities see value in working to gather more structure lowest floor elevations in flood prone areas – an activity that is shown as a regional mitigation action in the MAP. Real estate disclosure is limited by State regulations and not influenced by local government. Library materials, school programs, and open houses are included in the MAP for many communities. Committee members discussed train-the-trainer opportunities in conjunction with the City's Community Emergency Response Team (CERT) and the Tidewater Builders Association and several decided to add this as an action or to append it to existing actions. The HRPDC supports several efforts at inter-governmental coordination, including the Hampton Roads All Hazards Advisory Committee (AHAC) and HR Green. There is also a local CRS User's Group that is very active among CRS and CRS-interested communities in the study area.

SELECTION OF MITIGATION TECHNIQUES

In order to determine the most appropriate mitigation techniques, committee members 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 2017 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) each community's Comprehensive Plan, specifically components that may be compatible with mitigation goals, or that may be appropriate as mitigation actions; 3) contractor review of local floodplain regulations; 4) the mitigation action items from the existing plans with 2017 status information; and 5) FEMA Publication *Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards*, January 2013.

TABLE 7.2: MITIGATION TECHNIQUE MATRIX						
MITIGATION TECHNIQUE	HIGH RISK HAZARDS		MODERATE RISK HAZARDS			
	Flooding	Tropical/Coastal Storm	Sea Level Rise and Land Subsidence	Winter Storm	Wildfires	Hazardous Materials Incident
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 will be implemented according to the plan maintenance procedures established for the *Hampton Roads Hazard Mitigation Plan* (see Section 8: Plan Maintenance Procedures). The action items have been designed to achieve the mitigation goals and priorities established by the committee.

Each proposed mitigation action has been identified as an effective measure to reduce hazard risk in Hampton Roads. Each action is described with background information such as the 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 Hampton Roads 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, the committee reviewed the list of recommended actions included in their respective existing plans to determine if the actions should be deleted because they are completed, deferred, cancelled, or continued, and made recommendations regarding modified and new actions. Summary results of this review are included in **Appendix F**.

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?

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 G.

Key to Potential Funding Source Acronyms:

DHS U.S. Department of Homeland Security
- **PDM –** Predisaster Mitigation Program
- **HMGP –** Hazard Mitigation Grant Program
  - **CRMA – Climate Resilient Mitigation Activities - This relatively new funding type may include: aquifer storage and recovery, floodplain and stream restoration, flood diversion and storage and green infrastructure.**
- **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

Table 7.5 provides a matrix indicating that each critical and noncritical hazard affecting communities is addressed in the Mitigation Action Plan.

TABLE 7.5: MITIGATION ACTIONS FOR CRITICAL AND NON-CRITICAL HAZARDS

	Flooding	Tropical/Coastal Storm	Sea Level Rise	Tornado	Winter Storm	Hazardous Materials Incident	Shoreline Erosion	Earthquake	Wildfire
Regional Actions	M	2, 3	M	2	2	2, 4	2	2, 3	2
Hampton	M	M	M	M	M	M	M	M	M
Newport News	M	M	M	3	3	3	M	3, 5	3, 13
Poquoson	M	M	M	M	M	M	M	M	M
Williamsburg	M	M	M	M	M	M	M	M	M
James City County	M	M	M	M	M	M	6, 9	M	M
York County	M	M	M	M	M	M	M	M	M
Norfolk	M	M	M	M	M	3, 4	M	M	3,4
Portsmouth	M	M	M	M	M	M	M	M	M
Suffolk	M	M	M	8, 10	8, 10	8, 10	4	8, 10	8, 10
Virginia Beach	M	M	M	M	M	M	M	M	M
Chesapeake	M	M	M	M	M	M	M	M	M
Isle of Wight County	M	M	M	M	M	M	M	M	M
Smithfield	M	M	M	M	M	8	M	M	6, 8
Windsor	M	3	1	3	3	3	1	3	3
Franklin	M	M	M	M	M	M	5,11	M	M
Southampton County	M	M	17	M	M	M	M	M	M
Boykins	M	2,4	4	3,4	2,4	3,4	4	4	M
Branchville	M	M	M	M	M	M	1,3	M	M
Capron	1	1	1	1	1	1	1	1	1
Courtland	M	M	M	M	M	M	1,4	3,4	M
Ivor	4,3	3	3,4	3	3,4	3	3	3	M
Newsoms	M	1	M	1,2	1,5	1,2	1	1	1,2

M = 3 or more actions address this hazard

Regional Strategies

REGIONAL MITIGATION ACTION 1	
Use side-scan LIDAR to collect lowest floor elevation data for flood-prone structures in the region, focusing initially on repetitive loss areas in each community.	
BACKGROUND INFORMATION	
Site and Location:	Hampton Roads region, particularly repetitive flood loss areas as identified in Section 5 of this plan
Cost Benefit:	Lowest floor elevation data for pre-FIRM structures are critical information for developing robust cost-benefit analyses of mitigation options for flood-prone structures. The data are necessary in order to prioritize and fund mitigation projects, especially through Federal grant processes.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Sea Level Rise
Goal(s) Addressed:	Goal 1, Objectives 1.1, 1.2; Goal 3, Objectives 3.2, 3.3, 3.4
Priority (High, Moderate, Low):	High
Estimated Cost:	Estimated $30/structure, based on similar project in eastern North Carolina
Potential Funding Sources:	USACE: FPMS; DHS: PDM and HMGP 5% Initiative
Lead Agency/Department Responsible:	AHAC
Implementation Schedule:	Begin project within 1 year of plan adoption
ADDITIONAL COMMENTS	

REGIONAL MITIGATION ACTION 2	
Use AHAC structure and HRPDC resources to develop additional regional mitigation strategies and initiate annual workshop on mitigation project funding. Possible new topics include Climate Resilient Mitigation Activities (CRMA), HMGP 5% Initiative projects, and including Sea Level Rise estimates in elevation requirements under recent HMGP guidance.	
BACKGROUND INFORMATION	
Site and Location:	Throughout Hampton Roads study area
Cost Benefit:	Through AHAC organizational structure, VDEM and HRPDC can 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 Hazards
Goal(s) Addressed:	Goal 3, Objectives 3.3, 3.4
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	Travel costs and staff time
Potential Funding Sources:	Existing budgets; HMGP 5% Initiative
Lead Agency/Department Responsible:	AHAC/HRPDC, partner with Wetlands Watch, HR Green
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 to provide report on status of each mitigation action (modified, complete, not started and why).	

REGIONAL MITIGATION ACTION 3		
Analyze and update the platform, availability, and accuracy of HAZUS input data and output results for the purposes of conducting future, more detailed vulnerability analyses.		
BACKGROUND INFORMATION		
Site and Location:	Throughout Hampton Roads study area	
Cost Benefit:	Some of the data used to update HAZUS in this study were not intended for the purposes of flood vulnerability analyses. Particularly, the assessor databases from communities are for tax purposes and the data are incomplete. Also the PDC is considering providing a platform for regional GIS data geared toward this type of analysis, thereby reducing the cost and time to run various types of vulnerability analyses.	
MITIGATION ACTION DETAILS		
Hazard(s) Addressed:		Flooding, Sea Level Rise, Tropical/Coastal Storm and Earthquake
Goal(s) Addressed:		Goal 1, Goal 3; Objective 3.2, 3.3
Priority (High, Moderate, Low):		Moderate
Estimated Cost:		$60,000
Potential Funding Sources:		USACE, HMGP, HMGP 5% Initiative, PDM
Lead Agency/Department Responsible:		HRPDC
Implementation Schedule:		Within 3 years of plan adoption
ADDITIONAL COMMENTS		

REGIONAL MITIGATION ACTION 4	
Conduct Commodity Flow Study for Southside.	
BACKGROUND INFORMATION	
Site and Location:	Chesapeake, Norfolk, Portsmouth and Suffolk
Cost Benefit:	Having prior knowledge of the types, timing and quantities of regular hazardous materials shipments may allow emergency planners to make better plans for mitigative actions and ease response.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Hazardous Materials Incident
Goal(s) Addressed:	Goal 1, Goal 3
Priority (High, Moderate, Low):	Low
Estimated Cost:	$60,000
Potential Funding Sources:	DEQ, to be determined
Lead Agency/Department Responsible:	HRPDC
Implementation Schedule:	Within 5 years of plan adoption
ADDITIONAL COMMENTS	
Include process by which VEOC makes contact with the appropriate localities when they are notified of inbound Hazardous Materials.	

Hampton

HAMPTON MITIGATION ACTION 1	
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. 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, and Tropical/Coastal Storm
Goal(s) Addressed:	Goal 1, Objectives 1.1, 1.2, 1.5
Priority (High, Moderate, Low):	High
Estimated Cost:	Staff time
Potential Funding Sources:	Existing budgets
Lead Agency/Department Responsible:	Emergency Management, Public Works and Community Development
Implementation Schedule:	Annually
ADDITIONAL COMMENTS	

HAMPTON MITIGATION ACTION 2	
Acquire, elevate, relocate, retrofit or floodproof structures in flood prone areas. Flood protection may include small structural flood control projects, such as tide gates. This action includes Mitigation Reconstruction projects.	
BACKGROUND INFORMATION	
Site and Location:	Flood prone 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, and Tropical/Coastal Storm
Goal(s) Addressed:	Goal 1, Objectives 1.1, 1.2, 1.3, 1.5
Priority (High, Moderate, Low):	High
Estimated Cost:	Cost will be based on specific flood protection measures chosen. Under new guidance, FEMA will now fund hazard mitigation projects that include sea level rise estimates.
Potential Funding Sources:	DHS: PDM, HMGP, HMGP 5% Initiative, FMA, RFC; USACE: SFCP, FPMS; HUD: CDBG; USDA: WPFP
Lead Agency/Department Responsible:	Emergency Management
Implementation Schedule:	Ongoing
ADDITIONAL COMMENTS	
Locally funded projects may be creditable under the Community Rating System.	

HAMPTON MITIGATION ACTION 3	
Provide flood and wind protection and flood access/egress for critical facilities and infrastructure. Retrofits may include, but are not limited to: elevate and harden communication sites, relocate EOC/911/311 facility outside of floodplain, provide generator backup or prewire evacuation shelters for quick hook-ups, and upgrade sewer pump stations.	
BACKGROUND INFORMATION	
Site and Location:	Critical facilities Citywide
Cost Benefit:	Benefits of mitigating flood damage to critical facilities are realized by all citizens through the city's ability to maintain the highest operational capabilities post-disaster. Benefits are based on reduced response times, and longevity of critical infrastructure.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Sea Level Rise, Tropical/Coastal Storm, Extreme Heat
Goal(s) Addressed:	Goal 1, Objectives 1.3, 1.4, 1.5
Priority (High, Moderate, Low):	High
Estimated Cost:	Cost will be based on specific flood protection measures chosen for each building. Under new guidance, FEMA will now fund hazard mitigation projects that include sea level rise estimates.
Potential Funding Sources:	DHS: PDM, HMGP, HMGP 5% Initiative, FMA, RFC; Stafford Act Section 406 - post-disaster mitigation funds under Public Assistance for damaged public facilities
Lead Agency/Department Responsible:	Emergency Management
Implementation Schedule:	Ongoing
ADDITIONAL COMMENTS	

HAMPTON MITIGATION ACTION 4	
Purchase property from trustee sales/tax sales that are identified as repetitive loss or severe repetitive loss. Demolish flood-prone structures. This action includes Mitigation Reconstruction projects.	
BACKGROUND INFORMATION	
Site and Location:	Citywide
Cost Benefit:	This is a cost-effective way to remove severely flood-prone structures from the real estate market and prevent resale without mitigation.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Sea Level Rise, Tropical/Coastal Storm
Goal(s) Addressed:	Goal 1, Objectives 1.1, 1.2, 1.6; Goal 3, Objective 3.1, 3.3
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$25,000 to $150,000 per structure
Potential Funding Sources:	HMGP 5% Initiative
Lead Agency/Department Responsible:	Community Development, Treasurer's Office
Implementation Schedule:	Two years
ADDITIONAL COMMENTS	
These properties can be purchased fairly inexpensively. Treasurer's Office can provide list of tax sales on regular basis.	

HAMPTON MITIGATION ACTION 5		
Implement ordinance to create and enforce no-wake zones in flooded areas.		
BACKGROUND INFORMATION		
Site and Location:	Flood-prone areas Citywide	
Cost Benefit:	Wakes created by drivers send water into homes in flooded areas and can create additional damage by essentially increasing flood levels. Ordinance would dissuade onlookers from driving fast through floodwaters, thereby reducing damages.	
MITIGATION ACTION DETAILS		
Hazard(s) Addressed:		Flooding, Sea Level Rise, Tropical/Coastal Storm
Goal(s) Addressed:		Goal 1, Objectives 1.1, 1.2, 1.3, 1.5
Priority (High, Moderate, Low):		High
Estimated Cost:		Staff time
Potential Funding Sources:		N/A
Lead Agency/Department Responsible:		City Attorney's Office, Police Division
Implementation Schedule:		Hampton successfully lobbied for a bill allowing Virginia municipalities to adopt such an ordinance during 2016 Virginia General Assembly session. Ordinance under consideration immediately.
ADDITIONAL COMMENTS		
Vehicles drive down flooded streets just to see flooding effects. Vehicle movement through floodwaters creates waves or wakes of water that create additional damage to already flooded structures.		

HAMPTON MITIGATION ACTION 6	
Adopt and implement holistic watershed plan. May include Climate Resilient Mitigation Activities (CRMA).	
BACKGROUND INFORMATION	
Site and Location:	Citywide
Cost Benefit:	Spur redevelopment and add value to affected neighborhoods. Because this action may include CRMAs, additional benefits from environmental or ecosystem benefits may be included in the benefits cost analysis under HMGP guidance.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Sea Level Rise, Flooding, Tropical/Coastal Storm, Shoreline Erosion
Goal(s) Addressed:	Goal 1; Goal 3, Objectives 3.1, 3.3, 3.4
Priority (High, Moderate, Low):	High
Estimated Cost:	$300,000 in planning stage
Potential Funding Sources:	DHS: PDM; HMGP, HMGP 5% Initiative
Lead Agency/Department Responsible:	Community Development
Implementation Schedule:	Over the next 7 to 10 years
ADDITIONAL COMMENTS	
Follow through on previous Dutch Dialogs with Dutch flood engineers/experts. The plan concept is based on the idea of living with water and the focus would be on flood mitigation, redevelopment, and revitalization of flood-prone areas. Coordinate mitigation actions, instead of piecemeal implementation.	

HAMPTON MITIGATION ACTION 7	
Improve use of social media before, during and after hazard events.	
BACKGROUND INFORMATION	
Site and Location:	Citywide
Cost Benefit:	Minimal cost to reach larger audience more effectively
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Tropical/Coastal Storm, Tornado, Winter Storm, Earthquake, Wildfire, Drought, Extreme Heat, Hazardous Materials Incident
Goal(s) Addressed:	Goal 2; Objective 2.1
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	Minimal cost/staff time
Potential Funding Sources:	n/a
Lead Agency/Department Responsible:	Marketing Department
Implementation Schedule:	One year, and continuing thereafter
ADDITIONAL COMMENTS	
The prominence of social media points to a need to refine activity on Twitter, Facebook, Instagram and other programs. Need to be pro-active and targeted in messages. Identify specific messages, links. Other information that we will need to spread and the most effective methods, may include short videos, maps, links, photos, and infographics.	

HAMPTON MITIGATION ACTION 8	
Expand capacity/training for CERT groups and neighborhood-serving organizations to include communication about mitigation, building code requirements response.	
BACKGROUND INFORMATION	
Site and Location:	Citywide, with particular emphasis on vulnerable neighborhoods with less access to social or broadcast media
Cost Benefit:	Local residents are better able to address or communicate the needs of their specific neighborhoods. CERT members can expand capacity of City staff to communicate, mitigate and respond more effectively.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Sea Level Rise, Tropical/Coastal Storm, Tornado, Winter Storm, Earthquake, Wildfire, Hazardous Materials Incident
Goal(s) Addressed:	Goal 2, Objective 2.1; Goal 3, Objectives 3.1, 3.4
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$5,000 to $10,000
Potential Funding Sources:	General Fund – Neighborhood Education Programs; HMGP 5% Initiative
Lead Agency/Department Responsible:	Emergency Management and Community Development
Implementation Schedule:	Incorporate into annual education plan by 2017
ADDITIONAL COMMENTS	
Also considering partnerships with neighboring localities to share training opportunities for CERT.	

HAMPTON MITIGATION ACTION 9	
Improve drainage system maintenance, including increased sediment and debris clearance.	
BACKGROUND INFORMATION	
Site and Location:	Drainageways citywide. Engineering studies have specifically identified Mill Creek Terrace, Pochin Place, Mary Peake and Riverdale as particular areas of concern.
Cost Benefit:	The City's network of structures, channels and underground pipes that carry stormwater help reduce flooding, especially during high frequency events. Maintenance is required to keep the system functioning effectively.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Sea Level Rise, Tropical/Coastal Storm, Shoreline Erosion
Goal(s) Addressed:	Goal 1, Objectives 1.1, 1.2, 1.4, 1.5, 1.6
Priority (High, Moderate, Low):	High
Estimated Cost:	$7.9 million for the entire project
Potential Funding Sources:	Stormwater Utility Fee
Lead Agency/Department Responsible:	Public Works Engineering
Implementation Schedule:	Immediately
ADDITIONAL COMMENTS	
The existing and proposed draft of Hampton's MS4 permit already has requirements for this activity and the city is required to increase debris and sediment removal for each 5-year permit.	

HAMPTON MITIGATION ACTION 10	
Coordinate with owners of post-FIRM structures that are NFIP “minus-rated” to help property owners determine reason for rating and implementing solutions.	
BACKGROUND INFORMATION	
Site and Location:	Flood-prone locations citywide
Cost Benefit:	Problems are typically related to flood vents and are straightforward, low cost retrofits. Assistance from City staff could help owners reduce flood insurance premiums while gaining flood resilience.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Sea Level Rise, Tropical/Coastal Storm
Goal(s) Addressed:	Goal 1, Objectives 1.1, 1.2, 1.5; Goal 2, Objective 2.1
Priority (High, Moderate, Low):	High
Estimated Cost:	Staff time
Potential Funding Sources:	HMGP 5% Initiative
Lead Agency/Department Responsible:	Community Development, Emergency Management, Public Works
Implementation Schedule:	Within 6 months
ADDITIONAL COMMENTS	

HAMPTON MITIGATION ACTION 11	
Conduct repetitive loss area analyses of repetitive flood loss areas. Include outreach to homeowners regarding potential mitigation options.	
BACKGROUND INFORMATION	
Site and Location:	Repetitive flood loss areas Citywide (see Section 5 for maps)
Cost Benefit:	Analyses benefit property owners by identifying potential mitigation actions, making the repetitively flooded areas better known to elected officials and the public, and possibly garnering CRS points to contribute to reducing flood insurance premiums.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Sea Level Rise, Tropical/Coastal Storm
Goal(s) Addressed:	Goal 1, Objective 1.1, 1.2, 1.5
Priority (High, Moderate, Low):	High
Estimated Cost:	$20,000
Potential Funding Sources:	Grant funding through Emergency Management
Lead Agency/Department Responsible:	Public Works/Engineering and Emergency Management
Implementation Schedule:	Immediately
ADDITIONAL COMMENTS	

HAMPTON MITIGATION ACTION 12	
Build resiliency into how the city addresses its social, economic and physical challenges.	
BACKGROUND INFORMATION	
Site and Location:	Citywide
Cost Benefit:	
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	All
Goal(s) Addressed:	Goal 1
Priority (High, Moderate, Low):	High
Estimated Cost:	To be determined
Potential Funding Sources:	100 Resilient Cities challenge
Lead Agency/Department Responsible:	City Manager’s Office
Implementation Schedule:	2017
ADDITIONAL COMMENTS	

HAMPTON MITIGATION ACTION 13	
Prepare public outreach materials. Educate elected officials and residents on the importance of the NFIP and the City's floodplain management efforts, maintaining flood insurance coverage, the benefits of City's CRS participation, and methods for mitigating flood damage.	
BACKGROUND INFORMATION	
Site and Location:	Flood-prone areas Citywide
Cost Benefit:	Make sure homeowners have flood insurance coverage. Flood insurance coverage has been shown to reduce response needs and help Hampton's citizens return to normalcy more quickly after flooding.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Sea Level Rise, Tropical/Coastal Storm
Goal(s) Addressed:	Goal 1, Objectives 1.1, 1.2, 1.5; Goal 2, Objective 2.1
Priority (High, Moderate, Low):	High
Estimated Cost:	<$5000 per year
Potential Funding Sources:	Existing budgets; HMGP 5% Initiative
Lead Agency/Department Responsible:	Emergency Management
Implementation Schedule:	Continuous
ADDITIONAL COMMENTS	
While this action is ongoing, it is important to retain in the hazard mitigation plan to ensure continued funding is secured annually.	

HAMPTON MITIGATION ACTION 14	
Maintain storm-resistant beach from Grandview to Fort Monroe.	
BACKGROUND INFORMATION	
Site and Location:	Atlantic Ocean/Chesapeake Bay shoreline
Cost Benefit:	Maintaining the existing beach profile provides flood protection and wave protection to waterfront structures.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Sea Level Rise, Tropical/Coastal Storm, Shoreline Erosion
Goal(s) Addressed:	Goal 1, Objectives 1.1, 1.2, 1.3, 1.6
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$2,710,000, FY 17 thru FY 19
Potential Funding Sources:	Capital budgets
Lead Agency/Department Responsible:	Public Works
Implementation Schedule:	Ongoing
ADDITIONAL COMMENTS	

HAMPTON MITIGATION ACTION 15	
Implement warning system for coastal storms.	
BACKGROUND INFORMATION	
Site and Location:	Citywide
Cost Benefit:	Flood warning systems reduce damage by informing residents and providing time to prepare property for flooding through the use of sandbags, debris removal, elevation of specific items, installation of floodproofing components, etc.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Sea Level Rise, Tropical/Coastal Storm
Goal(s) Addressed:	Goal 1, Objectives 1.1, 1.2, 1.3, 1.4, 1.5; Goal 2
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	Unknown at this time
Potential Funding Sources:	DHS: PDM, HMGP, HMGP 5% Initiative, FMA
Lead Agency/Department Responsible:	Emergency Management
Implementation Schedule:	Three years
ADDITIONAL COMMENTS	
Everbridge notification system.	

Newport News

NEWPORT NEWS MITIGATION ACTION 1	
Maintain participation in National Flood Insurance Program and enroll in the 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. 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, and Tropical/Coastal Storm
Goal(s) Addressed:	Goal 1, Objectives 1.1, 1.2, 1.3
Priority (High, Moderate, Low):	High
Estimated Cost:	Staff time
Potential Funding Sources:	Existing budgets
Lead Agency/Department Responsible:	Emergency Management
Implementation Schedule:	Annually
ADDITIONAL COMMENTS	

NEWPORT NEWS MITIGATION ACTION 2			
Acquire, elevate, relocate, retrofit or floodproof structures in flood prone areas. Flood protection may include small structural flood control projects, such as tide gates, or backflow preventers. This action includes Mitigation Reconstruction projects.			
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's Flood Assistance Program has had measurable benefits using primarily acquisition to mitigate an estimated 2 structures per year for the last several years. Under new guidance, FEMA will now fund hazard mitigation projects that include sea level rise estimates.		
MITIGATION ACTION DETAILS			
Hazard(s) Addressed:		Flooding, Sea Level Rise, and Tropical/Coastal Storm	
Goal(s) Addressed:		Goal 1, Objectives 1.1, 1.2 and Goal 3	
Priority (High, Moderate, Low):		High	
Estimated Cost:		Estimated $750,000 per year through various channels and sources	
Potential Funding Sources:		DHS: PDM, HMGP, HMGP 5% Initiative, FMA, RFC; USACE: SFCP, FPMS; HUD: CDBG; USDA: WPFP. Flood Assistance Program has primarily used HMPG.	
Lead Agency/Department Responsible:		Engineering	
Implementation Schedule:		Ongoing	
ADDITIONAL COMMENTS			

NEWPORT NEWS MITIGATION ACTION 3		
Provide flood and flood access/egress for critical facilities and infrastructure. Retrofits may include, but are not limited to: upgrades or relocation of the 911/EOC/311 facilities; floodproofing or elevating pump stations; retrofit remaining pump stations with generators or quick-connect hookups.		
BACKGROUND INFORMATION		
Site and Location:	Critical facilities Citywide. City is considering the alternative of building joint, hardened facilities with Hampton to serve both cities. Pump stations #2, #53 and #99 have been identified as high priority locations for non-structural mitigation measures.	
Cost Benefit:	Benefits of mitigating flood damage to critical facilities are realized by all citizens through the city's ability to maintain the highest operational capabilities post-disaster. Benefits are based on reduced response times, and longevity of critical infrastructure. Joint facilities would reduce duplicate design and construction costs. Under new guidance, FEMA will now fund hazard mitigation projects that include sea level rise estimates.	
MITIGATION ACTION DETAILS		
Hazard(s) Addressed:		Flooding, Sea Level Rise, Tropical/Coastal Storm, Tornado, Winter Storm, Earthquake, Wildfire, Drought, Extreme Heat, Hazardous Materials Incident
Goal(s) Addressed:		Goal 1, Objectives 1.2, 1.3, 1.4s
Priority (High, Moderate, Low):		High
Estimated Cost:		Cost will be based on specific flood protection measures chosen for each building. Early estimate for shared Hampton/Newport News EOC facility is $50 million.
Potential Funding Sources:		DHS: PDM, HMGP, HMGP 5% Initiative, FMA, RFC; Stafford Act Section 406 - post-disaster mitigation funds under Public Assistance for damaged public facilities
Lead Agency/Department Responsible:		Emergency Management, Facilities Engineering
Implementation Schedule:		Long-term, 3 to 7 years
ADDITIONAL COMMENTS		

NEWPORT NEWS MITIGATION ACTION 4	
Enhance and stabilize shorelines and roadway embankments along Chesapeake Avenue, and reduce the impact and risk of flooding to private and public properties. This action may include Climate Resilient Mitigation Activities (CRMA).	
BACKGROUND INFORMATION	
Site and Location:	Salter's Creek watershed in South East neighborhood
Cost Benefit:	1.58, based on Benefit-Cost Analysis performed by consultant. Roadway and shoreline embankment will be stabilized, resulting in better commuting (less conflict between drivers and walkers/bikers), healthy drainage/stream channels, less flooding and better quality of life. Alternatives considered included: 1) replacing seawall with similar structure would not protect shoreline, roadways; 2) hard structures for stream restoration, such as levees, retaining walls or floodwalls, have much higher construction costs and fewer benefits. If CRMA are included, additional benefits from environmental or ecosystem benefits may be included in the benefits cost analysis. Also, under new guidance, FEMA will now fund hazard mitigation projects that include sea level rise estimates.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Sea Level Rise, Tropical/Coastal Storm, Shoreline Erosion
Goal(s) Addressed:	Goal 1, Objectives 1.1, 1.2, 1.3, 1.5; Goal 3
Priority (High, Moderate, Low):	Low
Estimated Cost:	$20 million
Potential Funding Sources:	HUD grant request not approved 1/1/16; HMGP/CRMA, HMGP 5% Initiative; other funding sources will be explored
Lead Agency/Department Responsible:	Engineering
Implementation Schedule:	Within 3 years of plan adoption
ADDITIONAL COMMENTS	
Project will increase water quality, control flooding, and reduce erosion issues by implementing stream and drainage ditch restoration projects. Project will improve neighborhood strength and sustainability by constructing a better-armored seawall structure and installing a tide gate and pumping station.	

NEWPORT NEWS MITIGATION ACTION 5	
Strengthen the Diascund Dam.	
BACKGROUND INFORMATION	
Site and Location:	Diascund Dam primary spillway experienced concrete slab uplifting.
Cost Benefit:	Uplifting of slab could jeopardize the structural integrity of the spillway and dam.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Tropical/Coastal Storm, Earthquake, Drought
Goal(s) Addressed:	Goal 1, Objective 1.3, Goal 3
Priority (High, Moderate, Low):	High
Estimated Cost:	$3,648,150
Potential Funding Sources:	CIP
Lead Agency/Department Responsible:	Facilities Engineering
Implementation Schedule:	Scheduled for completion in 2016
ADDITIONAL COMMENTS	

NEWPORT NEWS MITIGATION ACTION 6	
Raise the Lee Hall Reservoir dam.	
BACKGROUND INFORMATION	
Site and Location:	Scope includes demolition of the Lee Hall Lower Dam bascule gate; the new construction of a labyrinth spillway, articulated concrete block armored auxiliary spillway, and an outlet works conduit at the Lee Hall Lower Dam; raising and manipulating the Lee Hall Lower Dam embankment to a uniform slope and crest width; and demolition of the Lee Hall Upper Dam hydraulic control structure such that the pool elevation in the upper and lower reservoirs will equalize.
Cost Benefit:	Brings project into compliance with current VDCR standards.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Tropical/Coastal Storm
Goal(s) Addressed:	Goal 1, Objectives 1.3, 1.4
Priority (High, Moderate, Low):	High
Estimated Cost:	$15,229,630
Potential Funding Sources:	CIP
Lead Agency/Department Responsible:	Facilities Engineering
Implementation Schedule:	August 2015 to August 2017
ADDITIONAL COMMENTS	
Project also includes utility relocations and curb modifications to Ft. Eustis Blvd. to accommodate the new geometry of the dam.	

NEWPORT NEWS MITIGATION ACTION 7	
Raise the roadway at 27th Street and Buxton Avenue. This action may include Climate Resilient Mitigation Activities (CRMA).	
BACKGROUND INFORMATION	
Site and Location:	Intersection of 27th Street, 28th Street and Buxton Avenue.
Cost Benefit:	History of tidal flooding during both minor and major storm events. Raising the grade elevations of the roadways and intersection will reduce flooding, thus allowing the travel routes to Hampton and I-664 to remain open during most heavy rain events and give residents south of Anderson Park another access route besides 16th Street. If CRMA are included, additional benefits from environmental or ecosystem benefits may be included in the benefits cost analysis. Also, under new guidance, FEMA will now fund hazard mitigation projects that include sea level rise estimates.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Sea Level Rise, Tropical/Coastal Storm
Goal(s) Addressed:	Goal 1, Objectives 1.3, 1.4
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$1.7 million
Potential Funding Sources:	Capital Improvement program and State Revenue Sharing Program; DHS: HMGP
Lead Agency/Department Responsible:	Engineering
Implementation Schedule:	Construction to begin mid-2016
ADDITIONAL COMMENTS	
Also considered and rejected 2 other alternatives: 1) providing additional box culverts under 27th and 28th Streets to allow more capacity during heavy rains that coincide with high tides and storm surge; and 2) tide gate at 3 possible locations along Salters Creek, 16th Street or 25th Street.	

NEWPORT NEWS MITIGATION ACTION 8	
Construct new access road to Pump Station 49 on Warwick Boulevard.	
BACKGROUND INFORMATION	
Site and Location:	Pump Station 49, Warwick Blvd – new access road from Old Courthouse Way
Cost Benefit:	Existing access drive is below the 100-year flood elevation and has been flooded by the adjacent Stoney Run Creek during significant storm events. This flooding prevents access to the station including the delivery of fuel needed to run the station emergency power generator. Finished floor elevation of the station is above the 100-year flood elevation and it is not considered susceptible to flooding. Under new guidance, FEMA will now fund hazard mitigation projects that include sea level rise estimates.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Sea Level Rise, Tropical/Coastal Storm
Goal(s) Addressed:	Goal 1, Objectives 1.3, 1.4
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$200,000, includes acquisition of undeveloped commercial property
Potential Funding Sources:	DHS: HMGP
Lead Agency/Department Responsible:	Engineering
Implementation Schedule:	Within 5 to 7 years
ADDITIONAL COMMENTS	
Other alternatives considered but rejected include: 1) raise existing service road (would require undesirable impacts to Stoney Run); and 2) new access road from Warwick Blvd (steep grade issues would limit access).	

NEWPORT NEWS MITIGATION ACTION 9	
Drainage improvements on Chelsea Place, to include increased flow through the drainage outfall from the apartments and diversion of some of the flow from Edgemoor Drive to a new outfall. This action may include Climate Resilient Mitigation Activities (CRMA).	
BACKGROUND INFORMATION	
Site and Location:	Chelsea Place Apartments, Warwick Blvd
Cost Benefit:	Existing drainage system drains to a channel along the CSX right-of-way, then through a small culvert to a drainage channel along Warwick Blvd. The culvert under the railroad is undersized and causes flooding in the parking lot of the apartments. The flooding enters at least 15 ground floor apartments rendering them unrentable and has resulted in the loss of multiple vehicles. If CRMA are included, additional benefits from environmental or ecosystem benefits may be included in the benefits cost analysis.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Tropical/Coastal Storm
Goal(s) Addressed:	Goal 1, Objectives 1,1, 1,2, 1.3, 1.4, 1.5
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$750,000
Potential Funding Sources:	Stormwater Management Fund; DHS: HMGP
Lead Agency/Department Responsible:	Engineering
Implementation Schedule:	Construction to begin mid 2016
ADDITIONAL COMMENTS	

NEWPORT NEWS MITIGATION ACTION 10	
Improve the culvert on Gwynn Circle and Lucas Creek.	
BACKGROUND INFORMATION	
Site and Location:	Project area is west of Bland Boulevard, near the Newport News-Williamsburg airport.
Cost Benefit:	Approximately 100 homes and multiple large businesses upstream of the existing box culvert will benefit from the installation of the stormwater drainage system.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding
Goal(s) Addressed:	Goal 1, Objectives 1.1, 1.2, 1.3, 1.4, 1.5
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$500,000 for construction
Potential Funding Sources:	50/50 revenue sharing with VDOT and City Capital Improvement Funds
Lead Agency/Department Responsible:	Engineering
Implementation Schedule:	Construction to begin in 2016
ADDITIONAL COMMENTS	
Project is to upsize the current box culverts at Gwynn’s Circle and Lucas Creek to help alleviate flooding of the properties around the bridge. The culvert system will be designed to current stormwater management standards to conduct runoff from a 100-year storm event.	

NEWPORT NEWS MITIGATION ACTION 11	
Provide various watershed and flood warning improvements to reduce danger to lives and property from flooding along Newmarket Creek. This action may include Climate Resilient Mitigation Activities (CRMA) or Mitigation Reconstruction projects.	
BACKGROUND INFORMATION	
Site and Location:	Newmarket Creek watershed
Cost Benefit:	Several alternatives considered. Combination of computer modeling improvements, early warning/detection systems and drainage improvements considered most beneficial for multi-objective management of the watershed. Benefits include: 1) upgrades to current watershed models to pinpoint drainage improvements; 2) detection systems to alert City officials to pre-determined water levels in drainage system to initiate procedures for warning/evacuating residents; 3) drainage improvements (quality and quantity controls) to improve lifespan of the system, reduce nuisance flooding, and provide credit for pollutant reduction; 4) measures may provide sufficient flood mitigation/protection to result in removal of repetitive flood loss properties from the City's inventory and may provide points under CRS. If CRMA are included, additional benefits from environmental or ecosystem benefits may be included in the benefits cost analysis.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Sea Level Rise, Tropical/Coastal Storm
Goal(s) Addressed:	Goal 1, Objectives 1.1, 1.2, 1.3, 1.4, 1.5; Goal 3, Objectives 3.3, 3.4
Priority (High, Moderate, Low):	High
Estimated Cost:	Computer model upgrade = $152,000 Early Warning/Detection systems = $200,000 Drainage Improvements – pipe installations= $7,350,000 Drainage Improvements – channel upgrades = $3,725,000 Drainage Improvements – BMP installations = $6,683,000
Potential Funding Sources:	DHS: FMA, HMGP, HMGP 5% Initiative, HMGP CRMA
Lead Agency/Department Responsible:	
Implementation Schedule:	5 to 10 years
ADDITIONAL COMMENTS	
Other alternatives considered include: raise elevation of all houses within 100-year floodplain; purchase properties and relocate residents in 100-year floodplain; build structures (levees, floodwalls, gates/pumps) to protect properties; provide detection systems within watershed to alert to high water levels within major drainage channels; modify current City programs to streamline application process for homeowners; assist in redeveloping areas of the watershed (commercial/businesses, recreational areas, and residential neighborhoods).	

NEWPORT NEWS MITIGATION ACTION 12	
Improve drainage system maintenance, including increased sediment and debris clearance.	
BACKGROUND INFORMATION	
Site and Location:	Drainageways citywide.
Cost Benefit:	The City's network of structures, channels and underground pipes that carry stormwater help reduce flooding, especially during high frequency events. Maintenance is required to keep the system functioning effectively.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Sea Level Rise, Tropical/Coastal Storm, Shoreline Erosion
Goal(s) Addressed:	Goal 1, Objectives 1.3, 1.4
Priority (High, Moderate, Low):	High
Estimated Cost:	$2,275,500
Potential Funding Sources:	Wastewater user Fee, Capital Improvement Program
Lead Agency/Department Responsible:	Public Works
Implementation Schedule:	Ongoing as part of 5-year CIP updated annually. New projects continually identified.
ADDITIONAL COMMENTS	

NEWPORT NEWS MITIGATION ACTION 13	
Continue Forest Management Program to mitigate wildfire hazards and promote forest health.	
BACKGROUND INFORMATION	
Site and Location:	Program is primarily focused on Waterworks land holdings near the utility's reservoirs.
Cost Benefit:	This ongoing program reduces the number of fires, and works to control pine beetle infestations. Forest thinning is a primary control mechanism. This is one of many programs the utility implements related to hazard mitigation.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Wildfire, Drought
Goal(s) Addressed:	Goal 1
Priority (High, Moderate, Low):	High
Estimated Cost:	Net cost is low because costs are offset by selling the timber
Potential Funding Sources:	Waterworks Enterprise Fund
Lead Agency/Department Responsible:	Newport News Waterworks
Implementation Schedule:	Ongoing
ADDITIONAL COMMENTS	

NEWPORT NEWS MITIGATION ACTION 14	
Prepare public outreach materials. Educate elected officials and residents on the importance of the NFIP and the City's floodplain management efforts, maintaining flood insurance coverage, and methods for mitigating flood damage.	
BACKGROUND INFORMATION	
Site and Location:	Flood-prone areas Citywide
Cost Benefit:	Making sure homeowners have flood insurance coverage has been shown to reduce response needs and help Newport News' citizens return to normalcy more quickly after flooding.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Sea Level Rise, Tropical/Coastal Storm, Shoreline Erosion
Goal(s) Addressed:	Goal 1, Objectives 1.1, 1.2, 1.5; Goal 2, Objective 2.1
Priority (High, Moderate, Low):	High
Estimated Cost:	<$5,000 per year
Potential Funding Sources:	Existing budgets; DHS: HMGP 5% Initiative
Lead Agency/Department Responsible:	Emergency Management
Implementation Schedule:	Continuous
ADDITIONAL COMMENTS	
While this action is ongoing, it is important to retain in the hazard mitigation plan to ensure continued funding is secured annually.	

NEWPORT NEWS MITIGATION ACTION 15	
Hampton Avenue Channel Improvements & Constructed Wetlands Project. This action may include Climate Resilient Mitigation Activities (CRMA).	
BACKGROUND INFORMATION	
Site and Location:	1,400 linear feet of open drainage channel between Buxton Avenue and Pine Avenue.
Cost Benefit:	History of both stormwater runoff and tidal flooding during both minor and major storm events. Increasing capacity of channel along with larger culverts at 3 road crossings, thus allowing the travel routes (Buxton Ave. & Maple Ave.) to Hampton and I-664 to remain open during normal rainstorm events or minor tidal flooding in the Salters Creek area. If CRMA are included, additional benefits from environmental or ecosystem benefits may be included in the benefits cost analysis.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Sea Level Rise, Tropical/Coastal Storm
Goal(s) Addressed:	Goal 1, Objectives 1.3, 1.4
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$1.1 million
Potential Funding Sources:	Capital Improvement Plan & State Local Assistance Fund (SLAF); DHS: HMGP/CRMA
Lead Agency/Department Responsible:	Engineering
Implementation Schedule:	Construction to begin early 2017
ADDITIONAL COMMENTS	

NEWPORT NEWS MITIGATION ACTION 16	
Salters Creek Stream Restoration Project. This project may include Climate Resilient Mitigation Activities (CRMA).	
BACKGROUND INFORMATION	
Site and Location:	2,820 linear feet of the main open drainage channel of Salters Creek, from 35th Street outfall to 28th Street culvert.
Cost Benefit:	History of both stormwater runoff and tidal flooding during both minor and major storm events. Improvements will provide lower discharge elevations to major underground drainage systems reducing nuisance flooding of local streets, as well as increase the capacity of the main channel to reduce the impact of tidal flooding in the area. If CRMA are included, additional benefits from environmental or ecosystem benefits may be included in the benefits cost analysis.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Sea Level Rise, Tropical/Coastal Storm
Goal(s) Addressed:	Goal 1, Objectives 1.3, 1.4
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$1.67 million
Potential Funding Sources:	Capital Improvement Plan & State Local Assistance Fund (SLAF); DHS: HMGP/CRMA
Lead Agency/Department Responsible:	Engineering
Implementation Schedule:	Construction to begin mid-2017
ADDITIONAL COMMENTS	

Poquoson

POQUOSON MITIGATION ACTION 1	
Continue participating in the National Flood Insurance Program and the Community Rating System. Continue enforcement of standards in existing floodplain management ordinance that meet and exceed NFIP minimum requirements. **Study feasibility of implementing additional floodplain management ordinance changes, including:** **1. Changes to the definition of "substantial improvement" that would require accumulation of costs of improvements and repairs of buildings, based on issued building permits, over a set time period; and,** **2. Coastal A Zone regulations that apply coastal high hazard area requirements in areas delineated by FEMA as subject to wave heights between 3 feet and 1.5 feet high.**	
BACKGROUND INFORMATION	
Site and Location:	Special Flood Hazard Areas of Poquoson
Cost Benefit:	Additional measures to manage floodplains can further reduce flood response needs in the long-term, and reduce flood insurance premiums through CRS rating changes in the near-term. The NFIP and related flood mapping and development regulations have proven benefits nationwide.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Tropical/Coastal Storm, Sea Level Rise
Goal(s) Addressed:	Goal 1, Objectives 1.1, 1.2, 1.5
Priority (High, Moderate, Low):	High
Estimated Cost:	Travel costs and staff time
Potential Funding Sources:	Existing budgets; HMGP 5% Initiative
Lead Agency/Department Responsible:	Building Inspections
Implementation Schedule:	Ongoing with study of additional measures in 2015 and 2016
ADDITIONAL COMMENTS	

POQUOSON MITIGATION ACTION 2	
Elevate, relocate, retrofit or floodproof structures in hurricane prone areas. Flood protection may include minor localized flood reduction projects, as well. Wind retrofit measures are also included and may be appropriate for some structures, especially publicly-owned structures. This action includes Mitigation Reconstruction projects.	
BACKGROUND INFORMATION	
Site and Location:	Flood-prone areas Citywide, and Citywide for wind retrofits
Cost Benefit:	Retrofit measures that address flood- and wind-prone structures, particularly those designated as repetitive loss or severe repetitive loss by the NFIP, have quantifiable benefits by reducing future damages to the structures. Under new guidance, FEMA will now fund hazard mitigation projects that include sea level rise estimates.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Tropical/Coastal Storm, Sea Level Rise
Goal(s) Addressed:	Goal 1, Objectives 1.1, 1.2; Goal 3
Priority (High, Moderate, Low):	High
Estimated Cost:	In multiple $250,000 phases as grant money becomes available. Individual structure costs vary.
Potential Funding Sources:	DHS: PDM, HMGP, FMA, RFC; USDA
Lead Agency/Department Responsible:	Emergency Management and Building Inspections
Implementation Schedule:	Ongoing
ADDITIONAL COMMENTS	

POQUOSON MITIGATION ACTION 3	
Implement the Shoreline Management Plan developed by Virginia Institute of Marine Science, as conditions warrant.	
BACKGROUND INFORMATION	
Site and Location:	Shorelines Citywide
Cost Benefit:	Implementation is not costly and could be absorbed by existing department budgets. Materials to share with property owners and training for staff (and interested property owners) are available from VIMS at very low cost. Adding links from the City web page to the VIMS toolbox is low cost but would provide valuable information to property owners.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Tropical/Coastal Storm, Sea Level Rise, Shoreline Erosion
Goal(s) Addressed:	Goal 1, Objectives 1.3, 1.6; Goal 2, Objective 2.1; Goal 3, Objectives 3.1, 3.3, 3.4
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	Staff time only
Potential Funding Sources:	Existing budgets; DHS: HMGP 5% Initiative
Lead Agency/Department Responsible:	Planning Department, Permitting, and Engineering
Implementation Schedule:	Ongoing
ADDITIONAL COMMENTS	
Currently, Virginia's Shoreline Erosion Advisory Service is not funded. Property owners need guidance on best management shoreline protection methods from reliable sources and not necessarily just from shoreline repair contractors. The *Poquoson Comprehensive Plan 2008-2028*, Environmental Management Element, Shoreline Sub-Element, states as its second goal, "Develop a shoreline management plan to ensure property shoreline protection and create a framework for incentive[s] based on programs to encourage less intrusive means of shoreline protection." While permitting incentives were considered that might encourage living shorelines, City staff determined that permit fees and review times are already as low as possible.	

POQUOSON MITIGATION ACTION 4
Continue to increase flood and wind protection and flood access/egress for critical facilities and infrastructure. Elevate new critical facilities, retrofit existing facilities as necessary, and elevate roads to provide access to elevated critical facilities. Retrofits may include but are not limited to: installation of emergency backup power, elevation of structure or components, relocation or retrofit of building components. Coordinate with public utilities to protect or retrofit transformers, critical infrastructure and overhead power lines.

BACKGROUND INFORMATION	
Site and Location:	Critical facilities Citywide. Pump stations #8 (Poquoson Ave), #11 (N Odd Rd), #10 (Ridge Rd) and #7 (Little Florida at Far St) require backup generators.
Cost Benefit:	Benefits of mitigating flood damage to critical facilities are realized by all citizens through the city's ability to maintain the highest operational capabilities post-disaster. Flooding of roads prevents access to elevated critical facilities. Benefits are based on reduced response times, and longevity of critical infrastructure. Elevation of roads could reduce evacuation times once flooding begins, and protect road beds from erosion associated with sea level rise in the future. Under new guidance, FEMA will now fund hazard mitigation projects that include sea level rise estimates.

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Tropical/Coastal Storm, Sea Level Rise, Tornado, Winter Storm, also possibly Earthquake, Wildfire and Hazardous Materials Incident
Goal(s) Addressed:	Goal 1, Objectives 1.1, 1.2, 1.3, 1.4, 1.5
Priority (High, Moderate, Low):	High
Estimated Cost:	Cost will be based on specific flood protection measures chosen for each building
Potential Funding Sources:	DHS: PDM, HMGP, HMGP 5% Initiative, FMA, RFC; Stafford Act Section 406 - post-disaster mitigation funds under Public Assistance for damaged public facilities
Lead Agency/Department Responsible:	Public Works/Engineering, Fire Department, Police Department, Public Utilities
Implementation Schedule:	Ongoing

ADDITIONAL COMMENTS
Some vital infrastructure such as storm sewer and sanitary sewer are subject to flooding, and possibly vulnerable to sea level rise in the future.

POQUOSON MITIGATION ACTION 5	
Collect and share hazard-related data in GIS-compatible format, including but not limited to: 1) collect high water marks and calculate flood frequency for all coastal storms; 2) continue to collect Elevation Certificates for each structure in the 100-year floodplain; 3) use real-time storm surge/tidal conditions mapping developed in conjunction with NASA; and, 4) inventory and prioritize low-lying secondary roads and intersections critical to evacuation.	
BACKGROUND INFORMATION	
Site and Location:	Citywide
Cost Benefit:	Collection of elevation information and retention of Elevation Certificates can reduce surveying costs for property owners and buyers in the future. The partnership with NASA for real-time mapping has been a very successful and low-cost venture.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Tropical/Coastal Storm, Sea Level Rise, Shoreline Erosion, Winter Storm, Hazardous Materials Incident
Goal(s) Addressed:	Goal 3, Objectives 3.2, 3.3, 3.4
Priority (High, Moderate, Low):	High
Estimated Cost:	Staff time Post-disaster surveys could be used to collect structure elevations at approximately $300/structure (for a large number of structures at once)
Potential Funding Sources:	USACE: FPMS; VDEM: HMGP, HMGP 5% Initiative, USGS
Lead Agency/Department Responsible:	Engineering, Building Inspections, Emergency Management
Implementation Schedule:	Ongoing
ADDITIONAL COMMENTS	
The City Building Inspector continues to compile a collection of Elevation Certificates for existing structures, elevated/mitigated structures and new structures, and he maintains pertinent data from the forms in a digital format. Structural inventories with elevations, high water marks, and flood frequency data help prepare accurate cost-benefit analyses for a large number of structures rapidly, which is especially useful in a post-disaster scenario.	

POQUOSON MITIGATION ACTION 6	
Implement Pre-Disaster Debris Management Plan.	
BACKGROUND INFORMATION	
Site and Location:	Citywide
Cost Benefit:	Pre-disaster debris management reduces damage to structures and infrastructure from flood and wind. Also, regular clean-up requirements can reduce the costs of post-disaster debris clean-up. City could also have access to the additional 5-percent cost incentive from FEMA's Public Assistance money.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Tropical/Coastal Storm, Tornado, Winter Storm
Goal(s) Addressed:	Goal 1, Objectives 1.1, 1.2, 1.3, 1.4, 1.5, 1.6; Goal 2, Objective 2.1
Priority (High, Moderate, Low):	High
Estimated Cost:	Staff time
Potential Funding Sources:	Existing capital budgets; HMGP, PDM or FMA (with very clearly articulated benefits for flood damage reduction)
Lead Agency/Department Responsible:	Public Works, Solid Waste
Implementation Schedule:	Ongoing
ADDITIONAL COMMENTS	

POQUOSON MITIGATION ACTION 7	
Coordinate with public utilities, and use City resources to trim trees in the public right-of-way.	
BACKGROUND INFORMATION	
Site and Location:	Citywide
Cost Benefit:	Benefits include reduced debris clean-up costs and increased utility service reliability.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Tropical/Coastal Storm, Tornadoes, Winter Storm
Goal(s) Addressed:	Goal 1, Objectives 1.3, 1.5
Priority (High, Moderate, Low):	High
Estimated Cost:	$100,000, including contributions from utility providers
Potential Funding Sources:	Existing capital budgets, HMGP. In some cases, utilities may be eligible for some FEMA grant monies, as well.
Lead Agency/Department Responsible:	Public Works, utility providers
Implementation Schedule:	Ongoing
ADDITIONAL COMMENTS	

POQUOSON MITIGATION ACTION 8	
Eliminate barriers to the orderly evacuation of citizens: **1) Elevate and widen the causeway to Hampton (Wythe Creek Road);** **2) Widen Victory Boulevard;** **3) Continue car evacuation agreement with Langley Motor Speedway to allow citizens to park cars there prior to expected flooding; and,** **4) Address low-lying roadways/intersections identified in Mitigation Action #5.**	
BACKGROUND INFORMATION	
Site and Location:	Wythe Creek Road and Victory Boulevard
Cost Benefit:	These two roadways are considered critical infrastructure for the evacuation and protection of citizens in Poquoson. Wythe Creek Road floods regularly at high tide, cutting off the route and requiring all citizens to evacuate via Victory Boulevard. Providing a no-cost alternative for parking vehicles out of harm's way encourages people to consider the advantages and consequences of evacuating cars and people.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Tropical/Coastal Storm, Sea Level Rise, Wildfire, Hazardous Materials Incident
Goal(s) Addressed:	Goal 1, Objective 1.5; Goal 3, Objectives 3.1, 3.3, 3.4
Priority (High, Moderate, Low):	High
Estimated Cost to Poquoson:	Wythe Creek Road - $19.8 million Victory Boulevard - $22.7 million
Potential Funding Sources:	VDOT, Hampton, York County and other partners
Lead Agency/Department Responsible:	Engineering and City Manager's Office
Implementation Schedule:	Wythe Creek Road is scheduled for construction in 2018; Victory Boulevard widening is in the early stages and not expected until after 2018. Negotiations are underway with speedway officials.
ADDITIONAL COMMENTS	

POQUOSON MITIGATION ACTION 9	
Support and maintain decal system for re-entry to the City following a disaster. Use social networking to strengthen the system.	
BACKGROUND INFORMATION	
Site and Location:	Citywide
Cost Benefit:	Benefits accrue to: 1. property owners through reduced secondary damage (*e.g.,* from car wakes on flooded streets); and, 2. Police operating budgets through reduced traffic management costs, better response times and more efficient use of staff following a disaster.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Tropical/Coastal Storm, Tornadoes, Earthquake
Goal(s) Addressed:	Goal 1, Objectives 1.4, 1.5; Goal 2; Goal 3, Objective 3.1
Priority (High, Moderate, Low):	High
Estimated Cost:	$2,500 annually
Potential Funding Sources:	Capital budget; DHS: HMGP 5% Initiative
Lead Agency/Department Responsible:	City Manager's Office; Emergency Management
Implementation Schedule:	Ongoing
ADDITIONAL COMMENTS	
Gawkers and sightseers from outside Poquoson are not cognizant of the added damage and inconvenience their visits can inflict. A low-cost decal system was put in place in 2010, and together with police presence at key entry points to the City, officials can now control re-entry.	

POQUOSON MITIGATION ACTION 10	
Support and maintain Code Red, the City's 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 exceed budgetary restraints. Code Red quickly and efficiently uses existing infrastructure to notify property owners of appropriate pre- and post-disaster mitigation actions.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Tropical/Coastal Storm, Tornado, Winter Storm, Earthquake, Wildfire, Hazardous Materials Incident, Drought, Extreme Heat
Goal(s) Addressed:	Goal 1, Objectives 1.4, 1.5; Goal 2
Priority (High, Moderate, Low):	High
Estimated Cost:	$10,000 to $15,000
Potential Funding Sources:	Existing budgets; DHS: HMGP 5% Initiative
Lead Agency/Department Responsible:	Emergency Management
Implementation Schedule:	Ongoing
ADDITIONAL COMMENTS	
While the Code Red system is already functioning, an opportunity to use the system to urge property owners to take mitigative actions exists. Examine special needs population capabilities, availability of contract minutes and additional features, and additional messages to address other hazards.	

POQUOSON MITIGATION ACTION 11	
Protect flood-prone natural resources as a buffer against sea level rise, including, but not limited to: **1) Protect in perpetuity the 69 acres of natural land at the end of Poquoson Avenue donated to the City;** **2) Provide additional access points for the City's Blueway system, a series of canoe and kayak water trails in and around the City and Plum Tree Island; and,** **3) Provide opportunities for retail and residential development on land that is less prone to flooding and sea level rise, such as the Big Woods area.**	
BACKGROUND INFORMATION	
Site and Location:	Eastern portion of the City, especially undeveloped portions along the water.
Cost Benefit:	Just as damages from sea level rise are not easily quantifiable, the benefits of adjusting to sea level rise are also more abstract. These measures are relatively low in cost compared to the damages that flooding will continue to inflict in Poquoson if no adjustments are made.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Sea Level Rise, Flooding, Tropical/Coastal Storm, Shoreline Erosion
Goal(s) Addressed:	Goal 1, Objectives 1.2, 1.6
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	1) Existing budgets for legal and real estate costs. 2) Access points on the Blueway may incur costs to the city as additional sites are identified. Costs would be dependent on site amenities. 3) Staff time
Potential Funding Sources:	Existing budgets; VDCR: VRTF, L&WCF, VCWRLF
Lead Agency/Department Responsible:	Parks, City Manager's Office, Planning
Implementation Schedule:	Ongoing
ADDITIONAL COMMENTS	
A long-term plan of gradual adjustment begins with small steps. This action highlights the opportunity to identify additional ways to protect flood-prone areas with multiple benefits for citizens in the long- and short-term. CRS points may be available for sub-action #1.	

POQUOSON MITIGATION ACTION 12	
Continue to participate in coalition with Virginia Tech and others using drones for storm/event damage assessment and wildland fire management.	
BACKGROUND INFORMATION	
Site and Location:	Eastern portion of the City, primarily
Cost Benefit:	This low-cost method of assessing damage after a storm or to assess wildfire potential in undeveloped areas has benefits for the reduction of spreading wildfire risk and the management of post-flood redevelopment.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Sea Level Rise, Flooding, Tropical/Coastal Storm, Wildfire, Tornado, Shoreline Erosion
Goal(s) Addressed:	Goal 3, Objectives 3.1, 3.2, 3.3, 3.4
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	Staff time
Potential Funding Sources:	Existing budgets; VDCR: VRTF, L&WCF, VCWRLF; DHS: HMGP 5% Initiative
Lead Agency/Department Responsible:	City Manager's Office
Implementation Schedule:	Ongoing
ADDITIONAL COMMENTS	

POQUOSON MITIGATION ACTION 13	
Continue outreach efforts through a strategically-developed Plan for Public Information (PPI) using the following seven steps: **1. Create a PPI Committee** **2. Assess Poquoson's public information needs** **3. Formulate multi-hazard 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, Tropical/Coastal Storm, and Winter Storms
Goal(s) Addressed:	Goal 2, Objective 2.1; Goal 3, Objectives 3.1, 3.4
Priority (High, Moderate, Low):	High
Estimated Cost:	$10,000
Potential Funding Sources:	Existing budgets and staff time; DHS: HMGP 5% Initiative
Lead Agency/Department Responsible:	Building Inspections
Implementation Schedule:	2015 for Steps 1 and 2, 2016 for remainder

ADDITIONAL COMMENTS
Audiences include: property owners, businesses, city officials and schoolchildren. Stakeholders may include: Planning Department, HRPDC, CERT, Tidewater Builders Association, Parent Teacher Associations, VDEM, DEQ, DCR, adjacent communities and American Red Cross. Potential outreach needs include: focus on repetitive loss property owners in outreach efforts, 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 for floodplain management permitting process, early preparation of post-disaster permitting and redevelopment materials such as press releases, videos, brochures, forms, and fees (CRS credits available); integrate social networking and CodeRed into the methods of notification used by the City. Use questionnaires on social media to garner feedback. Continue to refine contents of the Library Welcome Bag and methods of distribution. Continue City TV channel disaster information series, postcards to citizens regarding new flood maps, and *Island Tide* magazine seasonal information bursts. Prepare press releases highlighting mitigation success stories. PPI should include analysis of staff and citizen training, cross-training, and train-the-trainer opportunities on an annual basis.

Williamsburg

WILLIAMSBURG MITIGATION ACTION 1	
Improve drainage system maintenance, including increased sediment and debris clearance.	
BACKGROUND INFORMATION	
Site and Location:	Drainageways citywide.
Cost Benefit:	The City's network of structures, channels and underground pipes that carry stormwater help reduce flooding, especially during high frequency events. Maintenance is required to keep the system functioning effectively.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Sea Level Rise, Shoreline Erosion
Goal(s) Addressed:	Goal 1, Objective 1.3, 1.4, 1.5
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$40,000
Potential Funding Sources:	Existing Budget and CIP
Lead Agency/Department Responsible:	Public Works
Implementation Schedule:	This is a continuous activity of the City's Public Works Department.
ADDITIONAL COMMENTS	
Smoke testing on sewer system is part of the action. Cross training on stormwater management problem detection with other departments is critical for maintenance in Williamsburg and will continue.	

WILLIAMSBURG MITIGATION ACTION 2	
Continue participating in the National Flood Insurance Program. Continue enforcement of standards in existing floodplain management ordinance that meet and exceed NFIP minimum requirements.	
BACKGROUND INFORMATION	
Site and Location:	Special Flood Hazard Areas of Williamsburg
Cost Benefit:	The NFIP and related flood mapping and development regulations have proven benefits nationwide.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Sea Level Rise, Tropical/Coastal Storm
Goal(s) Addressed:	Goal 1, Objectives 1.1, 1.2, 1.6
Priority (High, Moderate, Low):	High
Estimated Cost:	Staff time
Potential Funding Sources:	Existing budgets
Lead Agency/Department Responsible:	Designated Floodplain Manager (currently Rodney Rhodes)
Implementation Schedule:	Ongoing
ADDITIONAL COMMENTS	

WILLIAMSBURG MITIGATION ACTION 3		
Maintain StormReady designation through the National Weather Service.		
BACKGROUND INFORMATION		
Site and Location:	Citywide	
Cost Benefit:	StormReady helps arm communities with the communication and safety skills needed to save lives and property--before, during and after the event. StormReady helps community leaders and emergency managers strengthen local safety programs.	
MITIGATION ACTION DETAILS		
Hazard(s) Addressed:		Flooding, Tropical/Coastal Storm, Tornado, Winter Storm, Extreme Heat
Goal(s) Addressed:		Goal 1, Goal 2, Goal 3
Priority (High, Moderate, Low):		High
Estimated Cost:		<$2,000 annually
Potential Funding Sources:		Local funds
Lead Agency/Department Responsible:		Fire Department
Implementation Schedule:		Ongoing
ADDITIONAL COMMENTS		

WILLIAMSBURG MITIGATION ACTION 4	
Continue Colonial Williamsburg Annual Tree Maintenance Program.	
BACKGROUND INFORMATION	
Site and Location:	Citywide
Cost Benefit:	Seasonal inspections and trimming reduce storm damage from trees.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Winter Storm, Tornado, Tropical/Coastal Storm, Wildfire, Shoreline Erosion
Goal(s) Addressed:	Goal 1, Objectives 1.3, 1.4, 1.5, 1.6
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	<$5,000 annually
Potential Funding Sources:	Private – CWF
Lead Agency/Department Responsible:	CWF Landscape crew
Implementation Schedule:	Ongoing
ADDITIONAL COMMENTS	
This action will be coordinated with the Fire Department to make sure fire equipment access is maintained, as well.	

WILLIAMSBURG MITIGATION ACTION 5	
Continue shelter generator maintenance and monitoring program.	
BACKGROUND INFORMATION	
Site and Location:	Shelters citywide
Cost Benefit:	The maintenance and daily monitoring of shelter generators helps ensure that these facilities operate at full capacity when needed.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Tropical/Coastal Storm, Tornado, Winter Storm, Earthquake, Wildfire, Extreme Heat, Hazardous Materials Incident
Goal(s) Addressed:	Goal 1, Objective 1.3
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$4,000 annually
Potential Funding Sources:	Local funds; DHS: HMGP 5% Initiative
Lead Agency/Department Responsible:	Fire Department
Implementation Schedule:	Ongoing
ADDITIONAL COMMENTS	
Generator status is continually monitored through a computer system accessed by Fire Department personnel.	

WILLIAMSBURG MITIGATION ACTION 6	
Strengthen GIS digital mapping program.	
BACKGROUND INFORMATION	
Site and Location:	Citywide
Cost Benefit:	The City's ongoing efforts to increase databases related to hazards is reflected in this plan. Additional databases help staff and planners recognize and plan for various hazards, special needs populations, evacuations and response.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Sea Level Rise, Tropical/Coastal Storm, Tornado, Winter Storm, Earthquake, Wildfire, Hazardous Materials Incident, Shoreline Erosion
Goal(s) Addressed:	Goal 1; Goal 3, Objective 3.2
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$10,000
Potential Funding Sources:	Local funds; DHS: HMGP 5% Initiative
Lead Agency/Department Responsible:	IT
Implementation Schedule:	Ongoing
ADDITIONAL COMMENTS	
New layers are continually added to the system. Staff training on use of the map data is included in the cost estimate. City maintains handheld GPS unit for data collection.	

WILLIAMSBURG MITIGATION ACTION 7	
Expand capacity/training for CERT groups and neighborhood-serving organizations to include communication about mitigation and response.	
BACKGROUND INFORMATION	
Site and Location:	Citywide, with particular emphasis on vulnerable neighborhoods with less access to social or broadcast media
Cost Benefit:	Local residents are better able to address or communicate the needs of their specific neighborhoods. CERT members can expand capacity of City staff to communicate, mitigate and respond more effectively.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Sea Level Rise, Tropical/Coastal Storm, Tornado, Winter Storm, Earthquake, Wildfire, Drought, Extreme Heat, Hazardous Materials Incident, Shoreline Erosion
Goal(s) Addressed:	Goal 1; Goal 2, Objective 2.1; Goal 3, Objective 3.1
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$5,000 to $10,000
Potential Funding Sources:	HSGP/CCP grants, local funding; DHS: HMGP 5% Initiative
Lead Agency/Department Responsible:	Emergency Management and Human Services
Implementation Schedule:	Ongoing
ADDITIONAL COMMENTS	
CERT team is very active in Williamsburg and training is provided to members at least 2 times per year. They participate in 1 exercise per year and refresher training is also provided.	

WILLIAMSBURG MITIGATION ACTION 8	
Expedite damage assessment data collection through an automated software package.	
BACKGROUND INFORMATION	
Site and Location:	Citywide
Cost Benefit:	Expedited damage assessment frees staff to perform other tasks. Enhanced and expedited permitting for damaged structures.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Tropical/Coastal Storm, Tornado, Winter Storm, Earthquake, Wildfire, Hazardous Materials Incident
Goal(s) Addressed:	Goal 3, Objective 3.2
Priority (High, Moderate, Low):	High
Estimated Cost:	$3,000 initial, and $5,000 annually thereafter
Potential Funding Sources:	Local funding; DHS: HMGP 5% Initiative
Lead Agency/Department Responsible:	Codes Compliance, Planning
Implementation Schedule:	3 to 5 years
ADDITIONAL COMMENTS	

WILLIAMSBURG MITIGATION ACTION 9	
Expand social media and use of Everbridge mass notification system for pre- and post-disaster information distribution.	
BACKGROUND INFORMATION	
Site and Location:	Citywide
Cost Benefit:	Getting information to citizens before, during and after disaster events is critical to reducing damage, reducing panic and creating a resilient citizen base that responds positively to government messages.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Tropical/Coastal Storm, Tornado, Winter Storm, Earthquake, Wildfire, Drought, Extreme Heat, Hazardous Materials Incident
Goal(s) Addressed:	Goal 2; Goal 3, Objectives 3.3, 3.4
Priority (High, Moderate, Low):	High
Estimated Cost:	$10,500 annually
Potential Funding Sources:	Locality funding, VDEM Radiological funding DHS: HMGP 5% Initiative
Lead Agency/Department Responsible:	Communications Specialist, Emergency Management
Implementation Schedule:	Immediately upon adoption
ADDITIONAL COMMENTS	
The prominence of social media points to a need to refine activity on Twitter, Facebook, Instagram and other programs. Need to be pro-active and targeted in messages. Identify specific messages, links. Identify other information that City can disseminate and the most effective methods, such as short videos, maps, links, photos, and infographics.	

James City County

JAMES CITY COUNTY MITIGATION ACTION 1	
Protect critical facilities, including refuges, while increasing potential refuge capacity and/or protected areas. Protection measures may include emergency generators or other power sources, wind or flood retrofits, elevation, relocation, or reconstruction.	
BACKGROUND INFORMATION	
Site and Location:	Countywide
Cost Benefit:	The purpose of this action is to maintain citizen safety, and continuity of county operations during a disaster event. Under new guidance, FEMA will now fund hazard mitigation projects that include sea level rise estimates.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Tropical/Coastal Storm, Tornado, Winter Storm, Earthquake, Wildfire, Hazardous Materials Incident
Goal(s) Addressed:	Goal 1, Objective 1.3, 1.4, 1.5
Priority (High, Moderate, Low):	High
Estimated Cost:	To be determined based on corrective actions selected
Potential Funding Sources:	DHS: PDM, HMGP, HMGP 5% Initiative, FMA, EMPG
Lead Agency/Department Responsible:	Emergency Management
Implementation Schedule:	Continuing
ADDITIONAL COMMENTS	

JAMES CITY COUNTY MITIGATION ACTION 2	
Mitigate flooding problems identified in the flood studies performed for Powhatan Creek watershed. Measures may include, but are not limited to improvements to road crossings by increasing flow capacity, or installing over-topping protection. This action may include Climate Resilient Mitigation Activities (CRMA).	
BACKGROUND INFORMATION	
Site and Location:	Powhatan Creek watershed
Cost Benefit:	Lower cost improvements to roadways are expected to provide significant benefits in this area. If CRMA are included, additional benefits from environmental or ecosystem benefits may be included in the benefits cost analysis if HMGP funding is used.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Tropical/Coastal Storm
Goal(s) Addressed:	Goal 1, Objectives 1.1, 1.2, 1.3, 1.4, 1.5
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$6,000,000
Potential Funding Sources:	VDOT, Federal Transportation Administration, DHS
Lead Agency/Department Responsible:	General Services Stormwater
Implementation Schedule:	Within 4 years
ADDITIONAL COMMENTS	

JAMES CITY COUNTY MITIGATION ACTION 3	
Conduct annual meeting with VDOT and utilities to identify hazard areas and potential projects to mitigate those areas.	
BACKGROUND INFORMATION	
Site and Location:	Countywide
Cost Benefit:	Keeping roads and utilities operational during high frequency events and maximizing their operability during disasters is a countywide priority.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Winter Storm, Tropical/Coastal Storm, Tornado, Earthquake, Hazardous Materials Incident
Goal(s) Addressed:	Goal 1, Objective 1.3, 1.4, 1.5; Goal 3, Objective 3.1, 3.3, 3.4
Priority (High, Moderate, Low):	High
Estimated Cost:	Staff time
Potential Funding Sources:	N/A
Lead Agency/Department Responsible:	Emergency Management
Implementation Schedule:	Annually
ADDITIONAL COMMENTS	

JAMES CITY COUNTY MITIGATION ACTION 4	
Elevate, acquire, relocate, retrofit or floodproof structures in flood-prone areas. Flood protection may include minor localized flood reduction projects, as well. Wind retrofit measures are also included and may be appropriate for some structures, especially publicly-owned structures. This action includes Mitigation Reconstruction projects.	
BACKGROUND INFORMATION	
Site and Location:	Flood-prone areas Countywide, and Countywide for wind retrofits. Particular focus on Chickahominy Haven and Powhatan Shores, as well as repetitive flood loss areas throughout the County.
Cost Benefit:	Retrofit measures that address flood- and wind-prone structures, particularly those designated as repetitive loss or severe repetitive loss by the NFIP, have quantifiable benefits by reducing future damages to the structures. Under new guidance, FEMA will now fund hazard mitigation projects that include sea level rise estimates.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Tropical/Coastal Storm, Sea Level Rise
Goal(s) Addressed:	Goal 1, Objectives 1.1, 1.2, 1.3; Goal 3, Objective 3.1
Priority (High, Moderate, Low):	High
Estimated Cost:	Historically, approximately $90,000 per structure. However, this may change based on funding availability.
Potential Funding Sources:	DHS: PDM, HMGP, FMA, RFC; USDA and 5% initiative funds
Lead Agency/Department Responsible:	Community Housing
Implementation Schedule:	Ongoing
ADDITIONAL COMMENTS	

JAMES CITY COUNTY MITIGATION ACTION 5	
Continue strengthening the County's Floodplain Management Program with the following actions: **1) Review floodplain ordinance regularly for appropriateness of higher standards and necessary updates;** **2) Provide specialized training and support for Certified Floodplain Manager (CFM) certification for floodplain plan reviewers, inspectors and permit processors;** **3) Continue to assess repetitive loss data annually for loss accuracy, geographic accuracy, and determination whether structure(s) on property have been mitigated and if so, by what means. Provide corrections as necessary using FEMA AW-501;** **4) Conduct annual Flood Exercise in August with After Action Report and analysis; and,** **5) Building Safety and Permits plans examiners to provide information and resources to help builders and owners evaluate hydrostatic (flood) vent options. Materials to be available on department's web site, and hands-on assistance at the permit counter, including an operational vent to show builders.**	
BACKGROUND INFORMATION	
Site and Location:	Flood-prone areas Countywide
Cost Benefit:	The NFIP has a proven record of reducing annual flood damages through floodplain regulations that guide design of flood-prone properties.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Winter Storm, Tropical/Coastal Storm; Sea Level Rise
Goal(s) Addressed:	Goal 1, Objectives 1.1, 1.2, 1.5; Goal 3, Objective 3.2
Priority (High, Moderate, Low):	High
Estimated Cost:	Staff time
Potential Funding Sources:	N/A
Lead Agency/Department Responsible:	Development Management, Emergency Management
Implementation Schedule:	Ongoing
ADDITIONAL COMMENTS	

JAMES CITY COUNTY MITIGATION ACTION 6		
Continue outreach efforts through a strategically-developed Plan for Public Information (PPI) using the following seven steps: **1. Create a PPI Committee** **2. Assess County's public information needs** **3. Formulate multi-hazard 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:	Countywide	
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 County 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:		Flooding, Sea Level Rise, Tropical/Coastal Storm, Winter Storm, Shoreline Erosion, Tornado, Earthquake, Wildfire, Drought, Extreme Heat and Hazardous Materials Incident
Goal(s) Addressed:		Goal 2, Objective 2.1; Goal 3
Priority (High, Moderate, Low):		High
Estimated Cost:		Less than $7,500 annually
Potential Funding Sources:		Existing budgets and staff time; DHS: PDM, HMGP, HMGP 5% Initiative
Lead Agency/Department Responsible:		Emergency Management (lead) Development Management
Implementation Schedule:		Within 2 years of plan adoption

ADDITIONAL COMMENTS
Audiences include: property owners including new residents, tourists, businesses, County officials, pet owners, and schoolchildren. Stakeholders may include: various County departments, HRPDC, Peninsula Housing and Builders Association, Parent Teacher Associations, VDEM, DEQ, and DCR. Potential outreach needs include: flood risk awareness, focus on repetitive loss property owners in outreach efforts, contingency planning for businesses, response guidance with emphasis on community resiliency, publicizing the County's mitigation efforts, informing property owners of long-term and short-term property protection measures (*e.g.,* protecting vinyl siding windows from wind damage, flood vent demos and displays), creating a dedicated web site/social media sites 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.

JAMES CITY COUNTY MITIGATION ACTION 7	
Convene a task force to study/assess the wildland fire hazard and the urban interface. Task force recommendations may include such topics as: additional building code requirements in a mapped "interface zone", outreach or complimentary inspections for homeowners.	
BACKGROUND INFORMATION	
Site and Location:	Wildfire urban interface zones countywide
Cost Benefit:	Knowledge of wildfire hazards can be helpful in encouraging homeowners to mitigate the hazard themselves. Low-cost measures are available to responsibly mitigate the wildfire hazard, especially during high risk times.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Wildfire
Goal(s) Addressed:	Goal 1, Objectives 1.2, 1.5, 1.6; Goal 2; Goal 3
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	Staff time
Potential Funding Sources:	DHS: HMGP 5% Initiative
Lead Agency/Department Responsible:	Fire Department, Emergency Management
Implementation Schedule:	Within 5 years of plan adoption
ADDITIONAL COMMENTS	

JAMES CITY COUNTY MITIGATION ACTION 8	
Obtain StormReady designation through NOAA.	
BACKGROUND INFORMATION	
Site and Location:	Countywide
Cost Benefit:	StormReady helps arm communities with the communication and safety skills needed to save lives and property--before, during and after the event. StormReady helps community leaders and emergency managers strengthen local safety programs.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Sea Level Rise, Tropical/Coastal Storm, Tornado, Winter Storm, Wildfire, Earthquake
Goal(s) Addressed:	Goal 1, Goal 2, Goal 3
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	Staff time
Potential Funding Sources:	N/A
Lead Agency/Department Responsible:	Emergency Management
Implementation Schedule:	Within 2 years of plan adoption
ADDITIONAL COMMENTS	

JAMES CITY COUNTY MITIGATION ACTION 9	
Conduct annual Hazard Mitigation Workshop to update and share hazard mitigation information, discuss potential projects. Invite relevant County departments, non-profit agencies and other stakeholders. Develop annual Hazard Mitigation Potential Project List with ready packages for submittal as funding becomes available.	
BACKGROUND INFORMATION	
Site and Location:	Countywide
Cost Benefit:	Ready packages for submittal will: • allow the County to increase focus on hazard mitigation opportunities; • closely track hazard mitigation efforts, implementation, and successes; and, • maximize opportunities to move forward with specific mitigation actions identified over time.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	All
Goal(s) Addressed:	Goal 1, Objectives 1.1, 1.2, 1.3, 1.4, 1.5; Goal 3, Objectives 3.1., 3.3; Goal 4, Objectives 4.1, 4.2
Priority (High, Moderate, Low):	High
Estimated Cost:	Staff time
Potential Funding Sources:	Existing budgets
Lead Agency/Department Responsible:	Emergency Management, Finance, Development Management
Implementation Schedule:	Immediately
ADDITIONAL COMMENTS	

York County

YORK COUNTY MITIGATION ACTION 1	
Continue outreach efforts using the following steps: **1. Assess County's public information needs** **2. Formulate multi-hazard messages** **3. Identify outreach projects to convey the messages** **4. Examine other public information initiatives** **5. Implement**	
BACKGROUND INFORMATION	
Site and Location:	Countywide
Cost Benefit:	The organized nature of the approach reduces long-term costs by: 1) minimizing need to repeat messages; 2) investigating regional partnerships that could result in additional cost savings through cost sharing; 3) using existing programs and resources to maximum advantage.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Sea Level Rise, Tropical/Coastal Storm, Winter Storm, Shoreline Erosion, Tornado, Earthquake, Wildfire, Drought, Extreme Heat and Hazardous Materials Incident
Goal(s) Addressed:	Goal 2, Objective 2.1; Goal 3
Priority (High, Moderate, Low):	High
Estimated Cost:	Less than $7,500
Potential Funding Sources:	Existing budgets and staff time
Lead Agency/Department Responsible:	Emergency Management, Development Services
Implementation Schedule:	Within 2 years of plan adoption

ADDITIONAL COMMENTS
Audiences include: property owners, elected officials, businesses, County officials, pet owners, and schoolchildren. Stakeholders may include: various County departments, HRPDC, Peninsula Housing and Builders Association, Parent Teacher Associations, VDEM, DEQ, DCR, and American Red Cross. Potential outreach needs include: content and method of public service announcements, flood risk awareness, focus on repetitive loss property owners in outreach efforts, contingency planning for businesses, publicizing the County'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 floodplain management permitting process, increasing property owner awareness of flood zone location and flood insurance availability, awareness of the flood hazard in general, and information about the Letter of Map Amendment process regarding the FEMA FIRM, 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.

YORK COUNTY MITIGATION ACTION 2	
Continue strengthening the County's Floodplain Management Program with the following actions: 1) **Review and update floodplain ordinance regularly and continue to provide annual Floodplain Management Report;** 2) **Require deed restrictions on use of enclosed areas below elevated structures in Special Flood Hazard Areas.** 3) **Continue specialized training and support for Certified Floodplain Manager (CFM) certification for floodplain plan reviewers, inspectors and permit processors; and,** 4) **Continue to assess repetitive flood loss data annually for loss accuracy, geographic accuracy, and determination whether structure(s) on property have been mitigated and if so, by what means. Provide corrections as necessary using FEMA AW-501.**	
BACKGROUND INFORMATION	
Site and Location:	Flood-prone areas Countywide
Cost Benefit:	The NFIP has a proven record of reducing annual flood damages through floodplain regulations that guide design of flood-prone properties. Unlawful conversion of enclosed areas below elevated structures increases flood damage in flood-prone areas. Sample forms are available from DCR, so this sub-action has relatively low cost.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Winter Storm, Tropical/Coastal Storm, Sea Level Rise
Goal(s) Addressed:	Goal 1, Objectives 1.1, 1.2, 1.4; Goal 3, Objective 3.2
Priority (High, Moderate, Low):	High
Estimated Cost:	Staff time
Potential Funding Sources:	N/A
Lead Agency/Department Responsible:	Public Works and Development Services
Implementation Schedule:	Ongoing
ADDITIONAL COMMENTS	

YORK COUNTY MITIGATION ACTION 3	
Elevate, acquire, relocate, retrofit or floodproof structures in flood-prone areas. Flood protection may include minor localized flood reduction projects, as well. Wind retrofit measures are also included and may be appropriate for some structures, especially publicly-owned structures. This action includes Mitigation Reconstruction projects.	
BACKGROUND INFORMATION	
Site and Location:	Flood-prone areas Countywide, and Countywide for wind retrofits.
Cost Benefit:	Retrofit measures that address flood- and wind-prone structures, particularly those designated as repetitive loss or severe repetitive loss by the NFIP, have quantifiable benefits by reducing future damages to the structures. Under new guidance, FEMA will now fund hazard mitigation projects that include sea level rise estimates.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Tropical/Coastal Storm, Sea Level Rise
Goal(s) Addressed:	Goal 1, Objectives 1.1, 1.2, 1.5
Priority (High, Moderate, Low):	High
Estimated Cost:	In multiple phases as grant money becomes available. Individual structure costs vary.
Potential Funding Sources:	DHS: PDM, HMGP, FMA, RFC; USDA
Lead Agency/Department Responsible:	Emergency Management
Implementation Schedule:	Ongoing
ADDITIONAL COMMENTS	

YORK COUNTY MITIGATION ACTION 4	
Develop public outreach materials to educate citizens about the wildland fire hazard and the wildland/urban interface.	
BACKGROUND INFORMATION	
Site and Location:	Wildfire urban interface zones countywide
Cost Benefit:	Knowledge of wildfire hazards can be helpful in encouraging homeowners to mitigate the hazard themselves. Low-cost measures are available to responsibly mitigate the wildfire hazard, especially during high risk times.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Wildfire
Goal(s) Addressed:	Goal 2, Objective 2.1
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	Staff time
Potential Funding Sources:	DHS: HMGP 5% Initiative
Lead Agency/Department Responsible:	Department of Fire and Life Safety
Implementation Schedule:	Within 5 years of plan adoption
ADDITIONAL COMMENTS	

YORK COUNTY MITIGATION ACTION 5	
Maintain program for continued assessment of identified stormwater "choke points" when storms are approaching.	
BACKGROUND INFORMATION	
Site and Location:	Countywide
Cost Benefit:	Pre-disaster assessment and action to alleviate choke points can reduce flooding damage and improve the stormwater system's ability to perform as designed.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Sea Level Rise, Tropical/Coastal Storm, Shoreline Erosion, Winter Storm
Goal(s) Addressed:	Goal 1, Objectives 1.1, 1.2, 1.3, 1.4, 1.5
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	This program is absorbed into staff time spent on stormwater program and thus is not budgeted separately.
Potential Funding Sources:	Existing budgets
Lead Agency/Department Responsible:	Public Works and Development Services
Implementation Schedule:	Ongoing
ADDITIONAL COMMENTS	

YORK COUNTY MITIGATION ACTION 6	
Evaluate critical facilities for safety and sustainability during emergencies. Take appropriate corrective actions, which may include but are not limited to: providing backup power sources, wind retrofits and flood retrofits.	
BACKGROUND INFORMATION	
Site and Location:	Countywide
Cost Benefit:	Critical facility operation protects the public, maintains governmental operations and furthers community sustainability.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Tropical/Coastal Storm, Tornado, Winter Storm, Earthquake, Wildfire, Extreme Heat, Hazardous Materials Incident
Goal(s) Addressed:	Goal 1, Objectives 1.1, 1.2, 1.3, 1.4
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	To be determined
Potential Funding Sources:	DHS: PDM, HMGP, HMGP 5% Initiative
Lead Agency/Department Responsible:	Department of Fire and Life Safety
Implementation Schedule:	Ongoing
ADDITIONAL COMMENTS	

YORK COUNTY MITIGATION ACTION 7	
Continue support of the Newport News Department of Public Utilities (Waterworks) forest management program to mitigate wildfire hazards and promote the health of forests within the reservoir watersheds. This action includes Climate Resilient Mitigation Activities (CRMA).	
BACKGROUND INFORMATION	
Site and Location:	Waterworks reservoir watersheds in the County
Cost Benefit:	This ongoing program reduces the number of fires, and works to control pine beetle infestations. Forest thinning is a primary control mechanism. This is one of many programs the utility implements related to hazard mitigation. Additional benefits from environmental or ecosystem benefits may be included in the benefits cost analysis.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Wildfire, Winter Storm
Goal(s) Addressed:	Goal 1, Objective 1.3; Goal 3, Objectives 3.1, 3.3, 3.4
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	Staff time
Potential Funding Sources:	Waterworks Enterprise Fund, existing budgets; DHS: HMGP/CRMA
Lead Agency/Department Responsible:	Department of Fire and Life Safety
Implementation Schedule:	Ongoing
ADDITIONAL COMMENTS	

YORK COUNTY MITIGATION ACTION 8	
Manage shoreline erosion through the following actions: 1. **Request and share VIMS staff recommendations for shoreline erosion control permit applications with Wetlands Board citizen members; and,** 2. **Continue to include shoreline erosion control element in the Comprehensive Plan.**	
BACKGROUND INFORMATION	
Site and Location:	Shorelines countywide
Cost Benefit:	
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Shoreline Erosion
Goal(s) Addressed:	Goal 1, Objectives 1.2, 1.3, 1.6; Goal 3, Objectives 3.1, 3.3, 3.4
Priority (High, Moderate, Low):	Low
Estimated Cost:	Staff time
Potential Funding Sources:	N/A
Lead Agency/Department Responsible:	Development Services Department, Planning Division
Implementation Schedule:	Ongoing
ADDITIONAL COMMENTS	

YORK COUNTY MITIGATION ACTION 9	
Create and maintain geodatabase of known storage locations of hazardous materials.	
BACKGROUND INFORMATION	
Site and Location:	Countywide
Cost Benefit:	Such a database would provide critical information for hazard planning, especially when hazards overlap. For example, knowing the location of hazardous materials in the floodplain can be a critical element in floodplain management planning.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Hazardous Materials Incident, Flooding, Sea Level Rise, Tropical/Coastal Storm, Winter Storm, Earthquake, Wildfire
Goal(s) Addressed:	Goal 1, Objectives 1.2, 1.3; Goal 3, Objective 3.2
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$5,000 to $10,000
Potential Funding Sources:	Existing budgets; DHS: HMGP 5% Initiative
Lead Agency/Department Responsible:	Fire and Life Safety, GIS/mapping
Implementation Schedule:	Within 5 years of plan adoption
ADDITIONAL COMMENTS	

YORK COUNTY MITIGATION ACTION 10	
Install high water marks signs and/or gages in flood-prone areas.	
BACKGROUND INFORMATION	
Site and Location:	Flood-prone areas countywide
Cost Benefit:	Drivers who are aware of the extent of high water on roads can avoid unsafe travel, avoiding damage to humans, rescue personnel, and vehicles.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Sea Level Rise, Tropical/Coastal Storm
Goal(s) Addressed:	Goal 2
Priority (High, Moderate, Low):	High
Estimated Cost:	Estimated $200 per sign post, installed
Potential Funding Sources:	VDOT, DHS: PDM, HMGP, HMGP 5% Initiative
Lead Agency/Department Responsible:	Public Works
Implementation Schedule:	Within 5 years of plan adoption
ADDITIONAL COMMENTS	

YORK COUNTY MITIGATION ACTION 11	
Implement Pre-Disaster Debris Management Plan. Remove existing trees and debris that pose hazard during natural disaster.	
BACKGROUND INFORMATION	
Site and Location:	Citywide
Cost Benefit:	Pre-disaster debris management reduces damage to structures and infrastructure from flood, wind and possibly snow. Also, regular clean-up requirements can reduce the costs of post-disaster debris clean-up. County could also have access to the additional 5-percent cost incentive from FEMA's Public Assistance money.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Tropical/Coastal Storm, Tornado, Winter Storm, Earthquake, Wildfire
Goal(s) Addressed:	Goal 1, Objectives 1.1, 1.2, 1.3, 1.4, 1.5; Goal 3, Objective 3.1
Priority (High, Moderate, Low):	High
Estimated Cost:	Staff time
Potential Funding Sources:	Existing capital budgets; HMGP, HMGP 5% Initiative, PDM or FMA (with very clearly articulated benefits for flood damage reduction)
Lead Agency/Department Responsible:	Public Works
Implementation Schedule:	Within 3 years of plan adoption
ADDITIONAL COMMENTS	

NORFOLK

NORFOLK MITIGATION ACTION 1	
Maintain and protect the City's beaches and shorelines using structural means.	
BACKGROUND INFORMATION	
Site and Location:	Chesapeake Bay shoreline
Cost Benefit:	Increased frequency and severity of flooding in Norfolk is expected to dramatically increase flood damages in coming years. Without well-planned protection measures, Norfolk's shoreline is particularly vulnerable to erosion resulting from floods and sea level rise. Under new guidance, FEMA will now fund hazard mitigation projects that include sea level rise estimates.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Sea Level Rise, Flooding, Shoreline Erosion, Tropical/Coastal Storm
Goal(s) Addressed:	Goal 1, Objectives 1.1, 1.2, 1.3; Goal 3, Objectives 3.1, 3.3
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$20,000,000
Potential Funding Sources:	ACOE, General funds, Capital Improvements Plan
Lead Agency/Department Responsible:	Public Works
Implementation Schedule:	Ongoing
COMMENTS	
Multiple activities are covered under this effort, including breakwater and other structural features, beach surveys and source identification, and environmental permitting. Implement joint partnership with Army Corp of Engineers through the Willoughby vicinity beach nourishment project and all subsequent required nourishments of beach/berm project.	

NORFOLK MITIGATION ACTION 2	
Maintain and protect the City's beaches and shorelines using natural shoreline protection measures. This action may include Climate Resilient Mitigation Activities (CRMA).	
BACKGROUND INFORMATION	
Site and Location:	Chesapeake Bay shoreline
Cost Benefit:	Increased frequency and severity of flooding in Norfolk is expected to dramatically increase flood damages in coming years. Natural protection measures help the shoreline adjust to sea level rise with less intervention. If CRMA are included, additional benefits from environmental or ecosystem benefits may be included in the benefits cost analysis. Under new guidance, FEMA will now fund hazard mitigation projects that include sea level rise estimates.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Sea Level Rise, Flooding, Shoreline Erosion
Goal(s) Addressed:	Goal 1, Objectives 1.1, 1.2, 1.3, 1.6; Goal 3, Objectives 3.1, 3.3
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$10,000,000
Potential Funding Sources:	ACOE, General funds, Capital Improvements Plan, DHS: HMGP, HMGP/CRMA, PDM
Lead Agency/Department Responsible:	City Planning, Public Works
Implementation Schedule:	Ongoing
COMMENTS	
Multiple activities are covered under this effort, including living shorelines, and dune planting and stabilization and environmental permitting.	

NORFOLK MITIGATION ACTION 3	
Provide educational outreach and improve communications to residents to increase awareness of vulnerability to multiple hazards. Focus on hurricanes, sea level rise, flooding, nuisance flooding and severe repetitive flood losses.	
BACKGROUND INFORMATION	
Site and Location:	Citywide
Cost Benefit:	Public education can have numerous intangible benefits from the public safety peace of mind. It can result in preventing or lessening damage caused by disasters and can save lives.

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	All Hazards
Goal(s) Addressed:	Goal 2
Priority (High, Moderate, Low):	High
Estimated Cost:	$50,000
Potential Funding Sources:	Operating Budget, DHS: HMGP, HMGP 5% Initiative
Lead Agency/Department Responsible:	Emergency Preparedness & Response, Chief Resilience Officer, Planning, Public Works, Chief Marketing Officer
Implementation Schedule:	Ongoing

COMMENTS

Chief Marketing Officer would provide new and innovative ways to share risk to citizens. Norfolk has several stakeholder agencies who have a role to play in flood management and response, and are capable of disseminating flood-related information.

Outreach will include civic organizations, educational institutions, and city events. Methods would include question and answer sessions, recurring television ads, and teaching sessions.

Outreach to floodplain residents and repetitively flooded areas is a part of the community's CRS program and will continue. This action is also part of the City's Strategy for Continued Compliance with the NFIP.

This recommendation covers a wide range of topics including:

- Hazard Awareness Fairs;
- Development of a medical support registry;
- Education on defined Flood and Surge Zones and information on their meaning.

NORFOLK MITIGATION ACTION 4	
Provide outreach that increases citizens' ability to take mitigative actions prior to disaster event. Focus on hurricane preparedness and flood mitigation.	
BACKGROUND INFORMATION	
Site and Location:	Citywide
Cost Benefit:	Teaching citizens how to protect their lives and property themselves has tangible benefits to property owners and the City by reducing the need to for disaster response and increasing community resiliency.

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	All Hazards
Goal(s) Addressed:	Goal 1, Objectives 1.2; Goal 2, Objective 2.1
Priority (High, Moderate, Low):	High
Estimated Cost:	$50,000
Potential Funding Sources:	Operating Budget, DHS: HMGP, HMGP 5% Initiative
Lead Agency/Department Responsible:	Emergency Preparedness & Response, Chief Resilience Officer, City Planning
Implementation Schedule:	Ongoing

COMMENTS
Opportunities for outreach should expand to Norfolk Public Schools and colleges to create a culture of understanding of preparedness. Various stakeholder agencies involved in floodplain management may be used to disseminate how-to information. This action is also part of the City's Strategy for Continued Compliance with the NFIP. This recommendation covers a wide range of topics including: • What to do when a public warning is disseminated; • Flood proofing structures appropriately; • Wind proofing structures appropriately; • Property Protection seminars.

NORFOLK MITIGATION ACTION 5	
Purchase and install generators or other continuous power sources for critical facilities and infrastructure. This action may include, but is not limited to pump stations, EOC, shelters, underpasses and important traffic signals. **Include critical public facility generator requirements and required connection materials in the USACE Emergency Power Facility Assessment Tool (EPFAT).**	
BACKGROUND INFORMATION	
Site and Location:	Citywide
Cost Benefit:	Maintaining a functioning EOC is vital to response and recovery efforts Citywide from a large variety of possible hazards. Damage occurs yearly with damaged equipment and vehicles stuck in underpasses. During Hurricane Isabel, City lost +90 percent of traffic signal operations for various time periods. Under new guidance, FEMA will now fund hazard mitigation projects that include sea level rise estimates.

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Tropical/Coastal Storms, Winter Storms, Earthquakes, Tornadoes, Extreme Heat
Goal(s) Addressed:	Goal 1, Objectives 1.3, 1.4, 1.5
Priority (High, Moderate, Low):	High
Estimated Cost:	At least $900,000 to address remaining 6 stormwater pump stations + additional project costs to be determined
Potential Funding Sources:	Stormwater Fees, DHS: HMGP, HMGP 5% Initiative
Lead Agency/Department Responsible:	General Services, Public Works & Emergency Preparedness & Response
Implementation Schedule:	Ongoing

COMMENTS
Norfolk's Stormwater Program may be able to obtain funding from HMGP grants for some of these site actions. Having data in the EPFATS database will assist in expediting installations at Norfolk facilities following an event where commercial power is unavailable. The web site also offers a permanent storage location for that information providing the ability to update the information as facility requirements change.

NORFOLK MITIGATION ACTION 6
Continue to implement capital improvements that improve stormwater management and control flooding, especially for undersized and out-of-date drainage systems and patterns. This action may include Climate Resilient Mitigation Activities (CRMA).

BACKGROUND INFORMATION	
Site and Location:	Citywide. Projects mitigate flooding and run-off problems throughout the City. New projects will be chosen as opportunities to improve city TMDL requirements and stormwater capacity are identified.
Cost Benefit:	Annual damage occurs to homes and businesses in vulnerable areas due to poor drainage. Under new guidance, FEMA will now fund hazard mitigation projects that include sea level rise estimates. If CRMA are included, additional benefits from environmental or ecosystem benefits may be included in the benefits cost analysis.

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Sea Level Rise, Shoreline Erosion
Goal(s) Addressed:	Goal 1, Objectives 1.1, 1.2, 1.3, 1.4, 1.5
Priority (High, Moderate, Low):	High
Estimated Cost:	$3,000,000 per year
Potential Funding Sources:	General funds, DHS: HMGP, HMGP/CRMA, Private funds
Lead Agency/Department Responsible:	Public Works
Implementation Schedule:	Ongoing

COMMENTS
Hazard Mitigation Grants should be considered as a potential funding source and used as a basis for property protection. Existing consultant's study has identified multiple flood mitigation measures. Additional projects will be identified throughout city that will improve drainage capacity as well as improve water quality. Projects and designs should be prepared for future applications of funds when they become available.

NORFOLK MITIGATION ACTION 7	
Identify and improve critical facilities and infrastructure to minimize flood and wind damage, specifically targeting schools, EOC and emergency shelters. Action may also include placing utility lines underground or preemptive traffic systems for emergency vehicles.	
BACKGROUND INFORMATION	
Site and Location:	Citywide
Cost Benefit:	Critical facilities are located within the floodplain due to built environment of the City. Providing protected utilities and backups are necessary to properly aid in protecting and serving citizens.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Sea Level Rise, Tropical/Coastal Storm, Tornado, Extreme Heat
Goal(s) Addressed:	Goal 1, Objectives 1.1, 1.2, 1.3, 1.4, 1.5
Priority (High, Moderate, Low):	High
Estimated Cost:	$1,000,000
Potential Funding Sources:	DHS: HMGP, PDM
Lead Agency/Department Responsible:	City Planning, Public Works, Emergency Planning & Response, Public Utilities
Implementation Schedule:	Ongoing

COMMENTS
This action may include multiple projects including, upgrading of utilities and emergency connections, as well as improving transportation access to buildings and flood protection of facilities.

NORFOLK MITIGATION ACTION 8	
Protect flood-prone structures through the following ongoing actions: **1) Gather data on individual repetitive flood losses, including improved damage assessments (past and future), insurance claims data, structural features, first floor elevations;** **2) Give highest priority to protection of "severe repetitive losses" as defined by the National Flood Insurance Program (NFIP);** **3) Target potential properties or clusters of properties for purchase and conversion to public open space; and,** **4) Elevate, acquire, relocate or otherwise retrofit structures. This action includes Mitigation Reconstruction projects.**	
BACKGROUND INFORMATION	
Site and Location:	Floodplains throughout the City
Cost Benefit:	Repetitive losses and severe repetitive losses drain public funds for disaster response and require repeated expenditures on the part of property owners. Mitigation actions that fix the problems long-term are cost effective when average annual damages exceed average annual costs of retrofitting, elevating or acquiring the structure. Under new guidance, FEMA will now fund hazard mitigation projects that include sea level rise estimates.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Sea Level Rise
Goal(s) Addressed:	Goal 1, Objectives 1.1, 1.2; Goal 3, Objective 3.2
Priority (High, Moderate, Low):	High
Estimated Cost:	$5,000 to $300,000 per structure.
Potential Funding Sources:	DHS: HMGP, FMA, PDM, FMA; USACE: FPMS
Lead Agency/Department Responsible:	City Planning
Implementation Schedule:	Ongoing
COMMENTS	
Structures insured through the NFIP are often eligible for more grant funds than uninsured structures. The repetitive flood loss areas provided in Section 5 of this plan will help identify areas of the City to be addressed through this action. Measures should include parcel scale, neighborhood scale, and watershed scale protection measures. Parcel scale measures include rain barrels, pervious pavers, and rain gardens amongst other best practices.	

NORFOLK MITIGATION ACTION 9	
Improve post-event damage assessment procedures so that damages, event frequencies, and other data are more readily available for mitigation planning. **Identify, train and use volunteers to capture and submit high-water marks to use for flood event mapping and damage assessment.**	
BACKGROUND INFORMATION	
Site and Location:	Citywide
Cost Benefit:	Vulnerability data for this plan are based primarily on the National Climatic Data Center database, which underrepresents actual damages for almost all weather-related events. Without strong data to back up property damages, cost-benefit analyses may not accurately reflect project feasibility.

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Sea Level Rise, Tropical/Coastal Storm, Tornado, Winter Storm, Earthquakes
Goal(s) Addressed:	Goal 3, Objective 3.2
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	Staff time
Potential Funding Sources:	HMGP, HMGP 5% Initiative, City funds
Lead Agency/Department Responsible:	Information Technology, Emergency Preparedness & Response, Finance, City Planning
Implementation Schedule:	Ongoing

COMMENTS
New technology should be explored with the deployment of iPads for field inspectors with new building permit software. Technology can afford real-time information without manual entry of data by multiple people in the office, allowing for resources to be properly allocated. Create and implement a post-incident data collection plan which would organize city staff, volunteers and damage assessment teams. Install low cost sensors and/or use crowd-sourcing to capture high water marks and flooding data.

NORFOLK MITIGATION ACTION 10	
Implement actions to improve Community Rating System (CRS) classification to at least a Class 8 with a 10 percent discount on most flood insurance policies.	
BACKGROUND INFORMATION	
Site and Location:	Citywide
Cost Benefit:	The City's Class 9 rating currently results in flood insurance premium savings of 5%. A Class 8 rating would result in savings of an estimated 10%, doubling the benefits. The dollars saved go back into property owners' pockets to spend in the local economy. Implementing additional activities creditable under CRS is expected to increase the number of policies Citywide, thus decreasing reliance on City and federal resources after a flood. Many of the measures suggested by CRS activities are non-structural in nature and help reduce the flood vulnerability of new and substantially improved construction.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Tropical/Coastal Storm, Sea Level Rise
Goal(s) Addressed:	Goal 1, Objective 1.2; Goal 2, Goal 3
Priority (High, Moderate, Low):	High
Estimated Cost:	N/A
Potential Funding Sources:	Staff time
Lead Agency/Department Responsible:	Planning & Community Dev.; Public Works
Implementation Schedule:	Within 3 years
COMMENTS	
Additional actions have been taken to assure a move to a Class 8 in 2016. Additional steps need to be taken to implement a PPI and other measures to attempt another reclassification to a Class 7 providing a 15% reduction in flood insurance to those located in the special flood hazard areas.	

NORFOLK MITIGATION ACTION 11	
Verify the geographic location of each NFIP repetitive loss property, determine if that property has been mitigated and, if so: - **Record what methods were used to mitigate; and** - **Collect evidence and submit completed AW-501 (NFIP Repetitive Loss Update Worksheet) to request removal of the property from the repetitive loss database.**	
BACKGROUND INFORMATION	
Site and Location:	Repetitive flood loss areas throughout the City
Cost Benefit:	Repetitively flooded structures strain local and federal resources after disasters, and detract from the fiscal solvency of the NFIP. The NFIP focuses mitigation efforts and funds on properties listed as repetitive losses; therefore, checking the accuracy of the list is a necessity for the NFIP, States and, through this action, local governments.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Sea Level Rise
Goal(s) Addressed:	Goal 1, Objectives 1.1, 1.2; Goal 3, Objective 3.2
Priority (High, Moderate, Low):	High
Estimated Cost:	Staff time estimated at $50 per structure x 732 structures = $36,600
Potential Funding Sources:	DHS: PDM, HMGP, HMGP 5% Initiative, FMA, RFC
Lead Agency/Department Responsible:	City Planning
Implementation Schedule:	Ongoing
ADDITIONAL COMMENTS	
An initial attempt to contact property owners by mail will be followed up by phone calls, and site visits as necessary. This action could be expanded to prepare Repetitive Loss Area Analyses (RLAA) as described in the CRS User's Manual, and may qualify for CRS credit. City records can be reviewed to analyze status of all repetitive loss structure as initial review and update of data.	

NORFOLK MITIGATION ACTION 12		
Implement approved project through the National Disaster Resilience Competition (NDRC) HUD grant. This action may include Climate Resilient Mitigation Activities (CRMA) and Mitigation Reconstruction projects.		
BACKGROUND INFORMATION		
Site and Location:	Chesterfield Heights neighborhood/Ohio Creek watershed	
Cost Benefit:	Project was approved through the HUD grant program and identified as being innovative and could be replicated in multiple scenarios throughout the United States. Under new guidance, FEMA will now fund hazard mitigation projects that include sea level rise estimates. If CRMA are included, additional benefits from environmental or ecosystem benefits may be included in the benefits cost analysis.	
MITIGATION ACTION DETAILS		
Hazard(s) Addressed:		Flooding, Sea Level Rise
Goal(s) Addressed:		Goal 1, Objectives 1.1, 1.2; Goal 3, Objective 3.2
Priority (High, Moderate, Low):		High
Estimated Cost:		$121,000,000
Potential Funding Sources:		DHS: PDM, HMGP, HMGP/CRMA, FMA, RFC, ACOE, City CIP, HUD
Lead Agency/Department Responsible:		Chief Resilience Officer, Public Works, City Planning, Emergency Preparedness and Response
Implementation Schedule:		Ongoing
ADDITIONAL COMMENTS		
HUD grant requires matching funds from either in kind work or leveraging of existing projects that apply to the drainage area for Chesterfield Heights/Ohio Creek		

NORFOLK MITIGATION ACTION 13	
Protect historic resources and structures from flooding and sea level rise. Measures should include short-, medium- and long-term solutions. This action may include Climate Resilient Mitigation Activities (CRMA) and Mitigation Reconstruction projects.	
BACKGROUND INFORMATION	
Site and Location:	Historic structures and areas throughout the City
Cost Benefit:	Historic structures throughout the city are located in flood prone areas. Value of historic resources are more than just the value of the structure which adds value to normal mitigation methods. Under new guidance, FEMA will now fund hazard mitigation projects that include sea level rise estimates. If CRMA are included, additional benefits from environmental or ecosystem benefits may be included in the benefits cost analysis.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Sea Level Rise
Goal(s) Addressed:	Goal 1, Objectives 1.1, 1.2; Goal 3, Objective 3.2
Priority (High, Moderate, Low):	High
Estimated Cost:	Staff time/consultant fees estimated at $50,000 to resurvey existing historic areas with new surveys estimated at $75,000
Potential Funding Sources:	DHS: PDM, HMGP, HMGP/CRMA, FMA, RFC
Lead Agency/Department Responsible:	City Planning, Chief Resilience Officer
Implementation Schedule:	Ongoing
ADDITIONAL COMMENTS	

Initial methods should include updating surveys of listed historic areas and structures.

Other neighborhoods should be reviewed and determined if the structures and integrity of the neighborhood have been preserved to allow for additional surveys.

Different methods should be explored to preserve and protect structures as well as the generation of guidance that can be approved by FEMA for the protection of these structures and areas that differ from current allowed practices for residential and non-residential structures.

NORFOLK MITIGATION ACTION 14	
Identify and implement resilient strategies throughout the city to provide better watershed, neighborhood and parcel specific flood protection and mitigation. **This action may include Climate Resilient Mitigation Activities (CRMA) and Mitigation Reconstruction projects.**	
BACKGROUND INFORMATION	
Site and Location:	Citywide
Cost Benefit:	Resilient strategies range from small to larger scale projects. Ability to provide protection to properties at risk with innovative measures are necessary to protect entire city. Under new guidance, FEMA will now fund hazard mitigation projects that include sea level rise estimates. If CRMA are included, additional benefits from environmental or ecosystem benefits may be included in the benefits cost analysis.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Sea Level Rise
Goal(s) Addressed:	Goal 1, Objectives 1.1, 1.2; Goal 3, Objective 3.2
Priority (High, Moderate, Low):	High
Estimated Cost:	$3,000,000
Potential Funding Sources:	DHS: PDM, HMGP, HMGP/CRMA, FMA, RFC, ACOE, City CIP, HUD
Lead Agency/Department Responsible:	Chief Resilience Officer, Public Works, City Planning, Emergency Preparedness and Response
Implementation Schedule:	Ongoing
ADDITIONAL COMMENTS	
Methods should include hard infrastructure and green infrastructure. Multiple methods can be joined together to provide better protection to the properties and all citizens.	

Portsmouth

PORTSMOUTH MITIGATION ACTION 1	
Develop a post-disaster continuity of operations plan to assist in more rapid recovery after a disaster.	
BACKGROUND INFORMATION	
Site and Location:	Citywide
Cost Benefit:	By identifying post-disaster processes for almost all City department functions across an array of hazard events, and putting these processes on paper, the plan would aid staff and temporary staff in keeping processes running smoothly and not contributing to additional conflicts.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	All
Goal(s) Addressed:	Goal 1, Objectives 1.4, 1.5; Goal 3
Priority (High, Moderate, Low):	High
Estimated Cost:	$25,000
Potential Funding Sources:	Staff time, DHS planning grants, HMGP 5% Initiative
Lead Agency/Department Responsible:	Emergency Management, Planning, Permits & Inspections, Engineering, Public Works
Implementation Schedule:	Within 2 years
ADDITIONAL COMMENTS	

PORTSMOUTH MITIGATION ACTION 2	
Designate non-flood-prone pickup points within the city evacuation zones to assist citizens who must rely on alternative or public transportation to evacuate.	
BACKGROUND INFORMATION	
Site and Location:	Citywide
Cost Benefit:	As seen with Hurricane Katrina, the evacuation of large numbers of residents after a hazard event has already commenced adds layers of difficulty and danger. Promoting and providing safe pickup points will reduce hazards to citizens.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Tropical/Coastal Storm, Sea Level Rise
Goal(s) Addressed:	Goal 1, Objectives 1.4, 1.5; Goal 3
Priority (High, Moderate, Low):	High
Estimated Cost:	Staff time for identification of population centers and publicizing the pickup points
Potential Funding Sources:	City budgets
Lead Agency/Department Responsible:	Emergency Management, Planning
Implementation Schedule:	Within 2 years
ADDITIONAL COMMENTS	

PORTSMOUTH MITIGATION ACTION 3	
Hurricane/flood outreach/education to residents and businesses.	
BACKGROUND INFORMATION	
Site and Location:	Citywide
Cost Benefit:	Protection of personal property and lives
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Tropical/Coastal Storm, Sea Level Rise
Goal(s) Addressed:	Goal 2, Objective 2.1
Priority (High, Moderate, Low):	High
Estimated Cost:	$20,000
Potential Funding Sources:	City budgets; use free FEMA materials when available; HMGP 5% Initiative
Lead Agency/Department Responsible:	Emergency Management, Planning
Implementation Schedule:	Continuous
ADDITIONAL COMMENTS	

PORTSMOUTH MITIGATION ACTION 4	
Use Virginia Modeling, Analysis & Simulation Center (VMASC) survey data to identify location/vulnerability of special needs populations for mitigation, evacuation, response, recovery.	
BACKGROUND INFORMATION	
Site and Location:	Citywide
Cost Benefit:	Protection of special needs populations before, during and after hazard events has broad benefits for protecting lives and property.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Tropical/Coastal Storm, Tornado, Winter Storm, Earthquake, Wildfire, Hazardous Materials Incident, Extreme Heat
Goal(s) Addressed:	Goal 1, Objectives 1.4, 1.5; Goal 3, Objective 3.2
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	To be determined as projects are identified.
Potential Funding Sources:	City budgets; DHS: HMGP 5% Initiative
Lead Agency/Department Responsible:	Planning, GIS
Implementation Schedule:	Within 2 years
ADDITIONAL COMMENTS	

PORTSMOUTH MITIGATION ACTION 5	
Implement additional tide monitoring stations to track real-time water levels.	
BACKGROUND INFORMATION	
Site and Location:	Olde Towne/ Downtown, Paradise Creek/ Cradock
Cost Benefit:	Enable real-time assessment of flood levels which will allow more responsive warnings and alerts to be broadcast.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Tropical/Coastal Storm, Sea Level Rise
Goal(s) Addressed:	Goal 1, Objectives 1.3, 1.4, 1.5; Goal 3, Objective 3.2
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$80,000 plus $10,000 annual maintenance
Potential Funding Sources:	USGS, FEMA, State, City budgets; DHS: HMGP 5% Initiative
Lead Agency/Department Responsible:	Planning, Emergency Management
Implementation Schedule:	Within 5 years
ADDITIONAL COMMENTS	

PORTSMOUTH MITIGATION ACTION 6	
Systematically track and map areas that sustain non-tidal flooding and "sunny day" flooding.	
BACKGROUND INFORMATION	
Site and Location:	Citywide
Cost Benefit:	Tracking where flooding actually occurs will allow mitigation action and projects to be directed to those areas.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Tropical/Coastal Storm, Sea Level Rise
Goal(s) Addressed:	Goal 3, Objective 3.2
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	Staff time
Potential Funding Sources:	City CIP budget
Lead Agency/Department Responsible:	Engineering, Planning, Emergency Management, Public Works, GIS; DHS: HMGP 5% Initiative
Implementation Schedule:	Continuous
ADDITIONAL COMMENTS	

PORTSMOUTH MITIGATION ACTION 7	
Implement Citywide drainage improvement projects. This action may include Climate Resilient Mitigation Activities (CRMA).	
BACKGROUND INFORMATION	
Site and Location:	Citywide
Cost Benefit:	Frequent flooding in these areas damages cars, structures and contents. Damages to city infrastructure will also be reduced. If CRMA are included, additional benefits from environmental or ecosystem benefits may be included in the benefits cost analysis.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Tropical/Coastal Storm, Sea Level Rise
Goal(s) Addressed:	Goal 1, Objectives 1.1, 1.2, 1.3, 1.4, 1.5
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$500,000,000
Potential Funding Sources:	City CIP budget, stormwater funds, FEMA, State; DHS: HMGP/CRMA
Lead Agency/Department Responsible:	Engineering, Public Works
Implementation Schedule:	Long term; as funding becomes available
ADDITIONAL COMMENTS	

PORTSMOUTH MITIGATION ACTION 8	
Implement action items from 2015 Floodplain Management Plan and Rep Loss Plan.	
BACKGROUND INFORMATION	
Site and Location:	Citywide
Cost Benefit:	Each action has separate costs and benefits identified in Plan. Under new guidance, FEMA will now fund hazard mitigation projects that include sea level rise estimates.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Tropical/Coastal Storm, Sea Level Rise
Goal(s) Addressed:	Goal 1, Goal 2, Goal 3
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	As shown in the plan
Potential Funding Sources:	City budgets, DHS: HMGP, Severe Repetitive Loss, stormwater funds
Lead Agency/Department Responsible:	Planning, Emergency Management
Implementation Schedule:	Ongoing. Some long term as funding available
ADDITIONAL COMMENTS	

PORTSMOUTH MITIGATION ACTION 9	
Mitigate flood-prone and repetitive flood loss structures. Mitigation measures may include acquisition, relocation, elevation, or other retrofit measures to provide flood protection. This action includes Mitigation Reconstruction projects.	
BACKGROUND INFORMATION	
Site and Location:	Within the City's flood zones
Cost Benefit:	Benefits for individual structures are based on the average annual damages, which is based on the structure's lowest floor elevation and frequency of flooding. Under new guidance, FEMA will now fund hazard mitigation projects that include sea level rise estimates.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Sea Level Rise
Goal(s) Addressed:	Goal 1, Objectives 1.1, 1.2, 1.3
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$10,000 to $200,000 per structure (paid by citizen or through grant funds obtained by citizen)
Potential Funding Sources:	DHS: PDM, HMGP, FMA, RFC
Lead Agency/Department Responsible:	Planning, Emergency Management
Implementation Schedule:	Continuous
ADDITIONAL COMMENTS	

PORTSMOUTH MITIGATION ACTION 10	
Determine whether Repetitive Flood Loss properties have been mitigated.	
BACKGROUND INFORMATION	
Site and Location:	Repetitive flood loss areas throughout the City
Cost Benefit:	Repetitively flooded structures strain local and federal resources after disasters, and detract from the fiscal solvency of the NFIP. The NFIP focuses mitigation efforts and funds on properties listed as repetitive losses; therefore, checking the accuracy of the list is a necessity for the NFIP, States and, through this action, local governments.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Sea Level Rise
Goal(s) Addressed:	Goal 1; Goal 3, Objective 3.2
Priority (High, Moderate, Low):	High
Estimated Cost:	Staff time estimated at $50 per structure x 220 structures = $11,000
Potential Funding Sources:	DHS: PDM, HMGP, HMGP 5% Initiative, FMA, RFC
Lead Agency/Department Responsible:	Planning
Implementation Schedule:	Continuous
ADDITIONAL COMMENTS	

PORTSMOUTH MITIGATION ACTION 11	
Advocate for improved and increased grants for mitigation activities from State and Federal sources.	
BACKGROUND INFORMATION	
Site and Location:	Citywide
Cost Benefit:	The current processes are long and cumbersome. More streamlined processes and access to mitigation funds will aid in the mitigation of flooded properties and areas.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	All
Goal(s) Addressed:	Goal 3, Objectives 3.1, 3.2, 3.3, 3.4
Priority (High, Moderate, Low):	High
Estimated Cost:	Staff time
Potential Funding Sources:	City budgets
Lead Agency/Department Responsible:	Planning, Emergency Management, Permits & Inspections, Engineering
Implementation Schedule:	Continuous
ADDITIONAL COMMENTS	

PORTSMOUTH MITIGATION ACTION 12	
Review and revise City Codes to ensure that Code sections do not conflict and do not hamper recovery efforts.	
BACKGROUND INFORMATION	
Site and Location:	Citywide
Cost Benefit:	Ensuring that processes are in place prior to a disaster event will speed recovery and increase the community's resilience.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Sea Level Rise, Tropical/Coastal Storm, Winter Storm, Wildfire, Earthquake
Goal(s) Addressed:	Goal 1; Goal 3, Objective 3.1
Priority (High, Moderate, Low):	High
Estimated Cost:	Staff time
Potential Funding Sources:	City budgets; DHS: HMGP 5% Initiative
Lead Agency/Department Responsible:	Planning, Permits & Inspections, Engineering, Public Works, Emergency Management
Implementation Schedule:	Within 5 years
ADDITIONAL COMMENTS	

PORTSMOUTH MITIGATION ACTION 13	
Review existing plans to ensure that they integrate mitigation concepts. Ensure that future plans integrate mitigation concepts detailed in the Hazard Mitigation Plan.	
BACKGROUND INFORMATION	
Site and Location:	Citywide
Cost Benefit:	Ensuring that plans incorporate mitigation concepts and strategies will aid the City's resilience.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	All
Goal(s) Addressed:	Goal 3, Objective 3.1
Priority (High, Moderate, Low):	High
Estimated Cost:	Staff time
Potential Funding Sources:	City budgets
Lead Agency/Department Responsible:	Planning, Permits & Inspections, Engineering, Public Works, Emergency Management
Implementation Schedule:	Within 5 years and as new plans are developed
ADDITIONAL COMMENTS	

PORTSMOUTH MITIGATION ACTION 14	
Implement green infrastructure for flood and stormwater abatement. **This action includes Climate Resilient Mitigation Activities (CRMA).**	
BACKGROUND INFORMATION	
Site and Location:	Citywide
Cost Benefit:	Green infrastructure can be a cost-effective approach for improving water quality and can provide multiple environmental, economic, and community benefits. Under HMGP/CRMA grants, additional benefits from environmental or ecosystem benefits may be included in the benefits cost analysis.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding
Goal(s) Addressed:	Goal 1, Objectives 1.1, 1.2, 1.3, 1.6
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	To be determined
Potential Funding Sources:	City CIP budget, stormwater funds, FEMA, EPA, State; DHS: HMGP/CRMA
Lead Agency/Department Responsible:	Planning, Engineering, Public Works
Implementation Schedule:	Within 5 years
ADDITIONAL COMMENTS	

PORTSMOUTH MITIGATION ACTION 15	
Replace the Seawall.	
BACKGROUND INFORMATION	
Site and Location:	Downtown
Cost Benefit:	The Portsmouth waterfront seawall and bulkhead is a major element of the downtown waterfront. It is aging and in need of replacement to ensure safety of citizens and visitors. It is impacted daily by pedestrian and vessel use, weather and the waters of the river.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Sea Level Rise
Goal(s) Addressed:	Goal 1, Objectives 1.1, 1.2, 1.3, 1.5; Goal 3
Priority (High, Moderate, Low):	High
Estimated Cost:	$20,000,000
Potential Funding Sources:	City CIP budget, stormwater funds, FEMA, State
Lead Agency/Department Responsible:	Engineering
Implementation Schedule:	4 years
ADDITIONAL COMMENTS	

PORTSMOUTH MITIGATION ACTION 16	
Create dialogs with other governmental (e.g. HRT, HRSD, etc.) and non-governmental (e.g. Dominion Virginia Power, Verizon, etc) agencies to encourage and coordinate incorporation of mitigation strategies into projects and policies.	
BACKGROUND INFORMATION	
Site and Location:	Citywide
Cost Benefit:	Ensuring that our partner organizations incorporate mitigation concepts and strategies into their projects and policies will aid the City's resilience.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Sea Level Rise, Tropical/Coastal Storm, Tornado, Winter Storm, Earthquake, Wildfire, Hazardous Materials Incident
Goal(s) Addressed:	Goal 3
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	Staff time
Potential Funding Sources:	City budgets; DHS: HMGP 5% Initiative
Lead Agency/Department Responsible:	Planning, Engineering, Emergency Management
Implementation Schedule:	Continuous
ADDITIONAL COMMENTS	

PORTSMOUTH MITIGATION ACTION 17	
Develop inventory of first floor elevations (and possibly Elevation Certificates) of structures in flood zones in low- to moderate income housing areas.	
BACKGROUND INFORMATION	
Site and Location:	Citywide low to moderate areas
Cost Benefit:	In order to assess any potential mitigation actions, first floor elevations (at a minimum) will be needed. Assisting low to moderate income home owners to obtain this information will allow these structures to be protected from future flooding.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding
Goal(s) Addressed:	Goal 1; Goal 3, Objective 3.2
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	To be determined
Potential Funding Sources:	US Army Corps of Engineers, FEMA, HUD; DHS: HMGP 5% Initiative
Lead Agency/Department Responsible:	Planning
Implementation Schedule:	Within 5 years
ADDITIONAL COMMENTS	

SUFFOLK

SUFFOLK MITIGATION ACTION 1	
Protect repetitively flooded infrastructure and structures through elevation, acquisition, relocation, retrofits or repurposing. Other structural means are included, as appropriate, for protecting critical infrastructure. This action includes Mitigation Reconstruction projects.	
BACKGROUND INFORMATION	
Site and Location:	Throughout the City
Cost Benefit:	In rural areas of the city, roads flood each time there is a significant rainfall. In the urban downtown, commercial structures flood frequently. Under new guidance, FEMA will now fund hazard mitigation projects that include sea level rise estimates.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Sea Level Rise
Goal(s) Addressed:	Goal 1, Objectives 1.1, 1.2, 1.3, 1.4, 1.5
Priority (High, Moderate, Low):	Low
Estimated Cost:	$10,000 to $200,000 per structure; infrastructure protection costs to be determined
Potential Funding Sources:	DHS: PDM, HMGP, FMA, RFC
Lead Agency/Department Responsible:	Emergency Management and Public Works
Implementation Schedule:	Ongoing
ADDITIONAL COMMENTS	

SUFFOLK MITIGATION ACTION 2	
Provide emergency power to critical infrastructure, critical facilities and critical roadway intersections during extended power outages. Increase emergency generator capabilities at school facilities used as shelters to meet ADA functional needs requirements.	
BACKGROUND INFORMATION	
Site and Location:	Throughout the City
Cost Benefit:	Maintaining basic city functions in the aftermath of both major and minor events is important for the safety of citizens and the environment. Emergency power is mandatory at the shelters to address access and medical equipment that requires electricity. Under new guidance, FEMA will now fund hazard mitigation projects that include sea level rise estimates.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Tropical/Coastal Storm, Sea Level Rise, Extreme Heat
Goal(s) Addressed:	Goal 1, Objectives 1.3, 1.4
Priority (High, Moderate, Low):	High
Estimated Cost:	$500,000
Potential Funding Sources:	Existing Budgets; DHS: HMGP, HMGP 5% Initiative
Lead Agency/Department Responsible:	Public Utilities, Public Works, Facility Management
Implementation Schedule:	Ongoing
ADDITIONAL COMMENTS	

SUFFOLK MITIGATION ACTION 3	
Provide hurricane and flood outreach and education materials to hotels and motels within the City to make flood protection information available to business travelers and tourists.	
BACKGROUND INFORMATION	
Site and Location:	Throughout City floodplains
Cost Benefit:	Protection of personal property and lives
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Tropical/Coastal Storm, Sea Level Rise
Goal(s) Addressed:	Goal 2
Priority (High, Moderate, Low):	High
Estimated Cost:	<$500
Potential Funding Sources:	Existing budgets; use free FEMA materials; DHS: HMGP 5% Initiative
Lead Agency/Department Responsible:	Emergency Management
Implementation Schedule:	Within 2 years
ADDITIONAL COMMENTS	

SUFFOLK MITIGATION ACTION 4	
Continue to implement capital improvements that improve stormwater management and control flooding, especially for undersized and out-of-date drainage systems and patterns. This action may include Climate Resilient Mitigation Activities (CRMA).	
BACKGROUND INFORMATION	
Site and Location:	City-wide. Projects mitigate flooding and run-off problems throughout the City, including Sadler Pond Improvements, Chenango Court reconstruction, and Pughsville Drainage Study (programmed in the FY '12 budget)
Cost Benefit:	Annual damage occurs to homes and business in vulnerable areas due to poor drainage. If CRMA are included, additional benefits from environmental or ecosystem benefits may be included in the benefits cost analysis.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Sea Level Rise, Shoreline Erosion
Goal(s) Addressed:	Goal 1, Objectives 1.1, 1.2, 1.3, 1.4, 1.5; Goal 3, Objective 3.1
Priority (High, Moderate, Low):	High
Estimated Cost:	Estimated $1,000,000 annually, but variable based on several factors
Potential Funding Sources:	General funds, DHS: HMGP, HMGP/CRMA, Private funds
Lead Agency/Department Responsible:	Public Works
Implementation Schedule:	Ongoing

COMMENTS
Hazard Mitigation Grants should be considered as a potential funding source and used as a basis for property protection. An ongoing consultant's study to identify appropriate flood mitigation measures may provide additional cost data and priorities within this action.

SUFFOLK MITIGATION ACTION 5	
Develop a stormwater drainage plan to address issues in flood-prone areas; prioritize and implement plan recommendations. This action may include Climate Resilient Mitigation Activities (CRMA).	
BACKGROUND INFORMATION	
Site and Location:	Citywide
Cost Benefit:	Flooding as a result of stormwater accumulation can exacerbate coastal flooding, contributing to flood damages of cars, structures, roads and other infrastructure. Nuisance flooding can result in businesses closed down. If CRMA are included, additional benefits from environmental or ecosystem benefits may be included in the benefits cost analysis.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding
Goal(s) Addressed:	Goal 1, Objectives 1.1, 1.2, 1.3, 1.4, 1.5
Priority (High, Moderate, Low):	High
Estimated Cost:	$250,000 to $3,000,000
Potential Funding Sources:	General funds
Lead Agency/Department Responsible:	Planning and Public Works
Implementation Schedule:	Ongoing
ADDITIONAL COMMENTS	

SUFFOLK MITIGATION ACTION 6	
Continue strengthening the City's Floodplain Management Program with the following actions: **1) Reviewing and adopting State Model Floodplain Ordinance, including 1 foot freeboard elevation requirement;** **2) Incorporating floodplain requirements into permit process with information in the online FAQs, BFE required on the building permit application (as required by NFIP), creating and posting online standardized forms for substantial improvement/damage determination;** **3) Providing specialized training and support Certified Floodplain Manager (CFM) certification for floodplain plan reviewers, inspectors and permit processors;** **4) Preparing educational materials in the permit office on the value of flood insurance, freeboard and NFIP compliance; and,** **5) Continuing participation in the Severe Repetitive Loss program.**	
BACKGROUND INFORMATION	
Site and Location:	Floodplains throughout the City
Cost Benefit:	• The NFIP has a proven record of reducing annual flood damages through floodplain regulations that guide design of flood-prone properties. • Freeboard - More stringent measures for flood prone structures have a very small upfront cost that is recovered within approximately 10 years through lower flood insurance costs. The reduction in average annual damages with just 1 foot of freeboard is substantial.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Sea Level Rise
Goal(s) Addressed:	Goal 1, Objectives 1.1, 1.2, 1.5; Goal 2; Goal 3
Priority (High, Moderate, Low):	High
Estimated Cost:	Staff time
Potential Funding Sources:	N/A
Lead Agency/Department Responsible:	Planning and Public Works
Implementation Schedule:	Within 4 years
ADDITIONAL COMMENTS	

SUFFOLK MITIGATION ACTION 7	
Verify the geographic location of each NFIP repetitive loss property, and determine if that property has been mitigated and, if so, by what means.	
BACKGROUND INFORMATION	
Site and Location:	Repetitive flood loss areas throughout the City
Cost Benefit:	Repetitively flooded structures strain local and federal resources after disasters, and detract from the fiscal solvency of the NFIP. The NFIP focuses mitigation efforts and funds on properties listed as repetitive losses; therefore, checking the accuracy of the list is a necessity for the NFIP, States and, through this action, local governments.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding and Sea Level Rise
Goal(s) Addressed:	Goal 1, Objective 1.1; Goal 3, Objective 3.2
Priority (High, Moderate, Low):	High
Estimated Cost:	Staff time estimated at $50 per structure x 13 structures = $650
Potential Funding Sources:	DHS: PDM, HMGP, HMGP 5% Initiative, FMA, RFC
Lead Agency/Department Responsible:	Planning
Implementation Schedule:	Ongoing
ADDITIONAL COMMENTS	
An initial attempt to contact property owners by mail will be followed up by phone calls, and site visits as necessary.	

SUFFOLK MITIGATION ACTION 8	
Retrofit Primary Shelters in the City to conform to the Ultimate Design Wind Speed for Risk Category 3 structures as referenced in the current edition of the Uniform Statewide Building Code, Part 1 (USBC).	
BACKGROUND INFORMATION	
Site and Location:	Citywide locations
Cost Benefit:	According to the Suffolk Public Schools Director of Facilities, none of the schools in the City designated as shelters are engineered to withstand winds greater than 90 mph. A Category 2 or greater hurricane would result in residents having to take shelter outside the City. Transportation costs for such an evacuation would be staggering.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Sea Level Rise, Tropical/Coastal Storm, Tornado, Winter Storm, Earthquake, Wildfire. Hazardous Materials Incident, Extreme Heat
Goal(s) Addressed:	Goal 1, Objectives 1.3, 1.4, 1.5
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	To be determined
Potential Funding Sources:	Capital budgets
Lead Agency/Department Responsible:	Capital Programs Director and Public Schools Director of Facilities and Planning
Implementation Schedule:	5 to 7 years
ADDITIONAL COMMENTS	
Hurricane shutters may provide a partial solution for some structures at a lower cost than complete retrofits.	

SUFFOLK MITIGATION ACTION 9	
Install markers indicating the flood water depth along streets or roads subject to tidal, riverine or urban flooding.	
BACKGROUND INFORMATION	
Site and Location:	Flood prone areas citywide
Cost Benefit:	Elevated water levels in recent weather events have caused damage and down time to emergency vehicles damaged while responding to calls for assistance. These markers can also be useful during droughts to indicate low water levels.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Sea Level Rise, Drought
Goal(s) Addressed:	Goal 1, Objective 1.5; Goal 2
Priority (High, Moderate, Low):	Low
Estimated Cost:	<$10,000
Potential Funding Sources:	Public Works annual operating budget; DHS: HMGP 5% Initiative
Lead Agency/Department Responsible:	Traffic Engineering, Emergency Management
Implementation Schedule:	3 to 5 years
ADDITIONAL COMMENTS	
Other alternatives considered included developing a policy regarding emergency vehicle operations on flooded streets or roads; however, flood depth markers would have added benefits by alerting a broader audience of citizens and commuters regarding areas with unsafe water levels for driving. Savings of up to $5,000 per City vehicle in repairs could be realized.	

SUFFOLK MITIGATION ACTION 10	
Retrofit the East Suffolk Recreation Center with an emergency generator to support shelter operations for that section of the City.	
BACKGROUND INFORMATION	
Site and Location:	East Suffolk
Cost Benefit:	When school is in session, using a school as a shelter is a conflict. The Recreation Center is a potential alternative. Also, this center would add a second ADA-compatible shelter to the City's shelter inventory, increasing accessibility for special needs populations.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Tropical/Coastal Storm, Tornado, Winter Storm, Earthquake, Wildfire, Extreme Heat, Hazardous Materials Incident
Goal(s) Addressed:	Goal 1, Objectives 1.3, 1.4
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$5,000
Potential Funding Sources:	Capital Budget (for generator), Mitigation Grant (for quick-connect); DHS: HMGP 5% Initiative
Lead Agency/Department Responsible:	Capital Programs and Facilities, Department of Parks and Recreation
Implementation Schedule:	5 to 7 years
ADDITIONAL COMMENTS	

VIRGINIA BEACH

VIRGINIA BEACH MITIGATION ACTION 1	
Relocate the ComIT Data Center.	
BACKGROUND INFORMATION	
Site and Location:	ComIT Data Center Building 2 2405 Courthouse Drive
Cost Benefit:	There have been marginal flooding problems in Building 2 that included: 1) Flooding from a leak in the fire sprinkler system on the first floor. 2) Flooding from leaks in the roof's drainage system. 3) The appearance of water backup on the Data Center sub-floor, due to the drainage system, which has occurred on multiple occasions. 4) In 2004, there were two occasions of flooding due to equipment failure in Building 1 where damage and loss of service was avoided only because on-site staff discovered the flood before water reached the Data Center. 5) During Hurricane Isabel, it was necessary to shut down all computer systems in Data Center and physically move equipment to the second floor. Moving equipment carries associated risks and at least two servers were corrupted during this process.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Sea Level Rise, Tropical/Coastal Storm, Winter Storm
Goal(s) Addressed:	Goal 1, Objectives 1.1, 1.2, 1.3, 1.4, 1.5
Priority (High, Moderate, Low):	High
Estimated Cost:	To be determined
Potential Funding Sources:	DHS: HMGP, FMA, PDM, RFC; Existing budgets
Lead Agency/Department Responsible:	ComIT
Implementation Schedule:	Within 3 years
ADDITIONAL COMMENTS	
In recent years, the importance of data management to overall City operations has increased the priority of this action.	

VIRGINIA BEACH MITIGATION ACTION 2

Strengthen the City's Floodplain Management Program with the following actions:

1) **Continue participating in the National Flood Insurance Program. Continue enforcement of standards in existing floodplain management ordinance that meet and exceed NFIP minimum requirements;**
2) **Incorporate floodplain management tools/regulations into existing development review procedures;**
3) **Participate in the Community Rating System in order to reduce property owner premiums for flood insurance;**
4) **Provide specialized training and support Certified Floodplain Manager (CFM) certification for floodplain plan reviewers, inspectors and permit processors;**
5) **Prepare educational materials in the permit office on the value of flood insurance, freeboard and NFIP compliance; and,**
6) **Participate in the Severe Repetitive Loss program to mitigate flood-prone structures.**

BACKGROUND INFORMATION	
Site and Location:	Floodplains throughout the City
Cost Benefit:	• The NFIP has a proven record of reducing annual flood damages through floodplain regulations that guide design of flood-prone properties. • The large number of flood-prone properties and repetitive flood losses in Virginia Beach merits additional investigation to determine what measures have been taken by property owners to protect structures and what additional measures may have measurable benefits.

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Sea Level Rise
Goal(s) Addressed:	Goal 1, Objective 1.2; Goal 2, Goal 3
Priority (High, Moderate, Low):	High
Estimated Cost:	Staff time
Potential Funding Sources:	N/A
Lead Agency/Department Responsible:	Planning and Public Works
Implementation Schedule:	Within 4 years

ADDITIONAL COMMENTS

VIRGINIA BEACH MITIGATION ACTION 3	
Create coalition of business owners, including some who have implemented mitigation actions in the past, to promote the value of hazard protection and help identify and implement retrofit/elevation/acquisition projects in the business community.	
BACKGROUND INFORMATION	
Site and Location:	Citywide
Cost Benefit:	The hardening of businesses supports their ability to recover from potential disasters, thereby helping sustain citizens' way of life in the aftermath of a hazard event.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Sea Level Rise, Tropical/Coastal Storm, Shoreline Erosion, Winter Storm
Goal(s) Addressed:	Goal 1, Objective 1.1; Goal 2, Objective 2.1; Goal 3
Priority (High, Moderate, Low):	Low
Estimated Cost:	Minimal
Potential Funding Sources:	Existing Budgets; DHS: PDM, HMGP 5% Initiative; Private funds
Lead Agency/Department Responsible:	Emergency Management
Implementation Schedule:	Within 5 years
ADDITIONAL COMMENTS	

VIRGINIA BEACH MITIGATION ACTION 4	
Provide emergency power to critical infrastructure, critical facilities and critical roadway intersections during extended power outages. Emergency power and quick connect wiring is needed for critical intersections. Generator capability is needed at multiple school facilities used as shelters.	
BACKGROUND INFORMATION	
Site and Location:	Critical Intersections identified by Police Department and Public Works Building 18: Human Resources Building 19: Human Resources Training Rooms Building 21: Fire Administration Building 22: ComIT Public Information City Jail Various Storm Water Pump stations Various Sewer Pump stations Various Public Schools: Those designated as shelters, focusing on the high schools as the top priority.
Cost Benefit:	Maintaining basic city functions in the aftermath of both major and minor events is important for the safety of citizens and the environment. Emergency power is mandatory at the shelters to address access and medical equipment that requires electricity.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Sea Level Rise, Tropical/Coastal Storm, Tornado, Winter Storm, Earthquake, Extreme Heat
Goal(s) Addressed:	Goal 1, Objectives 1.3, 1.4, 1.5; Goal 3, Objective 3.1
Priority (High, Moderate, Low):	High
Estimated Cost:	$3,500,000
Potential Funding Sources:	Existing Budgets; DHS: HMGP, HMGP 5% Initiative
Lead Agency/Department Responsible:	Public Utilities, Public Works, Facility Management, Sheriff
Implementation Schedule:	Ongoing
ADDITIONAL COMMENTS	
The city has previously used HMGP funds, as well as CIP funding to provide quick connect capabilities for critical sewer pump stations. Public Utilities is currently working on providing generators for other critical facilities, as well. The city jail still has one generator that needs to be replaced, the other one has been awarded funding. Power at critical intersections would be provided for city cameras to monitor traffic conditions during power failures.	

VIRGINIA BEACH MITIGATION ACTION 5	
Retrofit public safety facilities vulnerable to wind damage and/or flooding.	
BACKGROUND INFORMATION	
Site and Location:	Various Sites, including but not limited to: Police Precincts (Headquarters, Third and Second Precincts, Law Enforcement Training Facility, Helicopter Shop), Fire Stations (Woodstock, Kempsville, Little Neck, Green Run, Stumpy Lake, Davis Corner Stations), Public Works, Public Utilities, Chesapeake Beach and Ocean Park EMS, Sheriff's Office, Courts and Court facilities (flooding)
Cost Benefit:	The Law Enforcement Training Academy has severe roof leaks and flooding during severe storms; improvements to grading and drainage for the building will minimize standing water that inundates the structure, but additional retrofits are necessary to protect the structure in the long-term. The Sheriff's Office, Courts and Court facilities vulnerable to flooding are critical operations that threaten community sustainability after a flood event. Under new guidance, FEMA will now fund hazard mitigation projects that include sea level rise estimates.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Sea Level Rise, Tropical/Coastal Storm, Winter Storm
Goal(s) Addressed:	Goal 1, Objectives 1.2, 1.3, 1.4, 1.5
Priority (High, Moderate, Low):	High
Estimated Cost:	$4,000,000
Potential Funding Sources:	DHS: HMGP, CIP and Existing budgets, stormwater fee
Lead Agency/Department Responsible:	Public Works and Police Department
Implementation Schedule:	Long-term, over a 15-year period
ADDITIONAL COMMENTS	
The city has conducted formal analyses of critical facilities and HMGP grants were obtained to harden some facilities. As HMGP funds become available through the State, additional grant requests should be prepared and ready to submit for "shovel-ready" projects.	

VIRGINIA BEACH MITIGATION ACTION 6	
Provide educational outreach to residents to increase awareness of vulnerability to multiple hazards and preventative actions that can be taken. Focus on hurricane preparedness, sea level rise and flooding.	
BACKGROUND INFORMATION	
Site and Location:	Citywide
Cost Benefit:	By training community leaders in how to protect hazard-prone properties, the City spreads information on the value of retrofitting directly to those in need at low cost.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	All Hazards
Goal(s) Addressed:	Goal 2, Objective 2.1; Goal 3, Objective 3.1
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$30,000
Potential Funding Sources:	DHS: HMGP, HMGP 5% Initiative; Operating Budget; FEMA materials available free
Lead Agency/Department Responsible:	Emergency Management
Implementation Schedule:	Within 2 years
ADDITIONAL COMMENTS	
The city has multiple programs and strategies for the dissemination of emergency preparedness information, but it is currently coming out of multiple offices and this will assist in streamlining the information. This action is part of Virginia Beach's strategy for continued compliance with the NFIP.	

VIRGINIA BEACH MITIGATION ACTION 7	
Replace, as necessary, and maintain the existing regional interoperable communications system.	
BACKGROUND INFORMATION	
Site and Location:	Citywide and Southside Hampton Roads region
Cost Benefit:	Modern interoperable communications systems support preparedness, response and recovery activities for all hazards.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Tropical/Coastal Storm, Tornado, Winter Storm, Earthquake, Wildfire, Extreme Heat, Hazardous Materials Incident
Goal(s) Addressed:	Goal 2; Goal 3, Objectives 3.1, 3.3
Priority (High, Moderate, Low):	High
Estimated Cost:	$10,000,000
Potential Funding Sources:	DHS: HMGP, others; CIP
Lead Agency/Department Responsible:	ComIT
Implementation Schedule:	Ongoing
ADDITIONAL COMMENTS	
The city has modernized much of its communication systems to include interoperability of city systems, as well as regional systems. New systems require maintenance and replacement on a regular basis.	

VIRGINIA BEACH MITIGATION ACTION 8	
Protect Atlantic Ocean and Chesapeake Bay shorelines from storm damage. Continue work with the Army Corps of Engineers and other federal agencies to ensure ongoing maintenance of the Hurricane Protection Project and other maintained beaches within the city.	
BACKGROUND INFORMATION	
Site and Location:	Atlantic Ocean and Chesapeake Bay shorelines, particularly Resort Area and Sandbridge
Cost Benefit:	Severe and frequent shoreline erosion in this economically valuable area merits structural protection on an ongoing basis. Multiple project reports contain detailed information on the costs and benefits of these projects. City continues to provide beach replenishment as funds and projects allow, which continues to provide ongoing storm protection to $3 billion worth of homes and businesses from Rudee Inlet to Fort Story.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Tropical/Coastal Storm, Sea Level Rise, Winter Storm
Goal(s) Addressed:	Goal 1, Objectives 1.1, 1.2, 1.3, 1.4, 1.5; Goal 3, Objectives 3.1, 3.3
Priority (High, Moderate, Low):	High
Estimated Cost:	Estimated $14,000,000 every ten years
Potential Funding Sources:	COE, CIP, Special Tax District, TGIF, SSD, TIF
Lead Agency/Department Responsible:	Public Works
Implementation Schedule:	Ongoing
ADDITIONAL COMMENTS	
In addition to maintaining existing “engineered beaches”, the City should seek additional beaches or shorelines to be considered for structural hardening. Currently, the city is working with homeowners on Chesapeake Bay to identify areas in which sand can be brought in for replenishment to strengthen the shoreline.	

VIRGINIA BEACH MITIGATION ACTION 9	
Develop a dam safety plan to address protection, preparedness, response, and rebuilding in dam inundation zones.	
BACKGROUND INFORMATION	
Site and Location:	Area downstream from dams in Virginia Beach
Cost Benefit:	Infrastructure in dam inundation zones is susceptible to flooding, but may not be protected from flood.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding
Goal(s) Addressed:	Goal 1, Objectives 1.2, 1.3, 1.4, 1.5, 1.6; Goal 3
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	To be determined
Potential Funding Sources:	DHS: PDM, FMA, RFC, HMGP, HMGP 5% Initiative
Lead Agency/Department Responsible:	Public Works and Public Utilities
Implementation Schedule:	Ongoing
ADDITIONAL COMMENTS	
Virginia DCR is increasingly involved in this action and recent regulatory changes have affected which dams are regulated.	

VIRGINIA BEACH MITIGATION ACTION 10	
Install mast arm supports with mechanical dampening systems for traffic signs and signals.	
BACKGROUND INFORMATION	
Site and Location:	Citywide
Cost Benefit:	Maintaining traffic safety during evacuations, periods of high wind, and through recovery reduces accidents and allows public safety officials to concentrate on other important tasks.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Tropical/Coastal Storms, Tornado, Winter Storm and Earthquake
Goal(s) Addressed:	Goal 1, Objectives 1.3, 1.4, 1.5
Priority (High, Moderate, Low):	High
Estimated Cost:	To be determined based on number of installations determined necessary
Potential Funding Sources:	Existing budgets
Lead Agency/Department Responsible:	Public Works
Implementation Schedule:	Ongoing
ADDITIONAL COMMENTS	
Light poles, especially on bridges and roadways near the coast, are susceptible to structural vibrations resulting from both normal and extreme winds. These wind-induced vibrations are typically caused by vortex shedding and galloping of the cantilevered structures. Two other types of wind effects that cause these vibrations in structures are natural wind gusts and truck-induced vibrations. Mast arm failures caused by wind effects have been observed in St. Augustine and Ft. Walton Beach, Florida. Light poles on the Howard Franklin Bridge in Tampa and on the New River Bridge in Ft. Lauderdale also experienced failures from vibration due to wind. Virginia Beach has recently installed mast arm supports on some signals, but additional action is still recommended.	

VIRGINIA BEACH MITIGATION ACTION 11	
Improve and/or update alert, warning and notification capabilities.	
BACKGROUND INFORMATION	
Site and Location:	Citywide
Cost Benefit:	Low cost hazard notification through the use of cellular phones and computers can now reach large segments of the population quickly. Notifying residents of low-lying flood-prone areas before flooding occurs helps reduce flood damages to cars, structures, and possessions. Traffic problems associated with evacuations, frequent flooding and other hazard events can cause secondary economic disasters and major disruptions to citizens' lives in Hampton Roads.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Tropical/Coastal Storm, Tornado, Winter Storm, Shoreline Erosion, Earthquake, Wildfire, Extreme Heat, Hazardous Materials Incident
Goal(s) Addressed:	Goal 2
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$750,000
Potential Funding Sources:	DHS: HMGP, HMGP 5% Initiative; Private funds
Lead Agency/Department Responsible:	Emergency Management, ComIT
Implementation Schedule:	Within 4 years
ADDITIONAL COMMENTS	
Action will focus on keeping up with new types of social media and the most modern methods of communicating with citizens in the event of a disaster. This action includes identification and real-time mapping of frequently flooded roads and will incorporate special planning regarding evacuation routes for special needs populations (nursing homes, assisted living facilities, hospitals). Virginia Beach has taken action in the last five years in this regard, but this action requires ongoing diligence.	

VIRGINIA BEACH MITIGATION ACTION 12	
Retrofit existing stormwater management system throughout the City into state-of-the-art facilities to minimize flooding after heavy storms while also addressing water quality objectives. This action may include Climate Resilient Mitigation Activities (CRMA).	
BACKGROUND INFORMATION	
Site and Location:	Citywide
Cost Benefit:	Frequent flooding in the City is a result of numerous factors. Updating stormwater management facilities will help reduce both nuisance flooding of yards, roads and intersections, and more severe flooding that affects structures. If CRMA are included, additional benefits from environmental or ecosystem benefits may be included in the benefits cost analysis. Under new guidance, FEMA will now fund hazard mitigation projects that include sea level rise estimates.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Sea Level Rise, Tropical/Coastal Storm
Goal(s) Addressed:	Goal 1, Objectives 1.1, 1.2, 1.3, 1.4, 1.5
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	To be determined
Potential Funding Sources:	Storm Water Management Program; DHS: HMGP/CRMA
Lead Agency/Department Responsible:	Public Works
Implementation Schedule:	Ongoing
ADDITIONAL COMMENTS	
This action ties into new requirements for TMDL and is consistent with the Comprehensive Plan.	

VIRGINIA BEACH MITIGATION ACTION 13	
Mitigate incursion of storm surge and tidal inundation of low-lying areas. Investigate coastal barrier technologies and tidal stream diversion techniques. This action may include Climate Resilient Mitigation Activities (CRMA).	
BACKGROUND INFORMATION	
Site and Location:	Shorelines and tidal tributaries Citywide
Cost Benefit:	Costs and benefits of various projects are continuously updated and compared. Projects are prioritized based on those that provide the greatest benefits to existing structures and infrastructure. Possible projects may include, but are not limited to: tide gates, check valves, or road/bridge/structure elevation. If CRMA are included, additional benefits from environmental or ecosystem benefits may be included in the benefits cost analysis. Under new guidance, FEMA will now fund hazard mitigation projects that include sea level rise estimates.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Sea Level Rise, Tropical/Coastal Storm
Goal(s) Addressed:	Goal 1, Objectives 1.1, 1.2, 1.3, 1.4, 1.5
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	To be determined
Potential Funding Sources:	Storm Water Management Program; DHS: HMGP/CRMA
Lead Agency/Department Responsible:	Public Works
Implementation Schedule:	Within 10 years
ADDITIONAL COMMENTS	
Nor'easters, hurricanes and tropical storms, and some severe thunderstorms produce heavy precipitation in low-lying areas, creating runoff that cannot flow into tidal bodies at high tide. As sea level rises over the long-term, areas affected by this problem are expected to increase. Public Works recently contracted with engineering consultants to study the City's flooding and sea level rise vulnerability in additional detail and provide cost estimates and benefits for an array of possible projects.	

VIRGINIA BEACH MITIGATION ACTION 14	
Elevate, relocate or retrofit structures in flood prone areas that have suffered repetitive flood damage. This action includes Mitigation Reconstruction projects.	
BACKGROUND INFORMATION	
Site and Location:	Within the City's flood-prone areas
Cost Benefit:	Benefits for individual structures are based on the average annual damages, which is based on the structure's lowest floor elevation and frequency of flooding. Under new guidance, FEMA will now fund hazard mitigation projects that include sea level rise estimates.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Sea Level Rise, Tropical/Coastal Storm
Goal(s) Addressed:	Goal 1, Objective 1.1, 1.2, 1.3
Priority (High, Moderate, Low):	High
Estimated Cost:	$50,000 to $200,000 per structure
Potential Funding Sources:	DHS: PDM, HMGP, FMA, RFC
Lead Agency/Department Responsible:	Planning, Emergency Management
Implementation Schedule:	Within 5 years
ADDITIONAL COMMENTS	
This is an ongoing strategy for Virginia Beach. City officials strategically excluded acquisition as a tactic for mitigating flood-prone structures. The city is addressing severe repetitive loss structures with grant funding currently; however, the city has over 500 repetitive loss structures.	

VIRGINIA BEACH MITIGATION ACTION 15	
Acquire open space in strategic locations that can provide multiobjective management benefits. Objectives may include but are not limited to: flood control, water quality, public access to waterways, preserving or creating tree canopy, and preserving unique ecological and cultural heritage sites. This action may include Climate Resilient Mitigation Activities (CRMA).	
BACKGROUND INFORMATION	
Site and Location:	Citywide
Cost Benefit:	Benefits from open space acquisition can occur in several categories for a single project. A flood-prone area can be set aside for recreation and flood control, for example. If CRMA are included, additional benefits from environmental or ecosystem benefits may be included in the benefits cost analysis.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Sea Level Rise, Tropical/Coastal Storm, Shoreline Erosion, Winter Storm
Goal(s) Addressed:	Goal 1, Objective 1.6; Goal 3
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	TBD
Potential Funding Sources:	DHS: PDM, HMGP, FMA, RFC; USACE; USDA, Agricultural Extension
Lead Agency/Department Responsible:	Agriculture; Parks and Recreation
Implementation Schedule:	Long-term, 5 to 10 years
ADDITIONAL COMMENTS	
Projects may tie in with the Agricultural Preserve Program and the Parks and Recreation Open Space Program.	

VIRGINIA BEACH MITIGATION ACTION 16	
Verify the geographic location of each NFIP repetitive loss property, and determine if that property has been mitigated and, if so, by what means. Prepare Repetitive Loss Area Analyses for CRS credit.	
BACKGROUND INFORMATION	
Site and Location:	Repetitive flood loss areas throughout the City
Cost Benefit:	Repetitively flooded structures strain local and federal resources after disasters, and detract from the fiscal solvency of the NFIP. The NFIP focuses mitigation efforts and funds on properties listed as repetitive losses; therefore, checking the accuracy of the list is a necessity for the NFIP, States and, through this action, local governments.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding (Storm Surge)
Goal(s) Addressed:	Goal 1, Objectives 1.1, 1.2; Goal 3, Objective 3.2
Priority (High, Moderate, Low):	High
Estimated Cost:	Staff time estimated at $50 per structure x 500 structures = $25,000
Potential Funding Sources:	DHS: PDM, HMGP, HMGP 5% Initiative, FMA, RFC
Lead Agency/Department Responsible:	Emergency Management
Implementation Schedule:	Ongoing
ADDITIONAL COMMENTS	

CHESAPEAKE

CHESAPEAKE MITIGATION ACTION 1	
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, Tropical/Coastal Storm, Winter Storms
Goal(s) Addressed:	Goal 1, Objective 1.1, 1.2, Goal 2, Goal 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.	

CHESAPEAKE MITIGATION ACTION 2	
Acquire, elevate, relocate, retrofit or floodproof structures in flood prone areas. Flood protection may include minor localized flood reduction projects, as well. This action includes Mitigation Reconstruction projects. This action may include Climate Resilient Mitigation Activities (CRMA).	
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. If CRMA are included, additional benefits from environmental or ecosystem benefits may be included in the benefits cost analysis. Under new guidance, FEMA will now fund hazard mitigation projects that include sea level rise estimates.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Sea Level Rise, Tropical/Coastal Storm, Winter Storm
Goal(s) Addressed:	Goal 1, Objectives 1.1, 1.2
Priority (High, Moderate, Low):	High
Estimated Cost:	In multiple $750,000 phases as grant money becomes available.
Potential Funding Sources:	DHS: PDM, HMGP, HMGP/CRMA, HMGP 5% Initiative, 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.

CHESAPEAKE MITIGATION ACTION 3	
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. This action may include Mitigation Reconstruction projects.	
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:	Flooding, Sea Level Rise, Tropical/Coastal Storm, Tornado, Winter Storm, Earthquake, Wildfire
Goal(s) Addressed:	Goal 1, Objectives 1.1, 1.2
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, HMGP 5% Initiative, 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. The cost of minor retrofits can have exponential benefits in reducing the risk to lives.	

CHESAPEAKE MITIGATION ACTION 4	
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, Tropical/Coastal Storm, Tornado, Winter Storms, Extreme Heat
Goal(s) Addressed:	Goal 1, Objectives 1.1, 1.2, 1.3, 1.4, 1.5
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, HMGP 5% Initiative, 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.

CHESAPEAKE MITIGATION ACTION 5	
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:	Wildfire
Goal(s) Addressed:	Goal 1, Objective 1.2, 1.3, 1.4
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.	

CHESAPEAKE MITIGATION ACTION 6	
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 3, Objectives 3.3, 3.4
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.	

CHESAPEAKE MITIGATION ACTION 7	
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:	Tornado, Tropical/Coastal Storm, Winter Storms, Wildfires
Goal(s) Addressed:	Goal 2, Objective 2.1
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 and by members of the public who participated in a public meeting January 16, 2014.	

CHESAPEAKE MITIGATION ACTION 8	
Improve stormwater management infrastructure. Prepare and implement preventive maintenance schedule. Provide 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, Winter Storm
Goal(s) Addressed:	Goal 1, Objective 1.1, 1.2, 1.3, 1.4, 1.5
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.	

CHESAPEAKE MITIGATION ACTION 9	
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 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; DHS: HMGP 5% Initiative
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.	

CHESAPEAKE MITIGATION ACTION 10	
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, Tropical/Coastal Storm, Winter Storm, Wildfire, Hazardous Materials Incident
Goal(s) Addressed:	Goal 1, Objective 1.2, 1.3, 1.4
Priority (High, Moderate, Low):	Low
Estimated Cost:	$8,000
Potential Funding Sources:	Existing budgets; DHS: HMGP 5% Initiative
Lead Agency/Department Responsible:	Emergency Management
Implementation Schedule:	Within eight years of plan adoption
ADDITIONAL COMMENTS	

CHESAPEAKE MITIGATION ACTION 11	
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; DHS: HMGP 5% Initiative
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.	

CHESAPEAKE MITIGATION ACTION 12	
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, Tropical/Coastal Storm
Goal(s) Addressed:	Goal 1, Objectives 1.3, 1.4, 1.5
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	

CHESAPEAKE MITIGATION ACTION 13	
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 Storm, Tropical/Coastal Storm, Wildfire
Goal(s) Addressed:	Goal 1, Objective 1.6; Goal 3, Objective 3.4
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.	

CHESAPEAKE MITIGATION ACTION 14	
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 multi-hazard 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, Tropical/Coastal Storm, Winter Storm
Goal(s) Addressed:	Goal 1, Goal 2, Goal 3
Priority (High, Moderate, Low):	High
Estimated Cost:	Less than $7,500
Potential Funding Sources:	Existing budgets and staff time; DHS: PDM, HMGP, HMGP 5% Initiative
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.

CHESAPEAKE MITIGATION ACTION 15	
Acquire open space in strategic locations that can provide multi-objective management benefits. Objectives may include but are not limited to: flood control, water quality, public access to waterways, preserving or creating tree canopy, and preserving unique ecological and cultural heritage sites. This action may include Climate Resilient Mitigation Activities (CRMA).	
BACKGROUND INFORMATION	
Site and Location:	Citywide
Cost Benefit:	Benefits from open space acquisition can occur in several categories for a single project. A flood-prone area can be set aside for recreation and flood control, for example. If CRMA are included, additional benefits from environmental or ecosystem benefits may be included in the benefits cost analysis.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Sea Level Rise, Tropical/Coastal Storm, Shoreline Erosion, Winter Storm, Tornado, Winter Storm, Wildfire
Goal(s) Addressed:	Goal 1, Objective 1.6; Goal 3
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	TBD
Potential Funding Sources:	DHS: PDM, HMGP, HMGP/CRMA, FMA, RFC; USACE; USDA, Va. Tech Agricultural Extension, DOI – LWCF
Lead Agency/Department Responsible:	Planning & Development; Parks, Recreation and Tourism
Implementation Schedule:	Long-term, 5 to 10 years
ADDITIONAL COMMENTS	
Projects may tie in with the recently adopted Green Sea Blueway and Greenway Plan.	

CHESAPEAKE MITIGATION ACTION 16	
Identify, create database, and plan uses for data regarding vulnerable populations. Uses may include targeted outreach, emergency notification and specialized evacuation planning.	
BACKGROUND INFORMATION	
Site and Location:	Citywide
Cost Benefit:	Outreach and early notification of events to vulnerable populations aids in evacuation, re-entry, sustainability and community resiliency.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Tropical/Coastal Storm, Tornado, Winter Storm, Earthquake Wildfire, Extreme Heat, Hazardous Materials Incident
Goal(s) Addressed:	Goal 2; Goal 3, Objective 3.2
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$10,000
Potential Funding Sources:	DHS: UASI, PDM, HMGP, HMGP 5% Initiative
Lead Agency/Department Responsible:	Emergency Management (lead) Public Communications
Implementation Schedule:	3 to 5 years
ADDITIONAL COMMENTS	

ISLE OF WIGHT COUNTY

ISLE OF WIGHT COUNTY MITIGATION ACTION 1	
Acquire, elevate, relocate or retrofit structures in coastal high hazard areas and other flood prone areas that have suffered repetitive flood damage. This action includes Mitigation Reconstruction projects.	
BACKGROUND INFORMATION	
Site and Location:	Within the VE and AE flood zones along the James River and associated tributaries in Isle of Wight County
Cost Benefit:	Just 17 structures alone in the VE zone suffered damages in 1999 during Hurricane Floyd ($62,000), and 2003 from Hurricane Isabel ($476,483). One structure was recently acquired. Under new guidance, FEMA will now fund hazard mitigation projects that include sea level rise estimates.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Sea Level Rise
Goal(s) Addressed:	Goal 1, Objectives 1.1, 1.2, 1.5
Priority (High, Moderate, Low):	High
Estimated Cost:	$3,400,000 (approximately $200,000/property) per phase. Up to 5 phases are planned. One recent acquisition cost $135,000.
Potential Funding Sources:	DHS: PDM, HMGP, FMA, RFC
Lead Agency/Department Responsible:	Planning and Zoning
Implementation Schedule:	Ongoing
ADDITIONAL COMMENTS	
There are 16 properties with structures located in the VE flood zone that are targeted for participation. The project will have to be performed in phases as grant funds are made available. Acquisition and demolition of structures represent land use changes that the County may be able to claim as credits under new Chesapeake Bay Total Maximum Daily Load (TMDL) requirements. Careful tracking of these projects can also contribute significant points to the Community Rating System classification (see Mitigation Action 2).	

ISLE OF WIGHT COUNTY MITIGATION ACTION 2	
Join the National Flood Insurance Program's Community Rating System, and conduct annual outreach to flood prone property owners.	
BACKGROUND INFORMATION	
Site and Location:	Countywide, Isle of Wight County
Cost Benefit:	Participation in the CRS at a Class 9 rating would result in 5% premium savings on most flood insurance policies. A Class 8 rating saves property owners 20% on premiums in the SFHA.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Sea Level Rise
Goal(s) Addressed:	Goal 1, Objectives 1.1, 1.2; Goal 2
Priority (High, Moderate, Low):	High
Estimated Cost:	Staff time
Potential Funding Sources:	N/A
Lead Agency/Department Responsible:	Planning and Zoning
Implementation Schedule:	Within 3 years
ADDITIONAL COMMENTS	
This action is part of the County's Strategy for Continued Compliance with the NFIP.	

ISLE OF WIGHT COUNTY MITIGATION ACTION 3	
Place the utility power lines, cable and telephone lines to County/Town Facilities and Emergency Shelters underground.	
BACKGROUND INFORMATION	
Site and Location:	County Facilities, Isle of Wight County
Cost Benefit:	This action limits damage to infrastructure and facilitates quick power restoration to government buildings.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Tropical/Coastal Storm, Winter Storm, Tornado, Wildfire, Earthquake, Extreme Heat
Goal(s) Addressed:	Goal 1, Objectives 1.3, 1.4, 1.5
Priority (High, Moderate, Low):	Low
Estimated Cost:	$3,000,000
Potential Funding Sources:	DHS: PDM
Lead Agency/Department Responsible:	Emergency Management and Public Works
Implementation Schedule:	Ongoing
ADDITIONAL COMMENTS	
Work with local power suppliers (Community Electric Coop and Dominion) to have utility lines leading to County and Town essential facilities buried underground. New municipal construction employs underground utility installations.	

ISLE OF WIGHT COUNTY MITIGATION ACTION 4	
Implement four-phase strategy to guide development in areas most vulnerable to sea level rise: **1) Create, adopt and distribute zoning maps identifying coastal and shoreline areas most vulnerable to sea level rise;** **2) Identify and protect valued ecosystem features through zoning, subdivision regulations or other existing regulatory tools (*e.g.*, shoreline setbacks, living shorelines, beach nourishment, erosion control);** **3) Adopt policies that encourage development investment *outside* of the most vulnerable areas (*e.g.*, tax incentives, fee waivers, County/State/Federal funds for roads, redevelopment or economic development, relocation assistance/planning); and** **4) Begin to armor existing development where relocation is not feasible (*e.g.*, elevation of new bridges, structural flood protection, tide gates).**	
BACKGROUND INFORMATION	
Site and Location:	Coastal floodplain areas of the County
Cost Benefit:	The effects of sea level rise are evident along the shorelines of the County. Increased damages from erosion and flooding can be expected to accelerate. County policies that discourage new development and protect existing development will help reduce damages over the long-term.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Sea Level Rise, Flooding, Shoreline Erosion
Goal(s) Addressed:	Goal 1, Objectives 1.1, 1.2, 1.3, 1.5, 1.6
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	Primarily staff time for phases 1 to 3; phase 4 costs could be substantial but would be identified on a project by project basis.
Potential Funding Sources:	DHS: PDM, FMA, HMGP, HMGP 5% Initiative, RFC
Lead Agency/Department Responsible:	Planning and Zoning, County Administration, Economic Development
Implementation Schedule:	Within 15 years
ADDITIONAL COMMENTS	
The Comprehensive Plan update includes resource conservation areas. While this action is multi-phase and may take many years or even decades to implement, each phase is comprised of small, measurable steps.	

ISLE OF WIGHT COUNTY MITIGATION ACTION 5	
Develop and implement a stormwater drainage plan to address issues in flood-prone areas; prioritize and implement plan recommendations. This action may include Climate Resilient Mitigation Activities (CRMA).	
BACKGROUND INFORMATION	
Site and Location:	Countywide
Cost Benefit:	Flooding as a result of stormwater accumulation can exacerbate coastal flooding, contributing to flood damages of cars, structures, roads and other infrastructure. Nuisance flooding can result in businesses closed down. If CRMA are included, additional benefits from environmental or ecosystem benefits may be included in the benefits cost analysis.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Sea Level Rise
Goal(s) Addressed:	Goal 1, Objectives 1.1, 1.2, 1.3, 1.4, 1.5
Priority (High, Moderate, Low):	High
Estimated Cost:	$250,000 to $3,000,000
Potential Funding Sources:	General funds; DHS: HMGP/CRMA
Lead Agency/Department Responsible:	Utility Services
Implementation Schedule:	Ongoing, with stormwater master plan under development within 1 year of mitigation plan adoption.
ADDITIONAL COMMENTS	

ISLE OF WIGHT COUNTY MITIGATION ACTION 6	
Maintain and implement countywide Transportation Plan; include coordination with the Virginia Department of Transportation to address safety along all evacuation routes, including culvert redesigns and other installations to alleviate flooding.	
BACKGROUND INFORMATION	
Site and Location:	Countywide
Cost Benefit:	Safe evacuation routes are mandatory for citizen protection during hazard events.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Sea Level Rise, Tropical/Coastal Storm, Winter Storm
Goal(s) Addressed:	Goal 1, Goal 3
Priority (High, Moderate, Low):	High
Estimated Cost:	Planning is underway; individual project costs to be determined through planning efforts
Potential Funding Sources:	General funds, VDOT and Federal assistance
Lead Agency/Department Responsible:	Planning and Public Works/Utility Services
Implementation Schedule:	Ongoing
ADDITIONAL COMMENTS	
U.S. 460 is a priority for the County. County recently added a transportation planner/VDOT liaison to staff.	

ISLE OF WIGHT COUNTY MITIGATION ACTION 7	
Replace, as necessary, and maintain the existing regional interoperable communications system.	
BACKGROUND INFORMATION	
Site and Location:	Countywide and Southside Hampton Roads region
Cost Benefit:	Modern interoperable communications systems support preparedness, response and recovery activities for all hazards.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	All Hazards
Goal(s) Addressed:	Goal 1; Goal 3, Objectives 3.1, 3.3, 3.4
Priority (High, Moderate, Low):	High
Estimated Cost:	$10 million to $14 million
Potential Funding Sources:	DHS: HMGP, HMGP 5 % Initiative, others; CIP
Lead Agency/Department Responsible:	Emergency Services
Implementation Schedule:	Within one year of mitigation plan adoption
ADDITIONAL COMMENTS	
Funding for this action has been included in the CIP, and the County is working with consultants to draw up specifications for the project.	

ISLE OF WIGHT COUNTY MITIGATION ACTION 8	
Verify the geographic location of each NFIP repetitive loss property, and determine if that property has been mitigated and, if so, by what means.	
BACKGROUND INFORMATION	
Site and Location:	Repetitive flood loss areas throughout the County
Cost Benefit:	Repetitively flooded structures strain local and federal resources after disasters, and detract from the fiscal solvency of the NFIP. The NFIP focuses mitigation efforts and funds on properties listed as repetitive losses; therefore, checking the accuracy of the list is a necessity for the NFIP, States and, through this action, local governments.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding
Goal(s) Addressed:	Goal 1, Objectives 1.1, 1.2; Goal 3, Objective 3.2
Priority (High, Moderate, Low):	High
Estimated Cost:	Staff time estimated at $50 per structure x 18 structures = $900
Potential Funding Sources:	DHS: PDM, HMGP, HMGP 5% Initiative, FMA, RFC
Lead Agency/Department Responsible:	Planning and Zoning
Implementation Schedule:	Ongoing
ADDITIONAL COMMENTS	
An initial attempt to contact property owners by mail will be followed up by phone calls, and site visits as necessary.	

ISLE OF WIGHT COUNTY MITIGATION ACTION 9	
Identify and address multiple hazards along high traffic evacuation routes throughout county, to include removal of utility poles and burying utility lines.	
BACKGROUND INFORMATION	
Site and Location:	High hazard areas for flood, and other areas of community importance (intersections, evacuation routes, critical facilities, and critical businesses)
Cost Benefit:	Overhead utilities are at risk of failure from several types of hazard events. By burying these lines underground, the vulnerability is dramatically reduced.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Winter Storm, Tropical/Coastal Storm, Tornado, Earthquake, Shoreline Erosion
Goal(s) Addressed:	Goal 1, Objectives 1.2; Goal 3, Objectives 3.3, 3.4
Priority (High, Moderate, Low):	High
Estimated Cost:	To be determined
Potential Funding Sources:	CIP, Private Funds
Lead Agency/Department Responsible:	Public Works
Implementation Schedule:	Long-term, over a 10-year period
ADDITIONAL COMMENTS	
Burying electrical power lines must be reviewed with Dominion Virginia Power for potential opportunities within the community. Much of Hampton Roads evacuates through Isle of Wight County; therefore, safe, evacuation routes are a high priority for the region as well.	

ISLE OF WIGHT COUNTY MITIGATION ACTION 10	
Improve use of social media before, during and after hazard events.	
BACKGROUND INFORMATION	
Site and Location:	Countywide
Cost Benefit:	Minimal cost to reach larger audience more effectively
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Coastal/Tropical Storm, Tornado, Winter Storm, Earthquake, Wildfire, Extreme Heat, Hazardous Materials Incident
Goal(s) Addressed:	Goal 2; Objective 2.1
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	Minimal cost/staff time
Potential Funding Sources:	DHS: HMGP 5% Initiative
Lead Agency/Department Responsible:	Public Information
Implementation Schedule:	One year, and continuing thereafter
ADDITIONAL COMMENTS	
The prominence of social media points to a need to refine activity on Twitter, Facebook, Instagram and other programs. Need to be pro-active and targeted in messages. Identify specific messages, links. Other information that we will need to spread and the most effective methods, such as short videos, maps, links, photos, and infographics.	

ISLE OF WIGHT COUNTY MITIGATION ACTION 11	
Strengthen GIS digital mapping program.	
BACKGROUND INFORMATION	
Site and Location:	Countywide
Cost Benefit:	Additional databases help staff and planners recognize and plan for various hazards.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	All
Goal(s) Addressed:	Goal 1; Goal 3, Objective 3.2
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	Staff time, software and staff training materials
Potential Funding Sources:	Estimated at $<500 annually; DHS: HMGP 5% Initiative
Lead Agency/Department Responsible:	IT
Implementation Schedule:	Ongoing
ADDITIONAL COMMENTS	
New layers are continually added to the system. Staff training on use of the map data is included in the cost estimate. County maintains handheld GPS unit for data collection.	

ISLE OF WIGHT COUNTY MITIGATION ACTION 12	
Protect critical facilities, including shelters. Protection measures may include emergency generators or other power sources, wind or flood retrofits, elevation, relocation, or reconstruction. This action includes Mitigation Reconstruction projects.	
BACKGROUND INFORMATION	
Site and Location:	Countywide
Cost Benefit:	The purpose of this action is to maintain citizen safety, and continuity of county operations during a disaster event. Under new guidance, FEMA will now fund hazard mitigation projects that include sea level rise estimates.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Tropical/Coastal Storm, Tornado, Winter Storm, Earthquake, Wildfire, Extreme Heat, Hazardous Materials Incident
Goal(s) Addressed:	Goal 1, Objective 1.3, 1.4, 1.5
Priority (High, Moderate, Low):	High
Estimated Cost:	To be determined based on corrective actions selected
Potential Funding Sources:	DHS: PDM, HMGP, HMGP 5% Initiative, FMA
Lead Agency/Department Responsible:	Emergency Management and Public Works
Implementation Schedule:	Continuing
ADDITIONAL COMMENTS	

ISLE OF WIGHT COUNTY MITIGATION ACTION 13	
Conduct annual meeting with VDOT and utilities to identify hazard areas and potential projects to mitigate those areas.	
BACKGROUND INFORMATION	
Site and Location:	Countywide
Cost Benefit:	Keeping roads and utilities operational during high frequency events and maximizing their operability during disasters is a countywide priority.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Winter Weather, Tropical/Coastal Storm
Goal(s) Addressed:	Goal 1, Objective 1.3, 1.4, 1.5; Goal 3, Objective 3.1, 3.3, 3.4
Priority (High, Moderate, Low):	High
Estimated Cost:	Staff time
Potential Funding Sources:	N/A
Lead Agency/Department Responsible:	Public Works
Implementation Schedule:	Annually
ADDITIONAL COMMENTS	

ISLE OF WIGHT COUNTY MITIGATION ACTION 14	
Obtain StormReady designation through NOAA.	
BACKGROUND INFORMATION	
Site and Location:	Countywide
Cost Benefit:	StormReady helps arm communities with the communication and safety skills needed to save lives and property--before, during and after the event. StormReady helps community leaders and emergency managers strengthen local safety programs.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Tropical/Coastal Storm, Tornado, Winter Storm, Wildfire
Goal(s) Addressed:	Goal 1, Goal 2, Goal 3
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	Staff time
Potential Funding Sources:	N/A
Lead Agency/Department Responsible:	Emergency Management
Implementation Schedule:	Within 2 years of plan adoption
ADDITIONAL COMMENTS	

ISLE OF WIGHT MITIGATION ACTION 15	
Develop a post-disaster continuity of operations plan to assist in more rapid recovery after a disaster.	
BACKGROUND INFORMATION	
Site and Location:	Countywide
Cost Benefit:	By identifying post-disaster processes for almost all County department functions and putting these processes on paper, the plan would aid staff and temporary staff in keeping processes running smoothly and not contributing to additional conflicts.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Coastal/Tropical Storm, Tornado, Shoreline Erosion, Winter Storm, Earthquake, Wildfire, Hazardous Materials Incident
Goal(s) Addressed:	Goal 1, Objectives 1.4, 1.5; Goal 3
Priority (High, Moderate, Low):	High
Estimated Cost:	$25,000
Potential Funding Sources:	Staff time, DHS planning grants
Lead Agency/Department Responsible:	Emergency Management, Planning, Permits & Inspections, Engineering, Public Works
Implementation Schedule:	Within 2 years
ADDITIONAL COMMENTS	

SMITHFIELD

SMITHFIELD MITIGATION ACTION 1	
Provide training for member(s) of Town staff to become Certified Floodplain Manager (CFM) through the Association of State Floodplain Managers (ASFPM).	
BACKGROUND INFORMATION	
Site and Location:	Throughout Town
Cost Benefit:	Training related to implementation of floodplain management regulations, permitting, reading Flood Insurance Rate Maps, and other topics will help Town staff properly administer floodplain management regulations, thereby protecting future development from flood damage.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Sea Level Rise, Shoreline Erosion
Goal(s) Addressed:	Goal 1, Objective 1.1
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	<$1,000 for conference attendance, test taking, and ASFPM membership
Potential Funding Sources:	Existing budgets
Lead Agency/Department Responsible:	Planning and Engineering
Implementation Schedule:	Within 2 years
ADDITIONAL COMMENTS	
This action is part of the Town's Strategy for Continued Compliance with the NFIP.	

SMITHFIELD MITIGATION ACTION 2	
Review information required on the Zoning Permit Application to ensure continued compliance with the NFIP.	
BACKGROUND INFORMATION	
Site and Location:	Throughout Town
Cost Benefit:	Identification of floodplain zones during the Zoning Permit review process provides this hazard information to developers and property owners early in the construction process to help ensure compliance with floodplain management regulations.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding
Goal(s) Addressed:	Goal 1, Objective 1.2
Priority (High, Moderate, Low):	High
Estimated Cost:	Staff time
Potential Funding Sources:	N/A
Lead Agency/Department Responsible:	Planning and Engineering
Implementation Schedule:	Within 2 years
ADDITIONAL COMMENTS	
The NFIP requires that applicants for a floodplain permit provide certain flood hazard information (e.g., Base Flood Elevation, flood zone, Flood Insurance Rate Map identifying information) on the permit application. Coordination with the County, which administers the building permit, may be required. This action is part of the community's Strategy for Continued Compliance with the NFIP.	

SMITHFIELD MITIGATION ACTION 3	
Identify strategic locations throughout town to remove utility poles and bury utility lines.	
BACKGROUND INFORMATION	
Site and Location:	High hazard areas for flood, and other areas of community importance (intersections, critical facilities, and critical businesses)
Cost Benefit:	Overhead utilities are at risk of failure from several types of hazard events. By burying these lines underground, the vulnerability is dramatically reduced.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Winter Storms, Coastal/Tropical Storms, Tornado, Earthquake, Shoreline Erosion
Goal(s) Addressed:	Goal 1, Objectives 1.2, 1.3, 1.4, 1.5
Priority (High, Moderate, Low):	High
Estimated Cost:	To be determined
Potential Funding Sources:	CIP, Private Funds
Lead Agency/Department Responsible:	Public Works
Implementation Schedule:	Long-term, over a 10-year period
ADDITIONAL COMMENTS	
Burying electrical power lines must be reviewed with Dominion Virginia Power for potential opportunities within the community.	

SMITHFIELD MITIGATION ACTION 4	
Verify the geographic location of each NFIP repetitive loss property, and determine if that property has been mitigated and, if so, by what means.	
BACKGROUND INFORMATION	
Site and Location:	Repetitive flood losses
Cost Benefit:	Repetitively flooded structures strain local and federal resources after disasters, and detract from the fiscal solvency of the NFIP. The NFIP focuses mitigation efforts and funds on properties listed as repetitive losses; therefore, checking the accuracy of the list is a necessity for the NFIP, States and, through this action, local governments.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding
Goal(s) Addressed:	Goal 1, Objective 1.1, 1.2; Goal 3, Objective 3.2
Priority (High, Moderate, Low):	High
Estimated Cost:	Staff time
Potential Funding Sources:	DHS: PDM, HMGP, HMGP 5% Initiative, FMA, RFC
Lead Agency/Department Responsible:	Planning and Zoning
Implementation Schedule:	Ongoing
ADDITIONAL COMMENTS	
An initial attempt to contact property owners by mail will be followed up by phone calls, and site visits as necessary.	

SMITHFIELD MITIGATION ACTION 5	
Waterworks Dam/Smithfield Lake - Conduct dam inundation study and determine potential mitigation actions that can then be implemented to reduce impacts, especially to the roadway along top of dam.	
BACKGROUND INFORMATION	
Site and Location:	Waterworks Dam is on the west side of Smithfield.
Cost Benefit:	Actions are mandated regardless of cost.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Winter Storm, Earthquake
Goal(s) Addressed:	Goal 1, Objective 1.2, 1.3, 1.4, 1.5
Priority (High, Moderate, Low):	High
Estimated Cost:	$250,000 for the study. Mitigation action costs to be determined by study.
Potential Funding Sources:	DEQ, DCR, Town funds
Lead Agency/Department Responsible:	Town Engineer
Implementation Schedule:	Within 5 years
ADDITIONAL COMMENTS	
On October 7, 2007, excessive rainfall caused the dam to be topped, resulting in dam erosion and damage to the roadway running along the top of the dam.	

SMITHFIELD MITIGATION ACTION 6	
Increase fuel storage at reverse osmosis water plant, allowing for extended operations during emergency situations.	
BACKGROUND INFORMATION	
Site and Location:	Town's water plant
Cost Benefit:	Due to size of the generator, the most cost effective option is to increase fuel capacity rather convert to natural gas.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Tropical/Coastal Storm, Tornado, Winter Storm, Earthquake, Wildfire
Goal(s) Addressed:	Goal 1, Objective 1.3, 1.4, 1.5
Priority (High, Moderate, Low):	High
Estimated Cost:	Estimated $100,000, depending on the size of the tank and ability to locate additional fuel storage
Potential Funding Sources:	DHS: PDM, HMGP, HMGP 5% Initiative; Town funds
Lead Agency/Department Responsible:	Plant Manager
Implementation Schedule:	3 to 5 years
ADDITIONAL COMMENTS	
Currently, the generator at the plant has a 48-hour run time. The town also has the ability to store around 48 hours of water supply in tanks, giving the town a 4-day supply depending on usage.	

SMITHFIELD MITIGATION ACTION 7	
Purchase variable message roadway signs, primarily for traffic control during flood events.	
BACKGROUND INFORMATION	
Site and Location:	Flood-prone roadways throughout the Town
Cost Benefit:	Signs will reduce damage by rerouting traffic around flooded areas, and increase availability of public safety staff for more important tasks. Signs will have other uses beyond traffic control for floods, improving the department's ability to get information out to the public and motorists.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Sea Level Rise, Tropical/Coastal Storm
Goal(s) Addressed:	Goal 1, Objective 1.5; Goal 2
Priority (High, Moderate, Low):	High
Estimated Cost:	$13,000 per sign
Potential Funding Sources:	Highway budget, VDOT; DHS: HMGP 5% Initiative
Lead Agency/Department Responsible:	Town Engineer
Implementation Schedule:	Purchase 1 sign per year for the next 5 years
ADDITIONAL COMMENTS	
Several roadways flood during even higher frequency events, so being able to reroute traffic around these roadways becomes even more critical during major storm events.	

SMITHFIELD MITIGATION ACTION 8	
Change generators at critical facilities from diesel to natural gas.	
BACKGROUND INFORMATION	
Site and Location:	Critical facilities throughout the town, including but not limited to: Public Works Maintenance Building, Police Department, and Sewer Pump Stations
Cost Benefit:	Recovery from major disasters requires continuity of operations for the town, to the extent possible.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	All
Goal(s) Addressed:	Goal 1, Objectives 1.3, 1.4
Priority (High, Moderate, Low):	High
Estimated Cost:	To be determined based on availability of natural gas and whether individual generators can be converted or will have to be replaced.
Potential Funding Sources:	DHS: UASI, PDM, HMGP, HMGP 5% Initiative
Lead Agency/Department Responsible:	Public Works
Implementation Schedule:	Begin work immediately, starting with the oldest and most critical systems
ADDITIONAL COMMENTS	
Delivery of fuel during disasters is problematic and the town wants to improve ability to maintain continuity of operations.	

WINDSOR

WINDSOR MITIGATION ACTION 1	
Provide training for member of Town staff to become a Certified Floodplain Manager (CFM) through the Association of State Floodplain Managers (ASFPM).	
BACKGROUND INFORMATION	
Site and Location:	Throughout Town
Cost Benefit:	Training related to implementation of floodplain management regulations, permitting, reading Flood Insurance Rate Maps, and other topics will help Town staff properly administer floodplain management regulations, thereby protecting future development from flood damage.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Sea Level Rise, Shoreline Erosion
Goal(s) Addressed:	Goal 1, Objective 1.2
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	<$1,000 for conference attendance, test taking, and ASFPM membership
Potential Funding Sources:	Existing budgets
Lead Agency/Department Responsible:	Planning and Zoning
Implementation Schedule:	Within 2 years
ADDITIONAL COMMENTS	
This action is part of the community's Strategy for Continued Compliance with the NFIP.	

WINDSOR MITIGATION ACTION 2	
Review information required on the Zoning Permit Application to ensure continued compliance with the NFIP.	
BACKGROUND INFORMATION	
Site and Location:	Throughout Town
Cost Benefit:	Identification of floodplain zones during the Zoning Permit review process provides this hazard information to developers and property owners early in the construction process to help ensure compliance with floodplain management regulations.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding
Goal(s) Addressed:	Goal 1, Objective 1.2
Priority (High, Moderate, Low):	High
Estimated Cost:	Staff time
Potential Funding Sources:	N/A
Lead Agency/Department Responsible:	Town Manager
Implementation Schedule:	Within 2 years
ADDITIONAL COMMENTS	
The NFIP requires that applicants for a floodplain permit provide certain flood hazard information (e.g., Base Flood Elevation, flood zone, Flood Insurance Rate Map identifying information) on the permit application. Coordination with the County, which administers the building permit, may be required. This action is part of the community's Strategy for Continued Compliance with the NFIP.	

WINDSOR MITIGATION ACTION 3	
Install emergency backup power generator for the Windsor Police Department.	
BACKGROUND INFORMATION	
Site and Location:	56 East Windsor Boulevard
Cost Benefit:	Continuity of operations for the town is dependent on the ability of this critical facility to have power.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Tropical/Coastal Storm, Tornado, Winter Storm, Earthquake, Wildfire, Hazardous Materials Incident, possibly Drought and Extreme Heat
Goal(s) Addressed:	Goal 1, Objective 1.4
Priority (High, Moderate, Low):	High
Estimated Cost:	$10,000
Potential Funding Sources:	DHS: UASI, HMGP, HMGP 5% Initiative
Lead Agency/Department Responsible:	Town Manager, Police Department
Implementation Schedule:	Install generator before the end of FY 16/17.
ADDITIONAL COMMENTS	

FRANKLIN

FRANKLIN MITIGATION ACTION 1	
Use existing stormwater and drainage studies to prioritize and implement recommended improvements. This action may include Climate Resilient Mitigation Activities (CRMA).	
BACKGROUND INFORMATION	
Site and Location:	Citywide, with particular emphasis on the Armory Drive Commercial District.
Cost Benefit:	Stormwater drainage minimizes road closures, reduces damage to structures. If CRMA are included, additional benefits from environmental or ecosystem benefits may be included in the benefits cost analysis.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Sea Level Rise
Goal(s) Addressed:	Goal 1, Objectives 1.1, 1.2, 1.3, 1.4, 1.5
Priority (High, Moderate, Low):	High
Estimated Cost:	City is currently completing a planning document that outlines recommended improvements and cost estimates for each.
Potential Funding Sources:	DHS: PDM, HMGP, HMGP/CRMA, FMA
Lead Agency/Department Responsible:	Public Works
Implementation Schedule:	Within 2 to 3 years
ADDITIONAL COMMENTS	

FRANKLIN MITIGATION ACTION 2	
Enroll in the Community Rating System (CRS).	
BACKGROUND INFORMATION	
Site and Location:	Flood insurance policyholders in the 100-year floodplain would be the primary beneficiaries. Standard X-Zone policyholders would also benefit up to a maximum 10 percent discount.
Cost Benefit:	Although there are numerous benefits to participation in CRS, the most quantifiable is the premium discounts to flood insurance policyholders. By reducing the amount residents pay in flood insurance premiums, this money is returned to the community and can be spent locally. Furthermore, many CRS communities experience a dramatic increase in the number of policies due to their outreach, which results in a reduction in uninsured losses after a flood. Then, Increased Cost of Compliance funds available to policyholders after a flood can be a valuable mitigation tool.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Sea Level Rise
Goal(s) Addressed:	Goal 1, Goal 2, Goal 3
Priority (High, Moderate, Low):	High
Estimated Cost:	There is no cost for submitting a CRS application, other than staff time. Additional hours are required for annual reviews and cycle applications every 5 years. FEMA/ISO will provide application assistance.
Potential Funding Sources:	Existing budgets.
Lead Agency/Department Responsible:	Community Development
Implementation Schedule:	Within 1 to 2 years
ADDITIONAL COMMENTS	
CRS provides a structured incentive program to address flood hazards by rewarding policyholders with premium discounts, enhancing public safety, reducing damage to property and public infrastructure, avoiding economic disruption and losses, reducing human suffering, protecting the environment, and increasing the flood insurance policy base.	

FRANKLIN MITIGATION ACTION 3

Compile elevation and flood damage data, including but not limited to:

1) **Gathering data from all known sources, including citizens and business owners, to document detailed historical flood damages and flood heights.**
2) **Developing action plan to gather high water marks, and damage data immediately following future floods.**
3) **Participating in regional efforts to collect topographic and structure elevation data, such as standardizing LIDAR.**
4) **Surveying elevations for all known high water marks and other known flood landmarks, especially in Downtown Franklin.**

BACKGROUND INFORMATION	
Site and Location:	Throughout City's flood hazard areas.
Cost Benefit:	Data will support analysis of costs and benefits of flood mitigation measures, particularly for repetitively flooded structures. Benefits accrue through reduced staff time in preparing mitigation grant applications, and improved accuracy of cost-benefit analyses and evacuation plans.

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Sea Level Rise
Goal(s) Addressed:	Goal 1, Objectives 1.1, 1.2; Goal 3, Objective 3.2
Priority (High, Moderate, Low):	High
Estimated Cost:	Staff time; approximately 100 hours.
Potential Funding Sources:	ACE: FPMS (high water marks, structure elevations), HRPDC: LIDAR DHS: HMGP, HMGP 5% Initiative
Lead Agency/Department Responsible:	Fire and Rescue
Implementation Schedule:	Within 2 years

ADDITIONAL COMMENTS

Gathering data to create an accurate cost-benefit analysis can be a particularly daunting part of the grant application process. By compiling data on historic floods and detailed damages in a single location/document, the City will support flood mitigation projects, both structural and nonstructural. Detailed elevation data in the Downtown Business District will assist in both evacuation planning and mitigation prioritization.

FRANKLIN MITIGATION ACTION 4	
Work with the Downtown Franklin Association and local business owners to identify and implement wet and dry floodproofing projects to protect structures from future flood events. Identify projects by providing flood audits to business owners. Mitigation projects may include acquisition, elevation, mitigation reconstruction projects, and retrofitting.	
BACKGROUND INFORMATION	
Site and Location:	Downtown Franklin
Cost Benefit:	Initial flood audits conducted by a structural engineer, together with detailed first floor elevations, will aid in prioritizing mitigation projects to ensure that implemented projects maximize the reduction in average annual flood damages and reduce economic strain on businesses and the City.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Sea Level Rise
Goal(s) Addressed:	Goal 1, Objectives 1.1, 1.2, 1.5; Goal 2
Priority (High, Moderate, Low):	High
Estimated Cost:	$2,500 to $10,000 per structure
Potential Funding Sources:	DHS: HMGP, RFC ACE: FPMS HRPDC SBA loans
Lead Agency/Department Responsible:	Community Development
Implementation Schedule:	Within 2 years
ADDITIONAL COMMENTS	
Investigate the potential for “peer-to-peer” mentoring with other communities that have implemented historic downtown flood mitigation projects. Potential communities in the region with successful downtown flood mitigation projects include Grundy and Staunton, Virginia and Belhaven, North Carolina. The HRPDC can assist.	

FRANKLIN MITIGATION ACTION 5	
Conduct community disaster awareness campaign through *City Clips,* the City's email newsletter to interested citizens, and the cable Public, Education and Government (PEG) Channel. Address mitigation actions for multiple hazards, including purchase of flood insurance.	
BACKGROUND INFORMATION	
Site and Location:	Citywide
Cost Benefit:	For low cost, the City can distribute information on a variety of hazards to interested citizens on a regular basis. Benefits accrue when citizens aware of hazards begin to take actions to protect lives and property.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Sea Level Rise, Tropical/Coastal Storm, Tornado, Winter Storm, Earthquake, Wildfire, Drought, Extreme Heat, Hazardous Materials Incident, Shoreline Erosion
Goal(s) Addressed:	Goal 2
Priority (High, Moderate, Low):	High
Estimated Cost:	Minimal costs for staff time. Materials are available from FEMA and other agencies for free.
Potential Funding Sources:	Existing budgets. DHS: HMGP 5% Initiative
Lead Agency/Department Responsible:	Fire and Rescue, American Red Cross
Implementation Schedule:	Within one year.
ADDITIONAL COMMENTS	

FRANKLIN MITIGATION ACTION 6	
Increase protection and access/egress for critical facilities and infrastructure, primarily as a result of flooding. Elevate or floodproof new critical facilities; retrofit, relocate or repurpose existing facilities, and protect existing power line infrastructure. Mitigation projects may include acquisition, elevation, mitigation reconstruction projects, or retrofitting.	
BACKGROUND INFORMATION	
Site and Location:	Citywide, with particular emphasis on: 1. Relocating main fire station out of the Special Flood Hazard Area (100-year floodplain); 2. Regionally, along power line right-of-ways; and, 3. Wastewater treatment plant mitigation or relocation.
Cost Benefit:	Benefits are reduced response times, longevity of critical infrastructure and reduced downtime for utilities after a disaster. The fire station was constructed in 1979 and was flooded in 1999 and 2006. The wastewater treatment plant was built in the 1950s and is also located in the Special Flood Hazard Area and is subject to regular inundation. Recently completed Franklin Southampton shared Water/Sewer Study outlines costs and benefits of various alternatives.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Tropical/Coastal Storm, Winter Storm
Goal(s) Addressed:	Goal 1, Objective 1.1, 1.2, 1.3, 1.4, 1.5
Priority (High, Moderate, Low):	High
Estimated Cost:	Relocation of Fire Station estimated at $5.5 million. Relocation or Mitigation of Wastewater Treatment Plan estimated at $2.6 million
Potential Funding Sources:	DHS: PDM, HMGP, FMA; ACE: FCW, SFCP Dominion
Lead Agency/Department Responsible:	Fire Station – Franklin Fire & Rescue Public Works, with Franklin Power & Light, and Dominion
Implementation Schedule:	Within 3 to 4 years
ADDITIONAL COMMENTS	
Shared Water/Sewer study for Franklin and Southampton County will be presented to elected officials in January/February 2016. Existing power lines in the floodway and floodplain are current issues of concern. Some power lines are outside of the City but provide power to the City and there is concern that power outages during floods could be extensive. The City should move forward with identification of available, non-flood-prone sites for a new Fire Station.	

FRANKLIN MITIGATION ACTION 7	
Reduce the prevalence of hazardous trees by: 1) **Coordinating with the Beautification Committee to prepare and distribute guidelines for property owners on how to properly care for aging trees, especially at the onset of hurricane season. Use *City Clips* and the PEG channel for distribution.** 2) **Providing professional arborist tree hazard inspections on private property at property owner request.**	
BACKGROUND INFORMATION	
Site and Location:	Franklin is a designated "Tree City USA" and the Beautification Committee administers an ordinance regulating tree pruning on publicly owned property.
Cost Benefit:	Benefits accrue through reduced damages to people, structures and vehicles. Reduced power outages get the City back to full operability faster.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Tropical/Coastal Storm, Winter Storm, Wildfire
Goal(s) Addressed:	Goal 1, Objective 1.2, 1.5; Goal 2
Priority (High, Moderate, Low):	Medium
Estimated Cost:	1) Staff time 2) estimated $500 per visit
Potential Funding Sources:	VDOF Urban and Community Forestry Assistance, VDOT Transportation Enhancement Grants
Lead Agency/Department Responsible:	Public Works (has a Landscape Technician who sits on Beautification Committee)
Implementation Schedule:	1) within 1 year 2) within 3 years
ADDITIONAL COMMENTS	
Tree failure has been identified by citizens as a significant hazard concern. During high wind events, trees that have not been properly pruned represent a hazard to people, structures, power lines, and vehicles.	

FRANKLIN MITIGATION ACTION 8		
Coordinate with CSX and Norfolk-Southern to regulate and manage the amount, types and times of hazardous materials transport through Franklin, and in preparing for potential hazardous material incidents.		
BACKGROUND INFORMATION		
Site and Location:	CSX and Norfolk Southern rail lines	
Cost Benefit:	Through the low-cost exchange of transport information with the railroads, Franklin officials can maximize preparedness, and reduce potential damage from an incident occurring during peak travel times or special events.	
MITIGATION ACTION DETAILS		
Hazard(s) Addressed:	Hazardous Materials Incident	
Goal(s) Addressed:	Goal 1, Objectives 1.2, 1.3, 1.5; Goal 3, Objective 3.4	
Priority (High, Moderate, Low):	High	
Estimated Cost:	Minimal	
Potential Funding Sources:	n/a	
Lead Agency/Department Responsible:	Fire and Rescue	
Implementation Schedule:	Ongoing	
ADDITIONAL COMMENTS		
The nearby Town of Boykins in Southampton County has passed an ordinance prohibiting overnight or longer-term parking of hazardous materials rail cars within town limits.		

FRANKLIN MITIGATION ACTION 9		
Continue upgrades to radio system to increase interoperability between departments and neighboring communities.		
BACKGROUND INFORMATION		
Site and Location:	Citywide and Neighboring Agencies	
Cost Benefit:	Improved response capability builds community sustainability and increases citizen confidence in City services.	
MITIGATION ACTION DETAILS		
Hazard(s) Addressed:	Flooding, Tropical/Coastal Storm, Tornado, Winter Storm, Earthquake, Wildfire, Extreme Heat, Hazardous Materials Incident	
Goal(s) Addressed:	Goal 1, Objective 1.4	
Priority (High, Moderate, Low):	Moderate	
Estimated Cost:	$750,000	
Potential Funding Sources:	DHS: PDM, HMGP, HSGP	
Lead Agency/Department Responsible:	Police; Fire and Rescue	
Implementation Schedule:	Within 4 years	
ADDITIONAL COMMENTS		
While many substantial upgrades have been made in the past five years, additional upgrades remain necessary.		

FRANKLIN MITIGATION ACTION 10	
Install citywide wireless network that will allow users to have access to computer network in a mobile environment.	
BACKGROUND INFORMATION	
Site and Location:	Citywide
Cost Benefit:	Improves response capability, thereby reducing damages.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Tropical/Coastal Storm, Tornado, Winter Storm, Earthquake, Wildfire, Extreme Heat, Hazardous Materials Incident
Goal(s) Addressed:	Goal 1, Objective 1.4
Priority (High, Moderate, Low):	High
Estimated Cost:	$250,000
Potential Funding Sources:	DHS: PDM, HMGP, HMGP 5% Initiative, HSGP
Lead Agency/Department Responsible:	Police
Implementation Schedule:	Ongoing
ADDITIONAL COMMENTS	
Install a citywide wireless network that will allow emergency responders to access internet, street level maps of city, HAZMAT information, pre-fire plans, and VCIN/NCIC for law enforcement. Interoperable communications of information exchanged via secure instant messaging. Allows interoperability of outside agencies responding to an incident within the City of Franklin. Several systems have been tested in recent years, but none found adequate for designated purposes.	

FRANKLIN MITIGATION ACTION 11	
Upgrade existing GIS system to incorporate wildfire, NFIP flood maps and other risk information into the site plan review process for new development.	
BACKGROUND INFORMATION	
Site and Location:	Citywide
Cost Benefit:	A very low cost mitigation action with the benefit of raising awareness of wildfire and flood hazards at a time when the (readily available) information can be used in the development process to protect new structures and infrastructure.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Wildfire, Flooding, Sea Level Rise, Shoreline Erosion
Goal(s) Addressed:	Goal 3, Objective 3.2
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	Staff time
Potential Funding Sources:	Existing budgets; DHS: HMGP 5% Initiative
Lead Agency/Department Responsible:	Community Development
Implementation Schedule:	Immediately
ADDITIONAL COMMENTS	

FRANKLIN MITIGATION ACTION 12	
Help businesses develop multi-disaster recovery plans.	
BACKGROUND INFORMATION	
Site and Location:	Citywide
Cost Benefit:	Disaster recovery plans minimize or eliminate disruptions to the local economy and may reduce the need for insurance claims or business assistance after events.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Tropical/Coastal Storm, Tornado, Winter Storm, Earthquake, Wildfire, Hazardous Materials Incident
Goal(s) Addressed:	Goal 2
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$30,000
Potential Funding Sources:	DHS: HSGP
Lead Agency/Department Responsible:	Community Development, with Chamber of Commerce and Downtown Franklin Association
Implementation Schedule:	Within 2 years
ADDITIONAL COMMENTS	
Businesses with disaster recovery plans in place will reduce or eliminate the impact of future disasters on themselves and Franklin's local economy. The identification of potential hazard mitigation measures (i.e., building retrofits/elevation, secondary storage facilities, backup systems) should be encouraged.	

FRANKLIN MITIGATION ACTION 13	
Continue evaluating local schools as evacuation shelters and implement recommended upgrades or retrofit projects.	
BACKGROUND INFORMATION	
Site and Location:	Local schools, with emphasis on providing generator backup for Franklin High School.
Cost Benefit:	Having safe and adequate emergency evacuation shelters decreases the possibility of a shelter becoming unsafe during a disaster. Safe shelters increase citizen confidence in local officials. Response costs increase dramatically when citizens must evacuate out of town or to hotels.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Tropical/Coastal Storm, Tornado, Winter Storm, Earthquake, Wildfire, Extreme Heat, Hazardous Materials Incident
Goal(s) Addressed:	Goal 1, Objectives 1.2, 1.3, 1.4
Priority (High, Moderate, Low):	High
Estimated Cost:	Project-dependent; Generator for Franklin High School estimated at $250,000
Potential Funding Sources:	DHS: PDM, HMGP, HMGP 5% Initiative, HSGP
Lead Agency/Department Responsible:	Fire & Rescue/Community Development
Implementation Schedule:	Within 2 to 3 years
ADDITIONAL COMMENTS	
Initial evaluations are complete.	

FRANKLIN MITIGATION ACTION 14	
Require, through job description or other means, that additional staff member(s) of the Community Development Department maintain Certified Floodplain Manager (CFM) designation.	
BACKGROUND INFORMATION	
Site and Location:	Citywide
Cost Benefit:	Helps assure that floodplain management regulations are properly enforced and citizens have access to the most up to date flood mitigation techniques.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Sea Level Rise, Flooding, Tropical/Coastal Storm
Goal(s) Addressed:	Goal 1, Objectives 1.1, 1.2
Priority (High, Moderate, Low):	High
Estimated Cost:	<$750 annually for training and/or conference attendance
Potential Funding Sources:	Existing budgets
Lead Agency/Department Responsible:	Community Development
Implementation Schedule:	Ongoing
ADDITIONAL COMMENTS	
Current Director is a CFM and shared Building Official is a CFM. Community may receive credit through the CRS from having a CFM on staff.	

FRANKLIN MITIGATION ACTION 15	
Identify and repair or demolish unsafe, unsanitary or hazardous housing and other structures, including those in repetitive flood loss areas. Mitigation projects may include acquisition, relocation, elevation, mitigation reconstruction projects, and/or retrofitting.	
BACKGROUND INFORMATION	
Site and Location:	Citywide
Cost Benefit:	Unsafe housing increases the potential for loss of life and property due to several hazards. By identifying housing vulnerable to natural hazards and prioritizing those structures for repair or demolition, average annual damages due to hazards can be reduced.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Sea Level Rise, Tropical/Coastal Storm, Winter Storm, Tornado, Hazardous Materials Incident, Wildfire
Goal(s) Addressed:	Goal 1, Objectives 1.1, 1.2, 1.3; Goal 2, Objective 2.1
Priority (High, Moderate, Low):	High
Estimated Cost:	Costs vary based on structure needs. Generally, costs for demolition start at about $10,000 per structure, while rehabilitation and elevation together start at approximately $100,000 per structure.
Potential Funding Sources:	HUD: CDBG DHS: PDM, FMA, HMGP, RFC (CDBG funds may be applied as a non-Federal match to DHS grant funds)
Lead Agency/Department Responsible:	Community Development
Implementation Schedule:	Ongoing
ADDITIONAL COMMENTS	
Community has an ongoing housing needs assessment that must be partnered with this initiative.	

FRANKLIN MITIGATION ACTION 16	
Verify the geographic location of identified NFIP repetitive loss structures, and determine if those properties have been mitigated and, if so, by what means.	
BACKGROUND INFORMATION	
Site and Location:	Repetitive flood loss areas throughout the City
Cost Benefit:	Repetitively flooded structures strain local and federal resources after disasters, and detract from the fiscal solvency of the NFIP. The NFIP focuses mitigation efforts and funds on properties listed as repetitive losses; therefore, checking the accuracy of the list is a necessity for the NFIP, States and, through this action, local governments.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Sea Level Rise
Goal(s) Addressed:	Goal 3, Objective 3.2
Priority (High, Moderate, Low):	High
Estimated Cost:	Staff time estimated at $50 per structure x 6 structures = $300
Potential Funding Sources:	DHS: PDM, HMGP, HMGP 5% Initiative, FMA, RFC
Lead Agency/Department Responsible:	Planning
Implementation Schedule:	Ongoing
ADDITIONAL COMMENTS	
An initial attempt to contact property owners by mail will be followed up by phone calls, and site visits as necessary.	

SOUTHAMPTON COUNTY

SOUTHAMPTON COUNTY MITIGATION ACTION 1	
Identify suitable sites for new County Emergency Operations Center outside of the floodplain, or retrofit existing EOC. Require new public safety buildings be located outside 500-year floodplain and that a detailed flood study be conducted to determine limits of the 100- and 500-year floodplains for proposed public safety buildings near approximate A Zone floodplain.	
BACKGROUND INFORMATION	
Site and Location:	To be determined
Cost Benefit:	The current EOC is subject to flooding which can hinder response efforts during flood events. Benefits accrue by increasing response capabilities and reducing average annual flood damages and predicted downtime for a critical public safety structure.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding
Goal(s) Addressed:	Goal 1, Objectives 1.3, 1.4
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	Staff time
Potential Funding Sources:	Existing budgets; DHS: HMGP 5% Initiative
Lead Agency/Department Responsible:	County Administrator's Office
Implementation Schedule:	Within 3 years
ADDITIONAL COMMENTS	
The current County EOC is located in a designated flood hazard area along the Nottoway River.	

SOUTHAMPTON COUNTY MITIGATION ACTION 2	
Solicit the Virginia Department of Forestry for wildfire mitigation comments on proposed major subdivisions in the County.	
BACKGROUND INFORMATION	
Site and Location:	To be determined
Cost Benefit:	During the site plan review process, comments regarding smart wildfire avoidance techniques, such as defensible space, can be incorporated into the project design.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Wildfire
Goal(s) Addressed:	Goal 1; Goal 3, Objective 3.4
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	Staff time
Potential Funding Sources:	VDOF
Lead Agency/Department Responsible:	Community Development
Implementation Schedule:	Within 2 years
ADDITIONAL COMMENTS	

SOUTHAMPTON COUNTY MITIGATION ACTION 3	
Protect repetitively flooded structures, including the County courthouse, from flood damage. Modifications could include floodproofing retrofits, elevation of structure and/or critical components, acquisition, relocation or repurposing the structure. This action includes Mitigation Reconstruction projects.	
BACKGROUND INFORMATION	
Site and Location:	Countywide, including the County Courthouse
Cost Benefit:	Average annual flood damages would be reduced through mitigation actions.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Winter Storm
Goal(s) Addressed:	Goal 1, Objectives 1.1, 1.2, 1.3, 1.4, 1.5
Priority (High, Moderate, Low):	High
Estimated Cost:	To be determined
Potential Funding Sources:	DHS: PDM, HMGP, FMA, RFC; HSGP
Lead Agency/Department Responsible:	County Administrator's Office
Implementation Schedule:	Ongoing
ADDITIONAL COMMENTS	

SOUTHAMPTON COUNTY MITIGATION ACTION 4	
Complete five remaining countywide drainage studies that prioritize drainage maintenance requirements and stormwater management projects to minimize flooding problems. Implement recommendations. This action may include Climate Resilient Mitigation Activities (CRMA).	
BACKGROUND INFORMATION	
Site and Location:	One study proposed for each County planning area (Newsoms has been completed)
Cost Benefit:	The exact nature of flooding problems merits additional study before the costs and benefits of individual flood mitigation projects can be calculated with accuracy, and in order to determine which drainage maintenance projects maximize benefits from reduced flooding. Much of the County has only been studied to show approximate A Zone floodplains. If CRMA are included, additional benefits from environmental or ecosystem benefits may be included in the benefits cost analysis.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding
Goal(s) Addressed:	Goal 1, Objectives 1.1, 1.2, 1.3, 1.4, 1.5
Priority (High, Moderate, Low):	High
Estimated Cost:	$250,000
Potential Funding Sources:	DHS: PDM, HMGP, HMGP/CRMA, HSGP; USDA: WPFP
Lead Agency/Department Responsible:	County Administrator's Office
Implementation Schedule:	Within 5 years of plan adoption
ADDITIONAL COMMENTS	
Many storm drainage ditches were constructed in the 1930's and are not maintained.	

SOUTHAMPTON COUNTY MITIGATION ACTION 5	
	**Implement necessary shelter retrofits and improvements to Southampton County High School.**
BACKGROUND INFORMATION	
Site and Location:	Southampton County High School
Cost Benefit:	Structure suffered damages during Hurricane Isabel, 2003, and Hurricane Floyd, 1999.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Tropical/Coastal Storm, Tornado, Winter Storm, Earthquake, Wildfire, Extreme Heat, Hazardous Materials Incident
Goal(s) Addressed:	Goal 1, Objective 1.2, 1.3, 1.4
Priority (High, Moderate, Low):	High
Estimated Cost:	$250,000
Potential Funding Sources:	DHS: PDM, HMGP, HMGP 5% Initiative, HSGP
Lead Agency/Department Responsible:	County Administrator's Office
Implementation Schedule:	Within 1 year
ADDITIONAL COMMENTS	
Southampton County High School serves as the County's designated shelter. Existing skylight has been determined to be a potential problem.	

SOUTHAMPTON COUNTY MITIGATION ACTION 6	
Institute annual direct mail educational program to provide multi-hazard structural protection techniques to property owners. Include information on responsible tree pruning.	
BACKGROUND INFORMATION	
Site and Location:	Countywide
Cost benefit:	Low-cost protection measures help citizens help themselves.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Tropical/Coastal Storm, Tornado, Winter Storm, Earthquake, Wildfire
Goal(s) Addressed:	Goal 2, Objective 2.1
Priority (High, Moderate, Low):	High
Estimated Cost:	Approximately $2,500 annually
Potential Funding Sources:	DHS: PDM, HGSP, HMGP, HMGP 5% Initiative; American Red Cross; FEMA materials available at no charge
Lead Agency/Department Responsible:	County Administrator's Office
Implementation Schedule:	Within 2 years
ADDITIONAL COMMENTS	
Particular life/safety concerns were identified, specifically related to driving on roads that have been or could be flooded, and promoting water conservation techniques during widespread power outages.	

SOUTHAMPTON COUNTY MITIGATION ACTION 7	
Verify the geographic location of all NFIP repetitive losses, and make inquiries as to whether the properties have been mitigated, and if so, by what means.	
BACKGROUND INFORMATION	
Site and Location:	Countywide
Cost Benefit:	Average annual flood damages would be reduced through mitigation actions.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Winter Storm
Goal(s) Addressed:	Goal 1; Goal 3, Objective 3.2
Priority (High, Moderate, Low):	High
Estimated Cost:	To be determined
Potential Funding Sources:	DHS: PDM, HMGP, HMGP 5% Initiative, FMA, RFC; HSGP
Lead Agency/Department Responsible:	County Administrator's Office
Implementation Schedule:	Ongoing
ADDITIONAL COMMENTS	

SOUTHAMPTON COUNTY MITIGATION ACTION 8	
Provide Certified Floodplain Manager (CFM) training for two employees.	
BACKGROUND INFORMATION	
Site and Location:	Countywide
Cost Benefit:	Training related to implementation of floodplain management regulations, permitting, reading Flood Insurance Rate Maps, and other topics will help Town staff properly administer floodplain management regulations, thereby protecting future development from flood damage.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding
Goal(s) Addressed:	Goal 1, Objectives 1.1, 1.2
Priority (High, Moderate, Low):	High. Current CFM is within retirement range.
Estimated Cost:	<$1,000 in training and certification costs
Potential Funding Sources:	Department training funds
Lead Agency/Department Responsible:	Franklin Southampton Department of Community Development
Implementation Schedule:	Within 2 years of plan adoption
ADDITIONAL COMMENTS	
There is only one CFM on the combined County/Franklin staff. With Franklin seeking to take part in the CRS program, there is an increased need for depth at that position. Also, the towns in the County will turn floodplain management over to the shared staff, so additional certification will be needed.	

SOUTHAMPTON COUNTY MITIGATION ACTION 10	
Secure Memorandums of Understanding for floodplain management between Franklin Southampton Community Development Department and towns.	
BACKGROUND INFORMATION	
Site and Location:	NFIP communities in Southampton County
Cost Benefit:	Although floodplain regulations reside in zoning ordinances and the towns have their own zoning ordinances, they do not have CFMs or other trained personnel on staff. Putting all floodplain management issues in one department helps ensure compliance, which reduces flood damage in the long-term.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding
Goal(s) Addressed:	Goal 1, Objective 1.2; Goal 3, Objective 3.4
Priority (High, Moderate, Low):	High
Estimated Cost:	None
Potential Funding Sources:	N/A
Lead Agency/Department Responsible:	Community Development staff, with Board of Supervisors and Town Councils
Implementation Schedule:	Within 2 years of plan adoption
ADDITIONAL COMMENTS	

SOUTHAMPTON COUNTY MITIGATION ACTION 11	
Provide necessary training and certification to all Stormwater Management Program staff.	
BACKGROUND INFORMATION	
Site and Location:	Countywide
Cost Benefit:	Regardless of cost, this is a state requirement.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding
Goal(s) Addressed:	Goal 1, Objectives 1.1, 1.2, 1.3, 1.5, 1.6; Goal 3, Objective 3.1
Priority (High, Moderate, Low):	High, required by DEQ
Estimated Cost:	$500-$1,000 annually per person
Potential Funding Sources:	Department budgets
Lead Agency/Department Responsible:	Community Development Department
Implementation Schedule:	Annually
ADDITIONAL COMMENTS	
Stormwater management is an important component of the floodplain management program, as on-site SWM helps limit the amount of stormwater leaving a site and impacting the community. Continued training helps staff learn the most effective means of managing stormwater and maintaining the system.	

SOUTHAMPTON COUNTY MITIGATION ACTION 12	
Put administrative procedures in place to stringently enforce 18-inch freeboard requirement for new and substantially improved structures in the County's FEMA-designated Special Flood Hazard Areas.	
BACKGROUND INFORMATION	
Site and Location:	The County and Town's FEMA-designated Special Flood Hazard Areas
Cost Benefit:	More stringent measures for flood prone structures, such as freeboard, have a very small upfront cost that is recovered within approximately 10 years through lower flood insurance costs. The reduction in average annual damages with 18 inches of freeboard is substantial.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding
Goal(s) Addressed:	Goal 1, Objectives 1.1, 1.2; Goal 3, Objective 3.1
Priority (High, Moderate, Low):	High
Estimated Cost:	Staff time
Potential Funding Sources:	In current department budget
Lead Agency/Department Responsible:	Community Development Department
Implementation Schedule:	Upon adoption of freeboard in each community. County adopted freeboard December 21, 2015.
ADDITIONAL COMMENTS	
This action partially addressed when Building Official gained CFM designation with shared services.	

SOUTHAMPTON COUNTY MITIGATION ACTION 13	
Enact tree preservation or landscape ordinance for new construction.	
BACKGROUND INFORMATION	
Site and Location:	Countywide
Cost Benefit:	Tree protection and landscape requirements mitigate effects of erosion and can contribute to stormwater management for new construction by requiring greater pervious areas and retention of existing landscaped areas.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Shoreline Erosion, Winter Storm, Wildfire
Goal(s) Addressed:	Goal 1, Objectives 1.1, 1.2, 1.3, 1.5, 1.6, Goal 3, Objective 3.1
Priority (High, Moderate, Low):	Low
Estimated Cost:	Staff time only
Potential Funding Sources:	DHS: HMGP 5% Initiative
Lead Agency/Department Responsible:	County Administrator/Public Works Department/Community Development Department
Implementation Schedule:	Over the next 5 to 7 years
ADDITIONAL COMMENTS	
County does not have capacity to clear and maintain ditches as roads are maintained almost exclusively by VDOT. Keeping them clear of debris/vegetation and in good repair helps the movement of stormwater during severe rainfall.	

SOUTHAMPTON COUNTY MITIGATION ACTION 14	
Encourage Litter Control Council and citizen groups to become more involved in roadside clean-ups to keep roadside ditches clear of debris.	
BACKGROUND INFORMATION	
Site and Location:	Countywide
Cost Benefit:	Citizen involvement in ditch maintenance reduces costs to County and VDOT for ditch maintenance.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Shoreline Erosion, Winter Storm
Goal(s) Addressed:	Goal 1, Objectives 1.2, 1.5, 1.6, Goal 2, Objective 2.1; Goal 3, Objective 3.3
Priority (High, Moderate, Low):	Low
Estimated Cost:	<$5,000
Potential Funding Sources:	Grants for Litter Control Council
Lead Agency/Department Responsible:	Public Works (staff liaison to Litter Control Council)
Implementation Schedule:	Over the next 5 to 7 years
ADDITIONAL COMMENTS	

SOUTHAMPTON COUNTY MITIGATION ACTION 15	
Increase use of Reverse 911 by citizens. Registration for the service is required and is currently advertised primarily on county web site.	
BACKGROUND INFORMATION	
Site and Location:	Countywide
Cost Benefit:	Reverse 911 has a cost to the County, but increased users are needed to make the system as cost-effective as possible.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Tropical/Coastal Storm, Tornado, Winter Storm, Earthquake, Wildfire, Extreme Heat, Hazardous Materials Incident
Goal(s) Addressed:	Goal 1, Objectives 1.2, 1.4, 1.5, Goal 2, Objective 2.1, Goal 3, Objective 3.1
Priority (High, Moderate, Low):	High
Estimated Cost:	<$2,500
Potential Funding Sources:	To be determined.
Lead Agency/Department Responsible:	County Administration, with help from Sheriff's Office, School Board, volunteer fire/rescue squads, churches, Social Services Department, Health Department
Implementation Schedule:	
ADDITIONAL COMMENTS	
Public Utility bills and County tax bills are a possible method for advertising the Reverse 911 service.	

SOUTHAMPTON COUNTY MITIGATION ACTION 16	
Incorporate flood mitigation measures when flood-prone public buildings are undergoing non-substantial renovations.	
BACKGROUND INFORMATION	
Site and Location:	Countywide
Cost Benefit:	County buildings undergo periodic renovations. Flood (and wind) retrofits could be scheduled into regular renovations at lower cost but with substantial benefits.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, possibly Tornado, Tropical/Coastal Storm and Winter Storm
Goal(s) Addressed:	Goal 1, Objectives 1.1, 1.2, 1.3, 1.4, 1.5; Goal 3, Objective 3.1
Priority (High, Moderate, Low):	Medium
Estimated Cost:	To be determined
Potential Funding Sources:	DHS: PDM, HMGP
Lead Agency/Department Responsible:	County Administration, Board of Supervisors
Implementation Schedule:	Long-term over the next 10 years
ADDITIONAL COMMENTS	
Improvements may be able to take place incrementally so as to spread costs over a number of renovation projects. Step 1: Assess impacted buildings so plan can be prepared for future actions as renovations occur. Step 2: Include mitigation measures in job specifications.	

SOUTHAMPTON COUNTY MITIGATION ACTION 17	
Include hazard mitigation discussion in budget preparation discussions.	
BACKGROUND INFORMATION	
Site and Location:	Countywide
Cost Benefit:	The process for funding other mitigation actions included in this plan must begin with countywide budget priorities. There is no cost to including a discussion of the hazards and vulnerability to which the county is exposed, but the benefits accrue as mitigation actions get implemented.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	All
Goal(s) Addressed:	Goal 1, Objectives 1.2, 1.3, 1.4, 1.5; Goal 3, Objectives 3.1, 3.3
Priority (High, Moderate, Low):	High
Estimated Cost:	Staff time
Potential Funding Sources:	N/A
Lead Agency/Department Responsible:	Director/Coordinator of Emergency Management
Implementation Schedule:	Annually
ADDITIONAL COMMENTS	
Funds for mitigation efforts are necessary. Some costs are minimal (e.g., direct mail, web updates), some are expensive (e.g., structural mitigation, relocation of critical facilities). It is important for all County staff to look at hazard mitigation as a set of on-going actions rather than as a hard copy plan on a bookshelf.	

SOUTHAMPTON COUNTY MITIGATION ACTION 18	
Implement drainage plan for Newsoms area. The plan was created through a DHCD grant, but is not currently funded. Seek additional funding sources. Through the use of green infrastructure, this action may include Climate Resilient Mitigation Activities (CRMA).	
BACKGROUND INFORMATION	
Site and Location:	Newsoms
Cost Benefit:	Drainage study and plan are completed and provide steps necessary to fix drainage problems and repair damaged homes.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding
Goal(s) Addressed:	Goal 1, Objectives 1.1, 1.2, 1.3, 1.4, 1.5; Goal 2, Objective 2.1; Goal 3, Objectives 3.1, 3.3
Priority (High, Moderate, Low):	High
Estimated Cost:	\$50,000 - \$500,000, per plan, which was broken into several geographic areas, so phased implementation is feasible.
Potential Funding Sources:	DHS: HMGP, HMGP/CRMA
Lead Agency/Department Responsible:	Director/Coordinator of Emergency Management
Implementation Schedule:	Annually
ADDITIONAL COMMENTS	

TOWN OF BOYKINS

TOWN OF BOYKINS MITIGATION ACTION 1			
Continue to support ongoing North Carolina / Virginia railroad efforts to widen and deepen ditches on both sides of railroad tracks south of Highway 186 to S. Railroad St., then back on Tarrara Swamp.			
BACKGROUND INFORMATION			
Site and Location:	Highway 186 to South Railroad Street		
Benefit Cost:	This area floods with high frequency and may be impeding free-flow of water to and through Tarrara Swamp.		
MITIGATION ACTION DETAILS			
Hazard(s) Addressed:		Flooding	
Goal(s) Addressed:		Goal 1, Objectives 1.1, 1.2, 1.3, 1.5; Goal 3	
Priority (High, Moderate, Low):		High	
Estimated Cost:		No cost to town	
Potential Funding Sources:		None needed	
Lead Agency/Department Responsible:		Town of Boykins Mayor's Office	
Implementation Schedule:		Ongoing	
ADDITIONAL COMMENTS			
Elimination of standing water in this area will also benefit mosquito control efforts.			

TOWN OF BOYKINS MITIGATION ACTION 2	
Continue to coordinate with Dominion Power on upgrading all poles, wires, attachments and generators (complete upgrade of services), removing all poles from swamp area and mitigating tree limb damage.	
BACKGROUND INFORMATION	
Site and Location:	Throughout Town
Benefit Cost:	Frequent outages during wind, thunderstorms and ice events affect residents and emergency response capabilities.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Tropical/Coastal Storm, Winter Storm, Wildfire
Goal(s) Addressed:	Goal 1, Objective 1.3; Goal 3, Objective 3.4
Priority (High, Moderate, Low):	High
Estimated Cost:	None to town
Potential Funding Sources:	DHS: HMGP
Lead Agency/Department Responsible:	Town of Boykins Mayor's Office
Implementation Schedule:	Ongoing
ADDITIONAL COMMENTS	
Significant progress has been made on this initiative between 2006 and 2011, but additional tasks remain.	

TOWN OF BOYKINS MITIGATION ACTION 3	
Broaden outreach for and increase participation in Reverse 911 citizen notification system for multiple hazards.	
BACKGROUND INFORMATION	
Site and Location:	Throughout Town
Benefit Cost:	A coordinated warning system for multiple hazards gives citizens time and opportunity to prepare for an event and to protect life and property.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Tornado, Wildfire, Flooding, Hazardous Materials Incident, Extreme Heat
Goal(s) Addressed:	Goal 2
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$5,000
Potential Funding Sources:	DHS: PDM, HGSP, HMGP, HMGP 5% Initiative
Lead Agency/Department Responsible:	Town of Boykins Mayor's Office
Implementation Schedule:	Within 4 years
ADDITIONAL COMMENTS	
This action could be coordinated with the County.	

TOWN OF BOYKINS MITIGATION ACTION 4	
Coordinate with Southampton County and the American Red Cross on public education and awareness campaigns to ensure citizens are knowledgeable of protective preparedness and mitigation activities that will lessen the potential impacts of disasters. Include information about the availability and value of flood insurance through the Town's participation in the National Flood Insurance Program (NFIP).	
BACKGROUND INFORMATION	
Site and Location:	Throughout Town
Benefit Cost:	Low-cost protection measures help citizens help themselves.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	All
Goal(s) Addressed:	Goal 1, Goal 2, and Goal 3
Priority (High, Moderate, Low):	High
Estimated Cost:	To be determined
Potential Funding Sources:	DHS: PDM, HGSP, HMGP, HMGP 5% Initiative; American Red Cross; FEMA materials provided at no charge
Lead Agency/Department Responsible:	Town of Boykins
Implementation Schedule:	Continuous
ADDITIONAL COMMENTS	
Particular life/safety concerns were identified, specifically related to driving on roads that have been or could be flooded, and promoting water conservation techniques during widespread power outages. Distribution of information on the value and availability of flood insurance is representative of the Town's Strategy for Continued Participation in the NFIP.	

TOWN OF BOYKINS MITIGATION ACTION 5	
Acquire floodprone structures and convert land to open space. Other mitigation measures may include elevation, retrofit, mitigation reconstruction projects, or relocation of floodprone structures.	
BACKGROUND INFORMATION	
Site and Location:	Flood-prone areas throughout town
Benefit Cost:	Additional flood-prone structures targeted for mitigation may be identified after future disasters.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding
Goal(s) Addressed:	Goal 1, Objectives 1.1, 1.2
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$25,000 for land; $5,000 for each demolition
Potential Funding Sources:	DHS: HMGP, PDM, FMA
Lead Agency/Department Responsible:	Town of Boykins Mayor’s Office
Implementation Schedule:	To be determined
ADDITIONAL COMMENTS	
Several high priority flood-prone homes on Spring Street have been purchased and the land converted to open space.	

TOWN OF BRANCHVILLE

TOWN OF BRANCHVILLE MITIGATION ACTION 1	
Enhance the community center's ability to serve as an assembly point, distribution and information center during disasters, whether long- or short-term events.	
BACKGROUND INFORMATION	
Site and Location:	Community Center in the Town of Branchville
Benefit Cost:	The center has served as a temporary shelter, but is not equipped to do so safely. Benefits accrue when residents are protected and do not have to be housed in motels.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Sea Level Rise, Tropical/Coastal Storm, Tornado, Winter Storm, Shoreline Erosion, Earthquake, Wildfire, Drought, Extreme Heat, Hazardous Materials Incident
Goal(s) Addressed:	Goal 1, Objectives 1.3, 1.4, 1.5
Priority (High, Moderate, Low):	High
Estimated Cost:	$20,000
Potential Funding Sources:	DHS: PDM, HMGP, HMGP 5% Initiative, HSGP
Lead Agency/Department Responsible:	Town of Branchville
Implementation Schedule:	Within 2 years
ADDITIONAL COMMENTS	
The Community Center has served as a short term staging area for distributing donated goods and foods to disaster victims during Hurricane Isabel in 2003, a 2002 HAZMAT incident, an ice storm in 2000, and Hurricane Floyd in 1999. However, this building is not equipped with a big enough kitchen, stockpiled foods, blankets and beds to accommodate evacuees or displaced residents at times when Branchville becomes isolated.	

TOWN OF BRANCHVILLE MITIGATION ACTION 2	
	**Coordinate with Southampton County regarding expansion of the culvert under the local CSX railroad trestle to minimize future flooding events.**
BACKGROUND INFORMATION	
Site and Location:	The culvert is located 0.2 miles east of the Town of Branchville on Highway 186.
Benefit Cost:	Hurricane Isabel-2003, Hurricane Floyd-1999, and other major storm events have routinely flooded residential areas in the Whitehead Road area and along Highway 666. Expansion of the culvert would reduce the annual flood damages in the area. On Whitehead Road, flood waters have come up to houses, flooded garages, and inundated areas underneath houses. Along Highway 666 the water has flooded areas surrounding houses, but most are elevated 12-18 inches above grade. Flood damages have not been confirmed. Flood waters have also reached the nearby church, with no damages confirmed. During Hurricane Floyd, caskets floated out of the ground.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Sea Level Rise
Goal(s) Addressed:	Goal 1, Objective 1.1, 1.2, 1.3, 1.4, 1.5; Goal 3
Priority (High, Moderate, Low):	High
Estimated Cost:	To be determined; requires engineering study
Potential Funding Sources:	DHS: PDM, HMGP; CSX
Lead Agency/Department Responsible:	Town of Branchville and Southampton County
Implementation Schedule:	Within 4 years
ADDITIONAL COMMENTS	
A small culvert (approximately 5’ x 4’) on the CSX railroad track located just outside of town caused widespread flooding in the north areas of Whitehead Road and has resulted in property damages. Railroad trestle blocks up, and “acts like a dam” causing the north side of Highway 186 to flood. Future flooding could cause repeated damages to residential structures in the area. Most flooding problems occur in unincorporated Southampton County – not in town limits – but one of the creeks is within town limits. People look to the Town for help.	

TOWN OF BRANCHVILLE MITIGATION ACTION 3	
Coordinate with Southampton County and the American Red Cross on extensive public education and awareness campaigns to ensure citizens are knowledgeable of protective preparedness and mitigation activities that will lessen the potential impacts of disasters. Include information about the availability and value of flood insurance through the Town's participation in the National Flood Insurance Program (NFIP).	
BACKGROUND INFORMATION	
Site and Location:	Throughout Town
Benefit Cost:	Low-cost protection measures help citizens help themselves.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	All
Goal(s) Addressed:	Goal 1, Goal 2, and Goal 3
Priority (High, Moderate, Low):	High
Estimated Cost:	To be determined
Potential Funding Sources:	DHS: PDM, HGSP, HMGP, HMGP 5% Initiative; American Red Cross; FEMA materials provided at no charge
Lead Agency/Department Responsible:	Town of Branchville
Implementation Schedule:	Continuous
ADDITIONAL COMMENTS	
Particular life/safety concerns were identified, specifically related to driving on roads that have been or could be flooded, and promoting water conservation techniques during widespread power outages. Distribution of information on the value and availability of flood insurance is representative of the Town's Strategy for Continued Participation in the NFIP. Distribution of information on the value and availability of flood insurance is considered a strategy for continued participation in the NFIP.	

TOWN OF BRANCHVILLE MITIGATION ACTION 4	
Educate town residents what can be expected following major disaster events and how to be prepared to be on their own for at least 72 hours before outside help arrives.	
BACKGROUND INFORMATION	
Site and Location:	Town of Branchville and surrounding communities
Benefit Cost:	In both Hurricane Isabel, 2003, and Hurricane Floyd, 1999, Branchville residents would have benefitted from better knowledge about how to prepare.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Tropical/Coastal Storm, Tornado, Winter Storm, Earthquake, Wildfire, Drought, Extreme Heat, Hazardous Materials Incident
Goal(s) Addressed:	Goal 2, Objective 2.1
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	Staff time
Potential Funding Sources:	N/A
Lead Agency/Department Responsible:	Town of Branchville
Implementation Schedule:	Continuous
ADDITIONAL COMMENTS	

TOWN OF BRANCHVILLE MITIGATION ACTION 5	
Request, gather and assist in distribution of information regarding regional evacuation plans in Virginia *and* North Carolina.	
BACKGROUND INFORMATION	
Site and Location:	Town of Branchville and surrounding communities
Benefit Cost:	Branchville resources are limited and the community is unable to house evacuees from outside the immediate area.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Tropical/Coastal Storm, Flooding, Winter Storm, Wildfire, Hazardous Materials Incident
Goal(s) Addressed:	Goal 2; Goal 3, Objective 3.1, 3.4
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	Staff time; and limited copying costs
Potential Funding Sources:	VDEM, NC Division of Emergency Management, Virginia Department of Transportation
Lead Agency/Department Responsible:	Town of Branchville
Implementation Schedule:	Within 5 years
ADDITIONAL COMMENTS	
During Hurricanes Isabel and Floyd, many evacuees from North Carolina ended up in Branchville for food, lodging and other needs. However, the Town was isolated from other major cities and lacked resources to accommodate evacuees. It is necessary to distribute information regionally on recognized evacuation routes to better guide evacuees from North Carolina, and to stockpile maps and road signs and other information about official emergency shelters.	

TOWN OF BRANCHVILLE MITIGATION ACTION 6	
Protect repetitively flooded structures from flood damage. Actions could include floodproofing retrofits, elevation of structure and/or critical components, acquisition and then demolition, relocation or repurposing of structure(s). This action includes Mitigation Reconstruction projects.	
BACKGROUND INFORMATION	
Site and Location:	Townwide
Cost Benefit:	Average annual flood damages would be reduced through mitigation actions.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Sea Level Rise, Winter Storm
Goal(s) Addressed:	Goal 1, Objective 1.1, 1.2
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	To be determined
Potential Funding Sources:	DHS: PDM, HMGP, FMA, RFC; HSGP
Lead Agency/Department Responsible:	Town Office
Implementation Schedule:	Ongoing
ADDITIONAL COMMENTS	

TOWN OF CAPRON

TOWN OF CAPRON MITIGATION ACTION 1	
Coordinate with Southampton County and the American Red Cross on extensive public education and awareness campaigns to ensure citizens are knowledgeable of protective preparedness and mitigation activities that will lessen the potential impacts of disasters.	
BACKGROUND INFORMATION	
Site and Location:	Throughout Town
Benefit Cost:	Low-cost protection measures help citizens help themselves.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	All
Goal(s) Addressed:	Goal 1, Goal 2, and Goal 3
Priority (High, Moderate, Low):	High
Estimated Cost:	To be determined
Potential Funding Sources:	DHS: PDM, HGSP, HMGP; American Red Cross; FEMA materials provided at no charge
Lead Agency/Department Responsible:	Town of Capron
Implementation Schedule:	Continuous
ADDITIONAL COMMENTS	
Particular life/safety concerns were identified regarding driving on roads that have been or could be flooded, and promoting water conservation techniques during widespread power outages.	

TOWN OF COURTLAND

TOWN OF COURTLAND MITIGATION ACTION 1	
Continue to implement stormwater drainage projects. **This action may include Climate Resilient Mitigation Activities (CRMA).**	
BACKGROUND INFORMATION	
Site and Location:	Throughout Courtland
Benefit Cost:	There have been multiple precipitation events, with excess stormwater causing damage to buildings, cars, cemetery plots and trees.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Sea Level Rise, Shoreline Erosion
Goal(s) Addressed:	Goal 1, Objectives 1.1, 1.2, 1.3, 1.4, 1.5
Priority (High, Moderate, Low):	High
Estimated Cost:	Project dependent
Potential Funding Sources:	DHS: HMGP/CRMA
Lead Agency/Department Responsible:	Town of Courtland
Implementation Schedule:	Ongoing
ADDITIONAL COMMENTS	
Recent progress has been made, but additional measures may be called for in the future, including use of an existing pond for drainage retention. VDOT has cleared lines, and regular maintenance and inspection is part of keeping the stormwater system operating well.	

TOWN OF COURTLAND MITIGATION ACTION 2	
Broaden outreach for and increase participation in Reverse 911 citizen notification system for multiple hazards.	
BACKGROUND INFORMATION	
Site and Location:	Throughout town
Benefit Cost:	A coordinated warning system for multiple hazards gives citizens time and opportunity to prepare for an event and to protect life and property.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Wildfire, Tornado, Tropical/Coastal Storm, Flooding, Hazardous Materials Incident, Extreme Heat
Goal(s) Addressed:	Goal 2
Priority (High, Moderate, Low):	High
Estimated Cost:	$5,000
Potential Funding Sources:	DHS: PDM, HGSP, HMGP, HMGP 5% Initiative
Lead Agency/Department Responsible:	Town of Courtland; Southampton County
Implementation Schedule:	As soon as possible
ADDITIONAL COMMENTS	
The Town is tied into the County’s Reverse 911 system, but additional action is necessary particularly to increase citizen activation.	

TOWN OF COURTLAND MITIGATION ACTION 3	
Evaluate and retrofit Courtland Elementary School to serve as a public shelter.	
BACKGROUND INFORMATION	
Site and Location:	Courtland Elementary School
Benefit Cost:	Additional public shelter would benefit evacuees in the region.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Tropical/Coastal Storm, Tornado, Winter Storm, Earthquake, Wildfire, Drought, Extreme Heat, Hazardous Materials Incident
Goal(s) Addressed:	Goal 1, Objective 1.2, 1.3
Priority (High, Moderate, Low):	High
Estimated Cost:	To be determined
Potential Funding Sources:	DHS**:** PDM, HGSP, HMGP, HMGP 5% Initiative
Lead Agency/Department Responsible:	Town of Courtland and the American Red Cross
Implementation Schedule:	As soon as possible
ADDITIONAL COMMENTS	
This building has been identified as having potential to serve as a shelter. Some mitigation actions have been implemented, but additional retrofits are necessary.	

TOWN OF COURTLAND MITIGATION ACTION 4	
Coordinate with Southampton County and the American Red Cross on extensive public education and awareness campaigns to ensure citizens are knowledgeable of protective preparedness and mitigation activities that will lessen the potential impacts of disasters. Include information about the availability and value of flood insurance through the Town's participation in the National Flood Insurance Program (NFIP).	
BACKGROUND INFORMATION	
Site and Location:	Throughout Town
Benefit Cost:	Low-cost protection measures help citizens help themselves.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	All
Goal(s) Addressed:	Goal 1, Goal 2, and Goal 3
Priority (High, Moderate, Low):	High
Estimated Cost:	To be determined
Potential Funding Sources:	DHS: PDM, HGSP, HMGP; American Red Cross; FEMA materials provided at no charge
Lead Agency/Department Responsible:	Town of Courtland, Southampton County
Implementation Schedule:	Continuous
ADDITIONAL COMMENTS	
Particular life/safety concerns were identified related to driving on roads that have been or could be flooded, and promoting water conservation techniques during widespread power outages. Distribution of information on the value and availability of flood insurance is representative of the Town's Strategy for Continued Participation in the NFIP.	

TOWN OF COURTLAND MITIGATION ACTION 5	
Protect repetitively flooded structures from flood damage. Actions could include floodproofing retrofits, elevation of structure and/or critical components, acquisition and then demolition, relocation or repurposing of structure(s). This action includes Mitigation Reconstruction projects.	
BACKGROUND INFORMATION	
Site and Location:	Townwide
Cost Benefit:	Average annual flood damages would be reduced through mitigation actions.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Sea Level Rise, Winter Storm
Goal(s) Addressed:	Goal 1, Objectives 1.1, 1.2
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	To be determined
Potential Funding Sources:	DHS: PDM, HMGP, FMA, RFC; HSGP
Lead Agency/Department Responsible:	Town Office
Implementation Schedule:	Ongoing
ADDITIONAL COMMENTS	
Town officials noted that there are no flood-prone town-owned structures of concern.	

TOWN OF IVOR

TOWN OF IVOR MITIGATION ACTION 1	
Conduct a public awareness campaign on burning laws in order to reduce the number of occurrences of wildfires.	
BACKGROUND INFORMATION	
Site and Location:	Ivor and surrounding areas identified as high risk for wildfire.
Benefit Cost:	Laws are designed to prevent high risk burning by property owners, so knowledge of those laws is critical to preventing wildfire. Benefits accrue through reduced wildfire damages.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Wildfire
Goal(s) Addressed:	Goal 2
Priority (High, Moderate, Low):	High
Estimated Cost:	$5,000 per year
Potential Funding Sources:	Virginia Department of Forestry (VDOF); DHS: HMGP 5% Initiative
Lead Agency/Department Responsible:	Town, in coordination with the Virginia Department of Forestry
Implementation Schedule:	Annually, prior to and during burning season
ADDITIONAL COMMENTS	
Work with VDOF to establish a more aggressive public awareness campaign to inform citizens of the burning laws and the consequences of breaking these laws.	

TOWN OF IVOR MITIGATION ACTION 2	
Establish buffer zones between residential construction and wooded areas in high wildfire risk zones.	
BACKGROUND INFORMATION	
Site and Location:	Ivor and surrounding areas identified as high risk for wildfire.
Benefit Cost:	Early identification of high wildfire zones during the development process allows easier incorporation of protection measures in the project design.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Wildfire
Goal(s) Addressed:	Goal 1, Objectives 1.2, 1.6
Priority (High, Moderate, Low):	High
Estimated Cost:	Staff time
Potential Funding Sources:	N/A
Lead Agency/Department Responsible:	Town, in coordination with Southampton County Department of Community Development
Implementation Schedule:	Within 2 years
ADDITIONAL COMMENTS	
Work with Southampton County Community Development staff to inform developers and individual homeowners if they are considering building in a high risk area for wildfire, and make suggestions on buffer zones for defensible space purposes.	

TOWN OF IVOR MITIGATION ACTION 3	
Coordinate with Southampton County and the American Red Cross on public education and awareness campaigns to ensure citizens are knowledgeable of protective preparedness and mitigation activities that will lessen the potential impacts of disasters. Include information about the availability and value of flood insurance through the Town's participation in the National Flood Insurance Program (NFIP).	
BACKGROUND INFORMATION	
Site and Location:	Throughout Town
Benefit Cost:	Hurricane Isabel, 2003 Hurricane Floyd, 1999 Multiple winter storms, severe thunderstorms and hazardous material events
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	All
Goal(s) Addressed:	Goal 1, Goal 2, and Goal 3
Priority (High, Moderate, Low):	High
Estimated Cost:	To be determined
Potential Funding Sources:	DHS: PDM, HGSP, HMGP; American Red Cross; FEMA materials provided at no charge
Lead Agency/Department Responsible:	Town of Ivor
Implementation Schedule:	Continuous
ADDITIONAL COMMENTS	
Particular life/safety concerns were identified related to driving on roads that have been or could be flooded, and promoting water conservation techniques during widespread power outages. Distribution of information on the value and availability of flood insurance is representative of the Town's Strategy for Continued Participation in the NFIP.	

TOWN OF IVOR MITIGATION ACTION 4	
Protect repetitively flooded structures from flood damage. Actions could include floodproofing retrofits, elevation of structure and/or critical components, acquisition and then demolition, relocation or repurposing of structure(s). This action includes Mitigation Reconstruction projects.	
BACKGROUND INFORMATION	
Site and Location:	Townwide
Cost Benefit:	Average annual flood damages would be reduced through mitigation actions.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Sea Level Rise, Winter storm
Goal(s) Addressed:	Goal 1, Objectives 1.1, 1.2
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	To be determined
Potential Funding Sources:	DHS: PDM, HMGP, FMA, RFC; HSGP
Lead Agency/Department Responsible:	Town Office
Implementation Schedule:	Ongoing
ADDITIONAL COMMENTS	

TOWN OF NEWSOMS

TOWN OF NEWSOMS MITIGATION ACTION 1	
Coordinate with Southampton County and the American Red Cross on extensive public education and awareness campaigns to ensure citizens are knowledgeable of protective preparedness and mitigation activities that will lessen the potential impacts of disasters.	
BACKGROUND INFORMATION	
Site and Location:	Throughout Town
Benefit Cost:	Low-cost protection measures help citizens help themselves.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	All
Goal(s) Addressed:	Goal 1, Goal 2, and Goal 3
Priority (High, Moderate, Low):	High
Estimated Cost:	To be determined
Potential Funding Sources:	DHS: PDM, HGSP, HMGP, HMGP 5% Initiative; American Red Cross; FEMA materials provided at no charge
Lead Agency/Department Responsible:	Town of Newsoms
Implementation Schedule:	Continuous
ADDITIONAL COMMENTS	
Particular life/safety concerns were identified related to driving on roads that have been or could be flooded, and promoting water conservation techniques during widespread power outages.	

TOWN OF NEWSOMS MITIGATION ACTION 2	
Broaden outreach for and increase participation in Reverse 911 citizen notification system for multiple hazards.	
BACKGROUND INFORMATION	
Site and Location:	Throughout Town
Benefit Cost:	A coordinated warning system for multiple hazards gives citizens time and opportunity to prepare for an event and to protect life and property. The existing siren system has limited capability and must be triggered from Courtland.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Tornado, Wildfire, Flooding, Hazardous Material Incident
Goal(s) Addressed:	Goal 2
Priority (High, Moderate, Low):	High
Estimated Cost:	$5,000
Potential Funding Sources:	DHS: PDM, HGSP, HMGP, HMGP 5% Initiative
Lead Agency/Department Responsible:	Town of Newsoms, Southampton County
Implementation Schedule:	Within 3 years
ADDITIONAL COMMENTS	
This action has been coordinated with the County; however additional action is required to increase citizen participation in the County's Reverse 911 system.	

TOWN OF NEWSOMS MITIGATION ACTION 3	
Implement projects to improve drainage as identified in Town's 2011 stormwater study. This action may include Climate Resilient Mitigation Activities (CRMA).	
BACKGROUND INFORMATION	
Site and Location:	Throughout Town
Benefit Cost:	An ongoing study will provide additional details regarding design storms, project costs and priorities. If CRMA are included, additional benefits from environmental or ecosystem benefits may be included in the benefits cost analysis.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding
Goal(s) Addressed:	Goal 1, Objectives 1.2, 1.3
Priority (High, Moderate, Low):	High
Estimated Cost:	$50,000 - $500,000
Potential Funding Sources:	DHS: PDM, HGSP, HMGP, HMGP/CRMA
Lead Agency/Department Responsible:	Town of Newsoms
Implementation Schedule:	Within 10 years
ADDITIONAL COMMENTS	

TOWN OF NEWSOMS MITIGATION ACTION 4	
Coordinate with the Virginia Department of Conservation and Recreation to resolve questions related to the Town's participation in the National Flood Insurance Program (NFIP).	
BACKGROUND INFORMATION	
Site and Location:	Throughout Town
Benefit Cost:	Citizens have expressed interest in purchasing flood insurance in areas not mapped as Special Flood Hazard Areas on the FIRM.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Sea Level Rise
Goal(s) Addressed:	Goal 1
Priority (High, Moderate, Low):	High
Estimated Cost:	None
Potential Funding Sources:	N/A
Lead Agency/Department Responsible:	Town of Newsoms with assistance from HRPDC
Implementation Schedule:	Within 1 year
ADDITIONAL COMMENTS	
Town officials believe that a resolution and an ordinance were passed in 2000 to gain acceptance into the NFIP; however, State officials and NFIP records do not show Newsoms as a participating jurisdiction.	

TOWN OF NEWSOMS MITIGATION ACTION 5	
Protect repetitively flooded structures from flood damage. Actions could include joining NFIP, floodproofing retrofits, elevation of structure and/or critical components, acquisition and then demolition, relocation or repurposing of structure(s). This action includes Mitigation Reconstruction projects.	
BACKGROUND INFORMATION	
Site and Location:	Townwide
Cost Benefit:	Average annual flood damages would be reduced through mitigation actions.
MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flooding, Sea Level Rise, Winter Storm
Goal(s) Addressed:	Goal 1, Objectives 1.1, 1.2
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	To be determined
Potential Funding Sources:	DHS: PDM, HMGP, FMA, RFC; HSGP Note: these funding sources are not available until the Town joins the NFIP.
Lead Agency/Department Responsible:	Town Office
Implementation Schedule:	Ongoing
ADDITIONAL COMMENTS	

PLAN MAINTENANCE PROCEDURES

2017 UPDATE

Section 8 was updated to modify the scope and to include all 22 communities participating in this planning process. Additional detail regarding the future plans of communities with regard to public outreach was also added.

INTRODUCTION

This section discusses how the *Mitigation Strategy* will be implemented by the communities and how the overall Hazard Mitigation Plan will be evaluated and enhanced over time. This section also discusses how the public and participating stakeholders will 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 will 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. Each community will seek 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 will 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.

Emergency Management officials in each community will be responsible for determining additional implementation procedures beyond those listed within the *Mitigation Action Plan*. This includes further integrating the Hazard Mitigation Plan into other local planning documents such as comprehensive or capital improvement plans, when appropriate. The members of the planning committees for each community 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 that those planning documents will not contribute to an increased level of hazard vulnerability in the region.

Opportunities to integrate the requirements of this Plan into other local planning mechanisms will continue to be identified through future meetings of each community's mitigation planning committee and through the five-year review process described in this section.

Each community will 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 will 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, each community will incorporate existing planning processes and programs addressing flood and sea level rise 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 changing federal, state and local regulations. Periodic evaluation of the Plan will also ensure that specific mitigation actions are being reviewed and carried out according to the *Mitigation Action Plan*.

Each community's hazard mitigation planning committee will continue to meet at least annually and following any disaster events warranting a re-examination of the mitigation actions, thus continuously updating the Plan to reflect changing conditions and needs within the communities. An annual report on the Plan will be developed and presented to elected officials 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 will be released to the media and made available to the public via appropriate methods, such as a community's web site, library, community bulletin board, or the HRPDC web site.

ANNUAL PROGRESS REPORTS

Each community's hazard mitigation planning committee will be responsible for producing an annual progress report to evaluate the Plan's overall effectiveness.

FIVE-YEAR PLAN REVIEW

At a minimum, the Plan will be reviewed and must be updated every five years by each the hazard mitigation planning committees as required by DMA 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 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. Each community will be responsible for reconvening and conducting the five-year review, although it is expected that the HRPDC will again lead the effort to update the plan in five years.

During the five-year plan review process, the following questions will 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?
- Has the implementation of identified mitigation actions resulted in expected outcomes?
- Has the committee 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 will 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 will be submitted to the VDEM State Hazard Mitigation Officer for review and approval. The State Hazard Mitigation Officer will submit the Plan amendments to FEMA for final review as required by DMA 2000.

DISASTER DECLARATION

Following a state or federal disaster declaration, the hazard mitigation planning committee will reconvene and the Plan will be revised as necessary to reflect lessons learned or to address specific circumstances arising from the event. Community committees 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 will be summarized by the committee in a report that will include an evaluation of the effectiveness of the Plan and any required or recommended changes or amendments. The report will 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, each community will forward information on the proposed change(s) to interested parties, including affected municipal departments. Information will also be forwarded to the VDEM. This information will 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 will be forwarded to HRPDC for final consideration. The committee will review the proposed amendments along with the comments received from other parties, and if acceptable, the committee will submit a recommendation for the approval and adoption of changes to the Plan. Minor revisions may be approved by each community's Chief Administrative Officer, while substantial amendments and addendums must be approved by the community's elected governing body. In determining whether to recommend approval or denial of a Plan amendment request, the following factors will be considered by the committee:

- 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 the committee and prior to adoption of the Plan, each community's governing body will hold a public hearing. The governing body will review the recommendation from the committee (including the factors listed above) and any oral or written comments received at public hearing(s). Following that review, the governing body will take one of the following actions:

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

CONTINUED PUBLIC INVOLVEMENT

44 CFR Requirement

Part 201.6(c)(4)(iii): The plan maintenance process will 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 will require a public hearing prior to any adoption procedures.

Other efforts to involve the public in the maintenance, evaluation and revision process will be made. These efforts differ by community based on each community's individual needs, public response and whether the community has been recently affected by a hazard event. Examples of how communities in Hampton Roads already engage the public during the interim planning period, or of how they may choose to approach this task in the future, include:

- Advertise meetings of the committee in the local newspaper, public bulletin boards, web sites, social media and City buildings. Designating a diverse community mitigation committee through official resolution of the governing board, and then scheduling regular meetings of the committee and advertising those meetings aggressively has worked well for some communities.
- Designate willing citizens and private sector representatives as official members of the planning committee. While real estate, financial and construction industry leaders are natural partners in mitigation planning, look beyond these to include business leaders, large employers, and representatives of local military installations and transportation hubs, such as the Port of Virginia. Cultural institutions, like Jamestown-Yorktown Foundation, are an important component in the economy of Hampton Roads and their collections are vulnerable to many of the hazards discussed in the plan. Neighborhood groups, civic leagues and other citizen groups are a valuable source of mitigation ideas for specific areas.
- Engage elected officials and planning commission members in the process, beyond simply providing updates or reports. Elected officials have a responsibility to protect the health, safety and welfare of their constituents and their support is critical to successful implementation of the Mitigation Action Plan in every Hampton Roads community.
- Use local media to update the public about any maintenance or periodic review activities taking place. The media have moved beyond traditional print and televised media and their social

media presence can be valuable in disseminating information about upcoming meetings or activities. Local non-profits can also be invaluable in spreading the word about mitigation planning meetings open to the public.

- Use questionnaires, open houses, fairs and other community events to obtain ongoing public comments on the Plan and its implementation. Many local emergency managers effectively use community events to inform and advise the public on preparedness and evacuation, but the venues can also be valuable for informing the citizenry about the components of effective mitigation, how their community is implementing their Mitigation Action Plan and gathering information from the public to inform the next plan revision.
- Use community web sites, social media and list-servs to advertise any maintenance or periodic review activities taking place.
- Hold area-specific meetings on a regular basis to solicit feedback from neighbors. Such meetings, held in public venues, can be used to distribute literature, educate citizens on mitigation actions they can implement on their own, and solicit input on how the mitigation process can be more effective for their area or neighborhood.
- Integrate mitigation action plans, goals and objectives, and other plan elements into other community planning objectives. When a community's comprehensive planning process includes similar team members and incorporates or references pieces of the hazard mitigation plan, the public gains familiarity with the links between the plans and the ways in which the efforts complement each other.
- Maintain hard copies of the Plan in public libraries, on the web, or other appropriate venues. While many citizens are engaged in community affairs through computer technology, keeping hard copies of the plan in public venues with a business card or other contact information for providing feedback or answering questions is an old-fashioned by necessary way of reaching a much larger segment of citizens.

Table 8.1 provides summary feedback from individual community's committee leaders indicating how they anticipate their community will include the public in the 5-year period following adoption.

TABLE 8.1: INCLUDING THE PUBLIC DURING PLAN IMPLEMENTATION PERIOD

SUBREGION	COMMUNITY	Advertise committee meetings	Designate citizens, private sector reps as members of committee	Use local media to update public on maintenance activities	Use questionnaires, open houses to obtain public comment	Use web sites to advertise maintenance activities	Maintain copies of the plan in libraries, on the web, or other venues	Other
Peninsula	Hampton	✓	✓	✓	✓	✓	✓	annual update to Council
	Newport News	✓	✓	✓	✓	✓	✓	
	Poquoson	✓	✓	✓	✓	✓	✓	
	Williamsburg	✓		✓		✓	✓	
	James City County	✓	✓	✓	✓	✓	✓	
	York County				✓		✓	
Southside	Norfolk				✓	✓	✓	annual update to Council
	Portsmouth	✓		✓	✓	✓	✓	
	Suffolk						✓	
	Virginia Beach	✓		✓		✓	✓	
	Chesapeake		✓	✓	✓	✓	✓	
Western Tidewater	Isle of Wight County	✓		✓	✓	✓	✓	
	Smithfield	✓		✓			✓	
	Franklin	✓		✓		✓	✓	
	Southampton County				✓			Booth at County fair

OPPORTUNITIES FOR IMPROVEMENT

The 2015-2017 plan update process represents the first time that mitigation planning in the Hampton Roads region has been addressed on such a large regional basis. Some previous plans were regional in nature, but covered a smaller geographic area with many shared traits. As such, several opportunities for improving the plan and planning process are outlined below in **Table 8.2**, primarily as suggestions or strategies that may enhance the planning process effectiveness for either individual communities in the coming 5-year period of implementation, or for future updates of the entire plan.

TABLE 8.2: OPPORTUNITIES FOR IMPROVEMENT	
Mitigation Planning Step	**Opportunities**
Phase I: Organize Resources Step 1. Get Organized Step 2. Plan for Public Involvement Step 3. Coordinate with Other Departments & Agencies	1. Prepare a Memorandum of Intent to Participate for all communities to complete in the early stages of the planning process. 2. Recommend and provide a template for each community to adopt a resolution naming their Steering Committee members. This has added benefit of informing public and elected officials that the process is about to begin. 3. Emergency managers and planners are not public information officers. Engage public information officers, web site managers and other community communications specialists from each community in the development of the Plan for Public Involvement. They will be critical committee members throughout the process. 4. Identify key committee members very early in the process. Distinguish between Steering Committee and at-large committee members. Hold listening sessions (public meetings) early in the process and recruit citizen members for committee from those meetings. 5. While questionnaires and surveys are not required, they facilitate large numbers of citizens providing input in a simple way, especially given the historically low turnout at public meetings. This committee recommends surveys be used in the future as a way to generate public comment, recommend conducting online survey for *at least* 2 weeks in the early stages of the planning process, perhaps in conjunction with initial public meetings, but definitely with the public information officers advising. 6. The regional planning authority can continue to ask and rely on communities to reach out to large businesses, military installations, educational and medical institutions, neighborhood associations, non-profits, utilities and other groups to spur their involvement in the process, but communities need to provide documentation of these "asks" that is then included in the plan.
Phase II: Assess Risk Step 4. Identify the Hazards Step 5. Assess the Risks	1. Incorporate citizen survey feedback in demonstrable ways for the committee's consideration during presentation of updated hazard and risk information.
Phase III: Develop Mitigation Plan Step 6: Review Mitigation Alternatives Step 7: Draft an Action Plan Step 8: Set Planning Goals	1. Provide a review form for each community to document their review and approval of each plan section. 2. Presentations by committee members on which mitigation actions have worked for them in the past would be useful during workshops. 3. Provide more time between workshops for committee members to do their own research, review and inquiries. 4. Request communities bring complete committees to workshops rather than send representatives and hold separate sessions afterward.