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# **2010 Multi-jurisdictional All Hazard Mitigation Plan Update Sussex County, Delaware**



Prepared for:

**Sussex County Emergency Operations Center**

Prepared by:



**March 2010**

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# Sussex County All Hazard Mitigation Plan

## Plan Executive Summary

March 2010



SUSSEX COUNTY  
ALL HAZARD MITIGATION PLAN SUMMARY  
March 2010

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### Introduction

The purpose of the Sussex County All Hazard Mitigation Plan Update (hereinafter referred to as the “Plan”) is to continue to provide guidance for hazard mitigation in Sussex County. It identifies hazard mitigation goals, objectives and recommended actions and initiatives for county and municipal government to reduce injury and damage from natural hazards.

This Plan meets the requirements for a local hazard mitigation plan under Final Rule, 44 CFR 201.4, published by the Federal Emergency Management Agency (FEMA) in September 2009.

This Plan Update continues to keep Sussex County qualified to obtain all disaster assistance to include all categories of Public Assistance, Individual Assistance and Hazard Mitigation grants available through the Robert T. Stafford Disaster Relief and Emergency Assistance Act, P.L. 93-288, as amended. Future enhancements of the State All Hazard Mitigation Plan will allow the State to obtain greater funding for hazard mitigation planning and projects (20 percent of federal Stafford Act disaster expenditures versus 7.5 percent for a standard state plan). It also keeps the state eligible for the annually funded Pre-Disaster Mitigation Program, and the Flood Mitigation Assistance Program.

*Without this plan, all eligible local jurisdictions – would be ineligible to receive a variety of disaster recovery programs, including the Public Assistance Program to repair or replace damaged public facilities, and the Fire Management Assistance Program to help the state and communities recover the costs of major disasters. However, the State and local communities would remain eligible for certain emergency assistance and Human Services programs available through the Stafford Act* .

### The Planning Process

This Plan Update is the product of the effort of people from many organizations and builds on a number of mitigation planning initiatives since 2004.

Staff from the Sussex County Emergency Operations Center led the development effort of the Sussex County All Hazard Mitigation Plan Update. The Director of the Emergency Operations Center directed the planning effort.



## Plan Summary

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The Sussex County Hazard Mitigation Advisory Committee, assembled by the Sussex County Emergency Operations Center and DEMA Natural Hazards Section, provided guidance and assisted with development of the All Hazard Mitigation Plan, including review of previous hazard mitigation planning initiatives, development of mitigation strategies, and an action plan. The members of the advisory committee provided expertise and perspective to all aspects of the planning process, including, land-use planning, building codes, transportation, and infrastructure, to name a few. Representation included members from the local government, law enforcement, fire service, Licensing & Inspections, emergency management community, state agencies, Public Works, emergency medical professionals, building officials, and private industry.

Once the Plan Update is promulgated by the Levy Court, and approved by (FEMA), the Committee will function as an advisor to the State Hazard Mitigation Officer on hazard mitigation efforts, including future reviews and revisions.

Participation of local agencies was critical in the development of the Plan. Thirty-five stakeholders (listed below) participated by identifying potential vulnerable facilities along with agency-specific goals to address their vulnerabilities through mitigation actions and initiatives.

Bethany Beach, Town of  
Bethel, Town of  
Blades, Town of  
Bridgeville, Town of  
Dagsboro, Town of  
Delmar, Town of  
Dewey Beach, Town of  
Ellendale, Town of  
Fenwick Island, Town of  
Frankford, Town of  
Georgetown, Town of  
Greenwood, Town of  
Henlopen Acres, Town of  
Laurel, Town of  
Lewes, City of  
Millsboro Town of  
Millville, Town of  
Milton, Town of  
Ocean View, Town of

Rehoboth Beach, City of  
Seaford, City of  
Selbyville, Town of  
Slaughter Beach, Town of  
South Bethany, Town of  
Bell Atlantic  
Department of Natural Resources and  
Environmental Control  
FEMA  
Vision Planning and Consulting and ESRGC  
Consultants  
Sussex OEM  
Sussex County Planning & Zoning  
Sussex County Sheriff's Office  
Sussex County Economic Development  
Sussex County Tax Assessor  
Sussex County EMS  
Sussex County Administration

### **Coordination of Local Planning**

The Consultants and the Emergency Operations Center worked with all 24 local jurisdictions to encourage their support of local hazard mitigation planning. The Consultants solicited input in a number of ways, including hazard and socio-economic information; local capability and risk assessments;

The State worked closely with the County on the Plan Update. County-level goals and actions were linked, to the goals established in the state Plan. This allowed more effective coordination of municipal, county and state goals. County goals provided valuable feedback to state officials as they developed broader state-level mitigation goals. This bottom-up approach allowed state officials to tailor their mitigation strategies to reflect the needs identified at the local level. County-level risk assessments were conducted in a manner that, when combined, served as the basis for the state-level risk assessment. This approach further linked local vulnerabilities to actions proposed at the state level. The number of local plans, and the areas they represented, provided adequate information influencing both the risk assessment and the mitigation strategies of the state plan.

### **Prioritizing Recipients for Hazard Mitigation Grants**

The process used to review, evaluate and select projects for hazard mitigation grants is built on years of public participation. The State's Hazard Mitigation Grant Program uses a competitive system where both federal and state criteria are used to evaluate and recommend projects for funding. Projects recommended for funding are those that best document their ability to reduce future impacts of natural disasters as well as demonstrate cost-effectiveness through a benefit-cost analysis. Only projects with a minimum benefit-cost ratio of 1-to-1 receive further consideration by a review committee. Typically, hazard mitigation funds following a disaster are available on a competitive basis to all eligible agencies and organizations statewide.

### **Maintaining the Plan**

The Sussex County All Hazard Mitigation Plan is a living document and will be reviewed, updated and adopted by county officials and submitted to FEMA for approval every five years. The Plan will be revised more frequently if conditions under which the plan was developed materially change as a result of new or revised policy, a major disaster, or availability of funding.

Participants in the maintenance of this plan include the State Hazard Mitigation Council and representatives of local jurisdictions whose hazard mitigation plans influenced the development of the Sussex County Plan.

Review of the Plan can take place in three ways:

- a       Annually, for progress made on mitigation actions and projects identified in

- the Mitigation Strategy.
- . ∂ After each presidentially declared disaster, to look for areas where the Plan should to be refocused due to the impact of the disaster.
- . ∂ Every five years before the county plan is resubmitted for approval to FEMA.

The process used to monitor mitigation measures is similar to the one used to monitor, evaluate and update the content of the plan. Actions and projects identified in the mitigation strategies will be reviewed annually. Local agencies will submit brief progress reports annually. DEMA will track the overall progress of actions and projects identified in the plan.

### **Risk Assessment**

The hazard identification, analysis, and vulnerability assessment, completed as part of the Sussex County Hazard Mitigation Plan Update identified twelve natural and three human-caused hazards that have the greatest potential to adversely affect the people, environment, economy and property of Sussex County. Hazards that were considered include: Flood, Tropical Storm Winds, Severe Thunderstorm Wind, Tornado, Drought, Hail, Winter Storms, Earthquake, Dam/Levee Failure, Terrorism, Energy Pipeline Failure, and Hazardous Material Release. The State has received 10 Presidential Disaster Declarations for natural hazard events since 1965. Below are synopses of these hazards and the risks they pose.

**Flood (Riverine and Coastal)** –Sussex Counties is at risk and vulnerable to flooding, validated by structures in the floodplain, number of flood insurance policies in effect and flood insurance claims paid. Flooding has resulted in six injuries and more than \$45 million in property damage. Of the 57 recorded events by the National Climatic Data Center, several events were considered notable based on such criteria as magnitude, number of deaths and amount of property damage.

The total potential annualized loss in Sussex County is \$129,520,000 with the greatest portion of that exposure being in the Atlantic coast communities as well as areas adjacent to the Indian River. In a 100-year flood event, as many as 1,561 facilities could sustain slight damage and 72 facilities could sustain moderate damage.

**Tropical Storm Wind** – Vulnerability models calculate that the potential annualized loss from tropical storm winds is \$1,926,244. That amount is thought to be considerably understated. 396 critical facilities would sustain light wind damage while 995 would sustain moderate damage from winds.

**Severe Thunderstorm Wind** – All buildings and facilities are exposed to thunderstorms and could potentially be impacted. It is not possible to estimate the number of residential, commercial, and other buildings or facilities that may experience losses.

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**Tornado** – It cannot be predicted where a tornado may touch down. All buildings and facilities are considered to be exposed to this hazard and could potentially be impacted. The potential annualized losses from tornadoes are negligible.

**Drought** – Although Sussex County as a whole is vulnerable to drought, it causes little damage to the built environment, mostly affecting crops and farmland. The potential annualized losses from drought are \$14,659, 834.

**Hail** - All buildings and facilities are exposed to hail and could potentially be impacted, so estimated annualized losses cannot be broken down into distinct categories (residential, commercial, etc.). The potential annualized losses from hail are negligible.

**Winter Storms** – Winter storms could potentially impacted the entire county, so estimated annualized losses cannot be broken down into distinct categories (residential, commercial, etc.). Potential annualized losses from winter storms are \$340,625.

**Earthquake** – The coastal plain of the Mid-Atlantic is notorious for being a seismically quiet zone. The Peak Ground Acceleration for a 100 year event is greater than .0060. Potential annualized losses from an earthquake are \$190,778. Of the 1,280 potentially affected critical facilities county-wide, they all would sustain less than 1% damage.

**Dam/Levee Failure** - The approach for determining vulnerability to dam and/or levee failure consists of a number of factors. Data from the USACE National Inventory of Dams (NID) in addition to the HAZUS-MH demographic inventory was used, with an assumption that dam breaks most likely will occur at the time of maximum capacity. The estimated exposure of people to dam failure in Sussex County is 5,816.

**Terrorism** – A vulnerability assessment was conducted for Weapons of Mass Destruction (WMDs) in order to expand the scope of the hazard mitigation planning process to include vulnerability to acts of terrorism. Due to the sensitivity of the data and conclusions, more in-depth discussion is available in the complete risk assessment maintained at DEMA.

Facility	Threat	Percent Comparison
Maximum Score in FEMA 426 Model	14.400	100%
Hospitals	7.800	54%
Military Facilities	7.200	50%
Day Care Centers	6.900	48%
Hazardous Material Sites	6.600	46%
Dams	6.600	46%
Reservoirs	6.300	44%
Major Bridges	5.280	37%
All Gas Pipelines	1.020	7%
U.S. Roads	0.960	7%
State Roads	0.960	7%

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**Hazardous materials** - Assessing vulnerability to a hazardous material (HazMat) release on a statewide scale consisted of the type(s) of hazardous material(s) present, the potential for mass casualties, and potential consequences for the surrounding area. The assessment documented information for 13 identified hazardous material sites from the State's exposure data. High consequence events were then selected (high material toxicity and population density), and ALOHA was used for calculating the impact area.

**Energy Pipeline Failure** - Energy pipelines cross most of the State of Delaware. If any of these energy pipelines, oil or gas, were to rupture, such an event could endanger property and lives in the immediate area (within less than half a mile radius)

### Overall Risk Ranking for Sussex County

Hazard	Rank
Flood	1
Drought	2
Winter Storm	3
Thunderstorm	4
Extreme Heat/Cold	5
Earthquake	6
Tornado	7
Hurricane Wind	8
Hail	9
Wildfire	Unranked
Coastal Erosion	Unranked
Dam/Levee Failure	Unranked
Tsunami	Unranked
Volcano	Unranked
Terrorism	Unranked
HazMat Incident	Unranked
Pipeline Failure	Unranked

### Mitigation Goals and Objectives

The Hazard Mitigation Advisory Committee supported the update of the goals, objectives, and mitigation actions. The mitigation actions address or solve local mitigation issues or problems. The Sussex County Hazard Mitigation Advisory Committee developed the following mission statement for the Sussex County All Hazard Mitigation Plan and the following goals and for hazard mitigation.

Mission: Develop to develop a comprehensive pre- and post-disaster hazard mitigation program guided by the adoption of stormwater management practices, the implementation of codes and regulations, the protection of critical facilities and infrastructure, the adoption of education and outreach efforts, pre-event planning and preparedness and the identification of projects designed to reduce the vulnerability of individuals, families, households, businesses, infrastructure and critical facilities to the negative effects of natural hazards.

- Goal #1      Sussex County and participating municipalities will continue to adopt enhanced stormwater management practices.
- Goal #2      Sussex County and participating municipalities will continue to adopt and enforce codes and regulations designed to reduce the impact of natural hazards.
- Goal #3      Sussex County and participating municipalities will continue to retrofit and protect critical facilities and infrastructure from natural and human-caused hazards.
- Goal #4      Sussex County and participating municipalities will continue to enhance education and outreach strategies to improve the dissemination of information to the public regarding hazards, including the steps that can be taken to reduce their impact.
- Goal#5      Sussex County and participating municipalities will continue to improve pre-event planning and preparedness activities.
- Goal#6      Sussex County and participating municipalities will continue to identify and implement sound hazard mitigation projects.

Work continues with local agencies and departments to develop projected timelines and potential funding sources for the actions identified in the mitigation strategy. Specific mitigation actions are contained in Section 6.2 of the Plan.

### **Disaster Resilient State Initiative**

A draft Executive Order is in place and is currently pending signature by the Governor. It is included below:

Executive Order Number X

RE: Sustaining the State of Delaware as a Disaster Resilient State through implementation of a Unified Hazard Mitigation Assistance Program against Natural and Technological Hazards.

WHEREAS, the State of Delaware, like all other states, is vulnerable to hurricanes, tornadoes, flooding, and other natural and technological disasters including terrorism and weapons of mass destruction that in the past have or could cause extensive loss of life and property, and severe disruption to essential human services;

WHEREAS, the Stafford Act was amended by the Disaster Mitigation Act of 2000 Section 322 (DMA2K) (P.L. 106-390) which provided new and revitalized approaches to mitigation planning and emphasized the need for state, local, and tribal entities to closely coordinate mitigation planning and implementation efforts; and

WHEREAS, two-thirds of the population lives in a single county; and

WHEREAS, during warmer months, tourists who visit the State's 90 miles of coastline, often coming from other states, may not fully understand the potential for hazards associated with coastal weather-related disruptive events; and

WHEREAS, disasters have caused the loss of lives, personal injuries and millions of dollars in property damage; and

WHEREAS, billions of dollars worth of residential, commercial, and coastal property in Delaware are at risk from hurricanes and weather-related damages; and

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WHEREAS, partnerships with all levels of government, the private sector, and the residents of Delaware can reduce the impact of future events through hazard mitigation planning; and

WHEREAS, compliance with the new mitigation plan requirements will position the State of Delaware to receive pre- and post-disaster mitigation funding.

Now, therefore, I, Jack Markell, on this 30<sup>th</sup> day of September 2009, do hereby order:

1. The State of Delaware's initiative to improve disaster resistance and resilience will be led by: the Delaware Emergency Management Agency (DEMA) by administrating the Hazard Mitigation Grant Program, Pre-Disaster Mitigation Program, and the Repetitive Flood Claims program; and the Department of Natural Resources and Environmental Control (DNREC) by administrating the Flood Mitigation Assistance Program and the Severe Repetitive Loss Program.
2. In cooperation with public and private partners, DEMA and DNREC will work to demonstrate the benefits of taking specific, creative steps to help Delaware communities reduce deaths, injuries, property damage, economic losses and human suffering caused by natural and technological disasters.
3. DEMA shall oversee a Statewide Hazard Mitigation Council (the "Council"), comprised of representatives from all levels of government and the private sector to act as a steering committee to further develop and implement State and local hazard mitigation strategies.
4. DEMA and DNREC shall maintain liaison with state agencies and private sector entities responsible and accountable for implementing actions in each of the areas listed below. Executives with authority and accountability in these areas will be asked to help the Council develop and maintain a comprehensive State All Hazard Mitigation Plan. The plan shall include the following areas:
  - a. Completing and periodically updating a state-wide risk and vulnerability assessment of its natural and technological hazards to include terrorism and weapons of mass destruction;



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- b. Maintaining partnerships with businesses to provide a public-private link, resulting in a coordinated approach across all 5 phases of emergency management, including prevention, preparedness, response, recovery and mitigation. Partnerships should include critical businesses involved in recovery from natural and technological hazard events (e.g., financial, utilities, communications, food suppliers, and medical facilities) and those businesses that would impact the local and state economy;
- c. Obtaining agreement to address relevant hazards and the risks they pose in any state-level land use decisions, including plans for state-owned property. The Council will also encourage municipalities to participate in the creation of county-level hazard mitigation plans that help guide day-to-day decision making;
- d. Sustaining local all-hazard mitigation plans that take into account state mitigation priorities;
- e. Encouraging communities to participate in the National Flood Insurance Program (NFIP) and the Community Rating System (CRS) and improve the rating of those communities that currently participate. DNREC will provide technical assistance for the preparation of CRS applications;
- f. Incorporating protective measures into public and private lifelines, infrastructure and critical facilities;
- g. Developing and supporting existing and future programs to increase the public's awareness of natural and technological hazards, including ways to reduce or prevent damage through a coordinated effort lead by the Statewide Hazard Mitigation Council;
- h. Supporting the incorporation of natural hazard awareness and reduction programs into school curricula through appropriate means, including the use of the State Department of Education, State university system, community colleges, and other educational institutions;
- i. Supporting mitigation training for county and municipal planners, developers, architects, engineers, surveyors, and other government and private sector professionals;
- j. Encouraging the participation of government, industry and professional organizations in this effort;
- k. Identifying existing incentives and disincentives for hazard loss reduction initiatives, and developing and implementing new incentives to further this effort;
- l. Encouraging the development of disaster resilient communities within the State through a collaborative partnership with the Federal Emergency Management Agency.

## Plan Summary

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# INTRODUCTION

This section provides a general introduction to the Sussex County Multi-jurisdictional All Hazard Mitigation Plan Update. It is broken down into the following four sections:

- Background
- Purpose
- Scope
- Authority

## *Background*

Natural hazards, such as floods, tornadoes and severe winter storms, are a part of the world around us. Their occurrence is natural and inevitable, and there is little we can do to control their force and intensity. In today's world we must also consider human-caused hazards, such as technological accidents or deliberate acts of terrorism, as legitimate and significant threats to life, safety and property.

Sussex County is vulnerable to a wide range of natural hazards, including flooding, tornadoes, tropical storms and hurricanes, winter storms and earthquakes. It is also vulnerable to a variety of human-caused hazards, including chemical releases, spills or explosions associated with the fixed storage or mobile transport of hazardous materials, including terrorist activities. These hazards threaten the life and safety of county 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 hazardous events can never be fully eliminated, there is much we can do to lessen their potential impact upon our community and our citizens. By minimizing the impact of hazards upon our built environment, we can prevent such events from resulting in disasters. The concept and practice of reducing risks to people and property from known hazards is generally referred to as *hazard mitigation*.



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

Hazard mitigation techniques include both structural measures, such as strengthening or protecting buildings and infrastructure from the destructive forces of potential hazards, and non-structural measures, such as the adoption of sound land use policies and the creation of public awareness programs. It is widely accepted that the most effective mitigation measures are implemented at the local government level, where decisions on the regulation and control of development are ultimately made. A comprehensive mitigation approach addresses hazard vulnerabilities that exist today and in the foreseeable future. Therefore it is essential that projected patterns of future development are evaluated and considered in terms of how that growth will increase or decrease a community's overall hazard vulnerability.

One of the most effective means that a community can implement a comprehensive approach to hazard mitigation is to continue to update its local *hazard mitigation plan* that establishes the broad community vision and guiding principles for reducing hazard risk, and further proposes specific mitigation actions to eliminate or reduce identified vulnerabilities.

## SUSSEX COUNTY, DELAWARE MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

The Sussex County Multi-jurisdictional All Hazard Mitigation Plan Update (hereinafter referred to as “Plan Update<sup>1</sup>”) is a logical step toward continuing to implement and incorporate hazard mitigation principles and practices into the routine government activities and functions of Sussex County and its municipalities. At its most inner core, the Plan Update recommends specific actions to combat the forces of nature and/or human-caused threats and protect its residents from losses to those hazards that pose the greatest risk. These mitigation actions go beyond simply recommending structural solutions to reduce existing vulnerability, such as elevation, retrofitting and acquisition projects. Local policies on community growth and development, incentives for natural resource protection, and public awareness and outreach activities are examples of other actions considered to reduce Sussex County’s future vulnerability to identified hazards. The Plan Update builds on the initial plan and is designed to be a living document, with implementation and evaluation procedures included to help achieve meaningful objectives and successful outcomes.

### **Disaster Mitigation Act of 2000**

In an effort to reduce the Nation's mounting natural disaster losses, the United States Congress passed the Disaster Mitigation Act of 2000 (DMA 2000) to provide new and revitalized approaches to mitigation planning. Section 322 of DMA 2000 emphasizes the need for state and local entities to closely coordinate mitigation planning and makes the development of a hazard mitigation plan a specific eligibility requirement for any local government applying for federal mitigation grant funds. These funds include the Hazard Mitigation Grant Program (HMGP) and the Pre-Disaster Mitigation (PDM) program, both of which are administered by the Federal Emergency Management Agency (FEMA). Communities with an adopted and federally-approved all hazard mitigation plan thereby become pre-positioned and more apt to receive available mitigation funds before and after the next disaster strikes.

This Plan was prepared in coordination with FEMA and the Delaware Emergency Management Agency to ensure that it meets all applicable DMA 2000 planning requirements in 2004. It has since been updated and outlined in the *Local Mitigation Plan Crosswalk*, found at the beginning of the document. The updated local crosswalk provides a summary of FEMA’s current minimum standards of acceptability and notes the location within the Plan Update where each planning requirement is met.

### ***Purpose***

The purpose of this All Hazard Mitigation Plan Update is:

- To continue to protect life, safety and property by reducing the potential for future damages and economic losses that result from natural or human-caused hazards;
- To continue to qualify for additional grant funding, in both the predisaster and post-disaster environment;
- To continue to speed recovery and redevelopment following future disaster events;
- To continue to demonstrate a firm local commitment to hazard mitigation principles; and

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<sup>1</sup> Reference to the “Plan” throughout this document will refer to the Sussex County All Hazard Mitigation Plan Update”.

## SUSSEX COUNTY, DELAWARE MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

- To continue to comply with federal legislative requirements for local hazard mitigation plans.

### *Scope*

This All Hazard Mitigation Plan is being updated and maintained to continually address those hazards determined to be “high risk” and “moderate risk” through a detailed hazard risk assessment for Sussex County (see Section 4: *Risk Assessment*). Other hazards that pose a low or negligible risk will continue to be evaluated during future updates to the Plan, but they will not be fully addressed until they are determined to be of high or moderate risk to Sussex County.

The geographic scope (e.g. the overall planning area) for the Plan includes all incorporated and unincorporated areas of Sussex County. This includes the following 24 jurisdictions:

- Bethany Beach, Town of
- Bethel, Town of
- Blades, Town of
- Bridgeville, Town of
- Dagsboro, Town of
- Delmar, Town of
- Dewey Beach, Town of
- Ellendale, Town of
- Fenwick Island, Town of
- Frankford, Town of
- Georgetown, Town of
- Greenwood, Town of
- Henlopen Acres, Town of
- Laurel, Town of
- Lewes, City of
- Millsboro Town of
- Millville, Town of
- Milton, Town of
- Ocean View, Town of
- Rehoboth Beach, City of
- Seaford, City of
- Selbyville, Town of
- Slaughter Beach, Town of
- South Bethany, Town of

### *Authority*

This All Hazard Mitigation Plan Update will be adopted by the Sussex County Council under the authority granted to counties under Title 9 (Counties) of the Delaware Code. This All Hazard Mitigation Plan will also be adopted by Sussex County’s participating incorporated jurisdictions under the authority granted to municipalities under Title 22 of the Delaware Code (Municipalities). Copies of all local resolutions to adopt the Plan are included in *Appendix A*.

SUSSEX COUNTY, DELAWARE  
MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

This Plan Update was developed in accordance with current federal rules and regulations governing local hazard mitigation plans. The Plan Update shall be routinely monitored 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 by FEMA's Interim Final Rule published in the Federal Register on February 26, 2002, at 44 CFR Part 201.
- Executive Order Number x, Sustaining the State of Delaware as a Disaster Resilient State through implementation of a Unified Hazard Mitigation Assistance Program against Natural and Technological Hazards, September 30<sup>th</sup>, 2009.

# PLANNING PROCESS

This section describes the planning process undertaken by Sussex County and the Contractor – the Vision Planning Team (comprising Vision Planning and Consulting from Columbia, Maryland, and the Eastern Shore Regional GIS Cooperative (ESRGC) from Salisbury, Maryland, in preparation of the All Hazard Mitigation Plan Update. Specific topics include:

- Overview of Hazard Mitigation Planning;
- Preparing the Plan;
- The Planning Team;
- Community Meetings and Workshops;
- Involving the Public;
- Involving Stakeholders; and
- Multi-Jurisdictional Participation.

## *Overview of Hazard Mitigation Planning*

Local hazard mitigation planning is the process of organizing community resources, identifying and assessing hazard risks, and determining how to best minimize or manage those risks. This process results in an all hazard mitigation plan that identifies specific mitigation actions, each designed to achieve both short-term planning objectives and a long-term vision. Responsibility for each mitigation action is assigned to a specific individual, department or agency along with a schedule for its implementation. Plan maintenance procedures are established for the routine monitoring of implementation progress, as well as the evaluation and enhancement of the mitigation plan itself. These plan maintenance procedures ensure that it remains a dynamic and functional planning document over time.

Mitigation planning offers many benefits, including:

- Saving lives and property;
- Saving money;
- Speeding recovery following disasters;
- Reducing future vulnerability through wise development and post-disaster recovery and reconstruction;
- Expediting the receipt of pre-disaster and post-disaster grant funding; and
- Demonstrating a firm commitment to improving community health and safety.

Typically, mitigation planning is described as having the potential to produce long-term and recurring benefits by breaking the repetitive cycle of disaster loss. A core assumption of hazard mitigation is that predisaster 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 solely 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, maintaining environmental health and enhancing recreational opportunities. Thus, it is vitally important that any local mitigation

## SUSSEX COUNTY, DELAWARE MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

planning process be integrated with other concurrent local planning efforts, and any proposed mitigation strategies must take into account other existing community goals or initiatives that will help complement or hinder their future implementation.

**44 201.6(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.*

### *Preparing the Plan*

Sussex County and the Contractor utilized the multi-jurisdictional planning process recommended by the Local Hazard Mitigation Guidance published by Federal Emergency Management Agency (FEMA Publication Series 386) in July 2008. A Local Mitigation Plan Crosswalk, found in *Appendix B*, provides a detailed summary of FEMA's current minimum standards of acceptability and notes the location of 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, in Part 201 of the Code of Federal Regulations (CFR).

The plan update process included six major steps that were completed over the course of four months. These tasks involved updating, monitoring, and evaluating the County's 2004 Hazard Mitigation Plan.

Each of the planning steps listed above resulted in critical update elements which collectively make up the All Hazard Mitigation Plan Update. The following sub-tasks were conducted as part of the Sussex County Plan Update Process:

#### Task 1: Organize Resources – Planning Process

- Participation in and facilitation all public and private meetings in reference to the planning process. Identification of who will be involved in the planning process, including the public, neighboring communities, agencies, businesses, academia, nonprofits and other interested parties involved in the process.
- Communication with key stakeholders and agencies to obtain information on any related mitigation efforts: Delaware Emergency Management Agency, Army Corps, Delaware Office of State Planning, Delaware Department of Natural Resources and Environmental Control, Delaware National Guard, Delaware Department of Transportation, Delaware Geological Survey, and University of Delaware.
- Mitigation strategy workshop with the Committee and municipalities to update existing and identify new mitigation strategies.
- Review and update of Section 3, Community Profile and integration with the Land Use Plan.
- Update of the status of existing plans, studies, reports, and technical information.
- Description of how the planning team reviewed and analyzed each section of the plan and whether each section was revised as part of the update process.

#### Task 2: Hazard Identification and Risk Assessment

- Review and update of Hazard Identification section.
- Update of Hazard Analysis for incidents since 2003.
- Update of Hazard Vulnerability, utilizing HAZUS-MH, statistical analysis, and statistical data from incident reports and an updated description of the jurisdiction's vulnerability to



## SUSSEX COUNTY, DELAWARE MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

- the hazards identified as well as: a) the types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazards; and b) an estimate of the potential dollar losses to vulnerable structures identified and a description of the methodology used to prepare for the estimate.
- Land uses and development trends and identification of any areas that may be proposed for intense development that are located in high hazard areas.

### Task 3: Goals and Objectives

- Review of mitigation goals and objectives of the current plan to reduce or avoid long term vulnerabilities to the identified hazards.

### Task 4: Mitigation Strategy

- Alignment of the updated Hazard Mitigation Plan in line with any FEMA revisions to regulations governing these plans.
- Reissue of the mitigation capability assessment survey to identify how the fiscal, administrative, and local mitigation capabilities have changed since 2004. Review of capability scores and ratings and updated the Risk and Capability Matrix to illustrate each jurisdiction's overall hazard risk in comparison to their overall capacity.
- Mitigation strategy workshop to update existing and collect new mitigation strategies.
- Update of the mitigation actions to include a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with particular emphasis on new and existing buildings and infrastructure including actions related to continued compliance with the National Flood Insurance Program (NFIP).
- Update of the action plan describing how the actions will be prioritized, implemented, and administered by the local jurisdiction.
- Identification of the completed, deleted or deferred mitigation actions as a benchmark for progress, and if activities are unchanged (i.e., deferred).

### Task 5: Plan Maintenance

- Update of the section describing the method and schedule of monitoring, evaluating, and updating the mitigation plan within a five-year cycle.
- Review and update of the process by which local governments incorporate the requirements of the mitigation plan into other planning mechanisms such as comprehensive or capital improvements plans, when appropriate.
- Identification of any additional local planning mechanisms available for incorporating the mitigation requirements of the mitigation plan.
- Continued public participation (public notices, committee, annual review meetings with stakeholders, etc.).

#### **Project Scope and Schedule**

1. Organize resources
  2. Hazard Identification and Risk Assessment
  3. Goals and Objectives
  4. Mitigation Strategy
  5. Plan Maintenance
  6. Plan Adoption
- Draft Plan Due to Sussex County – 7 March 2010
  - 1st Committee Meeting & 1st Public Meeting – 4 Feb 2010
  - Municipal Mitigation Strategy Workshop and 2nd Committee Meeting – 24 February 2010
  - 2nd Public Meeting – 24 February 2010

Figure 2.1  
Sussex County Hazard Mitigation Plan Update Tasks and Schedule

## SUSSEX COUNTY, DELAWARE MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

### Task 6: Plan Adoption

- Review of the draft plan prior to submission to DEMA and FEMA.
- Draft Plan to be approved by FEMA pending adoption.
- Adopt the Plan and forward Adoption Resolution letter to DEMA and FEMA.

### *The Planning Team*

Sussex County developed a community-based planning team to update the existing robust document prepared in 2004. Stakeholders, residents, and local government officials played a major role in reviewing the Plan. Sussex County shared responsibilities with the contractor, Vision Planning and Consulting, LLC, in engaging the public and in facilitating the Plan Update. The Eastern Shore Regional GIS Cooperative (ESRGC) updated the hazard identification and risk assessment sections of the Plan.

### **Hazard Mitigation Advisory Committee**

The following participants represent the members of the Sussex County Hazard Mitigation Advisory Committee who were responsible for participating in the development of the Plan. Committee members are listed by jurisdiction. The Plan Update Planning Committee's make up was similar to that of the previous Planning Committee (i.e. same offices represented), especially for those communities with multiple representatives. Those members who were no longer with the County or municipality were replaced on the Committee.

**Table 2.1 – Hazard Mitigation Advisory Committee Members**

Name	Jurisdiction	Department / Community Function
Richard Ronan	Bell Atlantic	
John Eckrich	Bethany Beach	Building Inspector
Michael Redmon	Bethany Beach	Police Department
Ralph Mitchell	Bethany Beach	Police Department
Jeff Hastings	Bethel	President
David Ruff	Blades	Council
Jesse Savage	Bridgeville	Town Manager
Debbie Miller	Bridgeville	Treasurer
James A Kollock, Jr.	Dagsboro	Vice Mayor
Stacy Long	Dagsboro	Town Clerk
Sara Bynum-King	Delmar	Town Manager
Dave Carlson	Delaware Emergency Management Agency	State Hazard Mitigation Officer
Lloyd Stoenber	Delaware Emergency Management Agency	Planning Supervisor of Natural Hazards Section
Michael Powell	Department of Natural Resources and Environmental Control	Soil and Water NFIP, FMA
Dell Tush	Dewey Beach	Mayor
Gordon Elliot	Dewey Beach	Chief of Police
Delores Price	Ellendale	Vice President

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Name	Jurisdiction	Department / Community Function
Audrey Serio	Fenwick Island	Mayor
Tony Carson	Fenwick Island	Town Manager
Terry Truitt	Frankford	Town Clerk
Bill Topping	Georgetown	Chief of Police
Eugene S. Dvornick Jr.	Georgetown	Town Manager
Donald Donovan	Greenwood	President
Angie Townsend	Greenwood	Town Clerk
Tomas A. Roth	Henlopen Acres	Town Manager
Wanda Davis	Henlopen Acres	Mayor
William J. Fasano, Jr.	Laurel	Town Manager
Nelson Wiles	Lewes	Project Coordinator & Grants Administrator
Paul Eckrich	Lewes	City Manager
Fay Lingo	Millsboro	Town Manager
Joseph Brady	Millsboro	Mayor
Deborah Botchie	Millville	Town Manager
George Dickerson	Milton	Town Manager
Stephanie Coulbourne	Milton	Town Clerk
Allen Atkins	Milton	Public Works Supervisor
James E. Bailey	Milton	President Broadkill Beach Preservation Association
Charlie McMullen	Ocean View	Emergency Operations Coordinator
Conway Gregory	Ocean View	Town Manager
Deepa Srinivasan	Vision Planning and Consulting, LLC	Consultant
Dr. Mike Scott	ESRGC	Consultant
Gregory Ferrese	Rehoboth Beach	Town Manager
Charles Anderson	Seaford	Director of Operations
Dolores Slatcher	Seaford	City Manager
Bob Dickerson	Selbyville	Town Manager
Scott Collins	Selbyville	Chief of Police
Fred Draper	Slaughter Beach	Mayor
Wayne A. Stacey	South Bethany	Town Manager
Carol Lewis	Sussex County	Office of Emergency Management
Joseph Thomas	Sussex County	Director, Office of Emergency Management
Lawrence Lank	Sussex County	Director Planning and Zoning
Robert Reed	Sussex County	County Sheriff
Robert Stickels	Sussex County	Administration
Stephen Masten	Sussex County	Economic Development
William Godwin Jr.	Sussex County	Tax Assessor
William Matthews	Sussex County	EMS Operations Manager

## SUSSEX COUNTY, DELAWARE MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

### *Community Meetings and Workshops*

The planning process for the most part, was similar to the process followed in 2003-2004 because it seemed effective. For this Plan Update, a total of two Committee meetings and two public meetings were held at the County's Emergency Management location.

The Plan Update process required a series of meetings and workshops for facilitating discussion and initiating data collection efforts with state and local municipal and county officials as well as stakeholders. Below is a summary of the key meetings and community workshops that took place throughout this process.

#### **Initial Project Kickoff Meeting**

The initial kick off meeting was held at the Sussex County Office of Emergency Management on 9th December 2009, with Director, Joseph Thomas. The purpose of this meeting was to finalize the contract as well as discuss the specific steps in the project. The project schedule, deliverables, and report format were finalized and specific phases of the project, i.e., risk assessment, capacity assessment, and mitigation actions were discussed.

#### **First Hazard Mitigation Advisory Committee Meeting**

The first Committee meeting was held on 4 February 2010 at the Emergency Operations Center in Georgetown. The purpose of this meeting was to present the updated Hazard Identification and Risk Assessment findings to Committee members. At this meeting, the overall risk ranking was also finalized by the Consultant and the Committee

#### **Second Hazard Mitigation Advisory Committee Meeting**

The second Committee Meeting was held on 24 February 2010 at the Emergency Operations Center in Georgetown. At this meeting, the County and municipalities were asked to review the goals and mitigation actions developed in 2003/2004 and evaluate their status. An update to the relevant plans and programs was also conducted.



Hazard	Rank
Coastal Flood	1
Riverine Flood	2
Drought	3
Hurricane Wind	4
Winter Storm	5
Severe Thunderstorm	6
Earthquake	7
Extreme Temperatures	8
Tornado	9
Hail	10

Figure 2.2 - PowerPoint presentation on the Risk Assessment at the 1<sup>st</sup> Committee Meeting



Figure 2.3 - 2nd Committee Meeting held on 24<sup>th</sup> February 2010 at the Sussex County EOC Building.

## SUSSEX COUNTY, DELAWARE MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

### Other Mitigation Meetings

A Hazard Mitigation Council Meeting was held by DEMA on 25<sup>th</sup> June 2009. At this meeting, the mitigation planning initiatives at the University of Delaware and Local Plan Updates (City of Wilmington and New Castle, Kent, and Sussex Counties) were discussed. Status of projects that were currently underway under the various mitigation grants were also elaborated on, at this meeting.

A Unified Hazard Mitigation Assistance Program Workshop was held by DEMA and DNREC representatives in Sussex County on 30 July 2009. The purpose of this workshop was to educate sub-applicants (municipalities) on the Federal mitigation programs (Flood mitigation assistance, Hazard Mitigation Grant Program, Pre-Disaster Mitigation, Severe Repetitive Loss, and Repetitive Flood Claims) available to assist communities in funding mitigation projects. Specific types of mitigation projects that would be eligible under these programs were discussed.

### *Involving the Public*

**44 CFR 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.*

A fundamental component of this plan update process involves public participation. The purpose of individual citizen and community-based input was to provide the community with a greater understanding of local concerns and ensure a higher degree of mitigation success by developing community “buy-in” from those directly affected by the decisions of public officials. As citizens become more involved in decisions that affect their safety, they are more likely to gain a greater appreciation of the natural hazards present in their community and take personal steps to reduce their potential impact. Public awareness is a key component of an overall mitigation strategy aimed at making a home, neighborhood, school, business, or city safer from the potential effects of natural hazards.



Figure 2.4 - PowerPoint presentation on the Mitigation Goals and Actions at the 2<sup>nd</sup> Public Meeting

The structure of the public meetings was kept simple and advertised in the local newspapers. They were held at two stages of the planning process; following the first Committee meeting and following the second Committee meeting prior to the completion of the draft Plan. The public meetings were held to present the findings of the risk and capability assessments and to garner input regarding unique hazard concerns and possible mitigation actions that could be included in the Hazard Mitigation Plan Update, including ideas for both policies and projects.

## SUSSEX COUNTY, DELAWARE MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

### First Public Meeting

The first public meeting was held at the Sussex County Emergency Operations Center on 4 February 2010. At this meeting, the project was introduced (2004 Plan and 2009 Plan Update) and the importance of integrating mitigation planning with land use planning was emphasized. A slide presentation discussed the planning process and schedule and also highlighted information from the Hazard Identification and Vulnerability Assessment (HIRA). The meeting was advertised in the local newspaper. Eight residents of Sussex County attended the first public meeting.

#### Sussex County HMP Update Goals

1. Adopt enhanced stormwater management practices.
2. Adopt and enforce codes and regulations designed to reduce the impact of natural hazards.
3. Retrofit and protect critical facilities and infrastructure from natural hazards.
4. Enhance education and outreach strategies to improve the dissemination of information to the public regarding hazards, including the steps that can be taken to reduce their impact.
5. Improve pre-event planning and preparedness activities.
6. Identify and implement sound hazard mitigation projects.

Figure 2.5 - PowerPoint presentation on the Mitigation Goals and Actions at the 2<sup>nd</sup> Committee Meeting

### Second Public Meeting

The second countywide planning workshop for the Sussex County Plan Update was held on 24 February 2010 at the Sussex County Emergency Operations Center in Georgetown. The purpose of this meeting was to present the mitigation actions for the County and municipalities and solicit comments to reduce future impacts of the identified hazards. Eight residents attended the second public meeting.

### *Involving Stakeholders*

**44 CFR 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 were involved in the mitigation planning process. Stakeholder involvement was encouraged through the use of public meetings, press releases, public notices and as well as telephone interviews. Since each Delaware county and their participating municipalities, were developing mitigation plans simultaneously, stakeholders from neighboring areas could coordinate and communicate their activities with one another.

The stakeholders were more involved in the Plan Update as compared to the initial planning process. Each agency was contacted individually and interviewed via telephone and also invited to the public meetings. An additional stakeholder who was not involved in during the 03/04 planning process (University of Delaware) was included in this process.

The coordination of local plans also facilitated the assistance of several state agencies, including Delaware Emergency Management Agency, Office of State Planning Coordination, Department of Natural Resources and Environmental Control, Office of the Delaware State Climatologist and

## SUSSEX COUNTY, DELAWARE MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

Department of Environment Observing System, University of Delaware - Department of Campus and Public Safety Services, and American Red Cross, in order to obtain input on their activities with respect to hazard mitigation. A summary of each of these departments' services related to mitigation activities is elaborated below:

### **Office of State Planning Coordination**

The Office of State Planning Coordination has been involved in planning activities as well as a neighborhood buyout project in New Castle County. This Office is responsible for creating not only the State comprehensive plan, but also the comprehensive plans for the three counties, and these plans are used to provide guidelines for development and growth throughout the State. These plans were, and continue to be sources of information for the local hazard mitigation plans. This Office has a very strong interest in being involved in the mitigation planning process as much as possible. They have conducted many environmental and other studies, and developed plans that could be valuable resources for local mitigation planning and be used to develop mitigation strategies and activities. The Office also has a successful working relationship with the Department of Natural Resources and Environmental Control and the Department of Transportation, two important stakeholders in mitigation activities around the State.

### **Department of Natural Resources and Environmental Control (DNREC)**

DNREC has worked closely with the State on various mitigation activities, as well as being responsible for floodplain mapping activities. DNREC provided the necessary information regarding National Flood Insurance Program (NFIP) compliance, and repetitive loss information for the 2003/2004 Local Mitigation Plans. DNREC's primary mitigation activities include overseeing NFIP ordinances and regulations, and guiding local jurisdictions on developing and adopting regulations to manage development in floodplains. They also conduct inspections of construction in floodplains to ensure compliance with NFIP guidelines. Specifically, DNREC worked with DelDOT on a FEMA funded buy-out of several properties that were demolished and turned in to open space, where DelDOT then became the land owner. DNREC is interested in having an active role in the development of the current mitigation plans and is willing to work with the three counties and the City of Wilmington on the development of their hazard identification and risk assessments, and mitigation strategies, as well as providing any available NFIP data. The Department is also looking forward to continuing what they feel has been a successful and cooperative relationship with other state agencies they have worked with in the past.

### **Office of the Delaware State Climatologist and the Department of Environmental Observing System (DEOS)**

The Office of the Delaware State Climatologist has worked with various State agencies including DEMA, DelDOT and DNREC on mitigation projects and activities. The Office of the Delaware State Climatologist also monitors and maintains DEOS. DEOS is a support tool for decision makers involved with emergency management, natural resource monitoring, transportation, and other activities throughout the State of Delaware. Their primary goal is to provide state agencies and the citizens of Delaware with immediate information about environmental conditions in and around the State. DEOS also archives data for historical environmental studies and research. This agency has been invaluable in categorizing and quantifying rainfall, flood, and wind activities during storms. Some of this information is reflected in Vulnerability Assessment section of this Plan. This information has also been critical to justifying many of the mitigation projects and actions completed in the past.

### **University of Delaware**

The Department of Campus and Public Safety Services at the University of Delaware is familiar with, and becoming more actively involved in mitigation on a campus and state wide level.



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Though the University was not involved in the initial round of Delaware local plans, they look forward to taking a larger part in mitigation activities state wide. The University is currently developing a Disaster Resistant University mitigation plan that will allow them to identify hazards that affect all university campuses and students, and to identify mitigation goals. Because the University has campuses and properties in each of the three counties and the City of Wilmington, the goal of the University is to work closely with the Counties and the City on the development of their plans and the University's plan, ensuring a free flow of valuable information and resources.

### **American Red Cross**

While the primary role of the Red Cross is to serve as a source of information and education, wherever possible the organization is interested in taking an active role in mitigation activities. For example, they were involved during the buyout of the Glenville neighborhood following numerous flooding events. The Red Cross also participates in mitigation through the creation and distribution of preparedness brochures that are used to educate the public and teach the importance of being prepared, and the steps to take before a hazardous event such as a flood or a hurricane. The Red Cross indicated a continued interest in being involved in the hazard mitigation planning process.

### **Delaware Geological Survey**

Delaware Geological Survey provides funding for coastal monitoring and the development of alert systems for the City of Bowers Beach in Kent County. They also monitor stream gauges on the Red Clay and White Clay creeks and the Brandywine River that provide real time information on flood stages, water quality, and potential drought conditions. Due to limited staffing and time constraints, the Delaware Geological Survey is unable to take on an in-depth role in the current mitigation planning process. However, they are interested in providing technical assistance and input during the planning process by reviewing plan sections, particularly those dealing with flood, drought, and earthquakes. Delaware Geological Survey has worked closely with DEMA and other State agencies on mitigation and continues to indicate an interest in being involved in the hazard mitigation process.

## *Multi-Jurisdictional Participation*

**44 CFR Part 201.6(a)(3):** *Multi-jurisdictional plans may be accepted as long as each jurisdiction has participated in the planning process.*

The Sussex County All Hazard Mitigation Plan is multi-jurisdictional and includes the participation of Sussex County and all of its incorporated municipalities. These participants are listed in Section 1: *Introduction*, under "Scope".

In order to satisfy multi-jurisdictional participation requirements, the local jurisdictions were required to perform the following tasks as part of the Plan Update:

- Attendance at Mitigation Planning Committee meetings;
- Update to the local Capability Assessment Survey;
- Revision of goals and objectives;
- Identification of completed local mitigation projects, where applicable; and



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- Adopt the County All Hazard Mitigation Plan Update, including the local Mitigation Action Plan which is simply an integral component of the larger plan.

The municipal participation varied in the planning process through the attendance at meetings, update of questionnaires, and review of mitigation actions (Table 2.2). Each jurisdiction is required to adopt their local action. This separate component of planning document provides the opportunity for jurisdictions to monitor and update their own specific actions without having to meet with the countywide planning group. This also allows for jurisdictions to only be responsible for the actions that apply to their jurisdiction, rather than adopting every action in the Sussex County Multi-jurisdictional All Hazard Mitigation Plan. The Table indicates the level of participation by the County and municipalities based on their attendance at meetings and review and update of plan sections.

**Table 2.2 – Municipal Participation**

Municipality	Updated Mitigation Capability Questionnaire	Attended HMA Workshop July 30, 2009	Attended 1 <sup>st</sup> Committee Meeting	Attended 2nd Committee Meeting	Updated Mitigation Actions
Sussex County (Unincorporated Areas)		I	I	I	
Town of Bethany Beach	I	I	I	I	I
Town of Bethel					
Town of Blades		I	I		I
Town of Bridgeville	I				I
Town of Dagsboro					I
Town of Delmar	I				
Town of Dewey Beach	I		I		
Town of Ellendale	I	I		I	I
Town of Fenwick Island					
Town of Frankford	I				
Town of Georgetown			I		
Town of Greenwood					
Town of Henlopen Acres			I		
Town of Laurel		I		I	I
Town of Lewes		I	I	I	
Town of Millsboro	I				I
Town of Millville	I				
Town of Milton	I	I			
Town of Ocean View			I	I	I
City of Rehoboth Beach		I			
City of Seaford		I	I		I
Town of Selbyville	I	I	I	I	I
Town of Slaughter Beach					
Town of South Bethany	I	I		I	I
<b>Total</b>	<b>11</b>	<b>11</b>	<b>10</b>	<b>8</b>	<b>11</b>

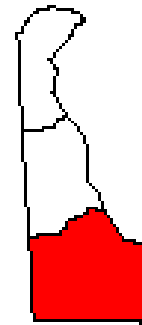
# COMMUNITY PROFILE

This section provides a general overview of Sussex County and its incorporated municipal jurisdictions. It is broken down into the following five sections:

- Geography and the Environment;
- Population and Demographics;
- Housing, Infrastructure and Land Use;
- Employment and Industry; and
- Disaster Declarations.

## *Geography and the Environment*

Sussex County is the southernmost county in Delaware and is bordered by Kent County, Delaware to the north, Maryland to the south and west, and Delaware Bay to the east. The county's location affords easy access to the major metropolitan areas of the Northeast United States — the cities of Baltimore, New York, Philadelphia and Washington, D.C. are all approximately within 150 miles of Sussex County. The county seat for Sussex County is the City of Georgetown.



Sussex County has a total area of 946 square miles, comprising nearly half of the state of Delaware. The area's topography is generally flat, ranging from sea level along the shores of Delaware Bay to approximately 45 feet above sea level at the highest points in the area.

Sussex County has a moderate climate, with an average annual temperature of 55 degrees Fahrenheit, and a mean daily temperature ranges from 35 degrees in January to 76 degrees in July. The county's normal annual rainfall is 40.84 inches per year and annual snowfall totals approximately 13.6 inches.

Sussex County has a total water area of 258 square miles, and has numerous waterways flowing through it; including the Broadkill River, the Indian River, and the Nanticoke River. Adequate surface and ground-water is available to meet the projected demand for fresh water. Sussex County lies within six (6) watersheds: Delaware Bay, Broadkill-Smyrna, Blackwater-Wicomico, Nanticoke, Pocomoke, and Chincoteague.

A portion of Sussex County lies within the Delaware River Basin, which drains 13,539 square miles in Delaware, New Jersey, New York and Pennsylvania. The river's main stem is 330 miles long and extends from the confluence of its east and west branches at Hancock, New York to the mouth of the Delaware Bay just south of Wilmington. It is the longest free-flowing (un-dammed) river east of the Mississippi.

Geologically, Sussex County is a part of the "Coastal Plain Province" composed of overlapping beds of unconsolidated or semi-consolidated clay, silt, sand and gravel. Delaware Bay is the area's most marked natural feature.

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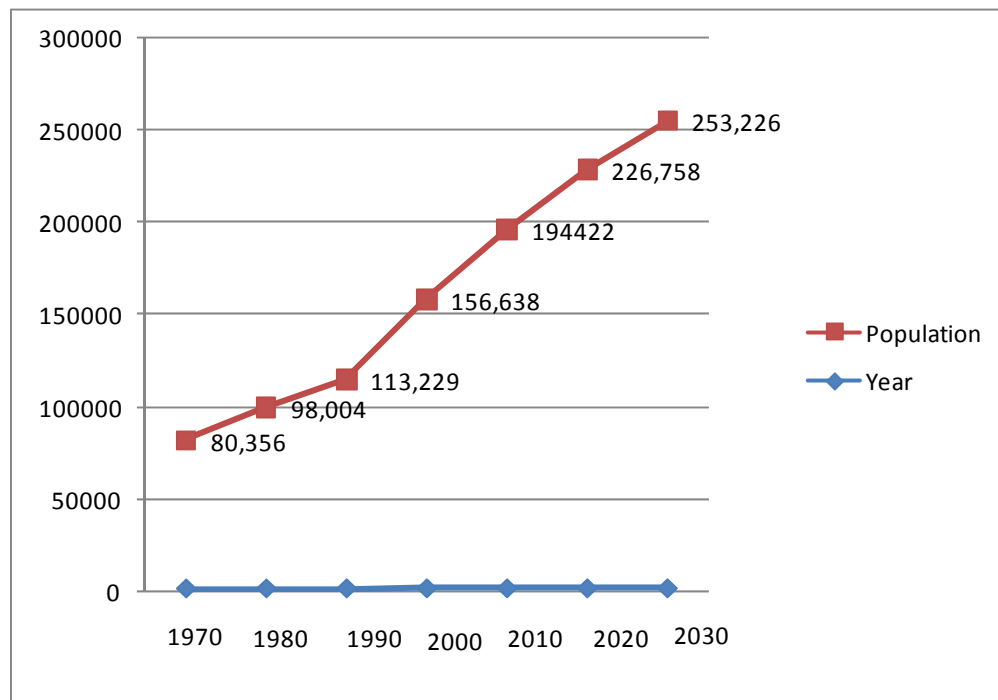
### *Population and Demographics*

Recent data from the 2006 U.S. Census estimates and other sources has been included where available. In cases where more recent data was not available, information from the 2000 Census has been retained.

The total population of Sussex County increased from 156,638 persons in 2000 to 180,275 persons (15%) in 2006.. The population in the County increased by 38 percent between 1990 and 2000. **Figure 3.1** shows the population growth of Sussex County from 1900 to 2000.

The Delaware Population Consortium projects that the County will continue to develop and grow but at a slower rate in the future. Growth between 2000 and 2010 is predicted to be around 24 percent compared to the higher growth rate (38%) in the 1990s. The Consortium forecasts the county's growth rate to continue moderately between 2010 and 2030.

**Figure 3.1**  
**Population Growth of Sussex County, 1970-2030**



*Source: U.S. Census Bureau and Delaware Population Consortium*

The County is approximately 37 square miles and is comprised of 24 incorporated municipalities.. **Table 3.1** shows the population for each of the incorporated municipalities in Sussex County and the unincorporated area according to U.S. Census 2000. The jurisdiction with the largest population in 2000 (4,643 persons) was Georgetown, the County seat.

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**Table 3.1**  
**Municipal Populations for Sussex County, 2000**

Jurisdiction	Population
Sussex County Unincorporated Areas*	121,519
Bethany Beach	903
Bethel	184
Blades	956
Bridgeville	1,436
Dagsboro	519
Delmar	1,407
Dewey Beach	301
Ellendale	327
Fenwick Island	342
Frankford	714
Georgetown	4,643
Greenwood	837
Henlopen Acres	139
Laurel	3,668
Lewes	2,932
Millsboro	2,360
Millville	259
Milton	1,657
Ocean View	1,006
Rehoboth Beach	1,495
Seaford	6,699
Selbyville	1,645
Slaughter Beach	198
South Bethany	492
<b>TOTAL</b>	<b>156,638</b>
*Includes Census Designated Places (CDP)	

Source: U.S. Census Bureau

According to U.S. Census 2000, the median age for persons in Sussex County is 41.1 years, which is older than the statewide average of 32.9 years. In 2008, persons over 65 years of age comprised 20.2 percent, an increase from 18.5 percent in 2000. Those under five years of age comprise 6.5 percent of the total population in 2008.

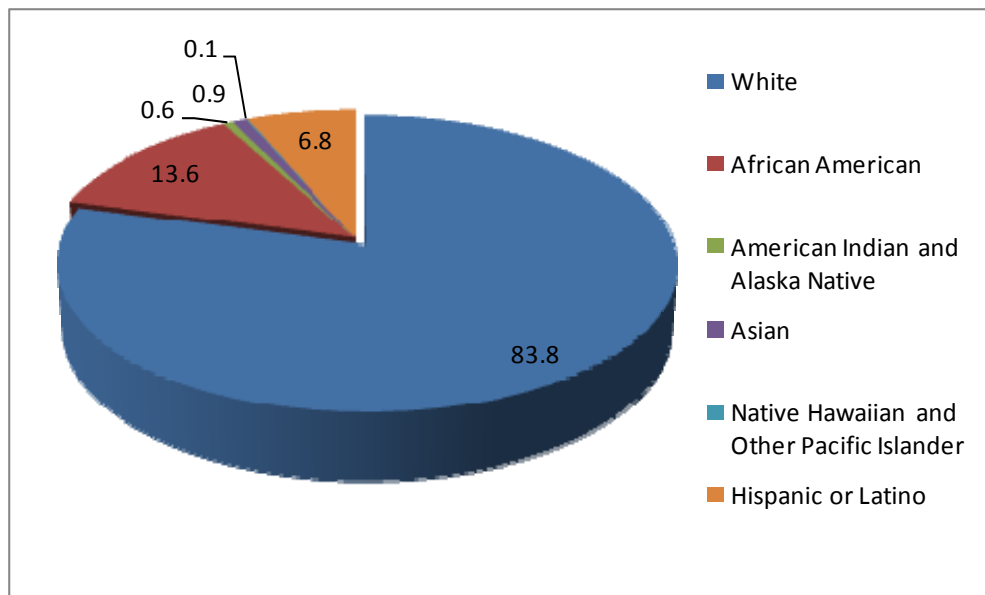
## SUSSEX COUNTY, DELAWARE MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

2000 Census figures indicate approximately 59 percent of the population as married, and 80.7 percent owning their own homes. Of all persons more than 25 years of age, approximately 76.5 percent are high school graduates and 16.6 percent have a bachelor's degree or higher.

White persons make up 80.3 percent of the Sussex County population followed by Black or African Americans making up 14.9 percent. **Figure 3.2** displays the most recent demographic data on race for Sussex County.

The percentage of White persons increased from 80.3 percent in 2000 to 83.8 in 2008 and that of African Americans dropped from 14.9 percent to 13.6 percent during the same period. The Hispanic population grew between 2000 (4.4%) to 6.8 percent in 2008. **Figure 3.2** displays demographic data on race for Kent County in 2008.

**Figure 3.2**  
**Race in Sussex County, 2008**



Source: US Census Quickfacts – Sussex County

### *Housing, Infrastructure and Land Use*

There were 116,587 housing units in Sussex County in 2008; an increase of 25% from 93,070 housing units in 2000. Based on 200 Census figures, the average household size for the County is 2.45 persons. The median home value in Sussex County in 2000 was \$122,400 for owner-occupied units. Approximately 9.7 percent of all housing units are located in multi-unit structures.

Transportation routes include U.S. Highways 13, 113, and 9 and State Route 1, which all serve to link the County with Interstates 95, 295, and 495. State Route 1, the largest project in the history of the Delaware Department of Transportation (DelDOT), has relieved congestion on the State's major north-south corridor, Route 13. Sussex County is also located less than 1½ hours south of

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the Port of Wilmington, providing access to Atlantic shipping lanes. The Baltimore-Washington International Airport is located less than two hours away from most locations in Sussex County.

The 2008 Sussex County Comprehensive Plan Update indicates that Sussex County has been the fastest growing area in the State and will maintain its roles as an agriculture leader, the State's tourism destination, and the State's major growth center in the foreseeable future. While Sussex County is projected to grow, population statistics do not provide a full picture of the County's growth pattern due to the fact that they do not count seasonal residents which are a sizable population. Seasonal homes could be accommodating over 64,000 people during prime vacation season.

The age profile of the County is also changing. The County's lower tax rate, quality of life, housing opportunities is attracting retirees. A number of communities cater to person age 55 and older. Between 1990 and 2000, the population between the ages of 45 and 64 years increased by 67 percent and the population that is 65+ increased 53 percent. These statistics have potential implication on transportation, eldercare, and healthcare, among other services.

DelDOT, the agency responsible for planning the State's transportation facilities, has recently studies land use trends in Sussex County. DelDOT anticipates the number of permanent households in Sussex County to increase by 67 percent between 2000 and 2030 to 104,000. Escalating land costs and scarce availability of land are pushing development westward from the resort areas. In 2002, Sussex County issued permits for the construction of over 4,000 dwelling units. New development peaked in 2005 with 100 proposed developments. In 2006, this number dropped to 76 developments. Based on the 2008 Comprehensive Plan Update, 2006 building permits were issued for 13,706 new housing units between January 2003 and December 2006. The majority of new home construction continues to occur in the areas closest to the inland bays and the coastal communities. Some large developments are proposed in the central and western parts of the County.

### *Employment and Industry*

Delaware has the strongest state economy in the region and remains an above average performer in comparison to the national economy. With lower than average unemployment, a fair and equitable tax system and a well-trained workforce, the State's economic climate has shown dramatic improvement since the early 1980s, partially in response to stable fiscal policies, careful debt management, conservative spending programs, and personal income tax reductions. Delaware's economy continues to have increasing levels of job growth, although more moderate than in previous years.

In 1999, the median household income for Sussex County was \$39,208, compared with \$47,381 in Delaware statewide. In 2007 the median income for the County and the State increased to \$50,132 and \$55,988, respectively. In 1999, the median per capita income was \$20,328, slightly lower than the statewide average of \$23,305. In November 2002, Sussex County had an employed labor force of 75,736 and an unemployment rate of 4 percent, similar to the statewide average. In July 2007, the unemployment rate in the County dropped to 2.9 percent and that of the State dropped to 3.4 percent. In Sussex County, the poverty rate in 2000 was 10.5 percent, compared with the statewide average of 9.2 percent. In 2007, the poverty rate in the County decreased to 9.7 percent and that of the State increased to 10.3 percent.

The Sussex economy is built upon tourism and agriculture, with considerable industry along U.S. 13 in the western part of the County. The beach resorts generate great wealth for the whole

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county. Sussex County is the largest poultry-producing county in America, and the modern broiler industry began there. Poultry production in turn supports corn and soybean production as feed, giving Sussex a stable and affluent farming economy. Sussex County sustains a diversified economy, with most firms being concentrated in the services sector. Health care and social assistance and Accommodation and food categories make up a total of 24.4 percent of the total employees. **Table 3.2** provides an overview of firms in Sussex County by sector.

**Table 3.2**  
**Firms by Sector for Sussex County, 2008**

Sector	Number of Employees	Percent of Total
Agriculture, forestry, fishing and hunting	767	1.09%
Construction	4,880	6.92%
Manufacturing	12,845	18.21%
Wholesale trade	1,374	1.95%
Retail trade	11,260	15.96%
Transportation and warehousing	1,686	2.39%
Information	500	0.71%
Finance and insurance	1,901	2.69%
Real estate and rental and leasing	2,004	2.84%
Professional and technical services	1,530	2.17%
Management of companies and enterprises	205	0.29%
Administrative and waste services	2,929	4.15%
Educational services	182	0.26%
Health care and social assistance	8,448	11.97%
Arts, entertainment, and recreation	833	1.18%
Accommodation and food services	8,792	12.46%
Other services, except public administration	2,256	3.20%
Federal government	546	0.77%
State government	1,695	2.40%
Local government	5,537	7.85%
Total government	7,778	11.02%
<b>Total</b>	<b>70,557</b>	

*Source: Delaware Economic Development Office*

**Table 3.3** lists Sussex County's top employers, according to Sussex County Economic Development. They include the government (State of Delaware), medical centers (Bayhealth and Beebe Medical Centers), and the banking industry (M&T Banking Services), among others.

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**Table 3.3**  
**Sussex County's Top Employers (in alphabetical order)**

Allen's Family Foods	Grotto Pizza, Inc.	Purdue, Inc.
Allen's Hatchery, Inc.	Indian River School District	Rusty Rudder Restaurant
Bayhealth Medical Center	Intervet America, Inc.	Sea Watch International Inc.
Beebe Medical Center	Invista Textile	State of Delaware
Caulk Dentsply Dental	M&T Banking Services	Sussex County Council
Food Lion Inc.	Mountaire of Delmarva, Inc.	Vlasic Foods, Inc.
Delaware Electric Cooperative, Inc.	Mountaire of Delmarva, Inc.	Wal-Mart, Inc.
Delmarva Power	Nanticoke Health Services	Wilmington Trust Company
DuPont Company	Pats Aircraft, LLC	
Eastern Shore Poultry	Pinnacle Foods Inc.	

*Source: Sussex County Comprehensive Plan, 2008*

## *Disaster Declarations*

Since 1965, Sussex County has experienced a total of ten presidential disaster declarations, which are shown in **Table 3.4**. The more recent disaster declarations occurred in 2003 (Hurricane Isabel), 2004 (Hurricane Katrina) and from the severe flooding in 2006.

Prior to 1965, any presidential declarations did not have county designations. The county has also experienced additional emergencies and disasters that were not severe enough to require federal disaster relief through a presidential declaration.



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**Table 3.4**  
**Presidential Disaster Declarations for Sussex County, 1965–2009**

Event	Declaration Date	Type of Assistance	Declaration Number
Water Shortage	08/15/1965	Individual Assistance	DR-207
Severe Coastal Storm	02/06/1992	Public Assistance	DR-933
Severe Coastal Storm and Flooding	01/15/1993	Public Assistance	DR-976
Severe Snowfall and Winter Storm	03/18/1993	Public Assistance	DR-3111
Severe Ice Storms and Flooding	03/16/1994	Public Assistance	DR-1017
Blizzard of '96 (Severe Snow Storm)	01/12/1996	Public Assistance	DR-1082
Severe Winter Storms, High Winds, and Flooding	02/13/1998	Public Assistance	DR-1205
Hurricane Isabel	09/20/2003	Individual Assistance Public Assistance	DR-1494
Hurricane Katrina	09/30/2005	Public Assistance	DR-3263
Severe Storms and Flooding	07/05/2006	Public Assistance	DR-1654

*Source: Federal Emergency Management Agency*

# HAZARD IDENTIFICATION

**Requirement §201.6(c)(2)(i):** *[The risk assessment **shall** include a] description of the type ... of all natural hazards that can affect the jurisdiction.*

The United States and its communities are vulnerable to a wide array of natural and human-caused hazards that threaten life and property. These hazards include:

## **Natural**

- **Flood**
- **Hurricanes and Coastal Storms**
- **Severe Thunderstorms and Tornadoes**
- **Wildfire**
- **Drought/Extreme Heat**
- **Winter Storms and Freezes**
- **Hail**
- **Erosion**
- **Dam/Levee Failure**
- **Earthquakes, Sinkholes and Landslides**
- **Tsunami**
- **Volcano**

## **Human-caused**

- **Terrorism**
- **Hazardous Materials (HazMat)**
- **Energy Pipeline Failures**

Some of these hazards are interrelated (i.e., hurricanes can cause flooding and tornadoes), and some consist of hazardous elements that are not listed separately (i.e., severe thunderstorms can cause lightning; hurricanes can cause coastal erosion). In addition, terrorist-related incidents or accidents involving chemical, radiological or biological agents can coincide with natural hazard events, such as flooding caused by destruction of a dam or an accidental chemical release caused by a tornado. It should also be noted that some hazards, such as severe winter storms, may impact a large area yet cause little damage, while other hazards, such as a tornado, may impact a small area yet cause extensive damage. This section provides a general description for each of the hazards listed above along with their hazardous elements, written from a national perspective.

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### *Flood*

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

Floods are generally the result of excessive precipitation, and can be classified under two categories: general floods, precipitation over a given river basin for a long period of time; and flash floods, the product of heavy localized precipitation in a short time period over a given location. The severity of a flooding event is determined by the following: a combination of stream and river basin topography and physiography; precipitation and weather patterns; recent soil moisture conditions; and the degree of vegetative clearing.

General floods are usually long-term events that may last for several days. The primary types of general flooding include riverine, coastal, and urban flooding. Riverine flooding is a function of excessive precipitation levels and water runoff volumes within the watershed of a stream or river. Coastal flooding is typically a result of storm surge, wind-driven waves, and heavy rainfall produced by hurricanes, tropical storms, nor'easters, and other large coastal storms. Urban flooding occurs where man-made development has obstructed the natural flow of water and decreased the ability of natural groundcover to absorb and retain surface water runoff.



*A total of 534 counties in nine states were declared for Federal disaster aid as a result of the Midwest Floods in June 1994. Homes, businesses and personal property were all destroyed by the high flood levels; 168,340 people registered for Federal assistance. (FEMA News Photo)*

Flash flooding events usually occur from a dam or levee failure within minutes or hours of heavy amounts of rainfall, or from a sudden release of water held by an ice jam. Most flash flooding is caused by slow-moving thunderstorms in a local area or by heavy rains associated with hurricanes and tropical storms. Although flash flooding occurs often along mountain streams, it is also common in urbanized areas where much of the ground is covered by impervious surfaces. Flash flood waters move at very high speeds—"walls" of water can reach heights of 10 to 20 feet. Flash flood waters and the accompanying debris can uproot trees, roll boulders, destroy buildings, and obliterate bridges and roads.

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

Floodplains are designated by the frequency of the flood that is large enough to cover them. For example, the 10-year floodplain will be covered by the 10-year flood and the 100-year floodplain by the 100-year flood. Flood frequencies such as the 100-year flood are determined by plotting a graph of the size of all known floods for an area and determining how often floods of a particular size occur. Another way of expressing the flood frequency is the chance of occurrence in a given year, which is the percentage of the probability of flooding each year. For example, the 100-year flood has a 1 percent chance of occurring in any given year.

# HAZARD IDENTIFICATION

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**Table 4.1-1** shows flood loss values by fiscal year from a national perspective.

**Table 4.1-1**  
**National Flood Losses by Fiscal Year (Oct.-Sept.), 1977-2007**

Fiscal Year	Damage (Thousands of Current Dollars)	Inflation Adjustment	Damage (Billions of 2007 Dollars)	U.S. Population (Millions)	Damage Per Capita (2007 Dollars)
1977	3,000,000	3.09	4.017	220.239	18.24
1978	1,300,000	2.87	2.009	222.585	9.03
1979	700,000	2.65	9.275	225.055	41.21
1980	3,500,000	2.46	3.690	227.225	16.24
1981	1,000,000	2.25	2.250	229.466	9.81
1982	2,500,000	2.08	5.200	231.664	22.45
1983	4,000,000	1.96	7.840	233.792	33.53
1984	3,750,000	1.92	7.200	235.825	30.53
1985	500,000	1.90	0.950	237.924	3.99
1986	6,000,000	1.85	11.100	240.133	46.22
1987	1,444,199	1.81	2.614	242.289	10.79
1988	225,298	1.76	0.397	244.499	1.62
1989	1,080,814	1.73	1.870	246.819	7.58
1990	1,636,431	1.68	2.749	249.464	11.02
1991	1,698,781	1.65	2.803	252.153	11.12
1992	762,762	1.60	1.220	255.030	4.78
1993	16,370,010	1.53	25.046	257.783	97.16
1994	1,120,309	1.47	1.647	260.327	6.33
1995	5,110,829	1.46	7.462	262.803	28.39
1996	6,121,884	1.42	8.693	265.229	32.78
1997	8,730,407	1.37	11.961	267.784	44.67
1998	2,496,960	1.35	3.371	270.248	12.47
1999	5,455,263	1.31	7.146	272.691	26.21
2000	1,338,735	1.28	1.714	282.125	6.08
2001	7,309,308	1.26	9.210	284.797	32.34
2002	1,211,339	1.22	1.478	288,368	5.13
2003	2,482,230	1.19	2.954	290,809	10.16
2004	13,970,646	1.12	15.647	293,191	53.37
2005	42,010,435	1.07	44.951	295,895	151.92
2005	3,744,636	1.03	3.857	298,754	12.91
2007	2,609,160	1.00	2.609	301,621	8.65

*Source: Hydrologic Information Center, National Weather Service*

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### *Hurricanes and Coastal Storms*

Hurricanes, tropical storms, nor'easters and typhoons, also classified as cyclones, are any closed circulation developing around a low-pressure center in which the winds rotate counter-clockwise in the Northern Hemisphere (or clockwise in the Southern Hemisphere) and whose diameter averages 10 to 30 miles across. A tropical cyclone refers to any such circulation that develops over tropical waters. Tropical cyclones act as a "safety-valve," limiting the continued build-up of heat and energy in tropical regions by maintaining the atmospheric heat and moisture balance between the tropics and the pole-ward latitudes. The primary damaging forces associated with these storms are high-level sustained winds, heavy precipitation, and tornadoes. Coastal areas are also vulnerable to the additional forces of storm surge, wind-driven waves, and tidal flooding which can be more destructive than cyclone wind.

The key energy source for a tropical cyclone is the release of latent heat from the condensation of warm water. Their formation requires a low-pressure disturbance, warm sea surface temperature, rotational force from the spinning of the earth, and the absence of wind shear in the lowest 50,000 feet of the atmosphere. The majority of hurricanes and tropical storms form in the Atlantic Ocean, Caribbean Sea, and Gulf of Mexico during the official Atlantic hurricane season, which encompasses the months of June through November. The peak of the Atlantic hurricane season is in early to mid-September and the average number of storms that reach hurricane intensity per year in this basin is about six (6).

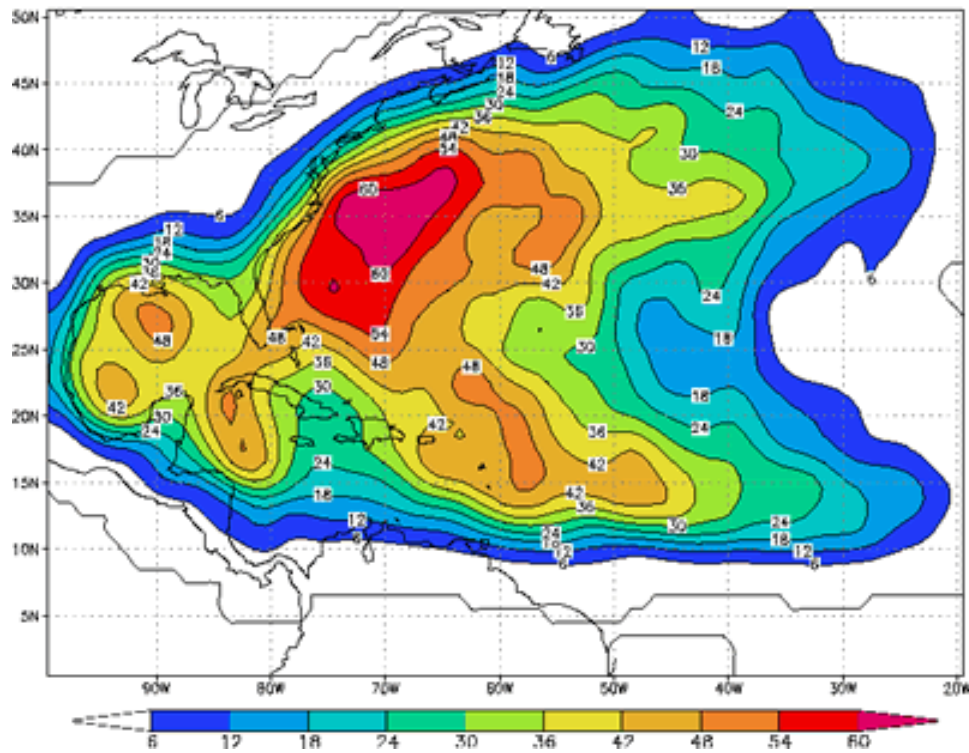
**Figure 4.1-1** shows for any particular location what the chance is that a tropical storm or hurricane will affect the area sometime during the whole June to November Atlantic hurricane season. The figure was created by the National Oceanic and Atmospheric Administration's Hurricane Research Division using data from 1944 to 1999 and counting hits when a storm or hurricane was within approximately 100 miles (165 km) of each location.



*Wind and rain from Hurricane Lili damage road signs along I-10 in Louisiana October 3, 2002. (Photo by Lauren Hobart/FEMA News Photo)*

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**Figure 4.1-1**  
**Empirical Probability of a Named Storm**



*Source: National Oceanic and Atmospheric Administration, Hurricane Research Division*

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

The Saffir-Simpson Scale is shown in **Table 4.1-2**.

**Table 4.1-2**  
**Saffir-Simpson Scale**

Category	Maximum Sustained Wind Speed (MPH)	Minimum Surface Pressure (Millibars)	Storm Surge (Feet)
1	74—95	Greater than 980	3—5
2	96—110	979—965	6—8
3	111—130	964—945	9—12
4	131—155	944—920	13—18
5	155+	Less than 920	19+

*Source: National Hurricane Center*

The Saffir-Simpson Scale categorizes hurricane intensity linearly based upon maximum sustained winds, barometric pressure, and storm surge potential, which are combined to estimate potential damage. Categories 3, 4, and 5 are classified as “major” hurricanes, and while hurricanes within this range comprise only 20 percent of total tropical cyclone landfalls, they account for over 70 percent of the damage in the United States. **Table 4.1-3** describes the damage that could be expected for each category of hurricane.

**Table 4.1-3**  
**Hurricane Damage Classification**

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

*Source: National Hurricane Center*

A storm surge is a large dome of water often 50 to 100 miles wide and rising anywhere from four to five feet in a Category 1 hurricane up to 20 feet in a Category 5 storm. 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



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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 northeast 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 along the immediate coast.

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. Hurricane Floyd, as an example, was at one time a Category 4 hurricane racing towards the North Carolina coast. As far inland as Raleigh, the state capital located more than 100 miles from the coast, communities were preparing for extremely damaging winds exceeding 100 miles per hour. However, Floyd made landfall as a Category 2 hurricane and will be remembered for causing the worst inland flooding disaster in North Carolina's history. Rainfall amounts were as high as 20 inches in certain locales and 67 counties sustained damages.



*Hurricane Floyd brought a devastating 15 feet of storm surge that damaged or destroyed hundreds of houses along the ocean front of Long Beach on Oak Island, North Carolina in September 1999. A prime example of successful hazard mitigation, the elevated home (right) survived while the older, ground-level block foundation of the home on the left was crushed. (Photo by Dave Gatley/FEMA News Photo)*

Similar to hurricanes, nor'easters are ocean storms capable of causing substantial damage to coastal areas in the Eastern United States due to their associated strong winds and heavy surf. Nor'easters are named for the winds that blow in from the northeast and drive the storm up the East Coast along the Gulf Stream, a band of warm water that lies off the Atlantic coast. They are caused by the interaction of the jet stream with horizontal temperature gradients and generally occur during the fall and winter months when moisture and cold air are plentiful.

Nor'easters are known for dumping heavy amounts of rain and snow, producing hurricane-force winds, and creating high surfs that cause 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 will increase and cause serious damage to coastal areas as the storm moves northeast.

**Table 4.1-4** shows an intensity scale proposed for nor'easters that is based upon levels of coastal degradation.



**Table 4.1-4  
Dolan-Davis Nor'easter Intensity Scale**

Storm Class	Beach Erosion	Dune Erosion	Overwash	Property Damage
1 (Weak)	Minor changes	None	No	No
2 (Moderate)	Modest; mostly to lower beach	Minor	No	Modest
3 (Significant)	Erosion extends across beach	Can be significant	No	Loss of many structures at local level
4 (Severe)	Severe beach erosion and recession	Severe dune erosion or destruction	On low beaches	Loss of structures at community-scale
5 (Extreme)	Extreme beach erosion	Dunes destroyed over extensive areas	Massive in sheets and channels	Extensive at regional-scale; millions of dollars

*Source: North Carolina Division of Emergency Management*

## *Severe Thunderstorms and Tornadoes*

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

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

Lightning is a discharge of electrical energy resulting from the buildup of positive and negative charges within a thunderstorm, creating a “bolt” when the buildup of charges becomes strong enough. This flash of light usually occurs within the clouds or between the clouds and the ground. A bolt of lightning can reach temperatures approaching 50,000 degrees Fahrenheit. Lightning rapidly heats the sky as it flashes but the surrounding air cools following the bolt. This rapid heating and cooling of the surrounding air causes thunder. On average, 89 people are killed each year by lightning strikes in the United States.



*Multiple cloud-to-ground and cloud-to-cloud lightning strokes observed during a nighttime thunderstorm. (Photo courtesy of NOAA Photo Library, NOAA Central Library; OAR/ERL/ National Severe Storms Laboratory)*

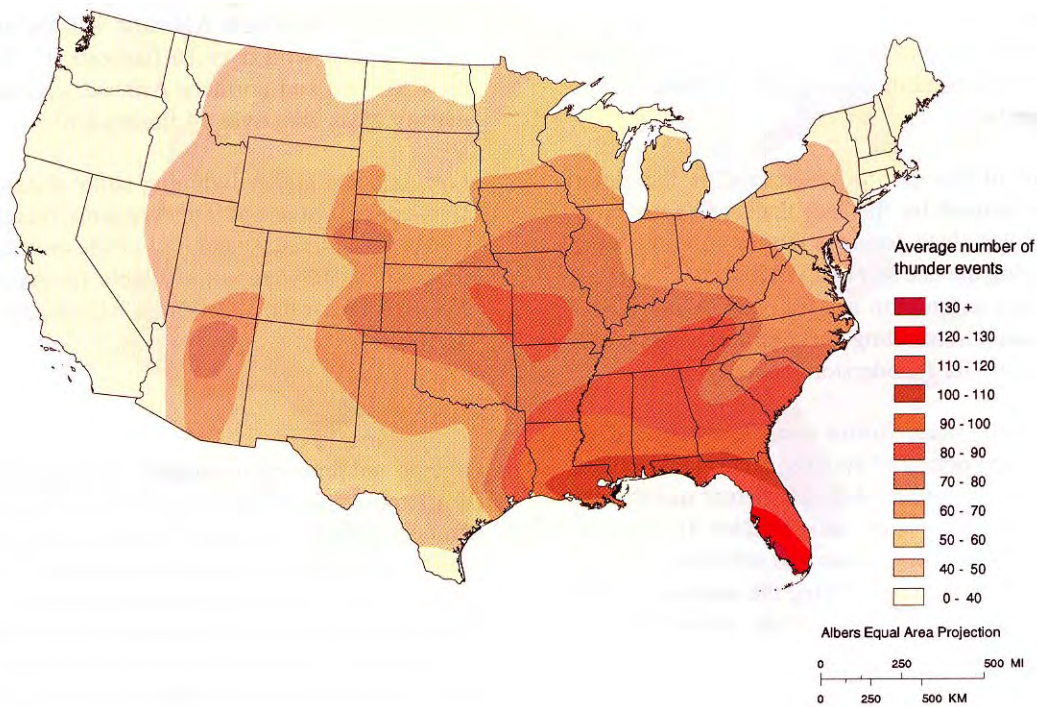
The National Weather Service collected data for thunder days, number and duration of thunder events, and lightning strike density for the 30-year period from 1948 to 1977. A series of maps was generated

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showing the annual average thunder event duration, the annual average number of thunder events, and the mean annual density of lightning strikes.

**Figure 4.1-2** illustrates thunderstorm hazard severity based on the annual average number of thunder events from 1948 to 1977.

**Figure 4.1-2**  
**Annual Average Number of Thunder Events**



*Source: Federal Emergency Management Agency*

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

Each year, an average of over 800 tornadoes is reported nationwide, resulting in an average of 80 deaths and 1,500 injuries (NOAA, 2002). They are more likely to occur during the spring and early summer months of March through June and can occur at any time of day, but are likely to form in the late afternoon and early evening. Most tornadoes are a few dozen yards wide and touch down briefly, but even small short-lived tornadoes can inflict tremendous damage. Highly destructive tornadoes may carve out a path over a mile wide and several miles long.

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

The destruction caused by tornadoes ranges from light to inconceivable depending on the intensity, size, and duration of the storm. Typically, tornadoes cause the greatest damages to structures of light construction such as residential homes (particularly mobile homes), and tend to remain localized in impact. The Fujita-Pearson Scale for Tornadoes (**Table 4.1-5**) was developed to measure tornado strength and associated damages.



*The most comprehensively observed tornado in history, this tornado south of Dimmitt, Texas developed June 2, 1995 curving northward across Texas Highway 86 where it entirely removed 300 feet of asphalt from the road tossing it more than 600 feet into an adjacent field. It also caused F4 damage at an isolated rural residence just north of the road. (NOAA Photo Library, NOAA Central Library; OAR/ERL/National Severe Storms Laboratory)*

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**Table 4.1-5  
Fujita-Pearson Scale for Tornadoes**

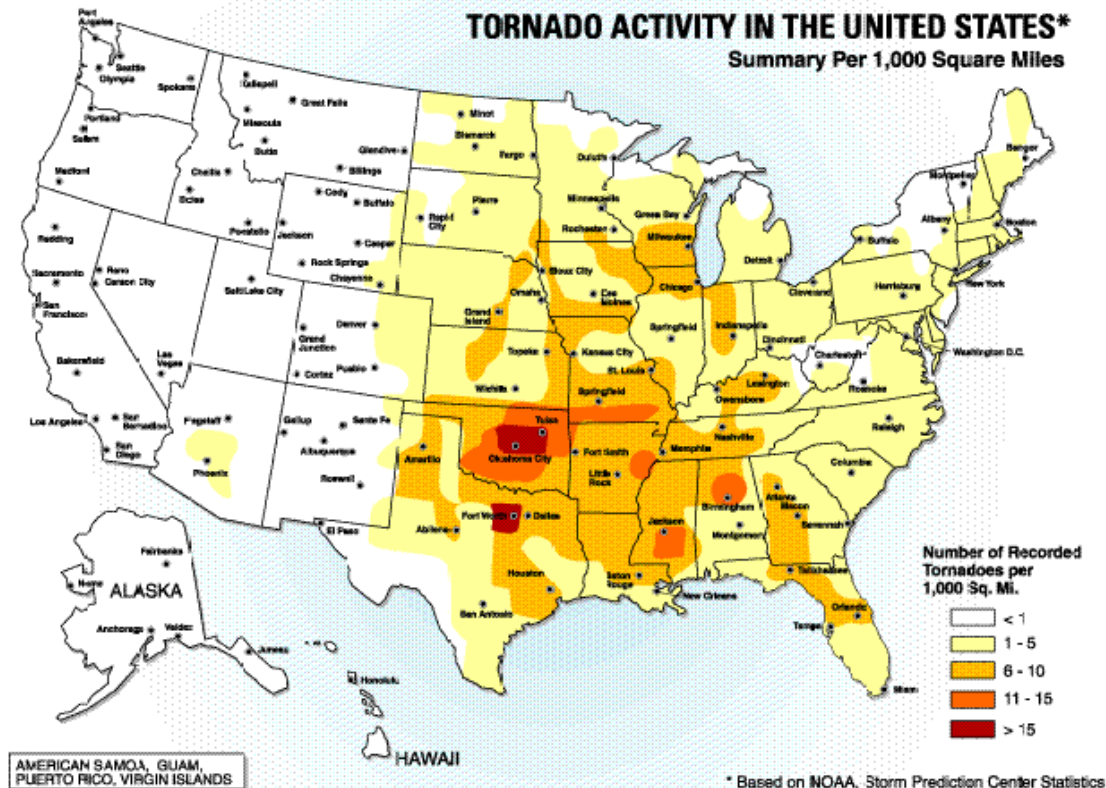
F-Scale Number	Intensity Phrase	Wind Speed	Type of Damage Done
<b>F0</b>	Gale tornado	40-72 MPH	Some damage to chimneys; breaks branches off trees; pushes over shallow-rooted trees; damages to sign boards.
<b>F1</b>	Moderate tornado	73-112 MPH	The lower limit is the beginning of hurricane wind speed;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

*Source: The Tornado Project, 2002.*

According to the NOAA Storm Prediction Center (SPC), the highest concentration of tornadoes in the United States has been in Oklahoma, Texas, Kansas and Florida respectively. Although the Great Plains region of the Central United States does favor the development of the largest and most dangerous tornadoes (earning the designation of “tornado alley”), Florida experiences the greatest number of tornadoes per square mile of all U.S. states (SPC, 2002). **Figure 4.1-2** shows tornado activity in the United States based on the number of recorded tornadoes per 1,000 square miles.

SUSSEX COUNTY, DELAWARE  
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**Figure 4.1-2**  
**Tornado Activity in the United States**



Source: American Society of Civil Engineers

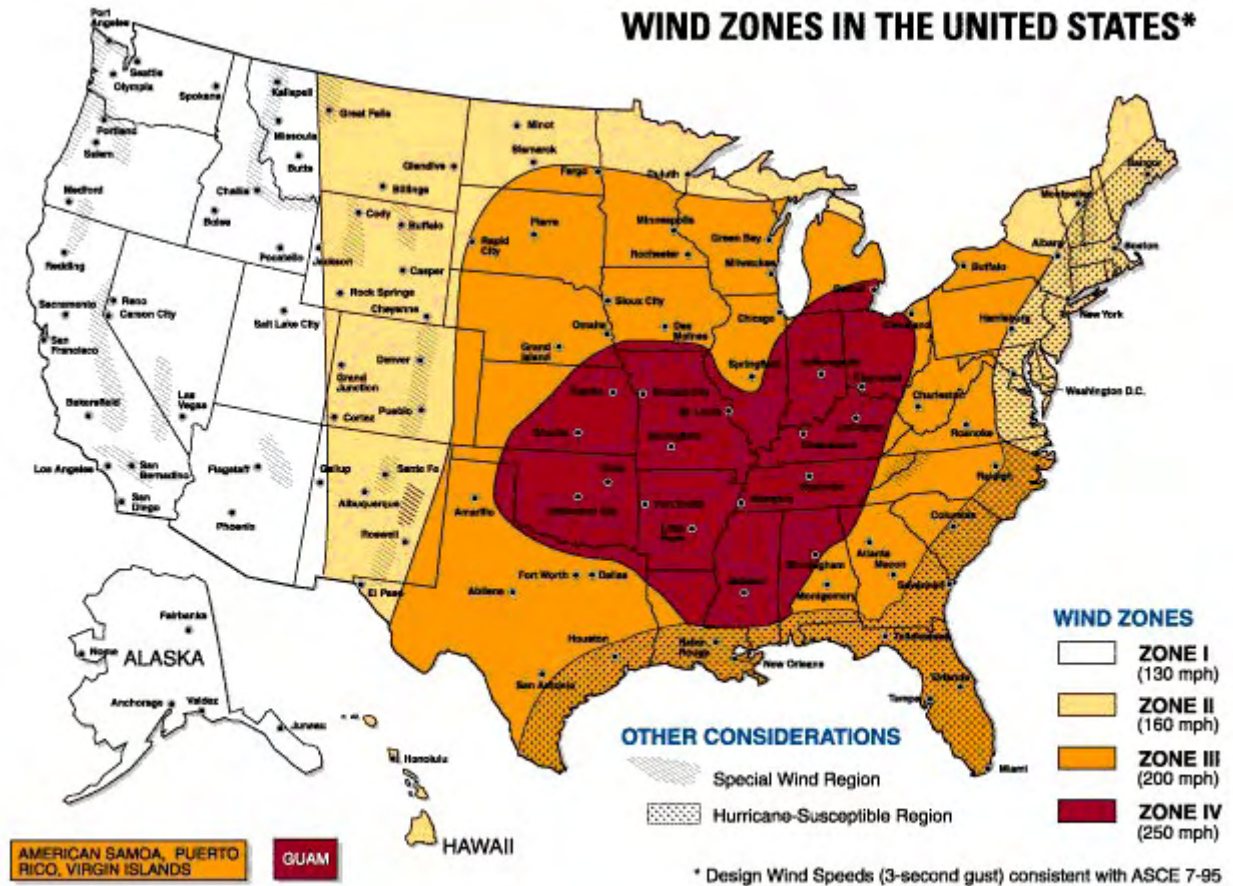
The tornadoes associated with tropical cyclones are most frequent in September and October when the incidence of tropical storm systems is greatest. This type of tornado usually occurs around the perimeter of the storm, and most often to the right and ahead of the storm path or the storm center as it comes ashore. These tornadoes commonly occur as part of large outbreaks and generally move in an easterly direction.

**Figure 4.1-3** shows how the frequency and strength of extreme windstorms vary across the United States. The map was produced by the Federal Emergency Management Agency and is based on 40 years of tornado history and over 100 years of hurricane history. Zone IV, the darkest area on the map, has experienced both the greatest number of tornadoes and the strongest tornadoes. As shown by the map key, wind speeds in Zone IV can be as high as 250 MPH.



## SUSSEX COUNTY, DELAWARE ALL HAZARD MITIGATION PLAN

**Figure 4.1-3**  
**Wind Zones in the United States**



**Figure 1.2** Wind zones in the United States  
*Source: Federal Emergency Management Agency*

## SUSSEX COUNTY, DELAWARE ALL HAZARD MITIGATION PLAN

### *Wildfire*

A wildfire is any fire occurring in a wildland area (i.e., grassland, forest, brush land) except for fire under prescription.<sup>1</sup> Wildfires are part of the natural management of the Earth's ecosystems, but may also be caused by natural or human factors. Over 80 percent of forest fires are started by negligent human behavior such as smoking in wooded areas or improperly extinguishing campfires. The second most common cause for wildfire is lightning.

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.

State and local governments can impose fire safety regulations on home sites and developments to help curb wildfire. Land treatment measures such as fire access roads, water storage, helipads, safety zones, buffers, firebreaks, fuel breaks, and fuel management can be designed as part of an overall fire defense system to aid in fire control. Fuel management, prescribed burning, and cooperative land management planning can also be encouraged to reduce fire hazards.



*On Sunday, August 6, 2000, several forest fires converged near Sula, Montana, forming a firestorm that overran 100,000 acres and destroyed 10 homes. Temperatures in the flame front were estimated at more than 800 degrees. Note the elk gathering near the East Fork of the Bitterroot River. (Photo by John McColgan/U.S. Forest Service Firefighter)*

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 (tornadoes, hurricanes, etc.) 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.

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

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<sup>1</sup> Prescription burning, or “controlled burn,” undertaken by land management agencies is the process of igniting fires under selected conditions, in accordance with strict parameters.

## SUSSEX COUNTY, DELAWARE ALL HAZARD MITIGATION PLAN

### *Drought/Extreme Heat*

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 can make areas more susceptible to wildfire. Human demands and actions can also hasten drought-related impacts.

Droughts are frequently classified as one of following four types:

- Meteorological,
- Agricultural,
- Hydrological, and
- 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.

While drought mostly impacts land and water resources, extreme heat can pose a significant risk to humans. Extreme heat can be defined as temperatures that hover 10 degrees or more above the average high temperature for the region, last for prolonged periods of time, and are often accompanied by high humidity. Under normal conditions, the human body's internal thermostat produces perspiration that evaporates and cools the body. However, in extreme heat and high humidity, evaporation is slowed and the body must work much harder to maintain a normal temperature. Elderly persons, young children, persons with respiratory difficulties, and those who are sick or overweight are more likely to become victims of extreme heat. Because men sweat more than women, they are more susceptible to heat-related illness because they become more quickly dehydrated. Studies have shown that a significant rise in heat-related illness occurs when excessive heat persists for more than two days. Spending at least two hours per day in air conditioning can significantly reduce the number of heat-related illnesses.

Extreme heat in urban areas can create health concerns when stagnant atmospheric conditions trap pollutants, thus adding unhealthy air to excessively hot temperatures. In addition, the “urban heat island effect” can produce significantly higher nighttime temperatures because asphalt and concrete (which store heat longer) gradually release heat at night.



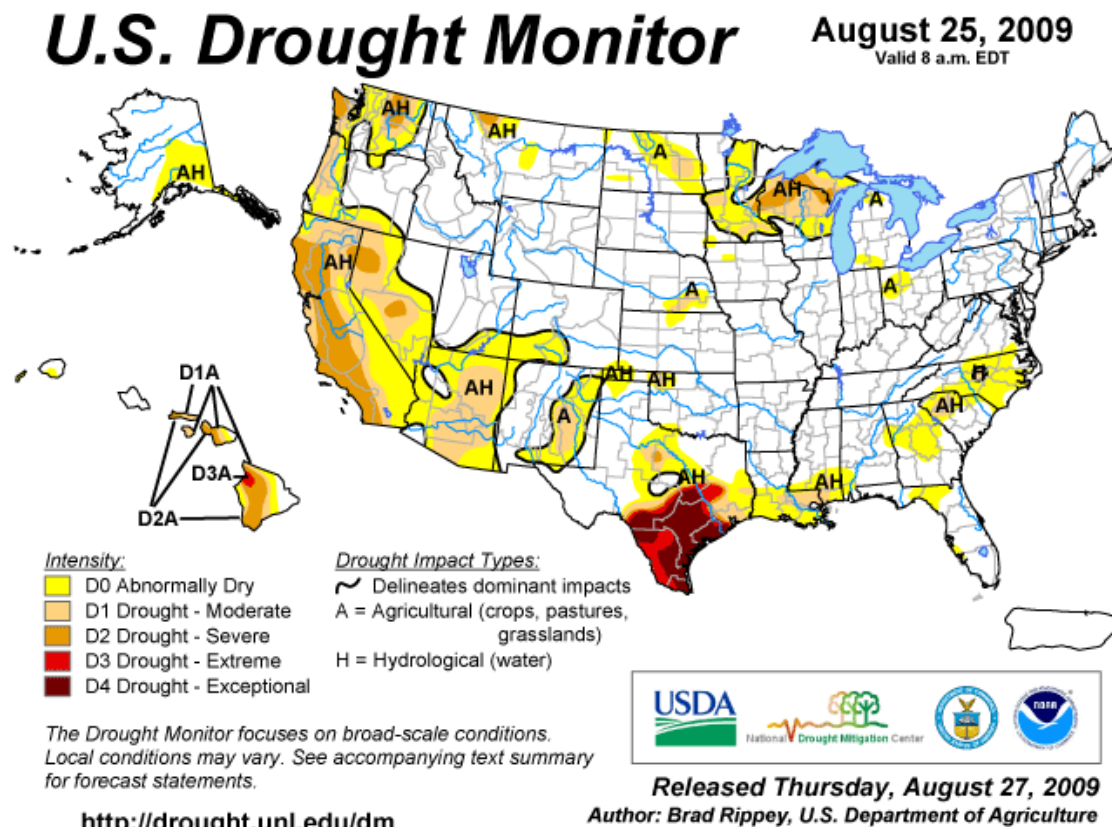
*A USGS streamflow gaging station at the Ogeechee River near Eden, Georgia in July 2000 illustrates the drought conditions that can severely affect water supplies, agriculture, stream water quality, recreation, navigation, and forest resources. (Photo courtesy of the United States Geological Survey)*



## SUSSEX COUNTY, DELAWARE ALL HAZARD MITIGATION PLAN

**Figure 4.1-4** shows a U.S. Drought Monitor summary map from the United States Department of Agriculture for August 25, 2009. Drought Monitor summary maps identify general drought areas and label droughts by intensity, with D1 being the least intense and D4 being the most intense.

**Figure 4.1-4**  
**U.S. Drought Monitor**



<http://drought.unl.edu/dm>

Weekly-updated maps may be obtained online from The Drought Monitor Web site, maintained by the National Drought Mitigation Center, located at the following Web address: <http://drought.unl.edu/dm>.

## SUSSEX COUNTY, DELAWARE ALL HAZARD MITIGATION PLAN

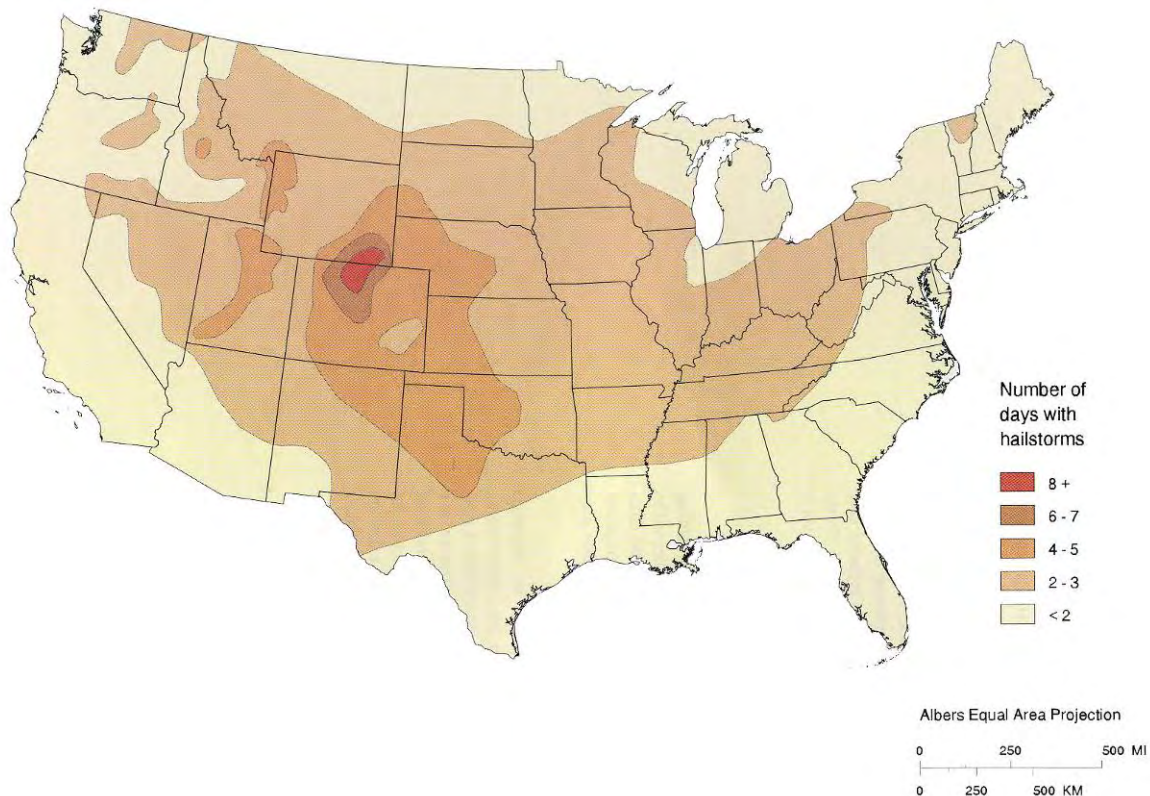
### *Hail*

Hailstorms are an outgrowth of severe thunderstorms. Early in the developmental stages of a hailstorm, ice crystals form within a low-pressure front due to the rapid rising of warm air into the upper atmosphere and the subsequent cooling of the air mass. Frozen droplets gradually accumulate on the ice crystals until, having developed sufficient weight, they fall as precipitation—as balls or irregularly shaped masses of ice greater than 0.75 in. (1.91 cm) in diameter. The size of hailstones is a direct function of the size and severity of the storm. High velocity updraft winds are required to keep hail in suspension in thunderclouds. The strength of the updraft is a function of the intensity of heating at the Earth's surface. Higher temperature gradients relative to elevation above the surface result in increased suspension time and hailstone size. **Figure 4.1-5** shows the annual frequency of hailstorms in the United States.



*Large hail collects on streets and grass during a severe thunderstorm. Larger stones appear to be nearly two to three inches in diameter. (NOAA Photo Library, NOAA Central Library; OAR/ERL/National Severe Storms Laboratory)*

**Figure 4.1-5**  
**Annual Frequency of Hailstorms in the United States**



Source: Federal Emergency Management Agency

## SUSSEX COUNTY, DELAWARE ALL HAZARD MITIGATION PLAN

### *Winter Storms and Freezes*

A winter storm can range from a moderate snow over a period of a few hours to blizzard conditions with blinding wind-driven snow that lasts for several days. Some winter storms may be large enough to affect several states, while others may affect only a single community. Many winter storms are accompanied by low temperatures and heavy and/or blowing snow, which can severely impair visibility.

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

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



*A heavy layer of ice was more weight than this tree in Kansas City, Missouri could withstand during a January 2002 ice storm that swept through the region bringing down trees, power lines and telephone lines. (Photo by Heather Oliver/FEMA News Photo)*

### *Erosion*

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

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

An area's potential for erosion is determined by four factors: soil characteristics, vegetative cover, topography climate or rainfall, and topography. Soils composed of a large percentage of silt and fine sand are most susceptible to erosion. As the content of these soils increases in the level of clay and organic material, the potential for erosion decreases. Well-drained and well-graded gravels and gravel-sand mixtures are the least likely to erode. Coarse gravel soils are highly permeable and have a good capacity for absorption, which can prevent or delay the amount of surface runoff. Vegetative cover can



## SUSSEX COUNTY, DELAWARE ALL HAZARD MITIGATION PLAN

be very helpful in controlling erosion by shielding the soil surface from falling rain, absorbing water from the soil, and slowing the velocity of runoff. Runoff is also affected by the topography of the area including size, shape and slope. The greater the slope length and gradient, the more potential an area has for erosion. Climate can affect the amount of runoff, especially the frequency, intensity and duration of rainfall and storms. When rainstorms are frequent, intense, or of long duration, erosion risks are high. Seasonal changes in temperature and rainfall amounts define the period of highest erosion risk of the year.

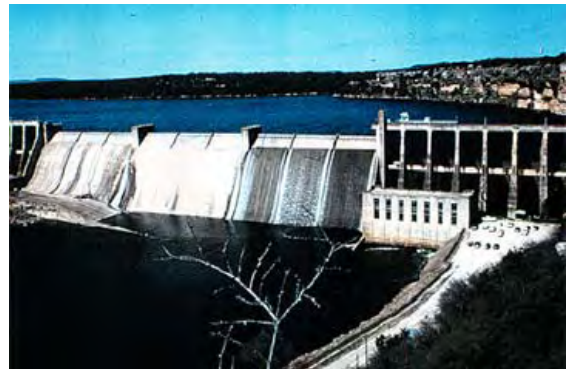
During the past 20 years, the importance of erosion control has gained the increased attention of the public. Implementation of erosion control measures consistent with sound agricultural and construction operations is needed to minimize the adverse effects associated with increasing settling out of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

### *Dam/Levee Failure*

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

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

Though dams have many benefits, they also can pose a risk to communities if not designed, operated, and maintained properly. In the event of a dam failure, the energy of the water stored behind even a small dam is capable of causing loss of life and great property damage if development exists downstream of the dam. If a levee breaks, scores of properties are quickly submerged in floodwaters and residents may become trapped by this rapidly rising water. The failure of dams and levees has the potential to place large numbers of people and great amounts of property in harm's way.



*Dam failure can result from natural events, human-induced events, or a combination of the two. Failures due to natural events such as hurricanes, earthquakes or landslides are significant because there is generally little or no advance warning. The most common cause of dam failure is prolonged rainfall that produces flooding. (Photo: Michael Baker Corporation)*

## SUSSEX COUNTY, DELAWARE ALL HAZARD MITIGATION PLAN

### *Earthquakes, Sinkholes and Landslides*

#### **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. Other damaging earthquake effects include landslides, the down-slope movement of soil and rock (mountain regions and along hillsides), and liquefaction, in which ground soil loses the ability to resist shear and flows much like quick sand. In the case of liquefaction, anything relying on the substrata for support can shift, tilt, rupture, or collapse.

Most earthquakes are caused by the release of stresses accumulated as a result of the rupture of rocks along opposing fault planes in the Earth's outer crust. These fault planes are typically found along borders of the Earth's ten 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. As earthquakes occurring in the mid-Atlantic trench usually pose little danger to humans, the greatest earthquake threat in North America is along the Pacific Coast.

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 4.1-5**). Each unit increase in magnitude on the Richter Scale corresponds to a ten-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 4.1-6**.



*Many roads, including bridges and elevated highways, were damaged by the 6.7 magnitude earthquake that impacted the Northridge, California area January 17, 1994. Approximately 114,000 structures were damaged and 72 deaths were attributed to the event. Damage costs were estimated at \$25 billion. (FEMA News Photo)*

**Table 4.1-5  
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.

**Table 4.1-6  
Modified Mercalli Intensity Scale for Earthquakes**

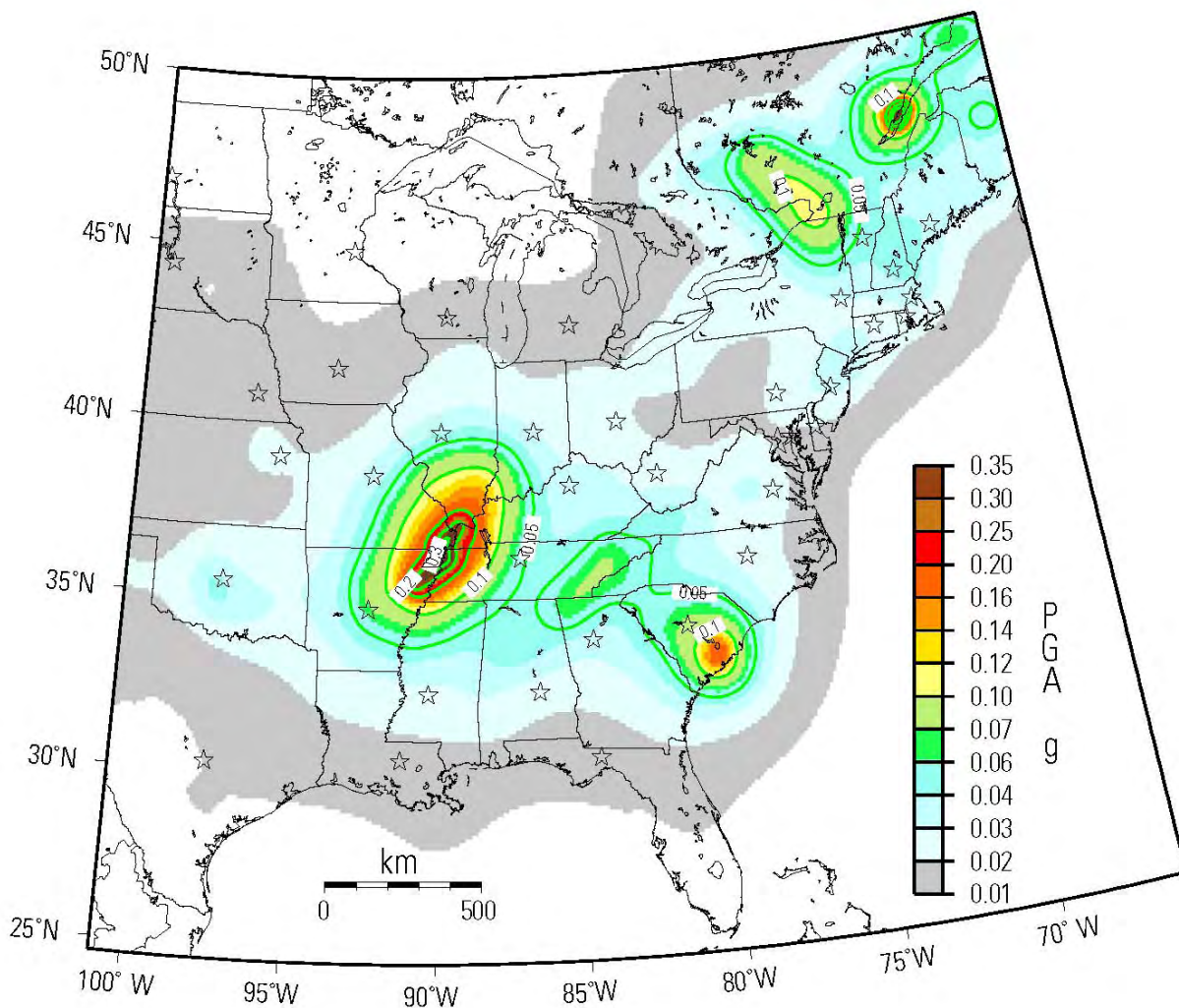
Scale	Intensity	Description of Effects	Corresponding Richter Scale Magnitude
I	Instrumental	Detected only on seismographs	
II	Feeble	Some people feel it	<4.2
III	Slight	Felt by people resting; like a truck rumbling by	
IV	Moderate	Felt by people walking	
V	Slightly Strong	Sleepers awake; church bells 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: North Carolina Division of Emergency Management*

## SUSSEX COUNTY, DELAWARE ALL HAZARD MITIGATION PLAN

**Figure 4.1-4** shows the probability that ground motion will reach a certain level during an earthquake in the Eastern US. The data show peak horizontal ground acceleration (the fastest measured change in speed, for a particle at ground level that is moving horizontally due to an earthquake) with a 10 percent probability of exceedance in 50 years. The map was compiled by the U.S. Geological Survey (USGS) Geologic Hazards Team, which conducts global investigations of earthquake, geomagnetic, and landslide hazards.

**Figure 4.1-4**  
**Peak Acceleration with 10 Percent Probability of Exceedance in 50 Years**



Source: United States Geological Survey, 2008



## SUSSEX COUNTY, DELAWARE ALL HAZARD MITIGATION PLAN

### Sinkholes

Sinkholes are a natural and common geologic feature in areas with underlying limestone and other rock types that are soluble in natural water. Most limestone is porous, allowing the acidic water of rain to percolate through their strata, dissolving some limestone and carrying it away in solution. Over time, this persistent erosional process can create extensive underground voids and drainage systems in much of the carbonate rocks. Collapse of overlying sediments into the underground cavities produces sinkholes.

The three general types of sinkholes are: subsidence, solution, and collapse. Collapse sinkholes are most common in areas where the overburden (the sediments and water contained in the unsaturated zone, surficial aquifer system, and the confining layer above an aquifer) is thick, but the confining layer is breached or absent. Collapse sinkholes can form with little warning and leave behind a deep, steep sided hole. Subsidence sinkholes form gradually where the overburden is thin and only a veneer of sediments is overlying the limestone. Solution sinkholes form where no overburden is present and the limestone is exposed at land surface.

Sinkholes occur in many shapes, from steep-walled holes to bowl or cone shaped depressions. Sinkholes are dramatic because the land generally stays intact for a while until the underground spaces get too big. If there is not enough support for the land above the spaces, then a sudden collapse of the land surface can occur. Under natural conditions, sinkholes form slowly and expand gradually. However, human activities such as dredging, constructing reservoirs, diverting surface water, and pumping groundwater can accelerate the rate of sinkhole expansions, resulting in the abrupt formation of collapse sinkholes.

Although a sinkhole can form without warning, specific signs can signal potential development:

- Slumping or falling fence posts, trees, or foundations;
- Sudden formation of small ponds;
- Wilting vegetation;
- Discolored well water; and/or
- Structural cracks in walls, floors.

Sinkhole formation is aggravated and accelerated by urbanization. Development increases water usage, alters drainage pathways, overloads the ground surface, and redistributes soil. According to the Federal Emergency Management Agency (FEMA), the number of human-induced sinkholes has doubled since 1930, insurance claims for damages as a result of sinkholes has increased 1,200 percent from 1987 to 1991, costing nearly \$100 million.



*Collapses, such as the sudden formation of sinkholes, may destroy buildings, roads, and utilities. (Photo: Bettmann)*

### Landslides

A landslide is the downward and outward movement of slope-forming soil, rock, and vegetation, which is driven by gravity. Landslides may be triggered by both natural and human-caused changes in the environment, including heavy rain, rapid snow melt, steepening of slopes due to construction or erosion, earthquakes, volcanic eruptions, and changes in groundwater levels.

There are several types of landslides: rock falls, rock topple, slides, and flows. Rock falls are rapid



## SUSSEX COUNTY, DELAWARE ALL HAZARD MITIGATION PLAN

movements of bedrock, which result in bouncing or rolling. A topple is a section or block of rock that rotates or tilts before falling to the slope below. Slides are movements of soil or rock along a distinct surface of rupture, which separates the slide material from the more stable underlying material. Mudflows, sometimes referred to as mudslides, mudflows, lahars or debris avalanches, are fast-moving rivers of rock, earth, and other debris saturated with water. They develop when water rapidly accumulates in the ground, such as heavy rainfall or rapid snowmelt, changing the soil into a flowing river of mud or "slurry." Slurry can flow rapidly down slopes or through channels, and can strike with little or no warning at avalanche speeds. Slurry can travel several miles from its source, growing in size as it picks up trees, cars, and other materials along the way. As the flows reach flatter ground, the mudflow spreads over a broad area where it can accumulate in thick deposits.

Landslides are typically associated with periods of heavy rainfall or rapid snow melt and tend to worsen the effects of flooding that often accompanies these events. In areas burned by forest and brush fires, a lower threshold of precipitation may initiate landslides. Some landslides move slowly and cause damage gradually, whereas others move so rapidly that they can destroy property and take lives suddenly and unexpectedly.

Among the most destructive types of debris flows are those that accompany volcanic eruptions. A spectacular example in the United States was a massive debris flow resulting from the 1980 eruptions of Mount St. Helens, Washington. Areas near the bases of many volcanoes in the Cascade Mountain Range of California, Oregon and Washington are at risk from the same types of flows during future volcanic eruptions.

Areas that are generally prone to landslide hazards include previous landslide areas; the bases of steep slopes; the bases of drainage channels; and developed hillsides where leach-field septic systems are used. Areas that are typically considered safe from landslides include areas that have not moved in the past; relatively flat-lying areas away from sudden changes in slope; and areas at the top or along ridges, set back from the tops of slopes.

In the United States, it is estimated that landslides cause up to \$2 billion in damages and from 25 to 50 deaths annually. Globally, landslides cause billions of dollars in damage and thousands of deaths and injuries each year.

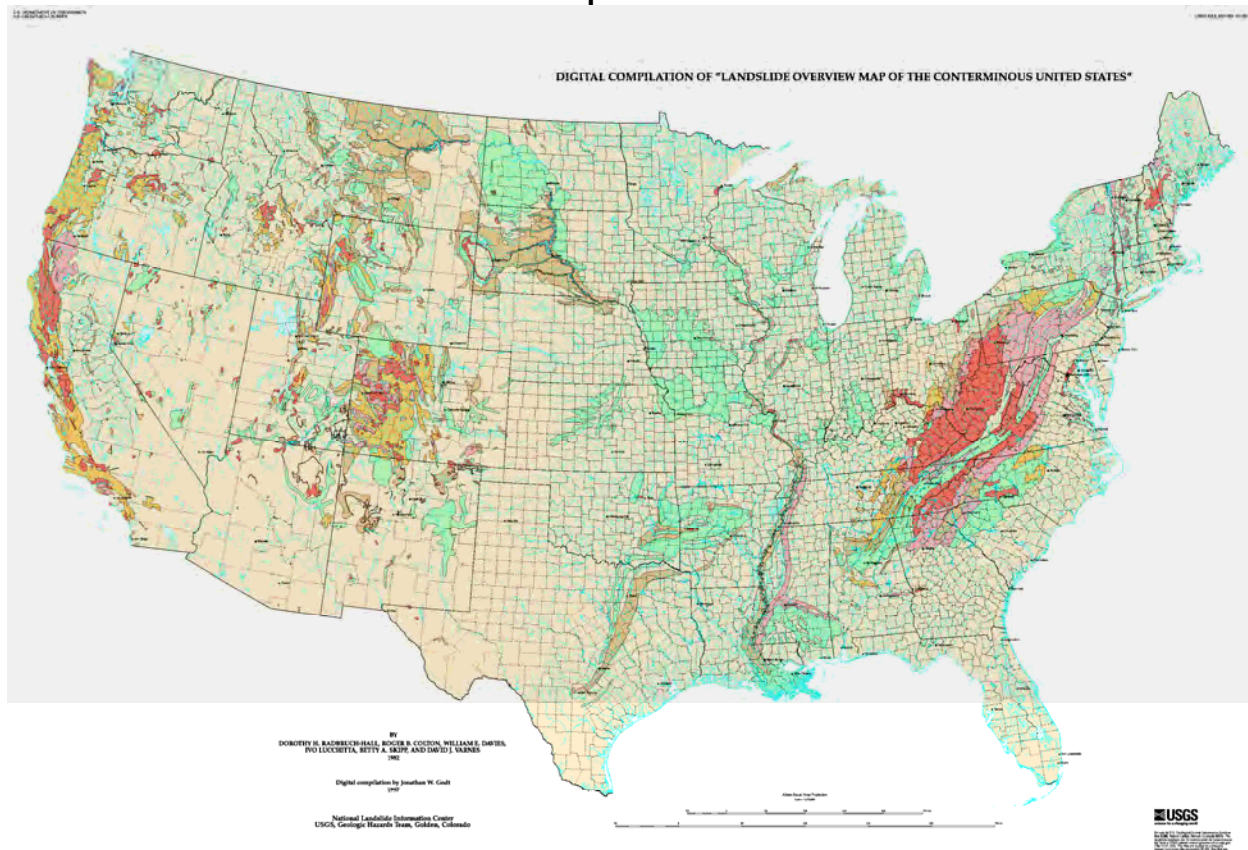
**Figure 4.1-5** delineates areas where large numbers of landslides have occurred and areas which are susceptible to landsliding in the conterminous United States. This map layer is provided in the U.S. Geological Survey Professional Paper 1183, Landslide Overview Map of the Conterminous United States, available online at [http://landslides.usgs.gov/html\\_files/landslides/nationalmap/national.html](http://landslides.usgs.gov/html_files/landslides/nationalmap/national.html).



*Landslides can damage or destroy roads, railroads, pipelines, electrical and telephone lines, mines, oil wells, buildings, canals, sewers, bridges, dams, seaports, airports, forests, parks, and farms. (Photo by Lynn Forman)*

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**Figure 4.1-5  
Landslide Overview Map of the Conterminous United States**



### EXPLANATION

#### LANDSLIDE INCIDENCE

- Low (less than 1.5% of area involved)
- Moderate (1.5%-15% of area involved)
- High (greater than 15% of area involved)

#### LANDSLIDE SUSCEPTIBILITY/INCIDENCE

- Moderate susceptibility/low incidence
- High susceptibility/low incidence
- High susceptibility/moderate incidence

Susceptibility not indicated where same or lower than incidence. Susceptibility to landsliding was defined as the probable degree of response of [the areal] rocks and soils to natural or artificial cutting or loading of slopes, or to anomalously high precipitation. High, moderate, and low susceptibility are delimited by the same percentages used in classifying the incidence of landsliding. Some generalization was necessary at this scale, and several small areas of high incidence and susceptibility were slightly exaggerated.

*Source: United States Geological Survey*

## SUSSEX COUNTY, DELAWARE ALL HAZARD MITIGATION PLAN

### *Tsunami*

The word tsunami is Japanese and means “harbor wave.” A tsunami is a series of great waves that are created by undersea disturbances such as earthquakes or volcanic eruptions. From the area of disturbance, tsunami waves will travel outward in all directions. Tsunamis can originate hundreds or even thousands of miles away from coastal areas.

The time between wave crests may be five to 90 minutes and the open ocean wave speed may average 450 miles per hour. As tsunami waves approach shallow coastal waters, they appear normal size and the speed decreases until the waves near the shoreline, where it may grow to great height and crash into the shore. Areas at greatest risk are less than 50 feet above sea level and within one mile of the shoreline. Rapid changes in the ocean water level may indicate that a tsunami is approaching. Most deaths during a tsunami are the result of drowning. Associated risks include flooding, polluted water supplies, and damaged gas lines.

In the United States, tsunamis have historically affected the West Coast, but the threat of tsunami inundation is also possible on the Atlantic Coast. Pacific Ocean tsunamis are classified as local, regional, or Pacific-wide. Regional tsunamis are most common. Pacific-wide tsunamis are much less common, with the last one being recorded in 1964, but are larger waves, which have high potential to cause destruction.

In 1949 the Pacific Tsunami Warning Center was established at Ewa Beach, Hawaii to monitor conditions in the Pacific Ocean and to provide warnings in case of tsunamis. According to the Pacific Tsunami Warning Center, 796 tsunamis were observed or recorded in the Pacific Ocean between 1900 and 2001. Approximately 117 caused casualties and damage and at least nine caused widespread destruction throughout the Pacific. The greatest number of tsunamis during any one-year was 19 in 1938, but all were minor and caused no damage. There was no single year of the period that was free of tsunamis.



*Tsunami Hazard Zone signs are posted at coastal access points or other low-lying areas that would clearly be vulnerable to a large, locally generated tsunami. Signs are placed at locations agreed upon by local and state governmental authorities. Tsunami Evacuation Route markers are used to designate the evacuation routes established by local jurisdictions in cooperation with emergency management officials. (Photos courtesy of Washington State Department of Transportation)*

## SUSSEX COUNTY, DELAWARE ALL HAZARD MITIGATION PLAN

### *Volcano*

Over 75 percent of the Earth's surface above and below sea level, including the seafloors and some mountains, originated from volcanic eruption. Emissions from these volcanoes formed the Earth's oceans and atmosphere. Volcanoes can also cause tsunamis, earthquakes, and dangerous flooding.

A volcano is a vent in the Earth's crust that emits molten rock and steam. They are evidence that the physical makeup of our planet is ever-changing. Volcanoes are relatively site specific, but the molten rock, steam, and other gases they release can have an impact on much larger areas.

Lahar is the mudflow of debris and water caused by a volcano. It is also known as debris flow or volcanic mudflow. Lahar is most often triggered by rainfall washing down the debris from the slopes of volcanoes. However, lahar flows can also be triggered by rapidly melting snow and ice, debris avalanches and breakouts of lakes that were dammed by volcanic debris.

Tephra is the general term used to describe the ash and other materials that are released into the air after a volcanic eruption. Tephra ranges in size from fine powder to larger rock-sized particles. Volcanic ash can contaminate water supplies, cause electrical storms, and collapse roofs, and can affect people hundreds of miles away.



*The May 18, 1980 eruption of Mount St. Helens created an eruptive cloud that rose to an altitude of more than 12 miles in 10 minutes. The swirling ash particles in the eruptive cloud generated lightning which in turn ignited forest fires. Other fires were ignited by the initial blasts and later pyroclastic flows. Nearly 550 million tons of ash fell over a 22,000 square mile area. (Photo courtesy of Department of Natural Resources, State of Washington)*

Volcanic explosions which are directed sideways are called lateral blasts. Lateral blasts can throw large pieces of rock at very high speeds for several miles. These explosions can kill by impact, burial, or heat and may have enough force to knock down entire forests of trees. The majority of deaths attributed to the Mount St. Helens volcano were a result of lateral blast and tree blow-down.

There are more than 500 active volcanoes in the world. More than half of these volcanoes are part of the "Ring of Fire," a region that encircles the Pacific Ocean. More than 50 volcanoes in the United States have erupted one or more times in the past 200 years. The most volcanically active regions of the nation are in Alaska, Hawaii, California, Oregon and Washington. The danger area around a volcano covers approximately a 20-mile radius. Some danger may exist 100 miles or more from a volcano.



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### *Terrorism*

The Federal Emergency Management Agency, in its guidance on integrating human-caused hazards into state and local hazard mitigation plans (FEMA Publication 386-7), has established a set of categories that can be applied to the profiling of intentional acts of terrorism. These categories are: contamination; energy release (i.e., explosives, arson, etc.); and disruption of a service.

#### **Contamination**

Contamination, as it relates to terrorist activity, refers to the intentional release of **chemical**, **biological** or **radiological** agents, as well as **nuclear** hazards. Contamination can apply to human and animal life, a geographic area, agriculture/food supplies (as in “agriterrorism”), and even the electronic world of computers and information via the Internet and e-mail (as in “**cyberterrorism**.”)

According to Jane’s Chem-Bio Handbook, **chemical** agents are liquid or aerosol contaminants that can be dispersed using sprayers or other aerosol generators, by liquids vaporizing from puddles or containers, or munitions. Chemical agents may pose viable threats for hours to weeks depending on the agent used and the conditions which exist at the exposed area. This type of hazard is especially volatile as contamination can be carried beyond the initial target zone by persons, vehicles, water and even the wind. Chemicals may also be corrosive or otherwise damaging over time, if not dealt with appropriately. **Biological** agents are liquid or solid contaminants that can be dispersed using sprayers or aerosol generators, or by point or line sources such as munitions, covert deposits or moving sprayers. Biological hazards may pose a danger for a period of hours to years, depending on the type of agent used and the conditions in which it exists. Contamination can be spread via water and/or wind, and infection can be spread via humans and/or animals.



*Cleanup of hazardous materials and contaminated debris following a terrorist attack can be an arduous 24-hour-a-day operation, as captured in this photo of debris removal from Ground Zero of the 9/11 attack to the Staten Island landfill. (Photo by Andrea Booher/FEMA News Photo)*

FEMA’s Radiological Emergency Management Course states that **radiological** agents can also be dispersed using sprayers or aerosol generators, or by point or line sources such as munitions, covert deposits and moving sprayers. Radiological contaminants may remain hazardous for seconds to years depending on the material used. The initial effects of a radiological attack are likely to be localized to the site of the attack; however, depending on meteorological conditions, the subsequent behavior of contaminants may become more dynamic. **Nuclear** hazards include the detonation of a nuclear device underground, on the Earth’s surface, in the air, or at a high altitude. Heat flashes and blast waves resulting from a detonation would last for seconds, however nuclear radiation and fallout hazards can continue on for years. In addition, an electromagnetic pulse, resulting from a high-altitude detonation and lasting for a few seconds, can affect unprotected electronic systems. The initial light, heat and blast effects of a subsurface, ground or air burst are static and are determined by the device’s characteristics. The fallout of radioactive contaminants may be dynamic depending on meteorological conditions.

**Cyberterrorism** is a relatively new concept. According to the National Strategy for Homeland Security, terrorists may seek to cause widespread disruption and damage, including casualties, by attacking

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electronic and computer networks which are linked to critical infrastructures such as energy, financial and securities networks. In addition, terrorist groups are known to exploit information technology and the Internet to plan attacks, raise funds, circulate propaganda, gather information and communicate. In terms of hazard mitigation, cyberterrorism is often explored as a component in business continuity planning.

### Energy Release

Energy release refers primarily to the use of explosive devices, such as conventional bombs, and incendiary operations such as arson attacks. The detonation of an explosive device whether on or near a target has an instantaneous effect, which can be compounded and/or prolonged by the use of multiple devices. The extent of damage caused by an explosion is, of course, determined by the type and quantity of explosive used. It should be noted that explosive incidents can result in cascading effects, such as the incremental failure of a structure or system.

Arson and other incendiary attacks refer to the initiation of fire (which can be of an explosive nature) on or near a target. This type of event can last for minutes or hours, and possibly longer depending on the type and quantity of device or accelerant used and the materials (fuels) present at the location of the attack. This type of attack can also result in cascading failures of structures or systems.

### Disruption of Service

Disruption of service refers to the interruption, failure or denial of a service due to terrorist attack, such as the sabotage or designed breakdown of infrastructure as with an attack on transportation facilities, utilities and other public services. While the Federal Bureau of Investigation found no evidence of terrorism or criminal activity in its investigation of the August 2003 blackout in the Northeast United States, and the paralyzing blackout in London, England the same month has been labeled a “freak event,” it is clear to see the potential damage and disruption that could be caused by intentional terrorist attack on a nation’s power grids.

### Weapons of Mass Destruction

The term “Weapons of Mass Destruction” (WMD) has various definitions, however common to all is the assumption that WMDs may consist of any of the agents discussed above: chemical, biological, radiological, nuclear, explosive or incendiary. The purpose of a WMD is to cause death or serious injury to persons or significant damage to property, typically assumed to be of a scale which has the potential to overwhelm the capabilities of many local and state governments.



*The Homeland Security Advisory System consists of five (5) Threat Conditions, each identified by a description and corresponding color. From lowest to highest, the levels and colors are: Low (Green); Guarded (Blue); Elevated (Yellow); High (Orange); and Severe (Red). The higher the Threat Condition, the greater the risk of a terrorist attack. For current Threat Conditions, visit [www.whitehouse.gov/homeland](http://www.whitehouse.gov/homeland).*

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### *Hazardous Materials (HazMat)*

Hazardous materials (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 an intentional terrorist attack. A HazMat incident can last hours to days, while some chemicals can be corrosive or otherwise damaging over longer periods of time. In addition to the primary release, explosions and/or fires can result from a release, and contaminants can be extended beyond the initial area by persons, vehicles, water, wind and possibly wildlife as well.

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



*Propane tanks, gasoline, oil and other hazardous materials and debris in Princeville, North Carolina were cleaned up by Environmental Protection Agency crews following Hurricane Floyd in September 1999. The town remained off limits to residents for some time due to health-related concerns. (Photo by Dave Saville/FEMA News Photo)*

### *Energy Pipeline Failures*

The energy infrastructure of the United States is comprised of many components, including the physical network of pipes for oil and natural gas, electricity transmission lines, and other means for transporting energy to the Nation's consumers. This infrastructure also includes facilities that convert raw natural resources into energy products, as well as the rail network, trucking lines and marine transportation. (U.S. Department of Energy, 2003) Much of this infrastructure is aging, and in addition to the challenges of keeping the infrastructure up-to-date with the latest technological advances and consumer needs, the potential for an energy pipeline failure to become a hazard in-and-of-itself must be considered.



*Virtually all natural gas in the United States is moved via pipeline. (Photo courtesy of the Department of Energy)*

The two million miles of oil pipelines in the United States are the principal mode for transporting oil and petroleum products such as gasoline, and virtually all natural gas in the United States is moved via pipeline as well. (DOE, 2003) Much of this oil pipeline infrastructure is old, requiring regular safety and environmental reviews to ensure its safety and

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reliability. The potential risk of pipeline accidents is a significant national concern.

The energy infrastructure is vulnerable to physical and cyber disruption, either of which could threaten its integrity and safety. (DOE, 2003) Disruptions could originate with natural events such as geomagnetic storms and earthquakes, or could result from accidents, equipment failures or deliberate interference. In addition, the Nation's transportation and power infrastructures have grown increasingly complex and interdependent—consequently, any disruption could have far-reaching consequences.



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## *Data Sources*

*American Society of Civil Engineers (ASCE), "Facts About Windstorms."*

Web site: [www.windhazards.org/facts.cfm](http://www.windhazards.org/facts.cfm)

*Bureau of Reclamation, U.S. Department of the Interior*

Web site: [www.usbr.gov](http://www.usbr.gov)

*Federal Emergency Management Agency (FEMA)*

Web site: [www.fema.gov](http://www.fema.gov)

*National Climatic Data Center (NCDC), U.S. Department of Commerce, National Oceanic and Atmospheric Administration*

Web site: <http://lwf.ncdc.noaa.gov/oa/ncdc.html>

*National Drought Mitigation Center, University of Nebraska-Lincoln*

Web site: [www.drought.unl.edu/index.htm](http://www.drought.unl.edu/index.htm)

*National Severe Storms Laboratory (NSSL), U.S. Department of Commerce, National Oceanic and Atmospheric Administration*

Web site: [www.nssl.noaa.gov](http://www.nssl.noaa.gov)

*National Weather Service (NWS), U.S. Department of Commerce, National Oceanic and Atmospheric Administration*

Web site: [www.nws.noaa.gov](http://www.nws.noaa.gov)

*Storm Prediction Center (SPC), U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service*

Web site: [www.spc.noaa.gov](http://www.spc.noaa.gov)

*The Tornado Project, St. Johnsbury, Vermont*

Web site: [www.tornadoproject.com](http://www.tornadoproject.com)

*United States Department of Energy*

Web site: [www.energy.gov](http://www.energy.gov)

*United States Geological Survey (USGS), U.S. Department of the Interior*

Web site: [www.usgs.gov](http://www.usgs.gov)

# HAZARD ANALYSIS

**Requirement §201.6(c)(2)(i):** *[The risk assessment **shall** include a] description of the ... 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.*

The *Hazard Analysis* section provides information on historical hazard occurrences in Sussex County for the hazards listed below. This listing differs slightly in terminology, order and grouping from the *Hazard Identification* section as those hazards affecting Sussex County are more fully explored.

## Natural

- **Flood**
  - **Riverine Flooding**
  - **Coastal Flooding**
- **Severe Winds**
  - **Hurricanes**
  - **Coastal Storms**
- **Thunderstorms**
- **Tornadoes**
- **Wildfire**
- **Drought/Extreme Heat**
- **Hail**
- **Winter Storms**
- **Coastal Erosion**
- **Dam/Levee Failure**
- **Earthquakes**
- **Tsunami**
- **Volcano**

## Human-caused

- **Terrorism**
- **Hazardous Materials (HazMat)**
- **Energy Pipeline Failures**

Historical records, such as those available from the National Oceanic and Atmospheric Administration's National Climatic Data Center (NCDC), are used to identify the level of risk. The methodological assumption is that the data sources cited are the best data available, however not always complete. To the extent possible, other sources have been used to supplement NCDC records.

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### *Flood*

According to the National Climatic Data Center, 57 flood events were reported in Sussex County between March 13, 1993 and November 30, 2009. These 57 events resulted in no deaths, six injuries and a combined total of approximately \$45,301,000 in property damage (NCDC, 2010). The following sections provide a breakdown of flood activity by type: flash flooding, riverine flooding and coastal flooding.

#### **Flash Flooding**

Flash flooding events that have significantly impacted people, property and the environment:

##### **Countywide, September 16, 1999, 8:30 a.m. ET**

Hurricane Floyd battered the State of Delaware with damaging winds and torrential rains that caused widespread flash flooding. Storm totals averaging around nine (9) inches fell within a 12-hour period from early morning through late afternoon. The highest verifiable storm total was 10.58 inches in Greenwood in Sussex County. This established a new 24-hour state record. Approximately 300 people were evacuated to shelters, mainly in Sussex and New Castle counties. The worst damage in Sussex County occurred inland. Serious flooding problems were reported in Bridgeville, Greenwood and Seaford. Seventy-five percent of downtown Greenwood was submerged under four feet of water.

##### **Northeast Sussex County, July 14, 2000, 5 p.m. through July 15, 2000, 3 a.m. ET**

Thunderstorms with torrential downpours and frequent lightning caused flash flooding in the northeast part of the county. Doppler Radar storm total estimates indicated an excess of four (4) inches of rainfall from the Ellendale area southeast through Dewey Beach. The heaviest rain fell in the Cedar Creek and Broadkill (north of Milton) Hundreds. A weather station at the Rookery Golf Course measured 12 inches of rain. About a dozen vehicles became stranded in high water. Stranded motorists were sheltered at the Eagle's Nest Church and the Milton Fire Hall. In Rehoboth Beach, 4.5 inches of rain fell in 90 minutes. Five major roadways were flooded. Downtown businesses suffered flood damage as the water and debris were too much for the storm drains. Water levels reached eight inches in some stores.

##### **Countywide, September 2, 2000, 1:30 p.m. to 4:30 p.m. ET**

Thunderstorms with torrential rain caused flash flooding, particularly in Broad Creek and Broadkill Hundreds. Doppler Radar storm total estimates reached between four (4) and five (5) inches in that area. The flash flooding spread across roadways and caused several major closures.

##### **Southwest Sussex County, August 11, 2001, 3 p.m. through August 12, 2001, 5 a.m. ET**

Slow moving thunderstorms with torrential rains inundated southwestern Sussex County during the late afternoon of the 11th. Doppler Radar storm total estimates reached 8.4 inches around Seaford. About a dozen municipal streets were closed because of the flooding including Delaware State Route 20. About midnight, the 100-year-old dam on Hearn's Pond gave way. The 60-acre pond drained out and a bulkhead along U.S. Route 13A was undercut by the flood waters which then undermined the roadway. The flooding caused extensive damage to the historic Hearn's and Rawlings Mills. Fifteen patients of a nearby nursing home were evacuated to the second floor.

##### **Bethany Beach, July 19, 2002, 1:30 p.m. to 4:30 p.m. ET**

Very slow moving thunderstorms with very heavy rain inundated the Bethany Beach area of southeastern Sussex County with copious amounts of rain. Doppler Radar storm total estimates reached about 10 inches in Bethany Beach. Two ground truth rainfall reports from Bethany Beach recorded 7.41 inches and six (6) inches. Most of the rain fell between 2 p.m. and 4 p.m. Every road east of Delaware State Route 1 was flooded. All side streets in Bethany Beach were flooded and closed. Up to two feet of water

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in the downtown area was recorded. The Bethany Fire Department (BFD) rescued occupants of two vehicles that were swept into ditches by flood waters. BFD also rescued an elderly man and woman who drove their vehicle into a pond near the Sea Colony Resort. Even the fire department was not immune: the heavy rain flooded the first floor of the fire station, soaked the furniture and caused the carpeting to float.

### **Countywide, September 1, 2002, 7 a.m. to 3 p.m. ET**

Very heavy rain which persisted over Sussex County from midnight through early afternoon on the 1st caused considerable poor drainage flooding as well as flooding of area streams. There were road closures in about two dozen locations throughout the county including U.S. Routes 9 and 113 and Delaware State Road 20. The Georgetown Plaza Shopping Center flooded and vehicles were stranded in the Wal-Mart parking lot in Seaford. The worst damage from the heavy rain occurred on the 3rd in Millsboro. The middle section of the Christian Storehouse roof collapsed. The building was in the process of having a new roof installed and older sections could not support the weight of the rain and the bundles of new shingles which were left on the roof.

### **Southwest Sussex County, June 25, 2006, 6:45 a.m. to 5 p.m. ET**

Repeating thunderstorms with torrential downpours dropped six to eight inches of rain across southwestern parts of Sussex County during the morning of the 25th. This caused extensive roadway, field and stream flooding. Hardest hit was the Seaford and Blades area where every major roadway was flooded and closed, shopping mall parking lots became lakes. Evacuations of homes and a long term care facility occurred. The torrential rains led to over 300 people being activated, nearly 200 water rescues from stranded vehicles and up to 40 roads were closed. In Seaford over 100 senior citizens were evacuated from Lifecare at Lofland Park Nursing Home because of concerns about the Williams Pond Spillway. The Hearn's Pond Dam was also damaged. The Sussex Plaza was flooded including the local Wal-Mart and several car dealerships. Just west of Seaford, the Craig's Pond Dam failed and damaged one road. Chapel Branch flooding reached 10 feet. Three sections of railroad rails and ties hung in suspension by the new gorge created by the flood waters. One sink hole was 30 feet by 30 feet. The dam failure damaged a largemouth bass fishery. In Blades, three mobile home parks were evacuated: Mobile Garden, Holly View and Hastings Estate.

## **Riverine Flooding**

Riverine flooding events that have significantly impacted people, property and the environment:

### **February 23, 2003, 1:27 p.m. through February 24, 2003, 8:57 a.m. ET**

Runoff from the heavy rain on the 22nd and the snow melt throughout the weekend (the 22nd and 23rd) led to minor flooding along the Nanticoke River in Sussex County. The Nanticoke River at Bridgeville was above its eight foot flood stage from 1:27 p.m. on the 23rd through 8:57 a.m. on the 24th. It crested at 8.28 feet at 725 p.m. on the 23rd. Storm totals included 1.9 inches in Greenwood, 1.62 inches in Georgetown and 1.54 inches in Milford.

### **June 25, 2006, 5 p.m. through June 26, 2006, 2:00 a.m. ET**

The same storm that brought flash flooding to the southwest portion of the county (see description above) also caused the Nanticoke River to exceed its banks the night of the 25th. The Nanticoke River at Bridgeville was above its 8 foot flood stage from 1045 p.m. EDT on the 25th through 300 a.m. EDT on the 26th. It crested at 8.04 feet at Midnight EDT on the 26th. Many road, dams, and bridges were damaged.

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### **April 15, 2007, 12:00 noon. through April 16, 2007, 8:20 p.m. ET**

Heavy rain caused poor drainage and field flooding on the 15th. The runoff from the heavy rain led to flooding along the Nanticoke River. The Nanticoke River at Bridgeville was above its 8 foot flood stage from 730 am EDT on the 16th through 920 pm on the 16th. It crested at 8.19 feet at 1245 pm EDT on the 16th. Precipitation totals included 2.80 inches in Lincoln.

### **Coastal Flooding**

Coastal flooding events that have significantly impacted people, property and the environment:

### **March 13, 1993, 12 p.m. through March 14, 1993, 3:30 a.m. ET**

A major winter storm that developed in the Gulf of Mexico moved northeast across the Mid-Atlantic region on the 13th and 14th producing a variety of weather, including minor coastal flooding which occurred at times of high tide Saturday and early Sunday morning. In Rehoboth Beach, waves broke through the dunes in a couple of places and beach erosion was significant. Dewey Beach had street flooding and beach erosion. Route 1, between Dewey and Bethany Beaches, was closed due to flooding. Sea water, with pizza-sized chunks of ice, flooded roads in Bowers Beach. \$50,000 in property damages were reported.

### **December 20, 1995, 5 a.m. to 9 a.m. ET**

A coastal storm brought a prolonged mixture of sleet and snow to interior Sussex County and some minor tidal flooding along the ocean side the county. The onshore flow on the 19th coupled with spring high tides caused minor tidal flooding at the times of high tide the morning of the 20th. Northwest winds the morning of the 20th prevented a further repeat of this flooding.

### **June 2, 1997, 3 p.m. through June 3, 1997, 8 p.m. ET**

A series of low pressure systems moving east off the North Carolina coast and a relatively strong high pressure system over eastern Canada brought a strong and persistent northeast flow from the 2nd through the 4th. The onshore flow peaked during the evening of the 2nd through the morning of the 3rd and produced some minor tidal flooding at times of high tide. A wind gust of 48 MPH was reported by the Cape May-Lewes Ferry the morning of the 3rd. Tidal departures averaged about two feet above normal, peaking the morning of the 3rd. The heavy surf also caused some minor beach erosion, especially in Rehoboth Beach.

### **November 7, 1997, 11 a.m. through November 8, 1997, 4 p.m. ET**

A slow moving nor'easter caused strong winds, heavy rain, beach erosion and widespread, but minor, tidal flooding from midday on the 7th through the morning of the 9th. The several-tide-cycle-pounding caused beach erosion and raised tidal departures to around 3.5 feet above normal and around 2.5 feet above normal at times of high tide from midday on the 7th through the afternoon on the 8th. This caused widespread, but minor, tidal flooding from the midday high tide on the 7th through the afternoon on the 8th. The highest tide reported at Lewes was 7.1 feet above mean low water.

### **November 14, 1997, 6 a.m. to 11 p.m. ET**

A coastal storm developed along the South Carolina coast the morning of the 13th, moving slowly northeast. This nor'easter unfortunately coincided with the full moon and spring tides and caused moderate tidal flooding during the morning high tide and minor tidal flooding during the evening high tide on the 14th as well as beach erosion. The high tides the morning of the 14th were only about two (2) feet above normal. However, the onshore flow coincided with relatively high astronomical tides (even by spring tide standards) and produced moderate tidal flooding. Tides reached 7.5 feet above mean low water at Lewes.

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### **December 29, 1997, 6 p.m. to 11 p.m. ET**

A strong onshore flow preceding a low pressure system caused some minor tidal flooding at the times of the evening high tide on the 29th. The heaviest rain in most places did not coincide with the incoming tide and thus did not exacerbate the flooding along Sussex County's coastal communities. The high tides that evening included 6.1 feet above mean low water in Lewes. Tidal departures averaged between two (2) and 2.5 feet above normal.

### **January 28, 1998, 6 a.m. through January 29, 1998, 12 p.m. ET**

An intense nor'easter pounded Sussex County with tidal flooding, beach erosion, strong winds and heavy rain on the 28th. Conditions were progressively worse closer to the coast. Severe coastal flooding was reported in the county. The high tide the morning of the 28th at Lewes was nine feet (4.3 feet above normal) above mean lower low water. This came within half a foot of the all-time record tide of 9.5 feet above mean lower low water set during the Ash Wednesday Storm of 1962. Wind gusts exceeded hurricane force—in the low 80s around Indian River Inlet and reaching 70 MPH at the Pilot Tower. Service was suspended on the Cape May-Lewes Ferry after wind gusts reached 65 MPH. Eight to 10 foot seas were reported within the breakwater on Delaware Bay. About 10,000 homes and businesses in the state lost power, most of which were in Sussex County. The bay went into the foundation of homes in Broadkill Beach as six foot waves crashed ashore. Flooding was described as "deep" and "unheard of" in Lewes as flooding reached Bay Avenue and Cedar Street. Several streets were barricaded because of the flooding and numerous cars were damaged. Along Coastal Sussex County most of the dune protection was lost from Dewey Beach to Fenwick Island. Waves breached the dunes in several places along the shore, but none were described as major. The boardwalk was damaged at Cape Henlopen State Park. In Henlopen Acres, 50 to 60 trees were uprooted and their limbs punched holes into homes. In Rehoboth Beach, the beach erosion was so severe that it swept away sand from the west side of the Boardwalk, exposed the shipwreck of the S.S. Thomas Tracey and the city's first jetty built in the 1920s. In Dewey Beach, the ocean broke through the dunes in two locations. There was also bayside flooding on the western side of the town. About 100 feet of beach was eroded from in front of McKinley Street. It was estimated that only 30 to 40 percent of the dune protection was left. No serious injuries were reported. Damage estimates were around \$1.3 million.

### **February 4, 1998, 1 p.m. through February 9, 1998, 9 a.m. ET**

The strongest nor'easter of the winter battered Sussex County with damaging winds, severe coastal flooding, extensive beach erosion, several dune breaches and heavy rain. The county was subsequently declared a disaster area. Damage was estimated at about \$1.7 million and was the worst storm to affect the area since January 1992. Hardest hit communities included North Shore and South Bethany on the ocean side, Broadkill Beach on Delaware Bay and Long Neck in the back bay. About 3,000 persons evacuated including most of the permanent residents of Dewey Beach. At Lewes the high tide was 8.6 feet above mean low water, a departure of about 4.5 feet above normal. The extensive flooding and erosion forced the closure of all three state parks along the shore and unearthed relics. About 1,000 acres of farmland were also damaged by salt infiltration. Along the ocean side in Sussex County, North Shores and South Bethany were hit the hardest. Damage in North Shores alone was estimated at \$500,000. Ocean front villas were badly damaged losing many decks. The tide ripped through the bottom floor of a group of homes. Toilets, washers, dryers, heat pumps and propane tanks were strewn in the streets. The sand blanketed streets as far as 300 feet from the ocean. In South Bethany, Ocean Drive was destroyed. Homes on the oceanfront lost steps, windows and decks for a mile long stretch. Debris clogged 1st through 9th Streets. The boardwalk was severely damaged. In Fenwick Island, a dune breach occurred east of "The Curves." Most of the town's dunes were badly damaged. The ocean met Little Assawoman Bay at the north end of town.

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**May 11, 1998, 6 p.m. through May 12, 1998, 9 p.m. ET**

A persistent northeast flow produced minor coastal flooding from the 10th through the 13th. Tidal flooding became locally moderate during the evening high tides on the 11th and 12th, especially in the inlets. The water in the inlets had a hard time draining because of the persistent onshore winds. Tidal departures averaged about 1.5 to 2 feet above normal at times of high tide along the ocean front. At Lewes, the tide was 6.7 feet above mean lower low water that evening. In addition to the tidal flooding, the pounding surf created more erosion problems along the shore.

**August 30, 1999, 10 a.m. through August 31, 1999, 2 p.m. ET**

The combination of swells from Hurricane Dennis and a stiff northeast flow caused by a strong high pressure system building over the New England States produced rip currents and minor tidal flooding. Rip currents from Dennis started along the Delaware Beaches on Sunday August 29th. About 100 rescues occurred with a few minor injuries. On the 30th, swimming was banned at most of the Delaware Beaches. Minor tidal flooding extended into the back bays and inlets as the northeast winds prevented the tide from receding. On the 30th, the waves and tide reached the dune lines and under the boardwalk at Rehoboth Beach. The water also reached the bulkhead at one end of Bethany Beach and caused flooding along Pennsylvania Avenue, a frequently flooded location. The constant pounding and strong winds did cause beach erosion. Ocean Drive in South Bethany was sand covered because of the strong winds. The highest tide at Lewes reached 6.6 feet above mean lower low water around 1 a.m. on the 31st.

**September 25, 2000, 5 p.m. through September 26, 2000, 9 p.m. ET**

The combination of spring tides near the new moon, a high pressure system over New England and a low pressure system over the Middle Atlantic States produced widespread minor tidal flooding during the times of high tide from the evening of the 25th through the evening of the 26th. The highest tides occurred during the morning of the 26th. The low pressure system traveled from the lower Tennessee Valley the morning of the 25th to just east of Wallops Island, Virginia the morning of the 26th. The onshore flow persisted for several tide cycles. By the evening of the 26th, the low was far enough offshore for winds to start backing to the northwest. The highest tide at Lewes was 7.1 feet above mean lower low water (a departure of 2.3 feet above normal) the morning of the 26th.

**September 29, 2001, 4 p.m. through October 1, 2001, 10:00 a.m. ET**

The onshore flow around a nor'easter brought minor to locally moderate tidal flooding along the Delaware Coast from the 29th through October 1st. The worst flooding occurred during the evening of the 30th. Some beach erosion also occurred. The worst flooding problems were reported in Bethany Beach and on Fenwick Island. In Bethany Beach, the Loop Canal overflowed its banks and flooded several blocks of Pennsylvania Avenue on both the 30th and October 1st. High tide at Breakwater Harbor reached 6.73 feet above mean lower low water around 8 p.m. on the 30th.

**September 1, 2006, 11 a.m. to 5 p.m. ET**

The combination of the remnants of Tropical Storm Ernesto and a large high pressure system over eastern Canada produced heavy rain and flooding, strong and in some cases damaging winds, tidal flooding and beach erosion in Delaware. Sussex County was hit the hardest with both the flooding (tidal and inland) and high winds. Downed trees damaged homes, vehicles and churches. The Delaware Bay Buoy set an all-time record high wave height for September, 22.3 feet. Ten to twelve foot waves were crashing along the shore line and enhanced rip currents and rough surf persisted through the 5th. There were even five foot waves in Rehoboth Bay. Sussex County took the brunt of the wind and water damage from the storm including the ocean and bayshore communities. In Lewes, the dock and exterior landing, stairway and hand rails at the Harbor of Refuge Lighthouse suffered damage. About 75 feet of beach front was lost. In Cape Henlopen State Park, the dune fencing was damaged. In Rehoboth, about 100 feet of beach was lost as waves reached 12 feet. A large tree damaged one home, another fallen tree

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destroyed a sidewalk. Sections of the dunes were destroyed. In Bethany Beach, nearly all of the beach was swept away. Erosion reached up to the first row of homes. Inland in Sussex County, the combination of run-off and high tides caused flooding along both the Broadkill Creek (downtown Milton) and the Mispillion River in Milford (Park Avenue and South Walnut Street).

**October 6, 2006, 6 p.m. through October 7, 2006, 10:00 a.m. ET**

A northeaster brought tidal flooding, heavy rain, strong winds and beach erosion to central and southern Delaware. Minor tidal flooding occurred along the ocean side with the high tide on the evening of the 6th and extended into Delaware Bay with the subsequent high tide during the morning and early afternoon on the 7th. Storm totals averaged two to three inches and highest wind gusts averaged around 50 mph. The worst damage occurred because of the tides and beach erosion. The hardest hit locations along the ocean were South Bethany and Bethany Beach. In Bethany Beach, the high tide went under the boardwalk as there was no beach at high tide. Waves actually crashed onto the boardwalk. In South Bethany, steps were damaged at five oceanfront properties and parts of several driveways were washed away. Beach erosion along the Atlantic was described as moderate. In Delaware Bay at Bowers Beach (Kent County), Main Street was flooded by the high tide on the 7th. The backyards of many homes were flooded. Homes were also surrounded by flood waters on Wyatt Street. The highest tides reached 7.4 feet above mean lower low water at Breakwater Harbor (Sussex County). Minor tidal flooding starts at 6.7 feet above mean lower low water.

**May 12, 2008, 4:00 a.m. to 7:00 a.m. ET**

Tidal flooding of minor to moderate occurred along coastal Delaware. The tidal gage at Reedy Point peaked at 8.3 feet mean lower low water at 6:00 AM EDT on the 12th. Moderate flooding begins at 8.2 feet mean lower low water. In addition, the Delaware City tidal gage peaked at 9.1 feet mean lower low water at 6:00 AM EDT on the 12th. This was reported to be a new record since the gage was installed in 2001. At Slaughter Beach (Sussex County), heavy wind pushed water over the area's sand dunes and onto roadways, which blocked off Route 36 and Slaughter Beach Road. While the town itself suffered only light damage, major roads were not usable again until the afternoon of the 13th. Perhaps the hardest hit by the storm were the residents of Milford Neck at the end of Lighthouse Road at Slaughter Beach. The "That's Right Fresh Seaford" processing facility suffered heavy damage when wind blew water into the steel building at a height of four feet. In addition, the home at the point, many not raised to avoid flood waters, suffered damage. A car was swamped by rising water from Canary Creek on New Road in Lewes (Sussex County) on the 12th. Major erosion along the dune was noted at the north end of the boardwalk in Rehoboth Beach. Although a new dune held in Bethany Beach (Sussex County), large waves created from the nor'easter on the 12th eroded a section, which created a large drop-off. Erosion was also noted at many other beaches, such as Dewey Beach (Sussex County). The nor'easter on May 12th added insult to injury as 2 to 4 inches of rain that fell up until then in parts of Delaware impacted crops. A couple of corn crops that were newly planted were completely flooded, which could mean they may likely not produce. An estimated 1,000 acres of farmland may have been affected by the tidal flooding from this storm.

**October 16, 2009, 4:00 a.m. through October 18, 2009, 10:00 a.m. ET**

A pair of nor'easters caused minor to moderate tidal flooding along the ocean and Delaware Bay from the evening high tide of the 15th into the morning high tide of the 19th. They also caused minor tidal flooding along the Delaware River from the morning high tide of the 16th through the morning high tide of the 17th. Tidal flooding extended into the inlets. In addition to the tidal flooding, heavy surf contributed to and exacerbated the erosion along the ocean and lower Delaware Bay. A few roadways were flooded and closed. In Sussex County, sections of Delaware State Route 1 were flooded and closed from the 16th through the 18th from Dewey Beach south into Fenwick Island. The Indian River Inlet Bridge was also closed. In Dewey Beach, Crabbers Cove flooded the morning of the 17th. Along the Sussex County beaches, scarping and erosion occurred. Sand fencing and dunes were damaged in Bethany Beach,



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South Bethany and Dewey Beach. In South Bethany, four dune crossings were closed. Waves at Bethany Beach reached as high as 9 feet.

### **November 12, 2009, 2:00 p.m. through November 14, 2009, 9:00 a.m. ET**

A powerful nor'easter produced wind gusts nearly as high as 60 mph, widespread moderate tidal flooding, heavy rain and severe beach erosion along the Delaware coast from November 12th through the 14th. Preliminary damage was estimated at 45 million dollars. The combination of heavy rain and tides caused about 50 roads in Delaware to be closed, the most notable Delaware State Route 1. Parts of the roadway remain closed through the 15th as three feet of sand accumulated on it. The highest tides occurred with the morning high tide on the 13th. This was the highest tides in Sussex County since the February 5, 1998 nor'easter. Because of the persistent onshore flow, tidal flooding also occurred in Rehoboth and Indian River Bays. Tidal departures reached four and a half feet. Delaware Governor Jack A. Markell declared a state of emergency on the 12th. Voluntary evacuations occurred in Oak Orchard, Riverdale and Mariners Cove. The Community Church in Oak Orchard was used as a shelter by about 100 people. In Rehoboth Beach, half of the dune sand was gone. There was a cut in the dunes north of the Henlopen Hotel. In Dewey Beach, flooding occurred along Rehoboth Bay. In Indian Beach, the dunes broke in several places and waves broke under homes. Beach erosion was described as the heaviest in Indian Beach and within the Delaware Seashore State Park. In Oak Orchard, Indian River Bay flooding was ranked as the third worst since the 1962 Ash Wednesday nor'easter. In Bethany Beach, four dunes disappeared and flooding occurred in the north side of the municipality. Waves were measured at 10 feet along the shore. In South Bethany, no dunes were left along the south side of the town. The highest tide at Lewes reached 7.88 feet above mean lower low water on the morning of the 13th. Moderate tidal flooding ranges from 7.00 to 7.99 feet above mean lower low water. This was the highest tide recorded in Lewes since the February 5, 1998 nor'easter.

## *Hurricanes and Tropical Storms*

Severe wind events resulting from hurricanes, tropical storms and nor'easters can cause widespread damage and loss life, as evidenced by the numerous coastal events that have impacted the State of Delaware. Although Delaware has not experienced a direct strike from a major hurricane in more than two decades (a fact often attributed to the geographic position of North Carolina), Delaware has experienced the effects of as many as 14 hurricanes and at least one significant tropical storm since the 1920s. Details of these events are presented below (Photos courtesy of the National Aeronautics and Space Administration (NASA). Historic hurricane track graphics courtesy of the National Hurricane Center). **Figure 4.2-1** graphically illustrates the paths of 15 storms that have passed directly through Sussex County since the earlier date of 1861.

### **Unnamed Tropical Storm (1877)**

All that is known about this unnamed event is that it passed directly through Sussex County on October 4, 1877 with wind speeds estimated to have been in excess of 55 MPH. No information is available with regard to any property damages, injuries or deaths that may have occurred as a result of this storm.

### **Unnamed Hurricane (1904)**

The effects of this storm are known to have impacted the City of Milford to some extent.

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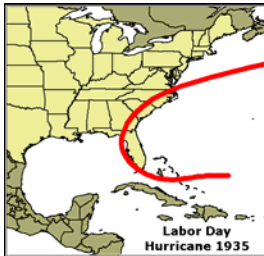
### San Felipe-Okeechobee Hurricane (1928)

No description/details available.



### Florida Keys Labor Day Hurricane (1935)

The Labor Day Hurricane of 1935 caused a bridge to collapse in the City of Milford.



### New England Hurricane (1938)

No description/details available.



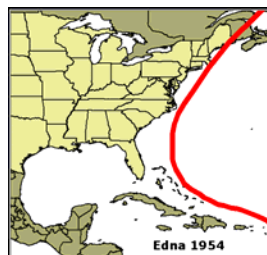
### Great Atlantic Hurricane (1944)

No description/details available.



### Hurricanes Carol and Edna (1954)

No description/details available.



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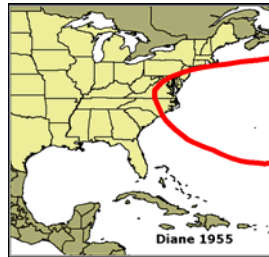
### Hurricane Hazel (1954)



Hurricane Hazel was first spotted east of the Windward Islands on October 5, 1954 and by October 15 the storm had turned north and accelerated—making landfall as a Category 4 hurricane near the North Carolina-South Carolina border. Subsequent rapid motion over the next 12 hours took the storm from the coast across the eastern United States and into southeastern Canada as it became extratropical. High winds occurred over large portions of the eastern United States. Washington, D.C. reported 78 MPH sustained winds, and peak gusts of over 90 MPH occurred as far northward as inland New York State. A storm surge of up to 18 feet inundated portions of the North Carolina coast.

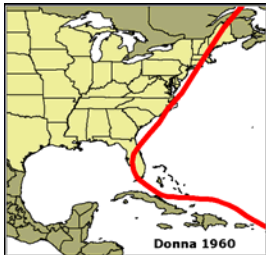
Heavy rains of up to 11 inches occurred as far northward as Toronto, Canada resulting in severe flooding. Hazel was responsible for 95 deaths (including at least one death in Delaware) and \$281 million in damage in the United States; 100 deaths and \$100 million in damage in Canada; and an estimated 400 to 1,000 deaths in Haiti.

### Hurricanes Connie and Diane (1955)



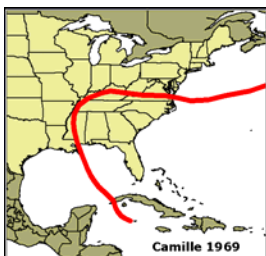
No description/details available.

### Hurricane Donna (1960)



No description/details available.

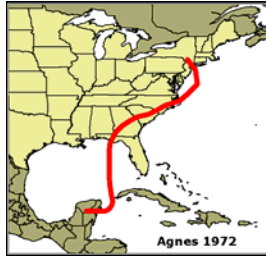
### Hurricane Camille (1969)



No description/details available.

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### Hurricane Agnes (1972)



No description/details available.

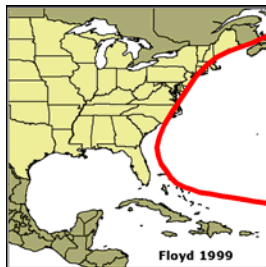
### Tropical Storm Bertha (1996)

A weakening Tropical Storm Bertha passed across the state on July 13, 1996. While the long trip over land from Wilmington, North Carolina through Virginia to Delaware did weaken Bertha, some wind-related damage did occur in Sussex and Kent counties. The only tidal flooding reported was minor and occurred on Delaware State Route 54 near Fenwick Island, one of the most flood-prone roads in the state. Beach erosion was minor. The storm dropped between 1.5 and three inches of rain across most of the state, with locally higher amounts of around four inches reported in Sussex County. This caused some poor drainage flooding, but the only river to flood was the Christina in New Castle County in the northern part of the state. (NCDC, 2003)

### Hurricane Edouard (1996)

On August 30, 1996, a hurricane watch and tropical storm warning was issued from Cape Lookout, North Carolina northward to Cape Henlopen, Delaware (including the Pamlico and Albermarle Sounds) in preparation for the approach of Hurricane Edouard. The hurricane watch was extended northward the following day to include north of Cape Henlopen, Delaware to Plymouth, Massachusetts. Early on September 2, Edouard veered sharply toward the northeast and the center of the hurricane passed about 75 nautical miles southeast of Nantucket Island, its closest point of approach to the United States.

### Hurricane Floyd (1999)



According to the National Climatic Data Center, a notable hurricane that has impacted the State of Delaware in recent history is Hurricane Floyd, which brought torrential rains and damaging winds on September 16, 1999. The hurricane caused widespread flash flooding as storm totals averaged around nine inches (10.58 inches in Sussex County). Most of this rain fell within a 12-hour period establishing a new state record. A total of \$8 million in property damage was reported, along with two fatalities—the first hurricane-related deaths in the state since Hurricane Hazel in 1954. In addition, there were a number of injuries, at least two of which were serious. Overall, the event most heavily affected New Castle County.

### Tropical Storm Henri (Remnants—2003)



The National Weather Service reported that over a two-day period remnants of Tropical Storm Henri dumped eight (8) to 10 inches of rain in a narrow, slow-moving band that included central and northern Delaware, with 7.08 inches reported in Hockessin over a period of a few hours. Much of the region already had received above-normal rainfall in recent weeks.

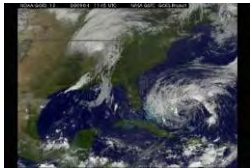
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### **Hurricane Isabel (2003)**



Isabel developed as a tropical storm September 6 about 600 miles west of the Southern Cape Verde Islands. The following day the storm was upgraded to a hurricane and within five days Isabel became the first Category 5 hurricane in the Atlantic since Hurricane Mitch in 1998. Isabel made landfall along the U.S. East Coast on September 18 as a Category 2 storm. Seven federal disaster declarations were issued as a result of Isabel, including the State of Delaware. Isabel may become best known for the wide-spread power outages it caused. Two days after Isabel lashed Delaware with wind and rain, approximately 60,000 of Conectiv's 280,000 customers were without power. A spokesperson for the power company said that trees falling across power lines caused most of the outages.

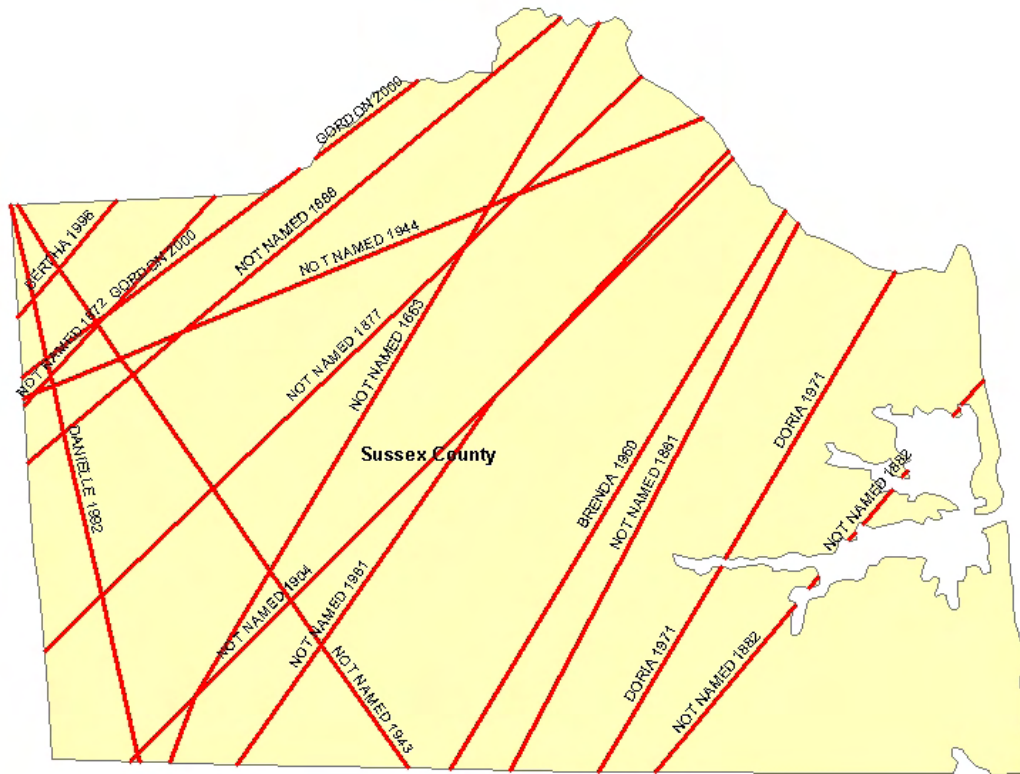
### **Tropical Storm Hanna (2008)**



Tropical Storm Hanna brought heavy rain and strong winds in Delaware and some minor tidal flooding in Delaware Bay on the 6th. Rain moved into the region during the morning, fell heavy at times in the afternoon and ended during the early evening. Storm totals ranged from around 1 to around 3.5 inches. The strongest winds occurred during the late morning and afternoon with peak gusts as high as 53 mph (recorded in Slaughter Beach). About 10,000 homes and businesses lost power on the Delmarva Peninsula. All power was restored by the 7th. Minor tidal flooding occurred in Delaware Bay during the afternoon as the surge averaged two to three feet. Many planned outdoor activities were cancelled. The heavy rain caused minor roadway and low lying area flooding. The unseasonably dry weather leading into Hanna prevented stream and river flooding from occurring. The pounding surf caused about a three foot vertical cut to occur at Rehoboth Beach.

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**Figure 4.2-1  
Historical Coastal Storm Tracks**



### *Thunderstorm Wind*

According to the National Climatic Data Center, Sussex County experienced 286 thunderstorm high wind events from January 1950 through October 2009. These events resulted in two (2) deaths, 10 injuries and a total of approximately \$8.6 million in property damage (NCDC, 2009). **Table 4.2-1** provides a breakdown of thunderstorm activity within the county during this period.

**Table 4.2-1  
Summary of Thunderstorm Activity in Sussex County (1950-2009)**

Storm Location	Date	Time	Type	Magnitude	Deaths	Injuries	Property Damage
Countywide	07/05/1957	1600	Thunderstorm Winds	70 kts.	0	0	0
Countywide	08/12/1958	2030	Thunderstorm Winds	0 kts.	0	0	0
Countywide	06/22/1959	1434	Thunderstorm Winds	0 kts.	0	0	0
Countywide	05/27/1965	2000	Thunderstorm Winds	0 kts.	0	0	0
Countywide	02/13/1966	1300	Thunderstorm Winds	0 kts.	0	0	0



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Storm Location	Date	Time	Type	Magnitude	Deaths	Injuries	Property Damage
Countywide	05/15/1967	1645	Thunderstorm Winds	0 kts.	0	0	0
Countywide	07/03/1969	1300	Thunderstorm Winds	0 kts.	0	0	0
Countywide	08/05/1969	0900	Thunderstorm Winds	0 kts.	0	0	0
Countywide	06/21/1970	2115	Thunderstorm Winds	0 kts.	0	0	0
Countywide	07/04/1970	1605	Thunderstorm Winds	0 kts.	0	0	0
Countywide	07/04/1970	1715	Thunderstorm Winds	0 kts.	0	0	0
Countywide	07/04/1970	1745	Thunderstorm Winds	0 kts.	0	0	0
Countywide	07/10/1970	1220	Thunderstorm Winds	0 kts.	0	0	0
Countywide	01/26/1971	1255	Thunderstorm Winds	0 kts.	0	0	0
Countywide	01/26/1971	1315	Thunderstorm Winds	0 kts.	0	0	0
Countywide	05/02/1971	1500	Thunderstorm Winds	0 kts.	0	0	0
Countywide	06/26/1971	1230	Thunderstorm Winds	0 kts.	0	0	0
Countywide	05/12/1974	1620	Thunderstorm Winds	0 kts.	0	0	0
Countywide	07/09/1975	1745	Thunderstorm Winds	0 kts.	0	0	0
Countywide	07/13/1975	0230	Thunderstorm Winds	0 kts.	0	0	0
Countywide	08/01/1976	0040	Thunderstorm Winds	0 kts.	0	0	0
Countywide	08/15/1976	1618	Thunderstorm Winds	0 kts.	0	0	0
Countywide	10/09/1976	0920	Thunderstorm Winds	0 kts.	0	0	0
Countywide	04/26/1977	1115	Thunderstorm Winds	0 kts.	0	0	0
Countywide	01/21/1979	1230	Thunderstorm Winds	0 kts.	0	0	0
Countywide	03/21/1980	1600	Thunderstorm Winds	0 kts.	0	0	0
Countywide	06/03/1980	1605	Thunderstorm Winds	0 kts.	0	0	0
Countywide	06/15/1980	1630	Thunderstorm Winds	52 kts.	0	0	0
Countywide	08/03/1980	1950	Thunderstorm Winds	0 kts.	0	0	0
Countywide	07/20/1982	1035	Thunderstorm Winds	0 kts.	0	0	0
Countywide	05/21/1983	1615	Thunderstorm Winds	0 kts.	0	0	0
Countywide	05/08/1984	1620	Thunderstorm Winds	0 kts.	0	0	0
Countywide	07/31/1985	1645	Thunderstorm Winds	0 kts.	0	2	0
Countywide	06/24/1986	0730	Thunderstorm Winds	0 kts.	0	1	0
Countywide	07/13/1986	2115	Thunderstorm Winds	0 kts.	0	0	0
Countywide	07/12/1987	1110	Thunderstorm Winds	0 kts.	0	0	0
Countywide	07/21/1987	1700	Thunderstorm Winds	70 kts.	0	0	0



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Storm Location	Date	Time	Type	Magnitude	Deaths	Injuries	Property Damage
Countywide	03/26/1988	2030	Thunderstorm Winds	0 kts.	0	2	0
Countywide	08/15/1988	1845	Thunderstorm Winds	0 kts.	0	0	0
Countywide	03/31/1989	1430	Thunderstorm Winds	0 kts.	0	0	0
Countywide	03/31/1989	1450	Thunderstorm Winds	0 kts.	0	0	0
Countywide	11/16/1989	0800	Thunderstorm Winds	0 kts.	0	0	0
Countywide	11/16/1989	0800	Thunderstorm Winds	0 kts.	0	0	0
Countywide	02/23/1990	2130	Thunderstorm Winds	0 kts.	0	0	0
Countywide	05/10/1990	1730	Thunderstorm Winds	0 kts.	0	0	0
Countywide	07/01/1990	1515	Thunderstorm Winds	0 kts.	0	0	0
Countywide	03/02/1991	0600	Thunderstorm Winds	0 kts.	0	0	0
Countywide	04/24/1991	1400	Thunderstorm Winds	0 kts.	0	0	0
Countywide	04/24/1991	1440	Thunderstorm Winds	56 kts.	0	0	0
Countywide	04/24/1991	1500	Thunderstorm Winds	65 kts.	0	0	0
Countywide	06/16/1991	1445	Thunderstorm Winds	0 kts.	0	0	0
Countywide	06/17/1991	1445	Thunderstorm Winds	0 kts.	0	0	0
Countywide	07/07/1991	1115	Thunderstorm Winds	100 kts.	0	2	0
Countywide	07/01/1992	1600	Thunderstorm Winds	61 kts.	0	0	0
Countywide	07/10/1992	1930	Thunderstorm Winds	50 kts.	0	0	0
Countywide	07/15/1992	1930	Thunderstorm Winds	0 kts.	0	0	0
Countywide	07/15/1992	1930	Thunderstorm Winds	0 kts.	0	0	0
Countywide	07/21/1992	1345	Thunderstorm Winds	65 kts.	0	0	0
Countywide	07/31/1992	1750	Thunderstorm Winds	60 kts.	0	0	0
Countywide	08/04/1992	1500	Thunderstorm Winds	0 kts.	0	0	0
Countywide	08/04/1992	1600	Thunderstorm Winds	0 kts.	0	0	0
Countywide	08/04/1992	1630	Thunderstorm Winds	0 kts.	0	0	0
Countywide	03/04/1993	1600	High Winds	0 kts.	0	0	\$50,000
Countywide	03/13/1993	0900	High Winds	0 kts.	0	0	\$50,000
Countywide	04/01/1993	1330	Thunderstorm Winds	N/A	0	0	\$5,000
Countywide	04/01/1993	1340	Thunderstorm Winds	N/A	0	0	\$5,000
Millsboro	11/28/1993	0535	Thunderstorm Winds	N/A	0	0	\$1,000
Countywide	06/15/1994	1800	High Winds/flooding	0 kts.	0	0	0
Gumboro	06/27/1994	1320	Thunderstorm Winds	N/A	0	0	0

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Storm Location	Date	Time	Type	Magnitude	Deaths	Injuries	Property Damage
Countywide	09/22/1994	1200	High Winds	0 kts.	0	0	\$5M
Seaford	05/18/1995	1500	Thunderstorm Winds	N/A	0	0	0
Dewey Beach	05/18/1995	1530	Thunderstorm Winds	N/A	0	0	0
Fairmont	07/22/1995	1830	Thunderstorm Winds	N/A	0	0	0
Countywide	11/11/1995	1900	High Wind	0 kts.	0	0	0
Dewey Beach	11/11/1995	2230	Thunderstorm Wind	N/A	0	0	\$1M
Live Oak	12/19/1995	0500	Winds	N/A	0	0	\$3,000
Countywide	01/07/1996	1800	High Wind	0 kts.	0	0	0
Countywide	01/24/1996	1805	High Wind	0 kts.	0	0	0
Countywide	01/27/1996	1200	High Wind	0 kts.	0	0	0
Countywide	03/19/1996	1710	High Wind	0 kts.	0	0	0
Countywide	08/13/1996	0345	Wind	N/A	0	0	0
Countywide	10/08/1996	1530	High Wind	50 kts.	0	0	0
Countywide	03/06/1997	0500	Wind	N/A	0	0	0
Georgetown	03/29/1997	1505	Thunderstorm Winds	61 kts.	0	0	0
Gumboro	03/29/1997	1505	Thunderstorm Winds	61 kts.	0	0	0
Countywide	03/31/1997	0800	High Wind	50 kts.	0	0	0
Countywide	04/01/1997	0000	High Wind	50 kts.	0	0	0
Nassau	05/06/1997	1330	Thunderstorm Winds	0 kts.	0	0	0
Countywide	06/02/1997	1800	Wind	N/A	0	0	0
Seaford	06/18/1997	2120	Thunderstorm Winds	0 kts.	0	0	0
Atlanta	06/26/1997	1630	Thunderstorm Winds	0 kts.	0	0	0
Fenwick Island	07/16/1997	1432	Thunderstorm Winds	0 kts.	0	0	0
Reliance	07/18/1997	2040	Thunderstorm Winds	78 kts.	0	0	0
Lewes	08/13/1997	1530	Thunderstorm Winds	0 kts.	0	0	0
Fenwick Island	08/17/1997	1855	Thunderstorm Winds	74 kts.	0	0	\$50,000
Georgetown	09/10/1997	1645	Thunderstorm Winds	0 kts.	0	0	0
Countywide	11/07/1997	1000	Wind	N/A	0	0	0
Countywide	01/28/1998	0400	High Wind	71 kts.	0	0	0
Countywide	02/04/1998	1000	High Wind	70 kts.	0	0	0
Countywide	02/17/1998	1200	Wind	N/A	0	0	0
Countywide	02/25/1998	0600	Wind	N/A	0	0	0

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Storm Location	Date	Time	Type	Magnitude	Deaths	Injuries	Property Damage
Countywide	03/09/1998	0200	Wind	N/A	0	0	0
Bethel	06/13/1998	1650	Thunderstorm Winds	71 kts.	0	0	0
Greenwood	06/26/1998	1736	Thunderstorm Winds	50 kts.	0	0	0
Greenwood	06/26/1998	1910	Thunderstorm Winds	55 kts.	0	0	0
Ellendale	09/07/1998	1500	Thunderstorm Winds	50 kts.	0	0	0
Countywide	12/22/1998	0700	Wind	N/A	0	0	0
Countywide	12/30/1998	0700	Wind	N/A	0	0	0
Countywide	01/03/1999	0500	Wind	N/A	0	0	0
Georgetown	02/12/1999	1910	Thunderstorm Winds	50 kts.	0	0	0
Countywide	03/04/1999	0400	Wind	N/A	0	0	0
Lewes	03/06/1999	2155	Thunderstorm Winds	57 kts.	0	0	0
Countywide	03/07/1999	0400	Wind	N/A	0	0	0
Countywide	03/18/1999	0900	Wind	N/A	0	0	0
Gumboro	07/24/1999	1325	Thunderstorm Winds	50 kts.	0	0	0
Countywide	09/16/1999	0300	High Wind	57 kts.	0	0	0
Countywide	11/02/1999	1400	High Wind	50 kts.	0	0	0
Countywide	01/04/2000	1600	Wind	N/A	0	0	0
Countywide	01/11/2000	1100	Wind	N/A	0	0	0
Countywide	01/13/2000	1300	Wind	N/A	0	0	0
Countywide	01/25/2000	0700	High Wind	50 kts.	0	0	\$50,000
Countywide	03/21/2000	1700	High Wind	58 kts.	0	0	0
Countywide	04/08/2000	1100	Wind	N/A	0	0	0
Countywide	04/09/2000	0400	Wind	N/A	0	0	0
Millsboro	05/10/2000	1846	Thunderstorm Winds	50 kts.	0	0	0
Bridgeville	05/24/2000	2202	Thunderstorm Winds	50 kts.	0	0	0
Lewes	06/02/2000	2025	Thunderstorm Winds	50 kts.	0	0	0
Countywide	12/12/2000	0900	Wind	N/A	0	0	0
Countywide	12/17/2000	0300	Wind	N/A	0	0	0
Countywide	02/10/2001	0600	Wind	N/A	0	0	0
Ellendale	06/21/2001	1555	Thunderstorm Winds	50 kts.	0	0	0
Laurel	07/05/2001	1900	Thunderstorm Winds	50 kts.	0	0	0
Roxana	08/11/2001	1700	Thunderstorm Winds	50 kts.	0	0	0

# HAZARD ANALYSIS

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SUSSEX COUNTY, DELAWARE  
MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

Storm Location	Date	Time	Type	Magnitude	Deaths	Injuries	Property Damage
Lewes	08/13/2001	2000	Thunderstorm Winds	50 kts.	0	0	0
Countywide	01/13/2002	0700	Wind	N/A	0	0	0
Countywide	02/01/2002	1200	Wind	N/A	0	0	0
Countywide	02/04/2002	1500	Wind	N/A	0	0	0
Countywide	02/11/2002	0700	Wind	N/A	0	0	0
Countywide	03/10/2002	0600	Wind	N/A	0	0	0
Countywide	03/21/2002	2000	Wind	N/A	0	0	0
Greenwood	04/03/2002	1525	Thunderstorm Winds	52 kts.	0	0	0
Lincoln	04/03/2002	1547	Thunderstorm Winds	57 kts.	0	0	\$100,000
Lewes	04/03/2002	1602	Thunderstorm Winds	61 kts.	0	0	0
Selbyville	05/13/2002	2021	Thunderstorm Winds	56 kts.	0	0	0
Bridgeville	05/18/2002	0730	Thunderstorm Winds	50 kts.	0	0	0
Gumboro	06/06/2002	1645	Thunderstorm Winds	50 kts.	0	0	0
Milford Apts	06/06/2002	1655	Thunderstorm Winds	52 kts.	0	0	0
Delmar	07/03/2002	1545	Thunderstorm Winds	50 kts.	0	0	0
Bethany Beach	07/19/2002	1322	Thunderstorm Winds	75 kts.	0	0	0
Bethany Beach	07/27/2002	1640	Thunderstorm Winds	0 kts.	0	0	0
Countywide	09/11/2002	0900	Wind	N/A	0	0	0
Countywide	11/23/2002	0100	Strong Wind	N/A	0	0	0
Countywide	12/26/2002	0100	High Wind	51 kts.	0	0	0
Countywide	01/11/2003	0100	Strong Wind	N/A	0	0	0
Countywide	02/04/2003	1300	Strong Wind	N/A	0	0	\$1,000
Countywide	02/12/2003	0800	Strong Wind	N/A	0	0	\$1,000
Countywide	02/17/2003	0300	Strong Wind	N/A	0	0	\$100,000
Countywide	02/23/2003	1200	Strong Wind	N/A	0	0	\$1,000
Countywide	05/12/2003	1100	Strong Wind	N/A	0	0	\$5,000
Bridgeville	07/06/2003	1710	Thunderstorm Winds	56 kts.	0	0	0
Rosedale Beach	07/06/2003	2244	Thunderstorm Winds	52 kts.	0	0	0
Delmar	07/09/2003	1915	Thunderstorm Winds	52 kts.	0	0	0
Concord	07/09/2003	2010	Thunderstorm Winds	52 kts.	0	0	0
Fairmount	07/09/2003	2020	Thunderstorm Winds	52 kts.	0	0	0
Bridgeville	07/22/2003	1615	Thunderstorm Winds	52 kts.	0	0	0

# HAZARD ANALYSIS

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## SUSSEX COUNTY, DELAWARE MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

Storm Location	Date	Time	Type	Magnitude	Deaths	Injuries	Property Damage
Greenwood	08/22/2003	2038	Thunderstorm Winds	52 kts.	0	0	0
Blades	08/26/2003	1710	Thunderstorm Winds	52 kts.	0	0	0
Lewes	08/30/2003	1715	Thunderstorm Winds	52 kts.	0	0	0
Seaford	10/14/2003	2230	Thunderstorm Winds	56 kts.	0	0	0
Countywide	10/15/2003	0900	Strong Wind	40 kts.	0	0	\$5,000
Milton	11/06/2003	0008	Thunderstorm Winds	50 kts.	0	0	0
Countywide	11/13/2003	0700	High Wind	61 kts.	0	1	\$500,000
Countywide	11/29/2003	1200	Strong Wind	40 kts.	0	0	\$5,000
Countywide	01/09/2004	1800	Cold/wind Chill	N/A	0	0	0
Countywide	01/15/2004	1200	Cold/wind Chill	N/A	0	0	0
Countywide	04/04/2004	2000	Strong Wind	40 kts.	0	0	\$5,000
Georgetown	05/17/2004	1326	Thunderstorm Winds	50 kts.	0	0	0
Laurel	06/17/2004	1855	Thunderstorm Winds	50 kts.	0	0	0
Seaford	08/21/2004	1525	Thunderstorm Winds	50 kts.	0	0	0
Countywide	11/05/2004	0400	Strong Wind	41 kts.	0	0	\$5,000
Countywide	12/01/2004	0900	Strong Wind	46 kts.	1	1	\$100,000
Countywide	12/19/2004	2300	Strong Wind	45 kts.	0	0	\$5,000
Countywide	12/20/2004	0000	Cold/wind Chill	N/A	0	0	0
Countywide	01/18/2005	0400	Cold/wind Chill	N/A	0	0	0
Countywide	01/23/2005	1800	Cold/wind Chill	N/A	0	0	0
Countywide	01/28/2005	0000	Cold/wind Chill	N/A	0	0	0
Countywide	03/08/2005	1100	Strong Wind	45 kts.	0	0	\$5,000
Milford Arpt	04/02/2005	2015	Thunderstorm Winds	50 kts.	0	0	0
Countywide	04/02/2005	1200	Strong Wind	40 kts.	0	0	\$10,000
Lewes	06/28/2005	1400	Thunderstorm Winds	52 kts.	0	0	0
Rosedale Beach	06/28/2005	1450	Thunderstorm Winds	52 kts.	0	0	0
Angola Beach	06/28/2005	1536	Thunderstorm Winds	52 kts.	0	0	0
Laurel	08/07/2005	1110	Thunderstorm Winds	52 kts.	0	0	0
Seaford	08/07/2005	1140	Thunderstorm Winds	50 kts.	0	0	0
Laurel	09/17/2005	2200	Thunderstorm Winds	50 kts.	0	0	0
Countywide	10/25/2005	1900	High Wind	54 kts.	0	0	0
Countywide	11/10/2005	0300	Strong Wind	40 kts.	0	0	\$5,000

# HAZARD ANALYSIS

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## SUSSEX COUNTY, DELAWARE MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

Storm Location	Date	Time	Type	Magnitude	Deaths	Injuries	Property Damage
Countywide	11/22/2005	1000	Strong Wind	40 kts.	0	0	\$5,000
Countywide	01/14/2006	1700	Strong Wind	45 kts.	0	0	\$5,000
Midway	01/14/2006	0515	Thunderstorm Winds	52 kts.	0	0	0
Countywide	01/18/2006	0500	Strong Wind	40 kts.	0	0	\$25,000
Countywide	01/18/2006	0500	High Wind	50 kts.	0	0	\$70,000
Countywide	02/12/2006	0100	Strong Wind	40 kts.	0	0	\$10,000
Countywide	02/17/2006	0700	Strong Wind	40 kts.	0	0	\$10,000
Countywide	02/24/2006	0700	Strong Wind	40 kts.	0	0	\$10,000
Countywide	03/14/2006	1000	Strong Wind	40 kts.	0	0	\$5,000
Countywide	03/15/2006	0700	Strong Wind	40 kts.	0	0	\$5,000
Countywide	04/05/2006	0700	High Wind	51 kts.	0	0	\$15,000
Dagsboro	06/02/2006	1715	Thunderstorm Winds	50 kts.	0	0	0
Seaford	06/02/2006	1904	Thunderstorm Winds	50 kts.	0	0	0
Selbyville	06/29/2006	1530	Thunderstorm Winds	50 kts.	0	0	0
Georgetown	07/02/2006	2320	Thunderstorm Winds	52 kts.	0	0	0
Lewes	07/04/2006	1835	Thunderstorm Winds	52 kts.	0	0	0
Rosedale Beach	07/05/2006	1717	Thunderstorm Winds	50 kts.	0	0	0
Milford Arpt	07/28/2006	1500	Thunderstorm Winds	50 kts.	0	0	0
Millsboro	08/24/2006	1600	Thunderstorm Winds	50 kts.	0	0	0
Fenwick Is	08/24/2006	1650	Thunderstorm Winds	50 kts.	0	0	0
Countywide	09/01/2006	0200	Strong Wind	41 kts.	0	0	\$400,000
Countywide	09/01/2006	1600	High Wind	54 kts.	0	0	\$350,000
Bridgeville	09/15/2006	1730	Thunderstorm Winds	52 kts.	0	0	0
Countywide	10/06/2006	1900	Strong Wind	48 kts.	0	0	\$5,000
Countywide	10/20/2006	1200	Strong Wind	40 kts.	0	0	\$1,000
Countywide	10/29/2006	0300	Strong Wind	44 kts.	0	0	\$1,000
Countywide	11/16/2006	1100	Strong Wind	40 kts.	0	0	\$1,000
Countywide	11/22/2006	0600	Strong Wind	48 kts.	0	0	\$5,000
Countywide	12/01/2006	1500	Strong Wind	40 kts.	0	0	\$1,000
Countywide	01/20/2007	0700	Strong Wind	40 kts.	0	0	\$1,000
Countywide	01/26/2007	0300	Cold/wind Chill	N/A	0	0	0
Countywide	02/05/2007	0300	Cold/wind Chill	N/A	0	0	0

# HAZARD ANALYSIS

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SUSSEX COUNTY, DELAWARE  
MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

Storm Location	Date	Time	Type	Magnitude	Deaths	Injuries	Property Damage
Countywide	02/06/2007	0300	Cold/wind Chill	N/A	1	1	0
Countywide	02/14/2007	1500	Strong Wind	40 kts.	0	0	\$2,000
Countywide	02/23/2007	0000	Strong Wind	40 kts.	0	0	\$1,000
Countywide	03/02/2007	0500	Strong Wind	39 kts.	0	0	\$1,000
Countywide	03/05/2007	1400	Strong Wind	40 kts.	0	0	\$1,000
Countywide	03/06/2007	0300	Cold/wind Chill	N/A	0	0	0
Countywide	03/16/2007	1100	High Wind	57 kts.	0	0	\$5,000
Countywide	03/16/2007	1100	Strong Wind	45 kts.	0	0	\$2,000
Countywide	04/16/2007	0300	High Wind	52 kts.	0	0	\$5,000
Countywide	04/16/2007	0300	Strong Wind	43 kts.	0	0	\$1,000
Milford Arpt	05/16/2007	1740	Thunderstorm Wind	50 kts.	0	0	0
Laurel	06/27/2007	2020	Thunderstorm Wind	52 kts.	0	0	0
Frankford	07/28/2007	1440	Thunderstorm Wind	52 kts.	0	0	0
Ocean View	08/16/2007	2130	Thunderstorm Wind	52 kts.	0	0	0
Georgetown	08/16/2007	2150	Thunderstorm Wind	61 kts.	0	0	0
Lewes	08/16/2007	2204	Thunderstorm Wind	52 kts.	0	0	0
Georgetown	08/16/2007	2235	Thunderstorm Wind	56 kts.	0	0	0
Countywide	12/03/2007	1000	Strong Wind	47 kts.	0	0	\$1,000
Countywide	12/16/2007	1800	Strong Wind	40 kts.	0	0	\$1,000
Countywide	01/30/2008	0900	Strong Wind	43 kts.	0	0	\$3,000
Countywide	02/10/2008	1100	Strong Wind	48 kts.	0	0	\$5,000
Gumboro	03/05/2008	0157	Thunderstorm Wind	55 kts.	0	0	\$5,000
Rehoboth Beach	03/05/2008	0225	Thunderstorm Wind	50 kts.	0	0	0
Countywide	03/08/2008	1600	Strong Wind	42 kts.	0	0	\$1,000
Countywide	03/20/2008	0400	Strong Wind	40 kts.	0	0	\$1,000
Countywide	04/29/2008	0900	Strong Wind	35 kts.	0	0	\$2,000
Countywide	05/12/2008	0700	High Wind	52 kts.	0	0	\$50,000
Countywide	05/12/2008	0700	Strong Wind	42 kts.	0	0	\$10,000
Milton	05/31/2008	1445	Thunderstorm Wind	50 kts.	0	0	0
Georgetown	06/04/2008	1542	Thunderstorm Wind	61 kts.	0	0	\$250,000
Delmar	07/04/2008	2000	Thunderstorm Wind	52 kts.	0	0	0
Georgetown	09/09/2008	1330	Thunderstorm Wind	50 kts.	0	0	0



# HAZARD ANALYSIS

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SUSSEX COUNTY, DELAWARE  
MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

Storm Location	Date	Time	Type	Magnitude	Deaths	Injuries	Property Damage
Countywide	10/28/2008	0800	Strong Wind	41 kts.	0	0	\$5,000
Countywide	12/07/2008	1000	Strong Wind	40 kts.	0	0	\$1,000
Countywide	12/11/2008	2200	Strong Wind	40 kts.	0	0	\$1,000
Greenwood	12/12/2008	0038	Thunderstorm Wind	65 kts.	0	0	\$100,000
Countywide	12/24/2008	2000	Strong Wind	40 kts.	0	0	0
Countywide	12/31/2008	1200	High Wind	64 kts.	0	0	\$25,000
Countywide	01/16/2009	0000	Cold/wind Chill	N/A	0	0	0
Countywide	02/12/2009	0500	Strong Wind	48 kts.	0	0	\$5,000
Countywide	02/22/2009	1300	Strong Wind	40 kts.	0	0	0
Countywide	03/02/2009	0000	High Wind	54 kts.	0	0	\$25,000
Countywide	03/02/2009	0000	Strong Wind	46 kts.	0	0	\$10,000
Countywide	04/03/2009	1300	Strong Wind	40 kts.	0	0	\$3,000
Countywide	04/03/2009	2000	Strong Wind	40 kts.	0	0	\$1,000
Countywide	04/15/2009	1300	Strong Wind	40 kts.	0	0	\$1,000
Countywide	05/14/2009	0800	Strong Wind	42 kts.	0	0	\$1,000
Roxana	06/02/2009	1740	Thunderstorm Wind	50 kts.	0	0	0
Dewey Beach	06/11/2009	2305	Thunderstorm Wind	53 kts.	0	0	0
Greenwood	06/13/2009	1605	Thunderstorm Wind	70 kts.	0	0	\$200,000
Millville	06/20/2009	1730	Thunderstorm Wind	52 kts.	0	0	0
Dagsboro	06/22/2009	1800	Thunderstorm Wind	52 kts.	0	0	0
Fenwick Is	07/28/2009	1410	Thunderstorm Wind	56 kts.	0	0	0
Frankford	07/31/2009	1555	Thunderstorm Wind	50 kts.	0	0	0
Bridgeville	08/02/2009	1240	Thunderstorm Wind	50 kts.	0	0	0
Slaughter Beach	08/09/2009	1905	Thunderstorm Wind	50 kts.	0	0	0
Countywide	09/11/2009	0200	High Wind	52 kts.	0	0	\$25,000
Countywide	10/07/2009	0800	Strong Wind	40 kts.	0	0	\$1,000
Countywide	10/15/2009	1400	Strong Wind	40 kts.	0	0	\$3,000
Countywide	10/17/2009	1500	Strong Wind	44 kts.	0	0	\$3,000
Countywide	10/24/2009	1100	Strong Wind	40 kts.	0	0	\$3,000
<b>TOTALS:</b>					<b>2</b>	<b>10</b>	<b>\$8,747,000</b>

Source: National Climatic Data Center

SUSSEX COUNTY, DELAWARE  
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## *Tornadoes*

In an assessment conducted by the National Weather Service Storm Prediction Center covering the period 1950 to 1994, the State of Delaware ranked #44 in the Nation for number of tornadoes (52), #36 in number of fatalities (2), #38 in number of injuries (73), and #42 in property damage (\$5,628,547 in adjusted dollars).

Independent of the Storm Prediction Center state ranking project, the National Climatic Data Center indicates that the geographic area of the State of Delaware experienced 58 tornado events from January 1, 1950 through July 31, 2009, a slightly longer span of time than the SPC study. NCDC data supports the statistics of two deaths and 73 injuries, and reflects a total of approximately \$13 million in property damage, with an additional \$5,000 in crop damage. In addition, The Tornado Project ([www.tornadoproject.com](http://www.tornadoproject.com)) has identified 16 tornadoes that occurred prior to 1950, dating as far back as 1789.

**Table 4.2-2** lists 18 tornadoes that were reported to the National Climatic Data Center in Sussex County. These events are responsible for 11 injuries and \$594,000 in property damages.

**Table 4.2-2**  
**Summary of Tornado Activity in Sussex County (1950-2003)**

Tornado Location	Date	Time	Type	Magnitude	Death	Injuries	Property Damage
County	08/12/1955	1526	Tornado	F2	0	1	\$3,000
County	07/05/1957	1600	Tornado	F1	0	0	\$3,000
County	09/10/1957	1624	Tornado	F1	0	0	\$3,000
County	06/24/1962	1700	Tornado	F1	0	0	\$25,000
County	03/19/1975	1015	Tornado	F1	0	0	\$3,000
County	08/04/1975	1230	Tornado	F0	0	0	\$3,000
County	06/30/1976	1230	Tornado	F0	0	0	0
County	05/08/1984	1630	Tornado	F1	0	2	\$250,000
County	05/08/1984	1630	Tornado	F1	0	8	\$250,000
County	07/18/1984	0730	Tornado	F2	0	0	\$25,000
County	08/15/1989	1309	Tornado	F1	0	0	0
County	07/15/1992	1800	Tornado	F0	0	0	0
County	07/15/1992	1800	Tornado	F0	0	0	0
County	07/15/1992	1800	Tornado	F1	0	0	\$25,000
County	08/28/1992	1620	Tornado	F0	0	0	0
Bridgeville	04/01/1993	1915	Tornado	F0	0	0	\$5,000
Bridgeville	06/26/1995	1315	Tornado	F0	0	0	\$1,000

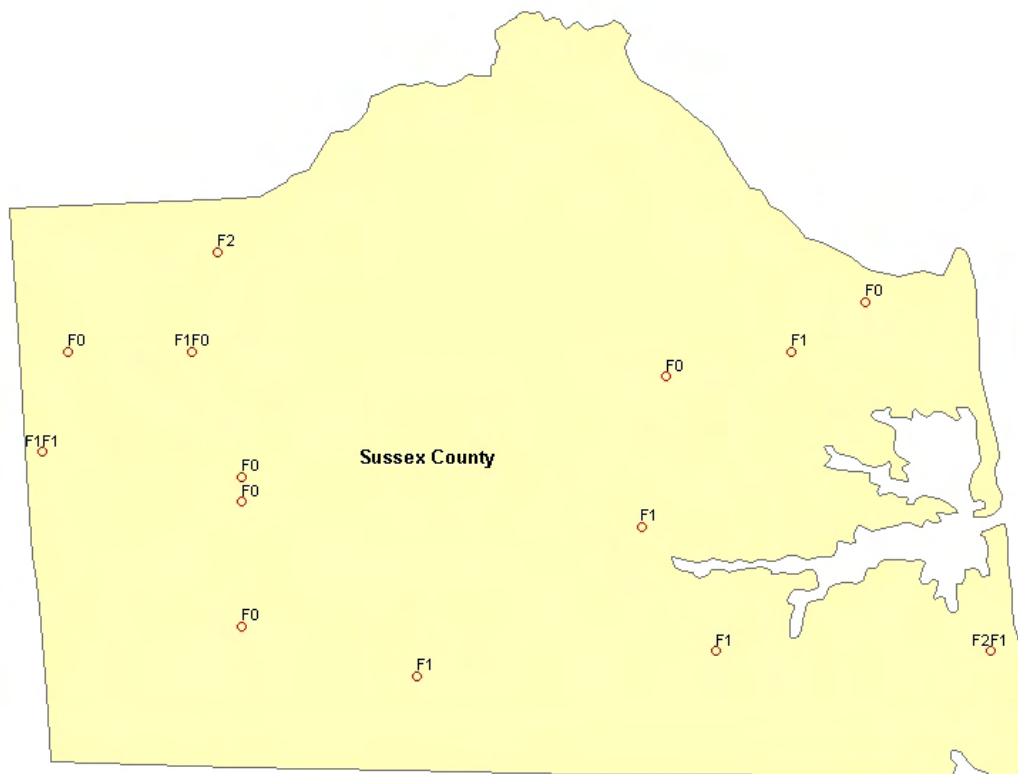
SUSSEX COUNTY, DELAWARE  
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Tornado Location	Date	Time	Type	Magnitude	Death	Injuries	Property Damage
Dewey Beach	08/13/1998	1233	Tornado	F0	0	0	0
TOTALS:					0	11	\$594,000

Source: National Climatic Data Center

Figure 4.2-2 graphically illustrates historical tornado occurrences within Sussex County.

**Figure 4.2-2**  
**Historical Tornado Occurrences**



## Wildfire

According to the Delaware Fire Service, the greatest wildfire danger is in those marshes along the Delaware Bay that contain large amounts of phragmites. One such example is the 1,400 acre fire that occurred at Prime Hook in 2002. Otherwise, the climate, forest types and terrain (flat, interspersed with cropland, ditches, roads, etc.) in Delaware do not promote large wildfires. Most of the wildfires within the state are small, ground fires that are fairly easily extinguished and seldom do much damage. (Austin Short, Delaware Forest Service, [austin.short@state.de.us](mailto:austin.short@state.de.us)).

SUSSEX COUNTY, DELAWARE  
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**Table 4.2-3**  
**Summary of Wildfire Events by County in Sussex County (2000-2009)**

Fire Location	Date	Time	Acres Burned	Deaths	Injuries	Property Damage
Dagsboro	05/18/2000	1700	7	0	0	\$0
Georgetown	02/24/2002	0700	20	0	0	\$0
Bethel/Georgetown	07/09/2004	1800	38	0	0	\$0
Millsboro	04/06/2005	1509	Unknown	0	0	\$0
Georgetown	04/13/2005	1330	200	0	0	\$0
Cedar Creek	03/14/2006	1200	1,280	0	0	\$5,000
Millsboro	03/22/2006	1200	70	0	0	\$0
County	04/27/2006	1500	Unknown	0	1	\$0
<b>TOTALS:</b>			<b>1,615+</b>	<b>0</b>	<b>1</b>	<b>\$5,000</b>

*Source: National Climatic Data Center*

## *Drought*

According to the National Climatic Data Center, the State of Delaware has experienced 49 reported droughts and/or periods of unseasonably dry weather from 1950 through July 2009, most of which affected the entire forecast zone of New Castle, Kent and Sussex counties.

All crop damage reported for this period (\$29.1 million) is tied to a single event—the drought that gripped the Middle Atlantic States throughout much of the growing season of 1999, which eased in mid-August of that year. Normal, and in some cases heavier than normal, rainfall returned, and on September 8 Governor Thomas Carper lifted the mandatory watering restrictions in northern Delaware. The drought, for all intents and purposes, ended with the arrival of the record-breaking rain associated with Hurricane Floyd on September 16. As much as 10.5 inches of rain (or about three months worth of normal rainfall) fell from Floyd across Delaware. The drought emergency was lifted by Governor Carper on September 21, however the heavy rain came too late to help farmers. Agricultural losses throughout the state were estimated at \$29.1 million. The 1999 corn harvest was 2.6 million bushels less than 1998 and the smallest crop since 1988. The soybean harvest in 1999 was 1.9 million bushels less than 1998 and the smallest harvest since 1995. The drought also greatly affected pastures and produced a later and smaller than usual pumpkin crop.

## *Extreme Temperature*

According to the National Climatic Data Center, Sussex County has experienced 78 reported cases of either extreme heat or extreme cold from 1995 through November 2009 (**Table 4.2-4**). These heat waves and cold snaps have caused 8 deaths, 42 injuries, and no reported damage,

SUSSEX COUNTY, DELAWARE  
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**Table 4.2-4**  
**Summary of Extreme Temperature Occurrences in Sussex County (1995-2009)**

Storm Location	Date	Time	Type	Deaths	Injuries	Property Damage
Countywide	02/06/1995	0000	Extreme Cold	0	0	0
Countywide	07/12/1995	0000	Heat Wave	0	0	0
Countywide	07/23/1995	0000	Unseasonably Warm	1	0	0
Countywide	08/12/1995	0000	Heat Wave	0	0	0
Countywide	08/12/1995	0000	Heat Wave	0	0	0
Countywide	08/16/1995	0000	Heat Wave	0	0	0
Countywide	12/09/1995	0000	Unseasonably Cold	0	0	0
Countywide	02/04/1996	1800	Extreme Cold	0	0	0
Countywide	05/19/1996	1000	Excessive Heat	0	0	0
Countywide	01/03/1997	1000	Unseasonably Warm	0	0	0
Countywide	01/17/1997	0100	Extreme Cold	0	0	0
Countywide	02/19/1997	1100	Unseasonably Warm	0	0	0
Countywide	02/26/1997	1200	Unseasonably Warm	0	0	0
Countywide	02/28/1997	2359	Unseasonably Warm	0	0	0
Countywide	03/01/1997	0000	Unseasonably Warm	0	0	0
Countywide	04/09/1997	0100	Unseasonably Cold	0	0	0
Countywide	06/21/1997	0900	Excessive Heat	0	0	0
Countywide	07/12/1997	1000	Excessive Heat	0	0	0
Countywide	08/16/1997	0900	Excessive Heat	0	3	0
Countywide	01/04/1998	1000	Unseasonably Warm	0	0	0
Countywide	01/31/1998	2359	Unseasonably Warm	0	0	0
Countywide	02/28/1998	2359	Unseasonably Warm	0	0	0
Countywide	03/27/1998	1000	Unseasonably Warm	0	0	0
Countywide	06/25/1998	0900	Hot Spell	0	0	0
Countywide	07/20/1998	0900	Excessive Heat	0	8	0
Countywide	08/22/1998	1000	Heat Wave	0	0	0
Countywide	09/27/1998	0900	Unseasonably Hot	0	0	0
Countywide	09/30/1998	2359	Unseasonably Warm And Dry	0	0	0
Countywide	11/28/1998	1000	Unseasonably Warm	0	0	0

# HAZARD ANALYSIS

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SUSSEX COUNTY, DELAWARE  
MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

Storm Location	Date	Time	Type	Deaths	Injuries	Property Damage
Countywide	12/01/1998	0000	Unseasonably Warm	0	0	0
Countywide	12/31/1998	2359	Unseasonably Warm And Dry	0	0	0
Countywide	06/07/1999	0900	Excessive Heat	0	5	0
Countywide	07/04/1999	0800	Excessive Heat	4	10	0
Countywide	07/16/1999	0900	Excessive Heat	0	0	0
Countywide	07/23/1999	0900	Excessive Heat	0	10	0
Countywide	07/31/1999	2359	Unseasonably Warm And Dry	0	0	0
Countywide	08/01/1999	0000	Excessive Heat	0	0	0
Countywide	11/30/1999	2359	Unseasonably Warm	0	0	0
Countywide	01/02/2000	1000	Unseasonably Warm	0	0	0
Countywide	03/08/2000	1000	Unseasonably Warm	0	0	0
Countywide	03/31/2000	2359	Unseasonably Warm/wet	0	0	0
Countywide	05/02/2001	1100	Unseasonably Hot	0	0	0
Countywide	08/06/2001	0900	Excessive Heat	0	0	0
Countywide	11/30/2001	2359	Unseasonably Warm	0	0	0
Countywide	12/01/2001	0800	Unseasonably Warm	0	0	0
Countywide	12/31/2001	2359	Unseasonably Warm	0	0	0
Countywide	01/27/2002	1800	Unseasonably Warm	0	0	0
Countywide	02/28/2002	2359	Unseasonably Warm	0	0	0
Countywide	06/24/2002	0900	Excessive Heat	0	0	0
Countywide	07/01/2002	0900	Excessive Heat	0	0	0
Countywide	07/15/2002	0900	Excessive Heat	0	0	0
Countywide	07/28/2002	0900	Excessive Heat	0	0	0
Countywide	08/01/2002	0000	Excessive Heat	0	0	0
Countywide	08/11/2002	1100	Excessive Heat	0	0	0
Countywide	01/14/2003	0300	Extreme Cold/wind Chill	0	0	0
Countywide	06/24/2003	0900	Excessive Heat	0	0	0
Countywide	01/09/2004	1800	Extreme Cold/wind Chill	0	0	0
Countywide	01/15/2004	1200	Extreme Cold/wind Chill	0	0	0
Countywide	12/20/2004	0000	Extreme Cold/wind Chill	0	0	0
Countywide	01/18/2005	0400	Extreme Cold/wind Chill	0	0	0

SUSSEX COUNTY, DELAWARE  
MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

Storm Location	Date	Time	Type	Deaths	Injuries	Property Damage
Countywide	01/23/2005	1800	Extreme Cold/wind Chill	0	0	0
Countywide	01/28/2005	0000	Extreme Cold/wind Chill	0	0	0
Countywide	07/25/2005	0900	Excessive Heat	0	0	0
Countywide	08/02/2005	0900	Excessive Heat	0	0	0
Countywide	08/11/2005	0900	Excessive Heat	0	0	0
Countywide	08/01/2006	0900	Excessive Heat	2	5	0
Countywide	01/26/2007	0300	Cold/wind Chill	0	0	0
Countywide	02/05/2007	0300	Extreme Cold/wind Chill	0	0	0
Countywide	02/06/2007	0300	Extreme Cold/wind Chill	1	1	0
Countywide	03/06/2007	0300	Cold/wind Chill	0	0	0
Countywide	06/26/2007	1100	Excessive Heat	0	0	0
Countywide	07/08/2007	1100	Excessive Heat	0	0	0
Countywide	08/07/2007	1100	Excessive Heat	0	0	0
Countywide	08/25/2007	1000	Excessive Heat	0	0	0
Countywide	06/07/2008	0900	Excessive Heat	0	0	0
Countywide	07/16/2008	0900	Excessive Heat	0	0	0
Countywide	01/16/2009	0000	Cold/wind Chill	0	0	0
Countywide	08/10/2009	0900	Excessive Heat	0	0	0
<b>TOTALS:</b>				<b>8</b>	<b>42</b>	<b>0</b>

Source: National Climatic Data Center

## Hail

According to the National Climatic Data Center, the geographic area of Sussex County experienced 28 hail events from 1950 through November 2009 (see **Table 4.2-5**), with some hail stones reaching two inches in diameter. These events total approximately \$310,000 in property damage (NCDC, 2010).

**Table 4.2-5**  
**Hail Activity in Sussex County (1950-2009)**

Location	Date	Time	Type	Magnitude	Deaths	Injuries	Property Damage	Crop Damage
Countywide	05/30/1968	1430	Hail	1.00 in.	0	0	0	0
Countywide	06/27/1968	2100	Hail	1.00 in.	0	0	0	0
Countywide	07/03/1969	1300	Hail	1.00 in.	0	0	0	0



# HAZARD ANALYSIS

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## SUSSEX COUNTY, DELAWARE MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

Location	Date	Time	Type	Magnitude	Deaths	Injuries	Property Damage	Crop Damage
Countywide	05/24/1974	1610	Hail	1.50 in.	0	0	0	0
Countywide	06/30/1976	1330	Hail	1.75 in.	0	0	0	0
Countywide	06/30/1976	1330	Hail	2.00 in.	0	0	0	0
Countywide	04/26/1977	1100	Hail	1.75 in.	0	0	0	0
Countywide	08/11/1983	1800	Hail	1.75 in.	0	0	0	0
Countywide	07/27/1988	1322	Hail	1.75 in.	0	0	0	0
Countywide	03/31/1989	1415	Hail	0.75 in.	0	0	0	0
Seaford	04/01/1993	1835	Hail	1.75 in.	0	0	\$5,000	0
Countywide	04/01/1993	1900	Hail	1.75 in.	0	0	\$5,000	0
Millsboro	08/05/1994	1523	Hail	0.75 in.	0	0	0	0
Oak Orchard	03/29/1997	1515	Hail	1.00 in.	0	0	0	0
Greenwood	06/26/1997	1620	Hail	1.00 in.	0	0	0	0
Bethany Beach	07/16/1997	1432	Hail	1.00 in.	0	0	0	0
Delmar	06/16/1998	1935	Hail	1.00 in.	0	0	0	0
Harbeson	04/21/2000	1905	Hail	0.88 in.	0	0	0	0
Laurel	07/03/2002	1529	Hail	1.75 in.	0	0	0	0
Bethany Beach	07/27/2002	1640	Wind/hail	0 kts.	0	0	0	0
Delmar	05/16/2004	1952	Hail	1.00 in.	0	0	0	0
Millsboro	04/15/2006	0010	Hail	1.00 in.	0	0	0	0
Laurel	06/11/2007	1730	Hail	0.88 in.	0	0	0	0
Rehoboth Beach	08/10/2008	1127	Hail	0.88 in.	0	0	0	0
Rehoboth Beach	08/15/2008	1420	Hail	0.88 in.	0	0	0	0
Greenwood	06/13/2009	1610	Hail	1.00 in.	0	0	0	\$300,000
Sycamore	06/13/2009	1714	Hail	1.00 in.	0	0	0	0
Fenwick Island	07/28/2009	1407	Hail	1.00 in.	0	0	0	0
<b>TOTALS:</b>					<b>0</b>	<b>0</b>	<b>\$10,000</b>	<b>\$310,000</b>

Source: National Climatic Data Center

### Winter Storms

According to the National Climatic Data Center, the geographic area of Sussex County experienced 66 distinct winter storm (snow and ice) events from January 1, 1950 through November 2009 (see **Table 4.2-6**). In recent history, the two most powerful and costly storms to affect Delaware were the Blizzard of

# HAZARD ANALYSIS

## SUSSEX COUNTY, DELAWARE MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

1996 and a storm over President's Day Weekend 2003. All 36 events together resulted in approximately \$5.5 million in property damage statewide and 65 reported injuries.

**Table 4.2-6  
Winter Storm Activity in Sussex County (1950-2003)**

Location	Date	Time	Type of Event	Deaths	Injuries	Property Damage	Crop Damage
Countywide	01/09/1993	0030	Winter Weather	0	0	0	0
Countywide	03/13/1993	0200	Winter Storm	0	0	\$50,000	0
Countywide	12/28/1993	1000	Heavy Snow	0	0	0	0
Countywide	12/19/1995	1800	Freezing Rain	0	0	0	0
Countywide	01/06/1996	2300	Winter Storm	0	0	\$1,000,000	0
Countywide	02/02/1996	0300	Winter Storm	0	0	0	0
Countywide	02/16/1996	0600	Heavy Snow	0	0	0	0
Countywide	02/08/1997	0600	Snow	0	0	0	0
Countywide	12/23/1998	1600	Wintry Mix	0	0	0	0
Countywide	12/23/1998	1600	Winter Storm	0	0	0	0
Countywide	01/08/1999	0800	Wintry Mix	0	0	0	0
Countywide	03/09/1999	1200	Snow	0	0	0	0
Countywide	03/09/1999	1200	Heavy Snow	0	0	0	0
Countywide	01/20/2000	0400	Heavy Snow	0	30	0	0
Countywide	01/23/2000	2130	Freezing Drizzle	0	0	0	0
Countywide	01/25/2000	0100	Winter Storm	0	25	0	0
Countywide	12/19/2000	0900	Snow	0	0	0	0
Countywide	12/22/2000	0100	Snow	0	0	0	0
Countywide	01/05/2001	1100	Snow	0	0	0	0
Countywide	01/20/2001	0900	Wintry Mix	0	0	0	0
Countywide	02/22/2001	1200	Heavy Snow	0	0	0	0
Countywide	03/26/2001	0300	Snow	0	0	0	0
Countywide	01/03/2002	0400	Snow	0	0	0	0
Countywide	01/19/2002	0930	Wintry Mix	0	0	0	0
Countywide	12/05/2002	0200	Winter Storm	0	0	0	0
Countywide	12/05/2002	0200	Winter Weather/mix	0	0	0	0
Countywide	01/16/2003	2100	Heavy Snow	0	0	0	0
Countywide	01/29/2003	0300	Winter Weather/Mix	0	0	0	0

# HAZARD ANALYSIS

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SUSSEX COUNTY, DELAWARE  
MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

Location	Date	Time	Type of Event	Deaths	Injuries	Property Damage	Crop Damage
Countywide	01/30/2003	1500	Winter Weather/Mix	0	0	0	0
Countywide	02/06/2003	2030	Winter Storm	0	0	0	0
Countywide	02/06/2003	2030	Winter Weather/Mix	0	0	0	0
Countywide	02/10/2003	0800	Winter Weather/Mix	0	0	0	0
Countywide	02/15/2003	0000	Winter Weather/Mix	0	0	0	0
Countywide	02/16/2003	0300	Winter Storm	0	0	\$4,400,000	0
Countywide	02/26/2003	0500	Winter Weather/Mix	0	0	0	0
Countywide	02/27/2003	1500	Winter Weather/Mix	0	0	0	0
Countywide	12/6/2003	0000	Winter Weather/mix	0	0	0	0
Countywide	1/17/2004	1900	Winter Weather/mix	0	0	0	0
Countywide	1/25/2004	2100	Heavy Snow	0	0	0	0
Countywide	1/27/2004	1800	Winter Weather/mix	0	0	0	0
Countywide	2/17/2004	1500	Winter Weather/mix	0	0	0	0
Countywide	12/19/2004	0100	Winter Weather/mix	0	0	0	0
Countywide	12/19/2004	1900	Winter Weather/mix	0	0	0	0
Countywide	1/19/2005	1100	Winter Weather/mix	0	0	0	0
Countywide	1/22/2005	0900	Winter Storm	0	0	0	0
Countywide	2/7/2005	2000	Winter Weather/mix	0	0	0	0
Countywide	2/24/2005	0300	Winter Weather/mix	0	0	0	0
Countywide	3/8/2005	1030	Winter Weather/mix	0	0	0	0
Countywide	12/6/2005	0400	Heavy Snow	0	0	0	0
Countywide	2/12/2006	0200	Winter Storm	0	0	0	0
Countywide	1/21/2007	1630	Winter Weather	0	0	0	0
Countywide	1/25/2007	2000	Winter Weather	0	0	0	0
Countywide	2/7/2007	1200	Winter Weather	0	0	0	0
Countywide	2/13/2007	0600	Winter Weather	0	0	0	0
Countywide	2/25/2007	1200	Winter Storm	0	0	0	0
Countywide	2/25/2007	1200	Winter Weather	0	0	0	0
Countywide	3/7/2007	0900	Winter Weather	0	0	0	0
Countywide	12/5/2007	1000	Winter Weather	0	0	0	0
Countywide	1/22/2008	2100	Winter Weather	0	0	0	0
Countywide	1/24/2008	1100	Winter Weather	0	0	0	0

SUSSEX COUNTY, DELAWARE  
MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

Location	Date	Time	Type of Event	Deaths	Injuries	Property Damage	Crop Damage
Countywide	1/28/2008	0500	Winter Weather	0	0	0	0
Countywide	2/14/2008	0100	Winter Weather	0	0	0	0
Countywide	2/20/2008	1300	Winter Weather	0	0	0	0
Countywide	2/22/2008	0100	Winter Weather	0	0	0	0
Countywide	11/21/2008	1800	Winter Weather	0	0	0	0
Countywide	1/18/2009	1715	Winter Weather	0	0	0	0
Countywide	1/19/2009	0500	Winter Weather	0	0	\$5,000	0
Countywide	1/27/2009	0715	Winter Weather	0	0	\$5,000	0
Countywide	2/3/2009	0600	Winter Weather	0	0	0	0
<b>TOTAL</b>				<b>0</b>	<b>55</b>	<b>\$5,450,000</b>	<b>\$0</b>

Source: National Climatic Data Center

## Coastal Erosion

An evaluation of erosion hazards in the United States was conducted as a collaborative project of The H. John Heinz III Center for Science, Economics and the Environment in April 2000, a study prepared for the Federal Emergency Management Agency ([www.heinzcenter.org](http://www.heinzcenter.org)). The Heinz Center evaluation provides an assessment of coastal erosion and the potential loss of property along U.S. shorelines.

In 1990, the State of Delaware had an estimated 1,000 people living within 500 feet of the Atlantic shoreline, according to data derived from analyzing U.S. Census Block Groups. Sussex County, one of the 18 counties studied in The Heinz Center's evaluation, is known to experience an average annual erosion rate of three (3) to four (4) feet per year. And, according to the study, an estimated 25 percent of those homes within 500 feet of U.S. coastlines and Great Lakes coastlines are likely to be lost to erosion by 2060.

**Figure 4.2-3** shows one Delaware community, South Bethany, and the expectation that the beach will erode inland approximately 60 feet over the next 60 years resulting in the hypothetical loss of three rows of housing.

SUSSEX COUNTY, DELAWARE  
MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

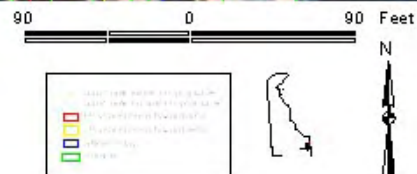
**Figure 4.2-3**  
**The Heinz Center Evaluation of Erosion Hazards (Delaware)**



**South Bethany, Delaware**

As shown on this aerial photo of South Bethany, DE, the beach is expected to erode inland about 60 feet (to the red line) over the next 60 years. Three rows of houses, marked with circles, are likely to be lost to erosion over this period.

The Heinz Center  
Evaluation of Erosion Hazards  
Prepared for FEMA





SUSSEX COUNTY, DELAWARE  
MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

### *Dam/Levee Failure*

According to the National Inventory of Dams, there are nine (9) known dams in the State of Delaware that are considered to be high risk for failure (see **Table 4.2-7** for county dam hazard data). Nearly 60 percent of the dams within the state are considered to be high or significant hazard facilities.

Dam hazard definitions, as accepted by the National Interagency Committee on Dam Safety, are as follows:

1. **LOW HAZARD POTENTIAL**—Dams assigned the low hazard potential classification are those where failure or mis-operation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the owner's property.
2. **SIGNIFICANT HAZARD POTENTIAL**—Dams assigned the significant hazard potential classification are those dams where failure or mis-operation results in no probable loss of human life but can cause economic loss, environment damage, disruption of lifeline facilities, or impact other concerns. Significant hazard potential classification dams are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure.
3. **HIGH HAZARD POTENTIAL**—Dams assigned the high hazard potential classification are those where failure or mis-operation will probably cause loss of human life.

**Table 4.2-7**  
**County Dam Hazard Data**

Name of Dam	General Location	Owner	Year Built	Hazard Potential
Wagamons Pond Dam	Broadkill River	DNREC	1815	High
Morris Millpond Dam	Cowbridge, Indian River	Merrill G Calloway	1929	Significant
Betts Pond Route 113 Dam	Shoals Branch	DeIDOT	1956	Significant
Williams Pond Dam	Clear Brook	DeIDOT	1956	Low
Hearns Pond Dam	Clear Brook(Bucks Brook)	Hearn And Rawlins Inc	1912	Significant
Collins Pond Dam	Gravelly Branch Nanticoke	DeIDOT	1965	Low
Records Pond Dam	Broad Creek	DNREC	1900	High
Chipman Pond Dam	Broad Creek	James W Lowe	1915	Low
Waples Pond Dam	Primehook Creek	DNREC	N/A	Significant
Abbotts Pond Dam	Johnson Br. Mispillion River	DNREC	1960	Significant
Swiggets Pond Dam	Cedar Creek	DeIDOT	1941	Significant
Denoname 5	Broad Creek	City of Laurel	1964	Significant
Denoname 4	Broad Creek	City of Laurel	1964	Significant
Denoname 3	Broad Creek	City of Laurel	1964	Significant
Goslee Mill Pond Dam	Goslee Creek	William and Eugene Bayard	N/A	Significant
Clendaniel Pond Dam	Cedar Creek	Mr. J. L. Warnell	1810	Significant
Cubbage Pond Dam	Cedar Creek	Ms. Mary E. Coffey	1880	Significant
Marshall Millpond Dam	Deep Branch	DeIDOT	N/A	Significant
Diamond Pond Dam	Ingram Branch	The Island Farm	N/A	Low

SUSSEX COUNTY, DELAWARE  
MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

Name of Dam	General Location	Owner	Year Built	Hazard Potential
Millsboro Pond	Indian River	DeIDOT	1920	High
Trap Pond Dam	Broad Creek	DNREC	1938	Low
Gordons Pond Dam	Lewes Rehoboth Canal	DNREC	1967	Low
Horseys Pond Dam	Meadow Branch Tributary of Broad Creek	State of Delaware	1956	Significant
Hudson Pond Dam	Cedar Creek	Warren S Golde	1958	L
Fleetwood Pond Dam	Tyndall Branch	DeIDOT	1968	S
Red Mill Pond Dam	Old Mill Creek Broadkill	DeIDOT	1925	S
Concord Pond Dam	Broad Creek	DNREC	1978	S

Source: National Inventory of Dams, USACE

## Earthquakes

According to the Delaware Geological Survey, 59 earthquakes have been impacted the State of Delaware during a period from 1638 through 2009. The greatest of these, in terms of the Modified Mercalli Intensity (MMI) scale for earthquakes, was the October 9, 1871 earthquake reported to have had an intensity of VII on the MMI scale in New Castle County. An event registering 7 would correspond to a ranking between 5.4 and 6.1 on the Richter Scale, and would be considered a “very strong” earthquake. The lower end of the spectrum for Delaware consists of several earthquakes classified as a II on the MMI scale, for instance the October 20, 1985 earthquake documented in the City of Wilmington in New Castle County. No damage estimates are currently available for these events.

**Table 4.2-8** lists all recorded earthquakes in the State of Delaware for the period 1638 through 2009, along with their intensity. Earthquake events specifically associated with Sussex County are highlighted in bold typeface for quick reference. For some events, the intensity appears as a range due to variations in distances across the impacted areas.

**Table 4.2-8**  
**Recorded Earthquakes in the State of Delaware (1638-2009)**

Date of Occurrence	Felt Area	Modified Mercalli Intensity (If Known)
October 9, 1871	Wilmington	VII
March 25, 1879	Dover	IV-V
<b>May 8, 1906</b>	<b>Seaford</b>	<b>IV</b>
<b>December 3, 1937</b>	<b>Georgetown</b>	<b>IV</b>
January 8, 1944	Wilmington	< V
July 14, 1971	SW Wilmington	III-IV
December 29, 1971	SW Wilmington	IV-V
January 2, 1972	SW Wilmington	III-IV
January 2, 1972	SW Wilmington	III-IV
January 6, 1972	SW Wilmington	III-IV
January 22, 1972	SW Wilmington	III-IV



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Date of Occurrence	Felt Area	Modified Mercalli Intensity (If Known)
January 22, 1972	SW Wilmington	III-IV
January 23, 1972	SW Wilmington	III-IV
February 10, 1972	ENE Newark	V
February 11, 1972	SW Wilmington	III
August 13, 1972	SW Wilmington	III-IV
August 13, 1972	SW Wilmington	III-IV
November 25, 1972	SW Wilmington	III-IV
November 27, 1972	SW Wilmington	III-IV
<b>February 28, 1973</b>	<b>Entire State</b>	<b>V-VI</b>
March 1, 1973	Claymont	I
March 2, 1973	Claymont	I
March 2, 1973	Claymont	I
March 3, 1973	Claymont	I
March 3, 1973	Claymont	I
March 3, 1973	Claymont	I
March 3, 1973	Claymont	I
July 10, 1973	Wilmington-Claymont	IV
April 28, 1974	Wilmington	V
February 10, 1977	Wilmington	V
<b>June 5, 1977</b>	<b>Georgetown</b>	-
<b>August 2, 1977</b>	<b>Georgetown</b>	-
February 25, 1980	Wilmington	I
November 17, 1983	Trolley Square area of Wilmington	V
November 17, 1983	Trolley Square area of Wilmington	-
December 12, 1983	NW Wilmington	IV
December 12, 1983	NW Wilmington	I-II
January 19, 1984	Wilmington	I-II
January 19, 1984	Wilmington	III-IV
February 15, 1984	N Wilmington	III-IV
October 10, 1985	N Wilmington	I-II
October 20, 1985	Wilmington	I
November 8, 1993	Wilmington	I-II
February 11, 1994	Wilmington Area	II
April 23, 1994	Wilmington	II-III
October 16, 1995	Wilmington	I-II
October 17, 1995	Wilmington	II-III
December 20, 1995	Wilmington	I-II
June 13, 1996	Wilmington	II-III

SUSSEX COUNTY, DELAWARE  
MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

Date of Occurrence	Felt Area	Modified Mercalli Intensity (If Known)
June 23, 1996	Wilmington	I-II
January 28, 1997	Wilmington	II
April 15, 1997	Wilmington	III-IV
March 15, 1998	Wilmington	III
March 19, 1998	Wilmington	III
March 19, 1998	Wilmington	I-II
October 27, 1998	Near Montchanin	II
August 13, 2003	Near Newark	II
April 9, 2005	North Wilmington	I-II
July 1, 2009	Kent County	Unknown

Source: Delaware Geological Survey

## Sinkholes and Landslides

Sinkholes and landslides, discussed in the *Hazard Identification* section, were not analyzed in detail due to extremely low probability of occurrence within the State of Delaware.

## Tsunami

Though tsunamis are more likely to affect Pacific Rim states, historical evidence does show that tsunamis have affected the Eastern United States and Gulf of Mexico, including Delaware. Forty tsunamis and tsunami-like waves have been documented in the Eastern United States since 1600. To cite one commonly referred to example in terms of Atlantic tsunamis, a severe earthquake (7.2 on the Richter Scale) on November 18, 1929 in the Grand Banks of Newfoundland generated a tsunami that caused considerable damage and loss of life at Placentia Bay, Newfoundland and is also known to have impacted upon the Maine shoreline to some degree. Due to the relatively low probability of a tsunami significantly impacting the State of Delaware, no further analysis or vulnerability assessment will be conducted for this hazard at this time.

## Volcano

There are no active volcanoes in the State of Delaware, thus no historical evidence of volcanic eruption exists within the planning area. There is also no indication that this hazard is a significant enough threat to the state to warrant further analysis or a vulnerability assessment at this time.

## Terrorism

Because of the relevantly recent, or heightened, focus being placed on managing terrorism and consequences of terrorism in the United States, no historical database is currently available for cataloging acts of terrorism. However, at the time of this Plan's development, no significant historical occurrences of terrorism were known to have taken place within the Sussex County planning area.

SUSSEX COUNTY, DELAWARE  
MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN*Hazardous Materials (HazMat)*

**Table 4.2-9** shows National Response Center (NRC) data for Sussex County for the last 5 years with regard to number of incidents, injuries, deaths and damages incurred as the result of hazardous materials incidents. From 2004 to 2008, there were 132 incidents, 2 injuries, no deaths, and no damage.

**Table 4.2-9**  
**NRC HazMat Data for Sussex County**

Year	Type of Incident							Injuries	Fatalities	Damages
	Fixed	Mobile	Rail	Tank	Vessel	Pipeline	Other			
2004	3	2	0	5	5	0	2	0	0	0
2005	3	0	0	0	14	1	2	0	0	0
2006	7	3	2	1	16	0	10	0	0	0
2007	3	4	2	0	12	1	2	2	0	0
2008	9	4	1	4	11	0	3	0	0	0
<b>Total</b>	<b>25</b>	<b>13</b>	<b>5</b>	<b>10</b>	<b>58</b>	<b>2</b>	<b>19</b>	<b>2</b>	<b>0</b>	<b>\$0</b>

*Energy Pipeline Failures*

A history of hazards is not currently available for energy pipeline failures in Sussex County.

*Probability of Future Events*

The final step of any hazard analysis is calculating the likelihood of future events. Given the number of events that have occurred in the past and the time period over which those events have occurred, one can calculate the number of events that occur per year. This gives a sense of the probability of future occurrences. The results of this calculation for Sussex County are presented in Table 4.2-10. For floods, the events that are tallied are generally nuisance events without a great deal of damage. The probability of a 100-year flood (and its predicted extent) is 1% in any given year. Earthquakes require a similar explanation. While 59 total events have taken place according to the historical record, only one of those was capable of causing any damage at all, however slight. Finally, there is no historical record of occurrence for several hazards.

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**Table 4.2-10**  
**Probability of Future Events (All Hazards)**

Hazard	Number of Events	Time Period	Events per Year	Probability of Future Occurrence
Flood	57	1993 – 2009	3.563/0.0100	High/Low
Tropical Storm	22	1877 – 2009	0.167	Low
Severe Thunderstorm	287	1950 – 2009	4.864	High
Tornado	18	1950 – 2009	0.305	Medium
Wildfire	8	1993 – 2009	0.500	Low
Drought	45	1995 – 2009	3.214	High
Extreme Temperature	78	1995 – 2009	5.286	High
Hail	28	1950 – 2009	0.475	Medium
Winter Storm	66	1993 – 2009	4.125	High
Coastal Erosion	Unknown	N/A	Unknown	Low
Dam Failure	Unknown	N/A	Unknown	Low
Earthquake	59 (1 MMI >= VI)	1871 – 2009	0.428/0.007	Medium/Low
Sinkhole/Landslide	Unknown	N/A	Unknown	Low
Tsunami	Unknown	N/A	Unknown	Low
Volcano	Unknown	N/A	Unknown	Low
Terrorism	Unknown	N/A	Unknown	Low
Hazardous Material Release	132	2004-2008	26.4	High
Energy Pipeline Failure	Unknown	N/A	Unknown	Low

SUSSEX COUNTY, DELAWARE  
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## *Data Sources*

**American Society of Civil Engineers (ASCE)**, "Facts About Windstorms."

Web site: [www.windhazards.org/facts.cfm](http://www.windhazards.org/facts.cfm)

**Bureau of Reclamation**, U.S. Department of the Interior

Web site: [www.usbr.gov](http://www.usbr.gov)

**Federal Emergency Management Agency (FEMA)**

Web site: [www.fema.gov](http://www.fema.gov)

**National Climatic Data Center (NCDC)**, U.S. Department of Commerce, National Oceanic and Atmospheric Administration

Web site: <http://lwf.ncdc.noaa.gov/oa/ncdc.html>

**National Geophysical Data Center**, "Tsunamis and Tsunami-Like Waves of the Eastern United States"

Web site: <http://www.ngdc.noaa.gov/seg/hazard/tsu.shtml>

**National Inventory of Dams**, U.S. Department of the Interior

Web site: <http://crunch.tec.army.mil/nid/webpages/nid.cfm>

**National Hurricane Center**, National Oceanic & Atmospheric Administration (NOAA)

Web site:

[http://www.nhc.noaa.gov/http://www.nhc.noaa.gov/HAW2/english/history/opal\\_1995\\_map.gif](http://www.nhc.noaa.gov/http://www.nhc.noaa.gov/HAW2/english/history/opal_1995_map.gif)

**National Severe Storms Laboratory (NSSL)**, U.S. Department of Commerce, National Oceanic and Atmospheric Administration

Web site: [www.nssl.noaa.gov](http://www.nssl.noaa.gov)

**National Weather Service (NWS)**, U.S. Department of Commerce, National Oceanic and Atmospheric Administration

Web site: [www.nws.noaa.gov](http://www.nws.noaa.gov)

**Storm Prediction Center (SPC)**, U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service

Web site: [www.spc.noaa.gov](http://www.spc.noaa.gov)

**The Tornado Project**, St. Johnsbury, Vermont

Web site: [www.tornadoproject.com](http://www.tornadoproject.com)

**United States Geological Survey (USGS)**, U.S. Department of the Interior

Web site: [www.usgs.gov](http://www.usgs.gov)

# VULNERABILITY ASSESSMENT

**Requirement §201.6(c)(2)(ii):** *[The risk assessment **shall** include a] description of the jurisdiction's vulnerability to the hazards described in paragraph (c)(2)(i) of this section. This description **shall** include an overall summary of each hazard and its impact on the community*

A high-level, detailed vulnerability assessment was completed for Sussex County for flood (riverine and coastal), severe winds (hurricanes and coastal storms), thunderstorms, tornadoes, drought, hail, winter storms, dam/levee failure, earthquakes, terrorism, hazardous materials and energy pipeline failures, due to the higher level of vulnerability for these hazards compared to others. It is important to note that this vulnerability assessment is based on best available data and represents a base-level assessment for the planning area. Additional work could be done on an ongoing basis to enhance, expand and further improve the accuracy of the baseline established here.

The loss estimates provided in this section have resulted in an *approximation* of vulnerability. These estimates should be used to understand relative vulnerability from hazards and potential losses. However, it is important to understand that uncertainties are inherent in any loss estimation methodology, arising in part from incomplete scientific knowledge concerning natural hazards and their effects on the built environment. Uncertainties also result from approximations and simplifications that are necessary for a comprehensive analysis (such as abbreviated inventories, demographics or economic parameters).

To conduct the vulnerability assessment effort, two distinct hazard vulnerability assessment methodologies were applied; utilizing both HAZUS-MH® MR3 (FEMA's loss estimation software) and a statistical vulnerability assessment methodology. Both approaches provide estimates for the potential impact by using a common, systematic framework for evaluation.

The HAZUS-MH vulnerability assessment methodology is parametric, in that distinct hazard and inventory parameters (for example, wind speed and building types) were modeled using the HAZUS-MH software to determine the impact (damages and losses) on the built environment. The HAZUS-MH software was used to estimate losses from wind (hurricane and tornado), earthquake and flood hazards.

The second methodology, a statistical vulnerability assessment methodology, was applied to analyze hazards of concern that are outside the scope of the HAZUS-MH software. The methodology uses a statistical approach and mathematical modeling of vulnerability to predict a hazard's frequency of occurrence and estimated impacts based on recorded or historic damage information.

For the 2009 Plan Update, this vulnerability assessment was recalculated to take advantage of improvements to the HAZUS-MH software algorithms, better and more accurate input data, and a more transparent and statistically sound loss estimation method for non-spatially specific hazards.

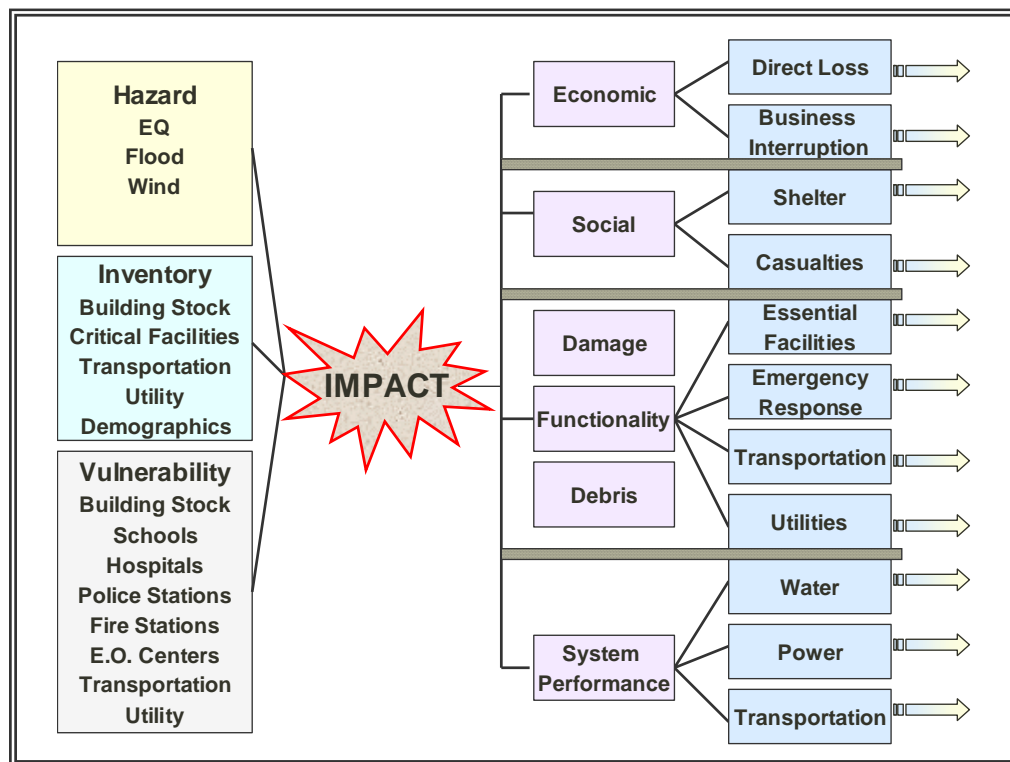
## Explanation of HAZUS-MH Vulnerability Assessment Methodology

HAZUS-MH MR3 is FEMA's standardized loss estimation software program, built upon an integrated geographic information system (GIS) platform (**Figure 4.3-1**). This vulnerability assessment applied HAZUS-MH to produce regional profiles and estimate losses for three of the seven hazards addressed in this section: flood, hurricane winds and earthquake. The version of HAZUS-MH that was used is known as Maintenance Release 3 or MR3.

# VULNERABILITY ASSESSMENT

SUSSEX COUNTY, DELAWARE  
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**Figure 4.3-1  
Conceptual Model of HAZUS-MH Methodology**



## Explanation of Regional Vulnerability Assessment Methodology

Vulnerabilities associated with other natural hazards were analyzed using a regional assessment methodology developed and used specifically for this effort. This approach is based on the principal that any spatially-nonspecific hazard event is essentially a random occurrence within a region and had just as much chance of occurring within the study area as outside. Historical data for each hazard are used and statistical evaluations are performed using manual calculations. The general steps used in the statistical vulnerability assessment methodology are summarized below:

- Buffer the study area to determine the regional assessment area;
- Compile hazard occurrence data for the regional area from national and local sources;
- Categorize hazard parameters for each hazard to be modeled (e.g., tornado);
- Calculate the annualized occurrence and loss estimates for each regional subdivision;
- Normalize the annualized occurrence and loss estimates by land area and number of housing units respectively; and
- Determine the overall regional average of annualized occurrence and loss

The economic loss results are presented here using two interrelated vulnerability indicators:



# VULNERABILITY ASSESSMENT

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## SUSSEX COUNTY, DELAWARE MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

- 1) The Annualized Loss (AL), which is the estimated long-term value of losses to the general building stock in any single year in a specified geographic area (i.e., city or county)
- 2) The Annualized Loss Ratio (ALR), which expresses estimated annualized loss as a fraction of the building inventory replacement value

The estimated Annualized Loss (AL) addresses the two key components of vulnerability: the probability of the hazard occurring in the study area and the consequences of the hazard, largely a function of building construction type and quality, and of the intensity of the hazard event. By annualizing estimated losses, the AL factors in historic patterns of frequent smaller events with infrequent but larger events to provide a balanced presentation of the vulnerability.

The Annualized Loss Ratio (ALR) represents the AL as a fraction of the replacement value of the local building inventory. This ratio is calculated using the following formula:

$$\text{"ALR = ANNUALIZED LOSSES / TOTAL EXPOSURE AT RISK"}$$

The annualized loss ratio gauges the relationship between average annualized loss and building replacement value. This ratio can be used as a measure of relative vulnerability between areas and, since it is normalized by replacement value, it can be directly compared across different geographic units such as metropolitan areas or counties.

It is important to note that HAZUS-MH was used to produce "worst case scenario" results. The outputs in this document are considered to be the result of a worst case scenario event for each hazard, and it is understood that any smaller events would most likely create fewer losses than those calculated here.

Finally, in each of the loss tables for specific jurisdictions, the loss is listed as negligible. Negligible specifically means less than \$5,000 in losses per jurisdiction. While not listed individually, these small losses are included in the total loss estimates.

### Minor Civil Divisions (MCDs)

Many of the tables presented in the *Vulnerability Assessment* use Minor Civil Divisions (MCDs), which are a traditional way to divide counties into subdivisions<sup>1</sup> (**Figure 4.3-2**). MCDs are recognized by the U.S. Census Bureau and are a national standard by which HAZUS-MH results are prepared (due in part to the reliance of HAZUS on U.S. Census data.) Minor Civil Divisions cover the entire country and provide a standard level of geography below the county boundary.<sup>2</sup>

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<sup>1</sup> The expanded definition of a Minor Civil Division according to the U.S. Census Bureau is, "the primary governmental or administrative division of a county or statistically equivalent entity in many states and statistically equivalent entities...a Minor Civil Division is created to govern or administer an area rather than a specific population."

<sup>2</sup> Minor Civil Divisions are typically most common in the Eastern United States, while Census County Divisions (CCDs), a similar method of dividing counties into subdivisions, are more common in the Western United States.

# VULNERABILITY ASSESSMENT

SUSSEX COUNTY, DELAWARE  
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**Figure 4.3-2**  
**Minor Civil Divisions (U.S. Census 2000)**



# VULNERABILITY ASSESSMENT

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## SUSSEX COUNTY, DELAWARE MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

In the studies conducted for Sussex County, cities—such as Lewes and Seaford for example—are separated from the MCDs in jurisdiction-level analyses. This was done in order to provide a more detailed cross section of the planning area and eliminate tendencies to double-count available information.

**Requirement §201.6(c)(2)(ii)(A):** *The plan **should** describe vulnerability in terms of the types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard area ... .*

### *Sussex County Overview*

According to the U.S. Census Bureau, the total population of Sussex County in 2000 was 156,638. (The total population in 2000 for the state of Delaware as a whole was 783,600.) **Figure 4.3-3** shows the distribution of this population across the county's geographic area.

The total dollar exposure within Sussex County is estimated to be approximately \$19 billion. This estimate consists of single family residential buildings, multi-family residential buildings and commercial facilities. As this information was derived from HAZUS-MH, any values unavailable in the current version of the software are not reflected. Critical facilities, an important component of the county's overall exposure, are addressed separately in this section for flood, wind and earthquake hazards and are defined in detail below.

### **Development Trends**

The resident population of the State of Delaware is projected to increase from 783,600 in 2000 to approximately 861,000 by 2025 (U.S. Census Bureau). Delaware's rate of population change, at 20.1 percent, ranks as the 28th largest in the Nation. The percent change in housing units in the State is estimated to have been 2.6 percent from 2000 to 2002, which ranks Delaware as 22nd in the Nation. These trends demonstrate that Delaware's population is increasing, and consequently the number of residential structures and the associated exposure of residential buildings will increase as well. Assuming a multiplier of 1.008<sup>3</sup>, the total residential exposure of Sussex County could reach an estimated dollar value of nearly \$22 billion by 2025. This estimate does not of course take into account many other development factors, such as available land for new residential construction. Future Plan updates will address development trends in more detail, in particular for hazards with a mappable hazard boundary (i.e., flood, storm surge, etc.)

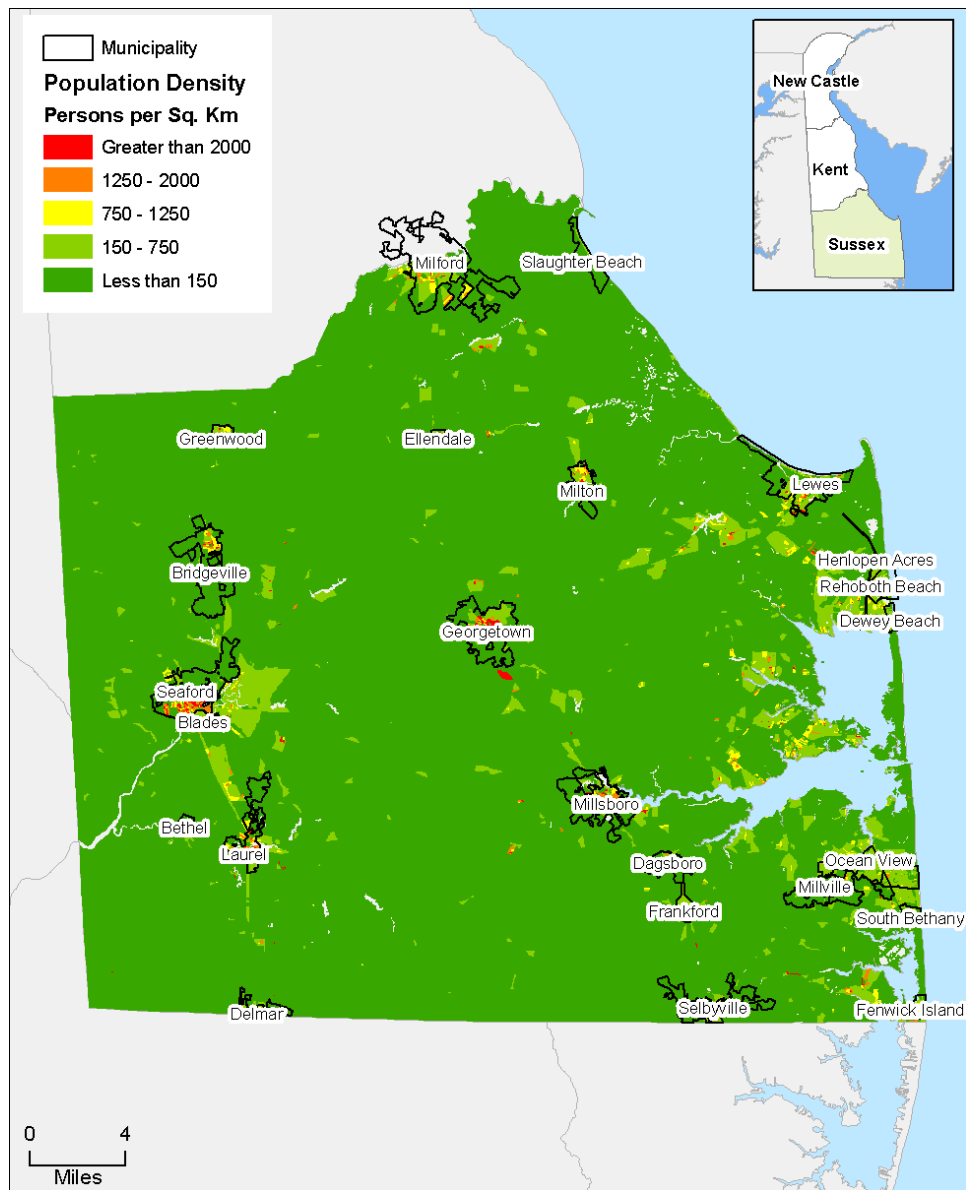
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<sup>3</sup> Based on the percent change in housing units for a two-year period and weighted for Sussex County.

# VULNERABILITY ASSESSMENT

## SUSSEX COUNTY, DELAWARE MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

**Figure 4.3-3  
Population Distribution (U.S. Census 2000)**



# VULNERABILITY ASSESSMENT

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SUSSEX COUNTY, DELAWARE  
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## Critical Facilities

For the purposes of this risk assessment, the label “critical facility” may refer to any of the following that may apply: airports, colleges, dams, day care centers, dispatch centers, electric switching stations, Emergency Operations Centers (EOCs), fire departments, food storage facilities, gas compressor stations, gas LNG plants, gate stations for utility companies, generating stations, government facilities, hospitals, hotels/motels, major bridges, medical facilities, military bases, minor bridges, newspaper offices, nursing homes, paramedic/EMS stations, police departments, ports, prisons, public shelters, radio/television towers, railroad facilities, schools, sewage treatment plants, substations and TV/radio stations.

## *Flood*

Using FEMA dFIRM, where available, along with the modeling approach described earlier, losses were estimated using return period events ranging from 10-year to 500-year events.<sup>4</sup> With this approach, annualized losses were calculated by accounting for the losses from different return period events and their respective annual probabilities of occurrence. (i.e., the annual probability of observing a 100-year flood is 1 percent).

Describing vulnerability in terms of annualized losses provides three primary benefits:

- (1) Potential losses from all future disasters are accounted for using this approach;
- (2) Results across hazards are readily comparable and hence easier to rank; and
- (3) A risk ranking approach facilitates the evaluation of mitigation alternatives.

## Coastal Flooding

Modeling conducted by the US Army Corps of Engineers in Philadelphia, PA provides an approximation of the extents of storm surge flooding by category of tropical storm. The Sea, Lake, and Overland Surges from Hurricanes (SLOSH) model is a robust, empirically-verified storm surge model that creates maps of potential storm surge areas. Coastal flooding profiles were created for Category 1 through Category 3 storms to illustrate the expected storm surge associated with each magnitude event. In Sussex County, the risk of a Category 2 storm surge is about 1% any given year. The area of storm surge was mapped to show the intersection of surge with major cities and major roads, and can also be compared to population density/distribution. **Figure 4.3-4** shows the storm surge areas for Category 1 through Category 3 storm events in Sussex County.

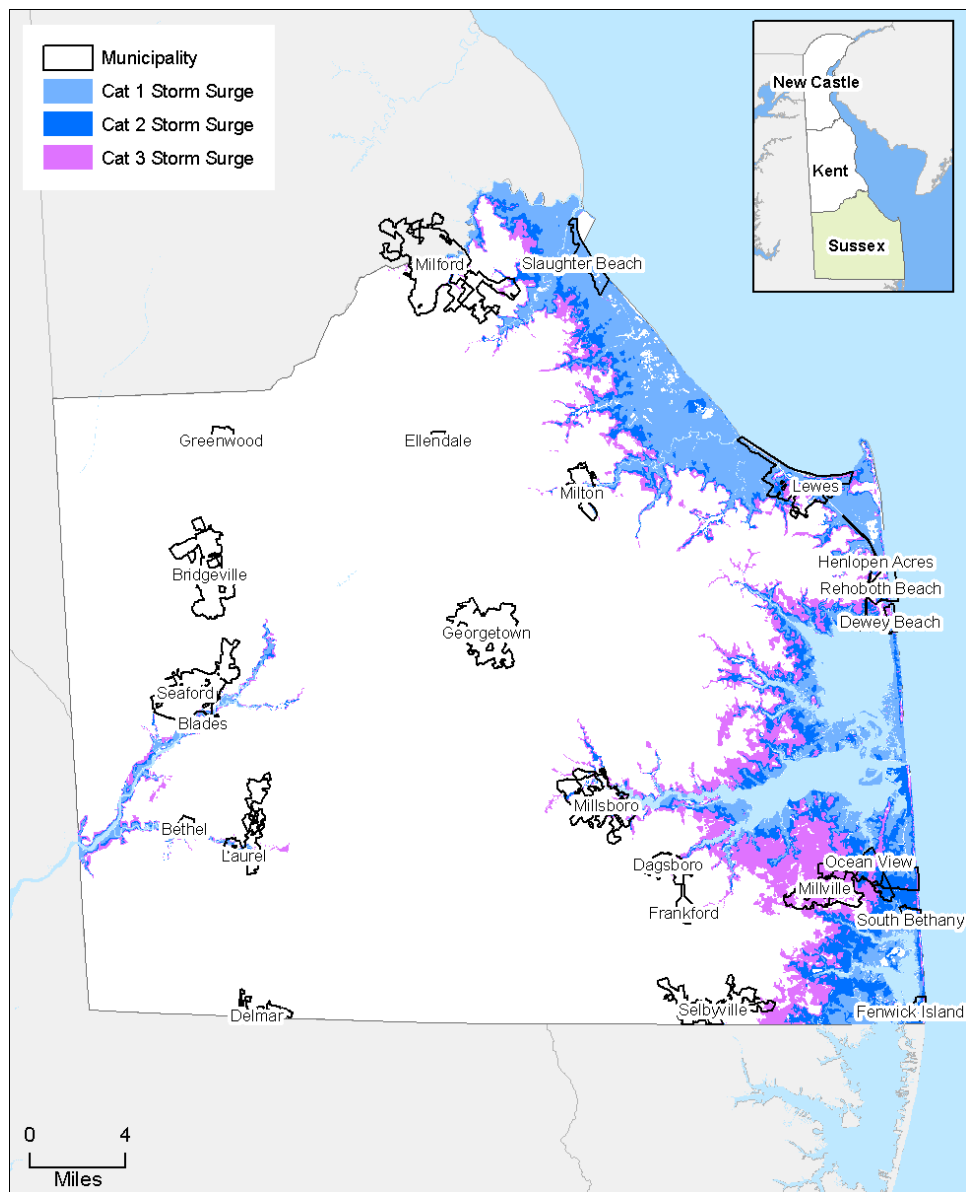
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<sup>4</sup> Flood depth was estimated at the pixel level for affected areas along with the proportion of the area affected within the block. HAZUS-MH inventory and damage functions were utilized in estimating losses.

# VULNERABILITY ASSESSMENT

SUSSEX COUNTY, DELAWARE  
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**Figure 4.3-4**  
**Hurricane Storm Surge Extent (USACE)**



# VULNERABILITY ASSESSMENT

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## SUSSEX COUNTY, DELAWARE MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

### Riverine Flooding

In addition to coastal flooding, the Sussex County is vulnerable to riverine flooding, primarily due to the accumulation of excessive rainfall in the watersheds upstream along the Mispillion River, Cedar Creek, Slaughter Creek, Primehook Creek, the Broadkill River, Old Mill Creek, Love Creek, Herring Creek, Guinea Creek, the Indian River, Pepper Creek, Vines Creek, Miller Creek, Dirickson Creek, the Nanticoke River, Broad Creek, Bridgeville Branch, Gravelly Branch, Marshyhope Creek, and other smaller tributaries. A map of the 100- and 500-year floodplains can be found in **Figure 4.3-5**.

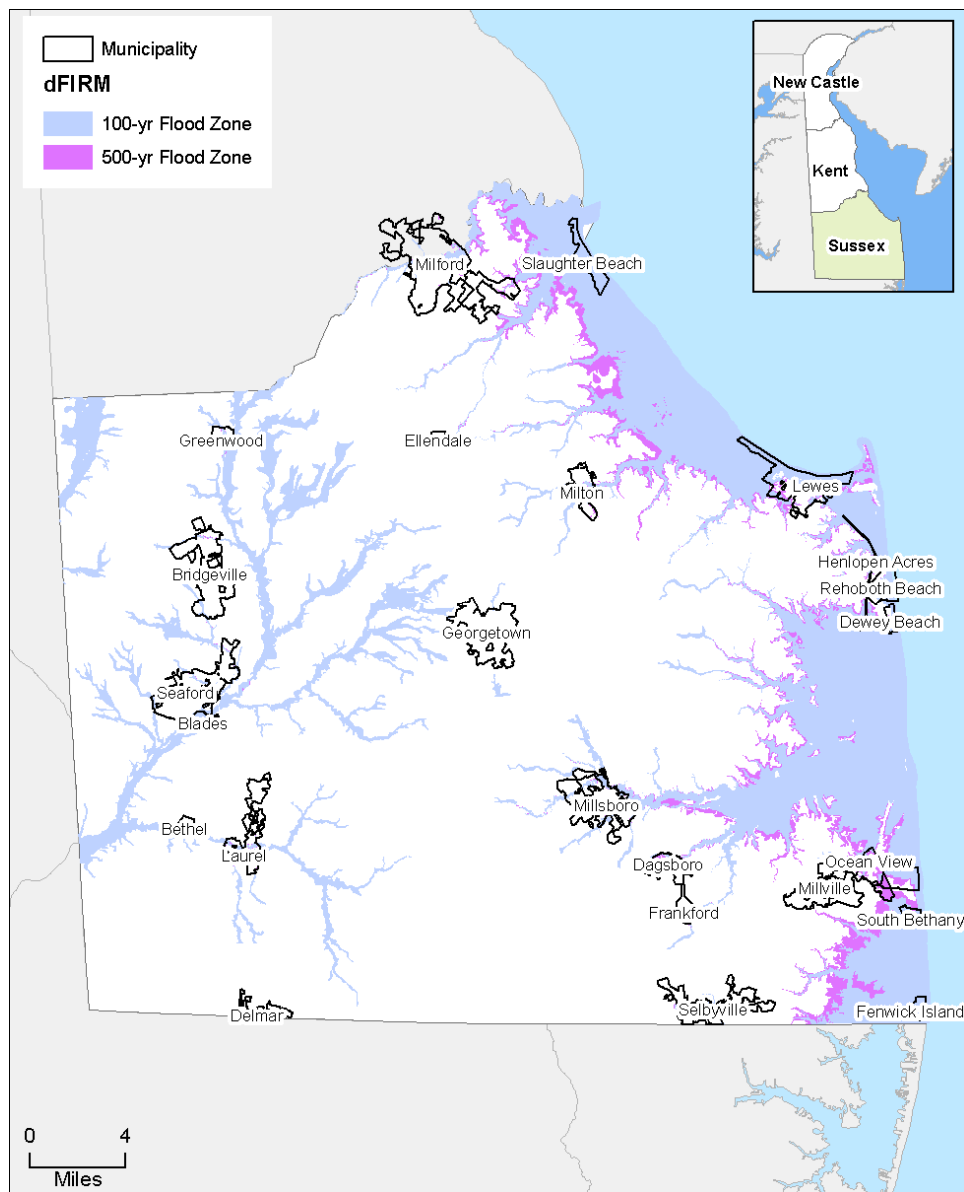
When taken together, the extent of potential coastal flooding and the extent of riverine flooding equal the total flood hazard zone. HAZUS-MH calculated the depth of the flood of various periodicities and compared that to the intersecting building stock exposure to predict the flood loss for each particular return period as well as an annualized estimate. **Figure 4.3-6** displays the result of the hydrology and hydraulic modeling in HAZUS-MH used to generate an estimate of the depth of the 100-year flood in Sussex County. **Table 4.3-1** shows total annualized expected losses from both coastal and riverine flooding events by jurisdiction within Sussex County. The total potential annualized losses for Sussex County equal \$129,520,000.



# VULNERABILITY ASSESSMENT

SUSSEX COUNTY, DELAWARE  
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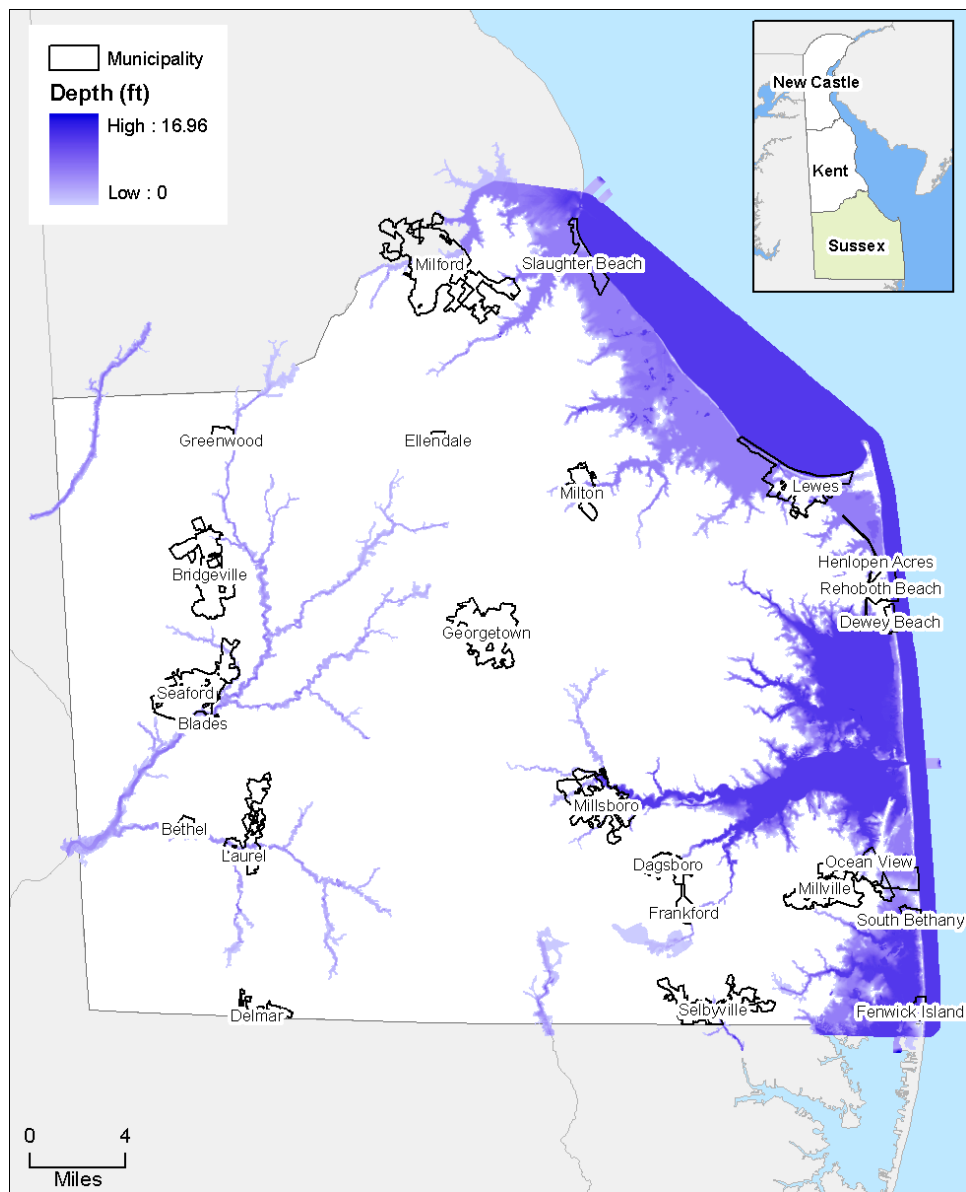
**Figure 4.3-5**  
**100-year and 500-year Floodplains**



# VULNERABILITY ASSESSMENT

SUSSEX COUNTY, DELAWARE  
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**Figure 4.3-6**  
**Modeled 100-year Flood Depth**



# VULNERABILITY ASSESSMENT

SUSSEX COUNTY, DELAWARE  
MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

**Table 4.3-1  
Potential Annualized Losses from Flooding**

<b>Jurisdiction</b>	<b>Estimated Losses</b>
Bethany Beach	\$8,221,887
Bethel	\$76,408
Blades	\$115,000
Bridgeville	Negligible
Dagsboro	Negligible
Delmar	Negligible
Dewey Beach	\$1,430,177
Ellendale	Negligible
Fenwick Island	\$2,258,541
Frankford	\$63,925
Georgetown	Negligible
Greenwood	\$7,101
Henlopen Acres	\$409,600
Laurel	\$2,182,198
Lewes	\$700,624
MCD Bridgeville-Greenwood	\$1,091,200
MCD Georgetown	\$255,801
MCD Laurel-Delmar	\$991,374
MCD Lewes	\$19,357,870
MCD Milford South	\$1,912,048
MCD Millsboro	\$36,640,370
MCD Milton	\$445,316
MCD Seaford	\$1,403,417
MCD Selbyville-Frankford	\$43,167,201
Milford	\$630,092
Millsboro	\$411,348
Millville	\$124,808
Milton	\$338,142
Ocean View	\$1,008,480
Rehoboth Beach	\$499,965
Seaford	\$560,861
Selbyville	\$148,809
Slaughter Beach	\$333,152
South Bethany	\$4,017,172
<b>TOTAL</b>	<b>\$129,520,000</b>

# VULNERABILITY ASSESSMENT

## SUSSEX COUNTY, DELAWARE MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

Another means of gauging the vulnerability within Sussex County to flooding was determined to be the vulnerability of state-owned critical facilities to the 100- and 500-year flood return periods. Within Sussex County, 1,637 critical facilities were assessed with regard to flood risk (**Table 4.3-2**). In summary, in a 100-year flood event, as many as 1,561 of these facilities could sustain slight damage and 72 could sustain moderate damage. In a 500-year event, as many as 1,240 could be slightly damaged and 397 could be moderately damaged. No facilities would escape with merely negligible damage (less than \$5,000) in either event.

**Table 4.3-2**  
**Potential Damage to Critical Facilities from Flood<sup>5</sup>**

Jurisdiction	Total Number of Critical Facilities	100-year Flood			500-year Flood		
		Moderate Damage	Slight Damage	Negligible Damage	Moderate Damage	Slight Damage	Negligible Damage
Bethany Beach	14	0	12	2	0	14	0
Bethel	1	0	1	0	0	1	0
Blades	7	0	7	0	0	7	0
Bridgeville	25	0	25	0	11	14	0
Dagsboro	11	0	11	0	0	11	0
Delmar	7	0	7	0	0	7	0
Dewey Beach	11	0	11	0	11	0	0
Ellendale	6	0	6	0	0	6	0
Fenwick Island	5	0	5	0	0	5	0
Frankford	8	0	8	0	0	8	0
Georgetown	40	0	40	0	0	40	0
Greenwood	8	0	8	0	0	8	0
Laurel	31	10	21	0	10	21	0
Lewes	40	0	39	1	0	40	0
MCD Bridgeville-Greenwood	76	12	64	0	31	45	0
MCD Georgetown	83	0	83	0	6	77	0
MCD Harrington	1	0	1	0	0	1	0
MCD Laurel-Delmar	172	17	155	0	48	124	0
MCD Lewes	175	8	166	1	30	145	0
MCD Milford North	1	0	1	0	0	1	0
MCD Milford South	121	0	121	0	19	102	0
MCD Millsboro	137	2	135	0	64	73	0

<sup>5</sup> The definitions used are as follows. Negligible: less than 1 percent damage. Slight: 1 to 5 percent damage. Moderate: 5 to 30 percent damage. Extensive (where applicable): 30 to 60 percent damage.

# VULNERABILITY ASSESSMENT

## SUSSEX COUNTY, DELAWARE MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

Jurisdiction	Total Number of Critical Facilities	100-year Flood			500-year Flood		
		Moderate Damage	Slight Damage	Negligible Damage	Moderate Damage	Slight Damage	Negligible Damage
MCD Milton	62	0	62	0	10	52	0
MCD Seaford	163	19	144	0	72	91	0
MCD Selbyville-Frankford	258	4	254	0	45	213	0
Milford	33	0	33	0	0	33	0
Millsboro	14	0	14	0	0	14	0
Millville	5	0	5	0	0	5	0
Milton	20	0	20	0	6	14	0
Ocean View	6	0	6	0	0	6	0
Rehoboth Beach	33	0	33	0	1	32	0
Seaford	50	0	50	0	33	17	0
Selbyville	2	0	2	0	0	2	0
Slaughter Beach	2	0	2	0	0	2	0
South Bethany	7	0	7	0	0	7	0
<b>TOTAL</b>	<b>1,637</b>	<b>72</b>	<b>1,561</b>	<b>4</b>	<b>397</b>	<b>1,240</b>	<b>0</b>

**Requirement §201.6(c)(2)(ii):** *[The risk assessment] must also address National Flood Insurance Program (NFIP) insured structures that have been repetitively damaged floods*

A repetitive loss property is an NFIP-insured property that has had at least four paid flood losses of more than \$1,000, or has had two paid flood losses within 10 years that, in aggregate, equal or exceed the value of the property, or has had three or more paid losses that, in aggregate, equal or exceed the value of the property. Addressing repetitive loss properties through the implementation of specific mitigation projects represent one of the most effective ways to reduce future flood losses. As a result, the mitigation strategies listed in the Sussex County Flood Mitigation Plan were specifically designed to address identified repetitive loss properties and are cited by reference here.<sup>6</sup> **Table 4.3-3** contains a tally of the number of repetitive loss properties in the County and individual municipalities, the number of flood insurance policies currently in force (as of July 1, 2009), and the percentage of current policies that represent repetitive loss properties. There are no severe repetitive loss properties in Sussex County. A severe repetitive loss property is one that has had at least four claim payments greater than \$5,000, or the cumulative amount of the four payments exceeds \$20,000, or has had two cumulative claim payments

<sup>6</sup> Sussex County Flood Mitigation Plan maintained by DNREC, last updated 1999

# VULNERABILITY ASSESSMENT

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## SUSSEX COUNTY, DELAWARE MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

that exceed the value of the property. The location of the repetitive loss properties in relation to the dFIRM floodplain may be found in **Figure 4.3-7**.

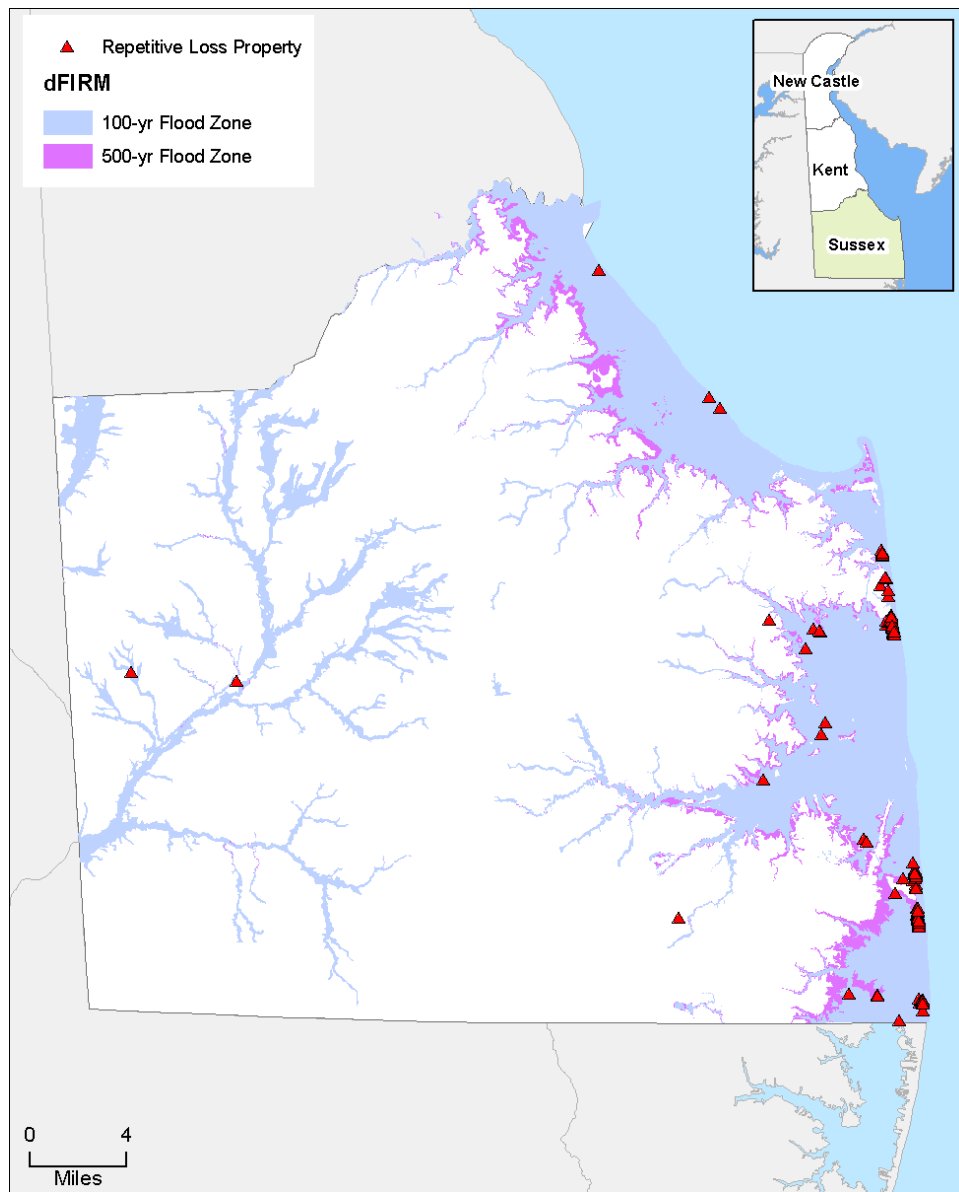
**Table 4.3-3**  
**Repetitive Loss Properties as of July 1, 2009 (DEMA)**

Jurisdiction	Number of Rep Losses	Number of Policies	% Rep Loss
Sussex County	231	12,427	1.9%
Town of Bethany Beach	68	2,016	3.4%
Town of Dewey Beach	67	1,116	6.0%
Town of Fenwick Island	23	687	3.3%
City of Rehoboth Beach	11	1,121	1.0%
Town of South Bethany	110	896	12.3%
City of Milford	6	74	8.1%

# VULNERABILITY ASSESSMENT

SUSSEX COUNTY, DELAWARE  
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**Figure 4.3-7**  
**Location of Repetitive Loss Properties**





# VULNERABILITY ASSESSMENT

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## *Tropical Storm Winds*

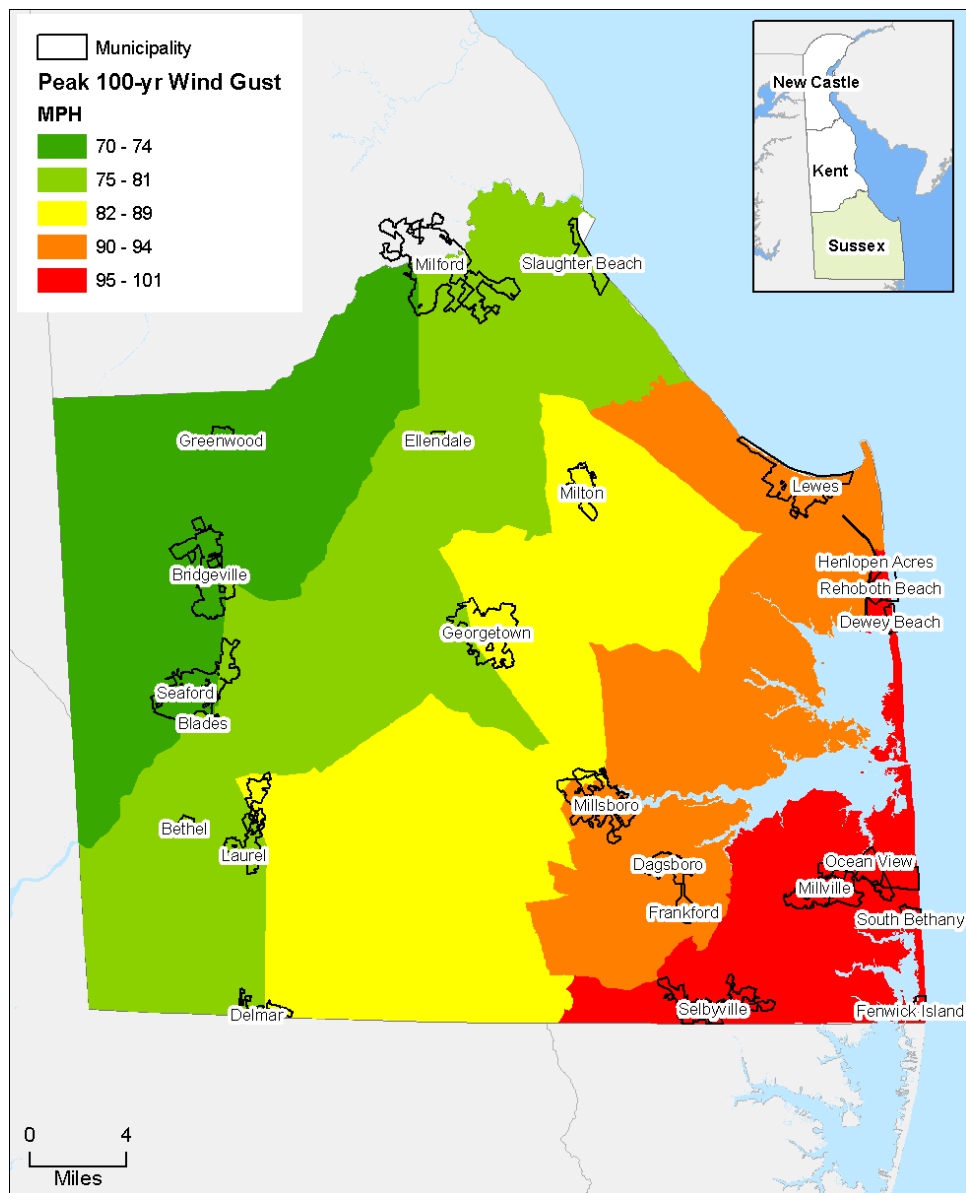
Historical evidence shows that the State of Delaware is vulnerable to hurricane and tropical storm-force winds. HAZUS-MH's modeling scenarios provided wind speed data for a range of return periods as well as an inventory and damage functions, which were used in estimating losses. The HAZUS-MH method involves Monte Carlo simulations to estimate the probable track of a tropical storm with a particular recurrence interval, and then estimates the wind field of that probably tropical storm to predict losses.

**Figures 4.3-8** shows the potential tropical storm winds that could affect the area for a 100-year wind event. The total potential annualized losses equal \$1,926,244.

# VULNERABILITY ASSESSMENT

## SUSSEX COUNTY, DELAWARE MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

**Figure 4.3-8**  
**Potential Hurricane Winds for 100-year Wind Events**



# VULNERABILITY ASSESSMENT

## SUSSEX COUNTY, DELAWARE MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

**Table 4.3-4** shows the potential damage to critical facilities from hurricane-force wind events. **Table 4.3-5** shows total annualized expected losses from hurricane wind events by jurisdiction within Sussex County.

**Table 4.3-4**  
**Potential Damage to Critical Facilities from Tropical Storm Winds<sup>7</sup>**

Jurisdiction	Total Number of Critical Facilities	100-year Wind			500-year Wind			
		Moderate Damage	Slight Damage	Negligible Damage	Extensive	Moderate Damage	Slight Damage	Negligible Damage
Bethany Beach	14	10	4	0	8	4	2	0
Bethel	1	1	0	0	0	0	1	0
Blades	7	4	2	1	0	2	5	0
Bridgeville	25	8	14	3	0	6	19	0
Dagsboro	11	6	5	0	2	5	4	0
Delmar	7	6	1	0	0	0	7	0
Dewey Beach	11	11	0	0	11	0	0	0
Ellendale	6	5	1	0	0	0	6	0
Fenwick Island	5	5	0	0	5	0	0	0
Frankford	8	5	3	0	1	3	4	0
Georgetown	40	34	4	2	11	4	25	0
Greenwood	8	4	2	2	0	3	5	0
Laurel	31	17	4	10	0	8	19	4
Lewes	40	30	10	0	15	8	17	0
MCD Bridgeville-Greenwood	76	30	19	27	0	40	36	0
MCD Georgetown	83	50	11	22	15	28	39	1
MCD Harrington	1	1	0	0	0	0	1	0
MCD Laurel-Delmar	172	67	46	59	2	97	70	3
MCD Lewes	175	136	36	3	127	31	14	3
MCD Milford North	1	0	0	1	0	1	0	0
MCD Milford South	121	50	24	47	11	63	41	6
MCD Millsboro	137	91	43	3	81	40	14	2
MCD Milton	62	44	14	4	43	15	3	1
MCD Seaford	163	85	36	42	0	63	96	4
MCD Selbyville-Frankford	258	180	78	0	156	70	32	0
Milford	33	22	6	5	4	8	21	0

<sup>7</sup> The definitions used are as follows. Negligible: less than 1 percent damage. Slight: 1 to 5 percent damage. Moderate: 5 to 30 percent damage. Extensive (where applicable): 30 to 60 percent damage.

# VULNERABILITY ASSESSMENT

## SUSSEX COUNTY, DELAWARE MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

Jurisdiction	Total Number of Critical Facilities	100-year Wind			500-year Wind			
		Moderate Damage	Slight Damage	Negligible Damage	Extensive	Moderate Damage	Slight Damage	Negligible Damage
Millsboro	14	11	3	0	5	2	7	0
Millville	5	5	0	0	5	0	0	0
Milton	20	11	7	2	3	6	9	2
Ocean View	6	2	4	0	2	4	0	0
Rehoboth Beach	33	31	2	0	27	2	4	0
Seaford	50	25	14	11	0	20	29	1
Selbyville	2	2	0	0	0	0	2	0
Slaughter Beach	2	2	0	0	1	0	1	0
South Bethany	7	4	3	0	4	3	0	0
<b>TOTAL</b>	<b>1,637</b>	<b>995</b>	<b>396</b>	<b>246</b>	<b>539</b>	<b>536</b>	<b>533</b>	<b>29</b>

**Table 4.3-5  
Potential Annualized Losses from Tropical Storm Winds**

Jurisdiction	Estimated Losses
Bethany Beach	\$11,377
Bethel	Negligible
Blades	Negligible
Bridgeville	Negligible
Dagsboro	Negligible
Delmar	Negligible
Dewey Beach	Negligible
Ellendale	Negligible
Fenwick Island	Negligible
Frankford	Negligible
Georgetown	\$5,236
Greenwood	Negligible
Henlopen Acres	Negligible
Laurel	Negligible
Lewes	\$7,481
MCD Bridgeville-Greenwood	\$25,390
MCD Georgetown	\$48,865
MCD Laurel-Delmar	\$95,369
MCD Lewes	\$367,759
MCD Milford South	\$48,034
MCD Millsboro	\$616,112

# VULNERABILITY ASSESSMENT

## SUSSEX COUNTY, DELAWARE MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

Jurisdiction	Estimated Losses
MCD Milton	\$111,662
MCD Seaford	\$61,270
MCD Selbyville-Frankford	\$451,242
Milford	Negligible
Millsboro	\$8,191
Millville	\$10,358
Milton	Negligible
Ocean View	\$10,134
Rehoboth Beach	\$5,387
Seaford	\$9,739
Selbyville	\$8,370
Slaughter Beach	Negligible
South Bethany	\$5,155
<b>TOTAL</b>	<b>\$1,926,244</b>

### *Severe Thunderstorm Wind*

Sussex County, according to historical records, is affected by severe thunderstorms several times a year. The strong winds and lightning generated from severe thunderstorms pose a threat to the residents, the built environment, and particularly the trees within the County. However, because severe thunderstorms are not spatially-constrained, one must consider the entire County at risk. In addition, the extent of damage from severe thunderstorm wind may be either localized or widespread but it is rarely consistent across space. Therefore, it is impossible to predict if certain areas of the county may be more vulnerable than others and even to estimate the number of buildings that may suffer loss from a severe thunderstorm wind.

Therefore, the approach to determining the County's vulnerability to severe thunderstorm wind is to examine not just severe thunderstorm events in the County boundary, but to look at all of the events of the neighboring counties within 25 miles of the boundary of the County as well. A severe thunderstorm that impacts Dorchester County, MD (to the west of Sussex County) could have just as easily impacted Sussex County instead. The actual location of the severe thunderstorm at this scale of analysis is simply a matter of luck rather than any of the County's unique geographical factors. Because the neighboring jurisdictions are of differing sizes and densities, the results for must be scaled appropriately. For example, Sussex County had 5.5 severe thunderstorm events per year, compared to Kent County's 4.69 events per year. But, Sussex County is bigger than Kent County – one would expect the larger county to have more thunderstorm events. In fact, Sussex County is 159% the size of Kent County. Therefore, a county the size of Kent would have been impacted by 7.46 events per year if the county had been the same size as Sussex. The annualized losses are scaled similarly, but use numbers of housing units as a proxy for differences in building exposure.

**Table 4.3-6** shows the number of events in Sussex County and those counties within 25 miles of Sussex County. **Table 4.3-7** shows the number of annual events and the amount of annual loss in Sussex County and those counties within 25 miles of the County after the appropriate scale factor has been applied.

# VULNERABILITY ASSESSMENT

## SUSSEX COUNTY, DELAWARE MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

**Table 4.3-8** shows annualized expected losses from severe thunderstorm wind events by jurisdiction within Sussex County. The total estimated annualized losses for the county equal \$168,211

**Table 4.3-6  
Losses from Severe Thunderstorm Wind Events (NOAA)**

County	Total Events	Total Loss	Years	Annual Events	Annual Loss	Deaths	Injuries
Sussex County, DE	286	\$8,747,000	52	5.50	\$168,211	2	10
Kent County, DE	239	\$4,153,000	51	4.69	\$81,431	2	5
Caroline County, MD	147	\$1,426,000	53	2.77	\$26,905	0	0
Dorchester County, MD	65	\$10,451,000	41	1.59	\$254,902	0	2
Wicomico County, MD	89	\$5,255,000	51	1.75	\$103,039	0	0
Worcester County, MD	59	\$6,605,000	53	1.11	\$124,622	0	0
<b>Average</b>	<b>147.5</b>	<b>\$6,106,167</b>	<b>50.2</b>	<b>4.50</b>	<b>\$126,518</b>	<b>0.67</b>	<b>2.83</b>

**Table 4.3-7  
Normalized Occurrences and Losses from Severe Thunderstorm Wind Events (NOAA)**

County	Annual Events	Area Scale Factor	Scaled Events	Annual Loss	HU Scale Factor	Scaled Annual Loss
Sussex County, DE	5.50	1.000	5.50	\$168,211	1.000	\$168,211
Kent County, DE	4.69	1.590	7.46	\$81,431	1.844	\$150,131
Caroline County, MD	2.77	2.929	8.11	\$26,905	7.624	\$205,115
Dorchester County, MD	1.59	1.691	2.69	\$254,902	6.340	\$1,615,948
Wicomico County, MD	1.75	2.046	3.58	\$103,039	2.705	\$278,766
Worcester County, MD	1.11	1.981	2.20	\$124,622	1.954	\$243,514
<b>Normalized Average</b>			<b>4.93</b>			<b>\$443,614</b>

**Table 4.3-8  
Potential Normalized Annualized Losses from Severe Thunderstorms by MCD and Municipality**

Jurisdiction	Estimated Losses
Bethany Beach	Negligible
Bethel	Negligible
Blades	Negligible
Bridgeville	Negligible
Dagsboro	Negligible
Delmar	Negligible

# VULNERABILITY ASSESSMENT

## SUSSEX COUNTY, DELAWARE MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

Jurisdiction	Estimated Losses
Dewey Beach	Negligible
Ellendale	Negligible
Fenwick Island	Negligible
Frankford	Negligible
Georgetown	Negligible
Greenwood	Negligible
Henlopen Acres	Negligible
Laurel	Negligible
Lewes	Negligible
MCD Bridgeville-Greenwood	\$17,559
MCD Georgetown	\$11,452
MCD Laurel-Delmar	\$30,869
MCD Lewes	\$14,471
MCD Milford South	\$20,936
MCD Millsboro	\$16,369
MCD Milton	\$10,649
MCD Seaford	\$15,314
MCD Selbyville-Frankford	\$21,801
Milford	Negligible
Millsboro	Negligible
Millville	Negligible
Milton	Negligible
Ocean View	Negligible
Rehoboth Beach	Negligible
Seaford	Negligible
Selbyville	Negligible
Slaughter Beach	Negligible
South Bethany	Negligible
<b>TOTAL</b>	<b>\$168,211</b>

### *Tornado*

Historical evidence shows that Sussex County is vulnerable to tornadic activity. This particular hazard may result from severe thunderstorm activity or may occur during a tropical storm or hurricane. Because it cannot be predicted where a tornado may touch down, all buildings and facilities are considered to be exposed to this hazard and could potentially be impacted. It is also not possible to estimate the number of residential, commercial, and other buildings or facilities that may experience losses.

The approach to determining vulnerability to tornadoes is similar to that used for severe thunderstorm wind. Historical tornado loss data from the National Oceanic and Atmospheric Administration (NOAA)



# VULNERABILITY ASSESSMENT

## SUSSEX COUNTY, DELAWARE MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

was gathered for Sussex County and the neighboring counties within 25 miles of the boundary of the County. All historical losses were scaled to account for inflation, and average historic tornado losses were calculated (**Table 4.3-9**). As with severe thunderstorms (above), because the neighboring jurisdictions are of differing sizes and densities, the results must be normalized appropriately using the method described previously (**Table 4.3-10**). Annualized expected losses from tornado events by jurisdiction within Sussex County is omitted as none registers more than a negligible amount. The total estimated annualized losses for the county equal \$11,000

**Table 4.3-9  
Losses from Tornado Events (NOAA)**

County	Total Events	Total Loss	Years	Annual Events	Annual Loss	Deaths	Injuries
Sussex County, DE	18	\$594,000	54	0.33	\$11,000	0	11
Kent County, DE	18	\$4,908,000	45	0.40	\$109,067	2	54
Caroline County, MD	6	\$375,000	57	0.11	\$6,579	0	0
Dorchester County, MD	11	\$5,722,000	25	0.44	\$228,880	1	16
Wicomico County, MD	8	\$133,000	47	0.17	\$2,830	0	2
Worcester County, MD	10	\$250,000	51	0.20	\$4,902	0	0
<b>Average</b>	<b>11.8</b>	<b>\$1,997,000</b>	<b>46.5</b>	<b>0.275</b>	<b>\$60,543</b>	<b>0.5</b>	<b>13.8</b>

**Table 4.3-10  
Normalized Occurrences and Losses from Tornado Events (NOAA)**

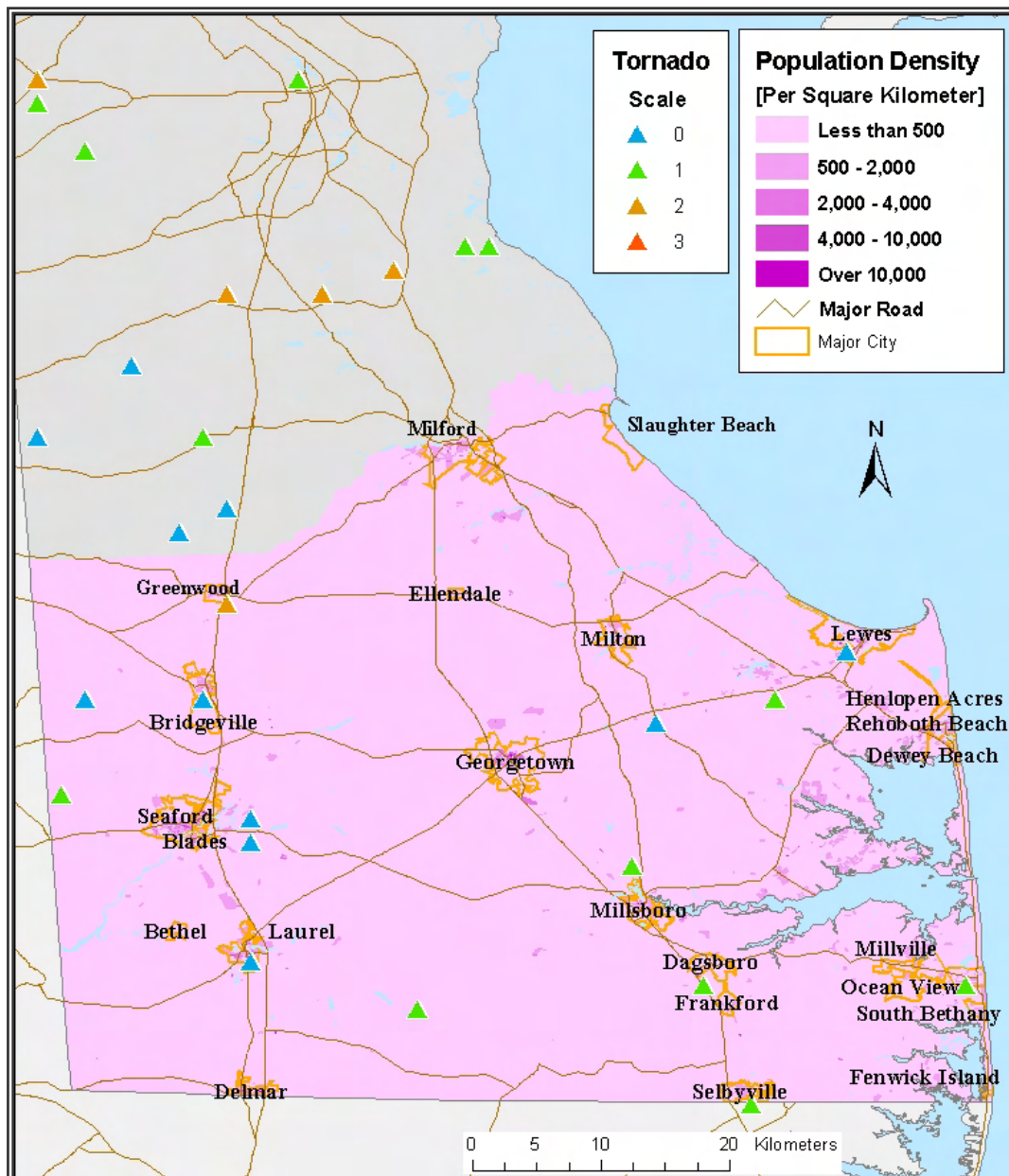
County	Annual Events	Area Scale Factor	Scaled Events	Annual Loss	HU Scale Factor	Scaled Annual Loss
Sussex County, DE	0.33	1.000	0.33	\$11,000	1.000	\$11,000
Kent County, DE	0.40	1.590	0.64	\$109,067	1.844	\$201,082
Caroline County, MD	0.11	2.929	0.31	\$6,579	7.624	\$50,156
Dorchester County, MD	0.44	1.691	0.74	\$228,880	6.340	\$1,450,982
Wicomico County, MD	0.17	2.046	0.35	\$2,830	2.705	\$7,656
Worcester County, MD	0.20	1.981	0.40	\$4,902	1.954	\$9,579
<b>Normalized Average</b>			<b>0.461</b>			<b>\$288,409</b>

**Figure 4.3-9** shows the location and magnitude of past tornado events in relation to population density.

# VULNERABILITY ASSESSMENT

SUSSEX COUNTY, DELAWARE  
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**Figure 4.3-9**  
**Location and Magnitude of Past Tornado Events in Relation to Population Density**



# VULNERABILITY ASSESSMENT

## SUSSEX COUNTY, DELAWARE MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

### *Drought*

Although the State of Delaware as a whole is vulnerable to drought, estimated potential losses are somewhat difficult to calculate because drought causes little damage to the built environment, mostly affecting crops and farmland. Therefore, it is assumed that all buildings and facilities are exposed to drought but would experience negligible damage in the occurrence of a drought event.

The approach used to determine vulnerability within Sussex County consisted of a number of factors. Statistical data for the past 100 years from the University of Nebraska, developed based on Palmer Drought and Crop Severity Indices, was analyzed. Drought event frequency/impact was then determined for Sussex County. Also used was USDA agriculture data from 1997. Drought impact on the non-irrigated agriculture products profile was then determined.

**Table 4.3-11** shows annualized expected losses from drought events by jurisdiction within Sussex County. The total estimated annualized losses for the county equal \$14,659,834.

**Table 4.3-11**  
**Annualized Expected Losses from Drought**

Jurisdiction	Estimated Losses
Bethany Beach	\$17,626
Bethel	\$6,671
Blades	\$7,230
Bridgeville	\$67,345
Dagsboro	\$20,999
Delmar	\$13,992
Dewey Beach	\$6,732
Ellendale	Negligible
Fenwick Island	\$7,536
Frankford	\$10,766
Georgetown	\$69,388
Greenwood	\$11,048
Henlopen Acres	Negligible
Laurel	\$40,473
Lewes	\$65,458
MCD Bridgeville-Greenwood	\$1,530,281
MCD Georgetown	\$998,028
MCD Laurel-Delmar	\$2,690,299
MCD Lewes	\$1,261,154
MCD Milford South	\$1,824,606
MCD Millsboro	\$1,426,546
MCD Milton	\$928,101
MCD Seaford	\$1,334,655
MCD Selbyville-Frankford	\$1,900,032

# VULNERABILITY ASSESSMENT

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## SUSSEX COUNTY, DELAWARE MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

Jurisdiction	Estimated Losses
Milford	\$142,649
Millsboro	\$61,221
Millville	\$35,871
Milton	\$24,765
Ocean View	\$37,724
Rehoboth Beach	\$24,588
Seaford	\$75,703
Selbyville	\$50,804
Slaughter Beach	\$20,816
South Bethany	\$7,933
<b>TOTAL</b>	<b>\$14,659,834</b>

**Figure 4.3-10** shows the hazard profile for drought in the geographic area surrounding Sussex County<sup>8</sup>.

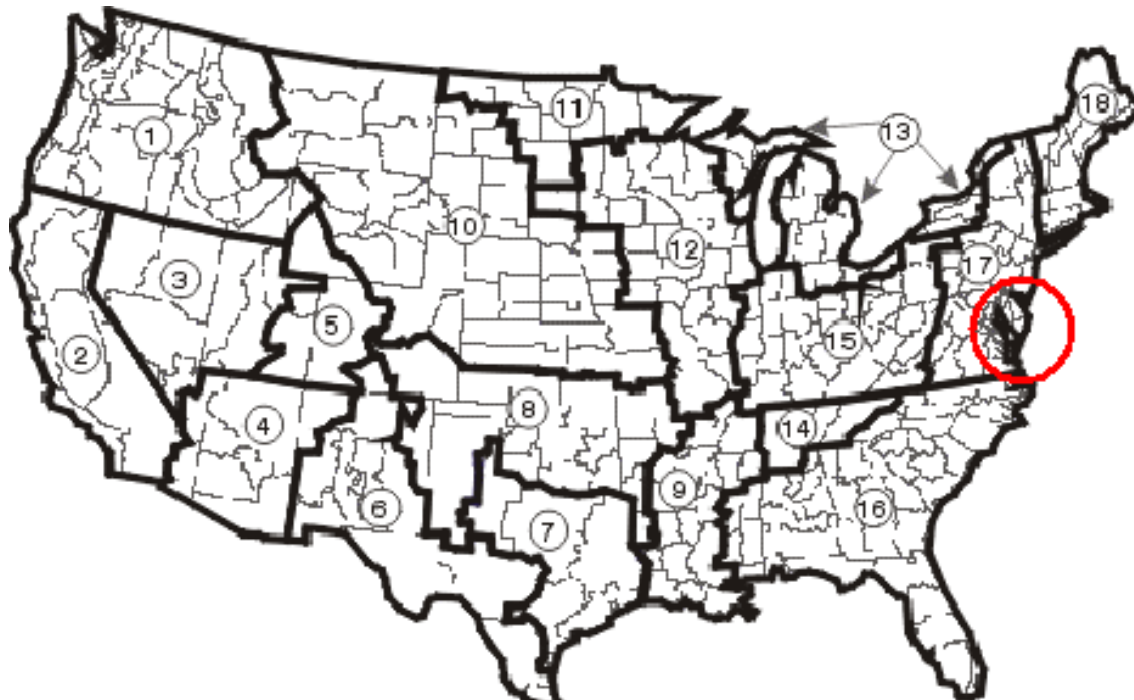
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<sup>8</sup> This information was obtained from the National Drought Mitigation Center ([www.drought.unl.edu](http://www.drought.unl.edu)), which helps people and institutions develop and implement measures to reduce societal vulnerability to drought.

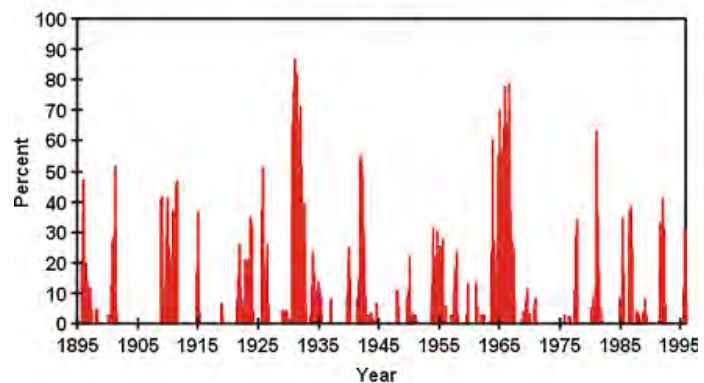
# VULNERABILITY ASSESSMENT

SUSSEX COUNTY, DELAWARE  
MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

**Figure 4.3-10**  
**Hazard Profile for Drought In and Around Sussex County**



**Percent Area of the Mid-Atlantic Basin  
Experiencing Severe to Extreme Drought  
1895–1995**



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# VULNERABILITY ASSESSMENT

## SUSSEX COUNTY, DELAWARE MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

### *Hail*

The State of Delaware is minimally vulnerable to hail storms. Hail does occur in the Mid-Atlantic but is usually not large enough nor widespread enough to cause any significant damage to the built environment. It does, however, have the potential of harming crops in the agricultural areas of Sussex County.

The approach to determining vulnerability to hail is similar to that used for severe thunderstorm wind. Historical hail loss data from the National Oceanic and Atmospheric Administration (NOAA) was gathered for Sussex County and the neighboring counties within 25 miles of the boundary of the County. All historical losses were scaled to account for inflation, and average historic losses were calculated (**Table 4.3-12**). As with severe thunderstorms (above), because the neighboring jurisdictions are of differing sizes and densities, the results must be normalized appropriately using the method described previously (**Table 4.3-13**). Because the total estimated annualized losses for the county is negligible (\$7,560), annualized expected losses from hail events by jurisdiction were not calculated.

**Table 4.3-12  
Losses from Hail Events (NOAA)**

County	Total Events	Total Loss	Years	Annual Events	Annual Loss	Deaths	Injuries
Sussex County, DE	28	\$310,000	41	0.68	\$7,560	0	0
Kent County, DE	22	\$105,000	41	0.54	\$2,561	0	0
Caroline County, MD	10	\$50,000	18	0.56	\$2,778	0	0
Dorchester County, MD	23	\$0	51	0.45	\$0	0	0
Wicomico County, MD	26	\$0	42	0.62	\$0	0	0
Worcester County, MD	25	\$3,000	51	0.49	\$59	0	0
<b>Average</b>	<b>22.3</b>	<b>\$78,000</b>	<b>41.0</b>	<b>0.56</b>	<b>\$2,160</b>	<b>0.0</b>	<b>0.0</b>

**Table 4.3-13  
Normalized Occurrences and Losses from Hail Events (NOAA)**

County	Annual Events	Area Scale Factor	Scaled Events	Annual Loss	HU Scale Factor	Scaled Annual Loss
Sussex County, DE	0.68	1.000	0.68	\$7,560	1.000	\$7,560
Kent County, DE	0.54	1.590	0.86	\$2,561	1.844	\$4,722
Caroline County, MD	0.56	2.929	1.64	\$2,778	7.624	\$21,179
Dorchester County, MD	0.45	1.691	0.76	\$0	6.340	\$0
Wicomico County, MD	0.62	2.046	1.27	\$0	2.705	\$0
Worcester County, MD	0.49	1.981	0.97	\$59	1.954	\$115
<b>Normalized Average</b>			<b>1.030</b>			<b>\$5,596</b>

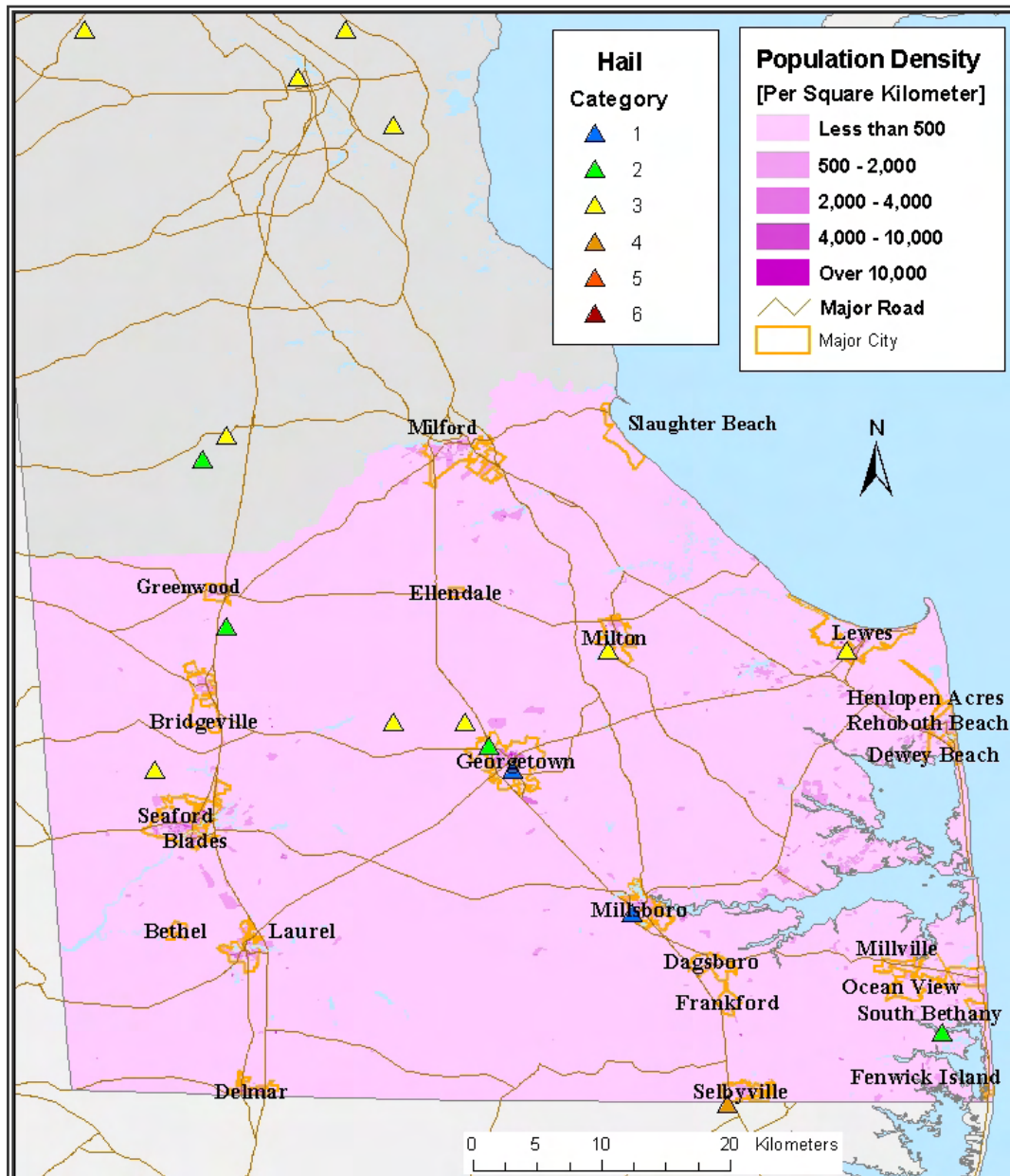


# VULNERABILITY ASSESSMENT

## SUSSEX COUNTY, DELAWARE MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

Figure 4.3-11 shows recorded hail activity by hailstone size in relation to population distribution.

**Figure 4.3-11**  
**Recorded Hail Activity by Hailstone Size in Relation to Population Distribution**



# VULNERABILITY ASSESSMENT

## SUSSEX COUNTY, DELAWARE MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

### *Winter Storms*

Historical evidence shows that Sussex County is quite vulnerable to winter storms, with several occurring each year. Because winter storms generally impact large areas, all buildings and facilities are considered to be exposed to this hazard and could potentially be impacted. It is also not possible to estimate the number of residential, commercial, and other buildings or facilities that may experience losses.

The approach to determining vulnerability to winter storms is similar to that used for severe thunderstorm wind. Historical winter storm loss data from the National Oceanic and Atmospheric Administration (NOAA) was gathered for Sussex County and the neighboring counties within 25 miles of the boundary of the County. All historical losses were scaled to account for inflation, and average historic losses were calculated (**Table 4.3-14**). As with severe thunderstorms (above), because the neighboring jurisdictions are of differing sizes and densities, the results must be normalized appropriately using the method described previously (**Table 4.3-15**). **Table 4.3-16** shows annualized expected losses from winter storm events by jurisdiction within Sussex County. The total estimated annualized losses for the county equal \$340,625<sup>9</sup>

**Table 4.3-14**  
**Losses from Winter Storm Events (NOAA)**

County	Total Events	Total Loss	Years	Annual Events	Annual Loss	Deaths	Injuries
Sussex County, DE	66	\$5,450,000	16	4.13	\$340,625	0	65
Kent County, DE	78	\$5,500,000	16	4.87	\$343,750	1	60
Caroline County, MD	67	\$1,400,000	16	4.19	\$87,500	0	0
Dorchester County, MD	42	\$5,000,000	16	2.63	\$312,500	0	0
Wicomico County, MD	39	\$5,000,000	16	2.44	\$312,500	0	0
Worcester County, MD	37	\$5,020,000	16	2.31	\$313,750	0	0
<b>Average</b>	<b>54.8</b>	<b>\$4,561,667</b>	<b>16.0</b>	<b>3.43</b>	<b>\$285,104</b>	<b>0.2</b>	<b>20.8</b>

**Table 4.3-15**  
**Normalized Occurrences and Losses from Winter Storm Events (NOAA)**

County	Annual Events	Area Scale Factor	Scaled Events	Annual Loss	HU Scale Factor	Scaled Annual Loss
Sussex County, DE	4.13	1.000	4.13	\$340,625	1.000	\$340,625
Kent County, DE	4.87	1.590	7.74	\$343,750	1.844	\$633,759
Caroline County, MD	4.19	2.929	12.27	\$87,500	7.624	\$677,073
Dorchester County, MD	2.63	1.691	4.45	\$312,500	6.340	\$1,981,089
Wicomico County, MD	2.44	2.046	4.99	\$312,500	2.705	\$845,451
Worcester County, MD	2.31	1.981	4.58	\$313,750	1.954	\$613,074

<sup>9</sup> It is important to note that for winter storm, some factors that contribute to a community's actual and perceived losses are not reflected in this analysis, such as removal of snow from roadways, debris clean-up, some indirect losses from power outages, etc.



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SUSSEX COUNTY, DELAWARE  
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Normalized Average		6.360		\$846,845
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**Table 4.3-16**  
**Annualized Expected Losses from Winter Storms**

Jurisdiction	Estimated Losses
Bethany Beach	Negligible
Bethel	Negligible
Blades	Negligible
Bridgeville	Negligible
Dagsboro	Negligible
Delmar	Negligible
Dewey Beach	Negligible
Ellendale	Negligible
Fenwick Island	Negligible
Frankford	Negligible
Georgetown	Negligible
Greenwood	Negligible
Henlopen Acres	Negligible
Laurel	Negligible
Lewes	Negligible
MCD Bridgeville-Greenwood	\$35,556
MCD Georgetown	\$23,189
MCD Laurel-Delmar	\$62,510
MCD Lewes	\$29,303
MCD Milford South	\$42,395
MCD Millsboro	\$33,146
MCD Milton	\$21,565
MCD Seaford	\$31,011
MCD Selbyville-Frankford	\$44,148
Milford	Negligible
Millsboro	Negligible
Millville	Negligible
Milton	Negligible
Ocean View	Negligible
Rehoboth Beach	Negligible
Seaford	Negligible
Selbyville	Negligible
Slaughter Beach	Negligible
South Bethany	Negligible
<b>TOTAL</b>	<b>\$340,625</b>

# VULNERABILITY ASSESSMENT

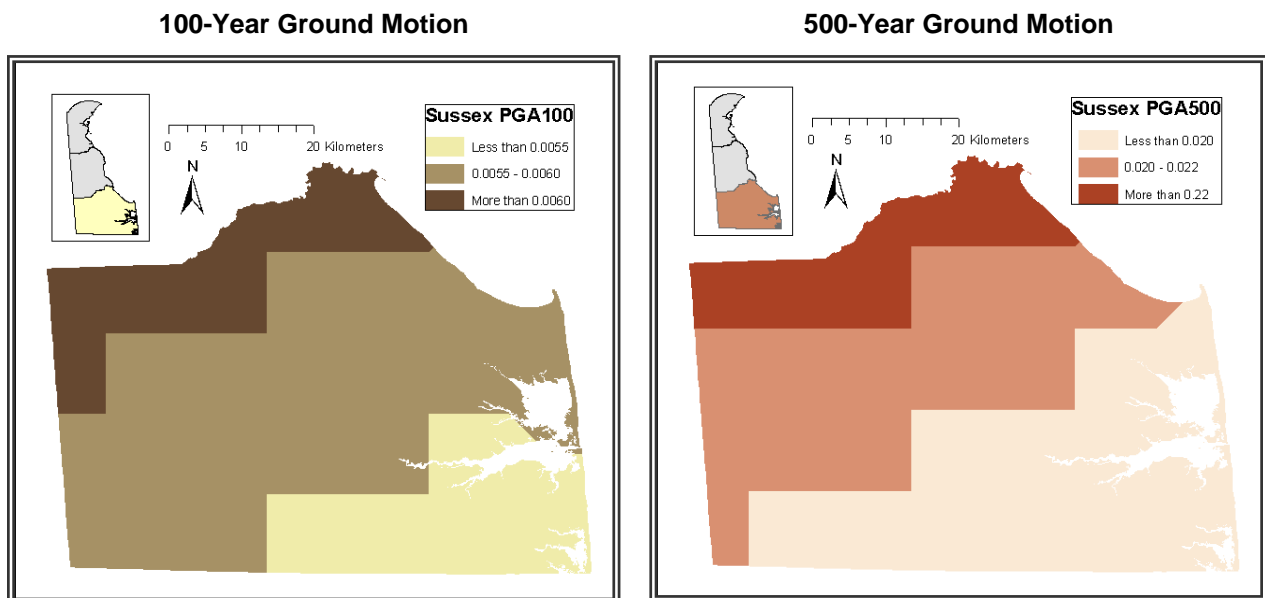
## SUSSEX COUNTY, DELAWARE MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

Jurisdiction	Estimated Losses
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### *Earthquake*

**Figure 4.3-12** shows the potential ground motion for a 100-year and 500-year earthquake. While Sussex County has felt earthquakes every so often, none have been significant enough to cause any damage for well over 100 years. The coastal plain of the Mid-Atlantic is notorious for being a seismically quiet zone. However, if a serious earthquake were to occur, the losses would likely be significant. This explains the amount of potential annualized losses for the county of \$190,778 (**Table 4.3-17**). **Table 4.3-18** shows potential damage to critical facilities from earthquake events by jurisdiction within Sussex County.

**Figure 4.3-12**  
**Peak Ground Acceleration (Ground Motion) for 100- and 500-Year Events**



# VULNERABILITY ASSESSMENT

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MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

**Table 4.3-17  
Potential Annualized Losses from Earthquake**

<b>Jurisdiction</b>	<b>Estimated Losses</b>
Bethany Beach	Negligible
Bethel	Negligible
Blades	Negligible
Bridgeville	Negligible
Dagsboro	Negligible
Delmar	Negligible
Dewey Beach	Negligible
Ellendale	Negligible
Fenwick Island	Negligible
Frankford	Negligible
Georgetown	Negligible
Greenwood	Negligible
Henlopen Acres	Negligible
Laurel	Negligible
Lewes	Negligible
MCD Bridgeville-Greenwood	\$11,232
MCD Georgetown	\$12,767
MCD Laurel-Delmar	\$14,884
MCD Lewes	\$40,144
MCD Milford South	\$16,310
MCD Millsboro	\$16,409
MCD Milton	\$9,429
MCD Seaford	\$21,886
MCD Selbyville-Frankford	\$24,987
Milford	Negligible
Millsboro	Negligible
Millville	Negligible
Milton	Negligible
Ocean View	Negligible
Rehoboth Beach	Negligible
Seaford	\$5,284
Selbyville	Negligible
Slaughter Beach	Negligible
South Bethany	Negligible
<b>TOTAL</b>	<b>\$190,778</b>

# VULNERABILITY ASSESSMENT

SUSSEX COUNTY, DELAWARE  
MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

**Table 4.3-18**  
**Potential Damage to Critical Facilities from Earthquake<sup>10</sup>**

Jurisdiction	Total Number of Critical Facilities	100-year Earthquake			500-year Earthquake		
		Moderate Damage	Slight Damage	Negligible Damage	Moderate Damage	Slight Damage	Negligible Damage
Bethany Beach	14	0	0	14	0	0	14
Bethel	1	0	0	1	0	0	1
Blades	7	0	0	7	0	0	7
Bridgeville	25	0	0	25	0	0	25
Dagsboro	11	0	0	11	0	0	11
Delmar	7	0	0	7	0	0	7
Dewey Beach	11	0	0	11	0	0	11
Ellendale	6	0	0	6	0	0	6
Fenwick Island	5	0	0	5	0	0	5
Frankford	8	0	0	8	0	0	8
Georgetown	40	0	0	40	0	0	40
Greenwood	8	0	0	8	0	0	8
Laurel	31	0	0	31	0	0	31
Lewes	40	0	0	40	0	0	40
MCD Bridgeville-Greenwood	76	0	0	76	0	0	76
MCD Georgetown	83	0	0	83	0	0	83
MCD Harrington	1	0	0	1	0	0	1
MCD Laurel-Delmar	172	0	0	172	0	0	172
MCD Lewes	175	0	0	175	0	0	175
MCD Milford North	1	0	0	1	0	0	1
MCD Milford South	121	0	0	121	0	0	121
MCD Millsboro	137	0	0	137	0	0	137
MCD Milton	62	0	0	62	0	0	62
MCD Seaford	163	0	0	163	0	0	163
MCD Selbyville-Frankford	258	0	0	258	0	0	258
Milford	33	0	0	33	0	0	33
Millsboro	14	0	0	14	0	0	14
Millville	5	0	0	5	0	0	5

<sup>10</sup> The definitions used are as follows. Negligible: less than 1 percent damage. Slight: 1 to 5 percent damage. Moderate: 5 to 30 percent damage. Extensive (where applicable): 30 to 60 percent damage.

# VULNERABILITY ASSESSMENT

## SUSSEX COUNTY, DELAWARE MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

Jurisdiction	Total Number of Critical Facilities	100-year Earthquake			500-year Earthquake		
		Moderate Damage	Slight Damage	Negligible Damage	Moderate Damage	Slight Damage	Negligible Damage
Milton	20	0	0	20	0	0	20
Ocean View	6	0	0	6	0	0	6
Rehoboth Beach	33	0	0	33	0	0	33
Seaford	50	0	0	50	0	0	50
Selbyville	2	0	0	2	0	0	2
Slaughter Beach	2	0	0	2	0	0	2
South Bethany	7	0	0	7	0	0	7
<b>TOTAL</b>	<b>1,280</b>	<b>0</b>	<b>0</b>	<b>1,280</b>	<b>0</b>	<b>0</b>	<b>1,280</b>

### *Dam/Levee Failure*

The approach for determining vulnerability to dam and/or levee failure consists of a number of factors. Data from the USACE National Inventory of Dams (NID)<sup>11</sup> in addition to the HAZUS-MH demographic inventory was used, with an assumption that dam breaks most likely will occur at the time of maximum capacity.<sup>12</sup> The affected population was then calculated.

**Table 4.3-19** shows estimated exposure of people to dam failure. **Figure 4.3-13** shows the location of dams within Sussex County, along with their hazard ranking (high, significant or low), in relation to population density.

<sup>11</sup> With the National Dam Inspection Act of 1972, the U.S. Congress authorized the U.S. Army Corps of Engineers (USACE) to inventory dams located in the United States. The Water Resources Development Act of 1986 authorized USACE to maintain and periodically publish an updated National Inventory of Dams (NID).

<sup>12</sup> Downstream quarter-circle buffer proportional to the maximum capacity of dams are assumed to represent the maximum impact area.

# VULNERABILITY ASSESSMENT

SUSSEX COUNTY, DELAWARE  
MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

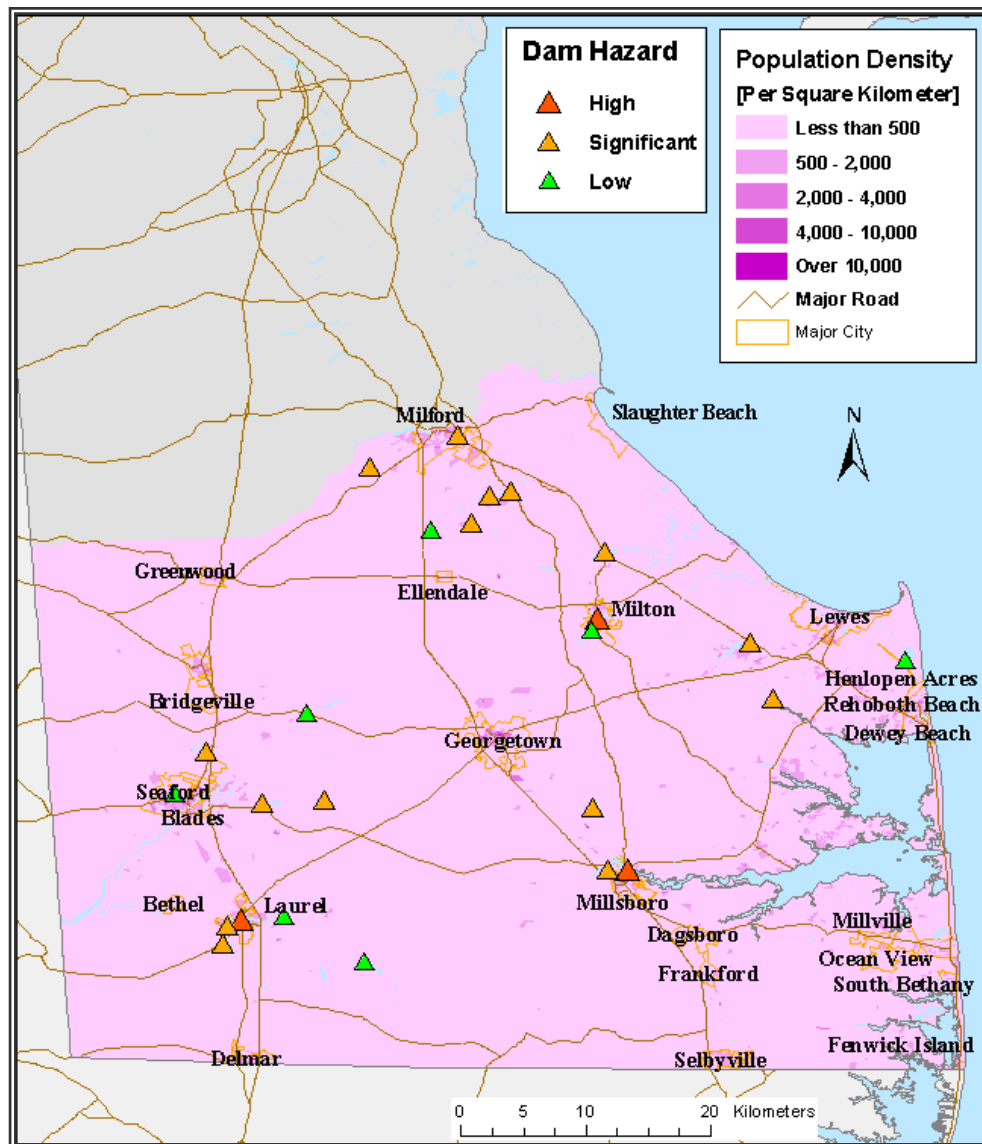
**Table 4.3-19  
Estimated Exposure of People to Dam Failure**

Dam Name	Nearest City/Town	Potential People at Risk
Williams Pond Dam	Seaford	716
Collins Pond Dam	Seaford SW	613
Hearns Pond Dam	Seaford S	549
Records Pond Dam	Laurel	466
Red Mill Pond Dam	Lewes E	346
Gordons Pond Dam	Rehoboth S	343
Horseys Pond Dam	Laurel NE	319
Wagamons Pond Dam	Milton	281
Denoname 4	Laurel	266
Denoname 3	Laurel	266
Swiggets Pond Dam	Milford NW	261
Millsboro Pond	Millsboro	229
Denoname 5	Laurel	221
Cabbage Pond Dam	Milford NW	204
Chipman Pond Dam	Laurel SW	174
Waples Pond Dam	Broadkill Beach E	149
Marshall Millpond Dam	Milford	121
Goslee Mill Pond Dam	Lewes NE	95
Trap Pond Dam	Laurel NW	83
Diamond Pond Dam	Milton NE	67
Hudson Pond Dam	Ellendale S	47

# VULNERABILITY ASSESSMENT

SUSSEX COUNTY, DELAWARE  
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**Figure 4.3-13**  
**Location of Dams (With Hazard Ranking) in Relation to Population Density**





# VULNERABILITY ASSESSMENT

SUSSEX COUNTY, DELAWARE  
MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

## *Weapons of Mass Destruction*

Using FEMA Publication 426—Reference Manual to Mitigate Potential Terrorist Attacks in High Occupancy Buildings—as a basis, a vulnerability assessment was conducted for Weapons of Mass Destruction (WMDs) in order to expand the scope of the hazard mitigation planning process in the State of Delaware to include vulnerability to acts of terrorism. The methodology used employs a vulnerability ranking of 1 to 5 for certain transportation, water/hydrology, emergency and public safety, and utility elements. The sum total for each element is then multiplied against a value for that asset (also on a 1 to 5 scale) and multiplied against a factor representing the Department of Homeland Security Threat Level. For the purposes of this Plan, the Threat Level is assumed to be Orange (High). This part of the assessment is the same for all three counties in Delaware. In the final analysis, the total risk for each county is multiplied by a unique weighted factor to arrive at county-specific scores. For Sussex County, a weighted factor of 1.00 was used. Abbreviated findings of this methodology are presented in **Table 4.3-20**. Complete information is stored in a Microsoft® Excel® file separate from this Plan.

**Table 4.3-20**  
**Assessment of Vulnerability to Weapons of Mass Destruction**

		Based on FEMA 426: Reference Manual to Mitigate Potential Terrorist Attacks in High Occupancy Buildings															
		Asset Visibility	Target Value to Pot. Threat Element	Asset Accessibility	Asset Mobility	Target Threat of CBR Hazard	Collateral Damage Potential	Site Population/Capacity	Pot. for Collateral Mass Casualties	SUM	Asset Value of Target Site	Homeland Security Threat Condition				Risk	Sussex
																X	1.00
<b>Transportation</b>																	
	Major bridges	5	4	5	5	0	2	1	0	22	X	4	X	6	=	528	: 528
	Airports	4	4	3	5	0	1	2	0	19	X	4	X	6	=	456	: 456
<b>Water / Hydrology</b>																	
	Reservoirs	3	5	3	5	1	3	1	0	21	X	5	X	6	=	630	: 630
	Dams	4	5	2	5	1	4	1	0	22	X	5	X	6	=	660	: 660
<b>Emergency and Public Safety</b>																	
	Hospitals	4	3	4	5	4	2	2	2	26	X	5	X	6	=	780	: 780
	Military Facilities	2	4	1	5	4	3	3	2	24	X	5	X	6	=	720	: 720
	Schools	4	4	4	5	1	1	2	1	22	X	3	X	6	=	396	: 396
<b>Utilities</b>																	
	Gas LNG plant	3	3	3	5	2	3	1	2	22	X	3	X	6	=	396	: 396
	Electric substations	3	2	3	5	1	2	1	0	17	X	2	X	6	=	204	: 204

# VULNERABILITY ASSESSMENT

## SUSSEX COUNTY, DELAWARE MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

In order to give some perspective to these findings, the final scores for each element in Table 15 were compared to the maximum score defined in FEMA Publication 426 (**Table 4.3-21**). This comparison shows hospitals, military facilities and day care centers to have the three highest rankings compared to all other elements. These three elements are the focal point of the chemical and radiological agents sections.

**Table 4.3-21**  
**Comparison of Sussex County and FEMA 426 Model**

Facility	Threat	Percent Comparison
<b>Maximum Score in FEMA 426 Model</b>	<b>14.400</b>	<b>100%</b>
Hospitals	7.800	54%
Military Facilities	7.200	50%
Day Care Centers	6.900	48%
Hazardous Material Sites	6.600	46%
Dams	6.600	46%
Reservoirs	6.300	44%
Major Bridges	5.280	37%
All Gas Pipelines	1.020	7%
U.S. Roads	0.960	7%
State Roads	0.960	7%

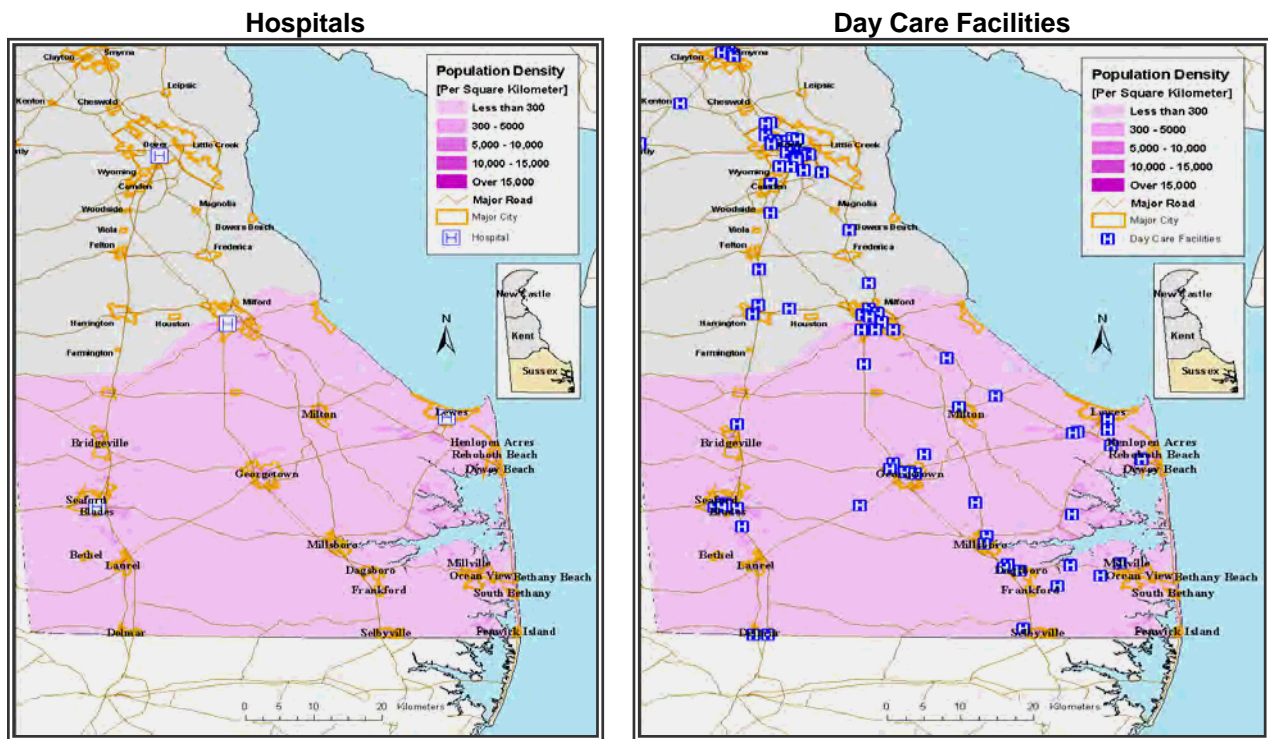
### Chemical Agents

In planning for the possible release of a chemical agent as an act of terrorism, Sussex County identified two (2) hospitals and 47 day care facilities throughout the county as potential targets. (**Figure 4.3-14** graphically illustrates the locations of these facilities.) In order to create a more complete assessment of the damage that would be inflicted should such an attack occur, Sussex County also determined the surrounding population and building stock within both an 8-mile radius of the target (the "Immediate Response Zone") and a 20-mile radius (the "Protective Action Zone"). This approach is believed to more accurately represent the overall exposure of the county and its communities to the threat of a chemical agent. **Tables 4.3-22** and **4.3-23** offer the results of this analysis. In order to keep this planning document brief, only the top three day care facilities in terms of affected population are included in Table 18. Complete information for all 47 facilities is stored in a Microsoft® Excel® file separate from this Plan.

# VULNERABILITY ASSESSMENT

## SUSSEX COUNTY, DELAWARE MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

**Figure 4.3-14**  
**Location of Day Care Facilities and Hospitals in Sussex County**



**Table 4.3-22**  
**Hospitals and Surrounding Exposure**

Name of Hospital	City	Immediate Response Zone (IRZ) 8 miles from each hospital		Protective Action Zone (PAZ) 20 miles from each hospital	
		Population	Buildings	Population	Buildings
Beebe Medical Center	Lewes	27,779	24,313	104,072	67,839
Nanticoke Memorial Hospital	Seaford	39,178	15,727	105,689	41,312

**Table 4.3-23**  
**Day Care Facilities and Surrounding Exposure<sup>13</sup>**

Name of Day Care Facility	City	Immediate Response Zone (IRZ) 8 miles from each hospital		Protective Action Zone (PAZ) 20 miles from each hospital	
		Population	Buildings	Population	Buildings
Little Hearts Learning Center, Inc.	Dagsboro	42,170	33,212	98,415	67,841
Noah's Ark II	Millsboro	47,946	35,688	105,026	70,483
Child Craft Company	Seaford	38,877	15,611	103,191	40,292

<sup>13</sup> Complete information is stored in a Microsoft® Excel® file separate from this Plan.

# VULNERABILITY ASSESSMENT

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SUSSEX COUNTY, DELAWARE  
MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

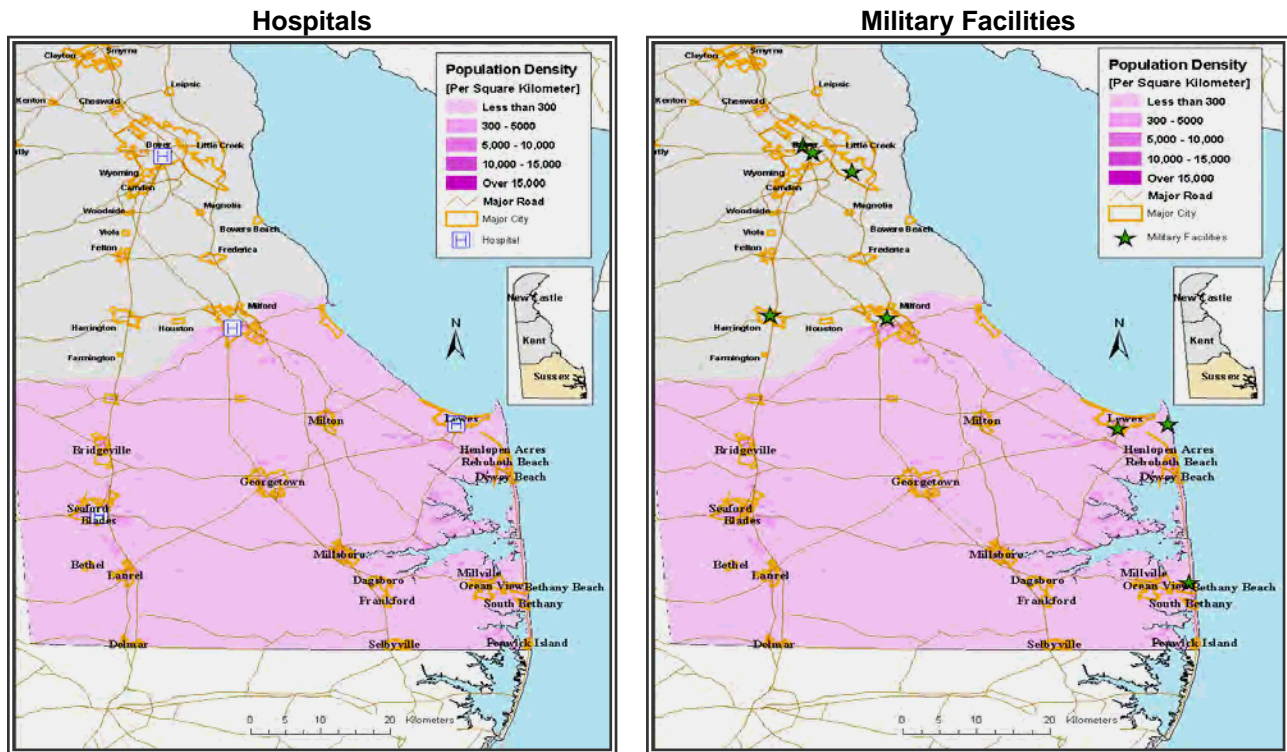
## Radiological

In planning for the possible release of a radiological agent as an act of terrorism, Sussex County identified two (2) hospitals and three (3) military facilities throughout the county as potential targets. (**Figure 4.3-15** graphically illustrates the locations of these facilities.) In order to create a more complete assessment of the damage that would be inflicted should such an attack occur, Sussex County also determined the surrounding population and building stock within both an 8-mile radius of the target (the "Immediate Response Zone") and a 20-mile radius (the "Protective Action Zone"). This approach is believed to more accurately represent the overall exposure of the county and its communities to the threat of a radiological agent. **Tables 4.3-24** and **4.3-25** contain the results of this analysis.

# VULNERABILITY ASSESSMENT

## SUSSEX COUNTY, DELAWARE MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

**Figure 4.3-15**  
**Location of Hospitals and Military Facilities in Sussex County**



**Table 4.3-24**  
**Hospitals**

Name of Hospital	City	Immediate Response Zone (IRZ) 8 miles from each hospital		Protective Action Zone (PAZ) 20 miles from each hospital	
		Population	Buildings	Population	Buildings
Beebe Medical Center	Lewes	37,030	29,952	289,318	142,796
Nanticoke Memorial Hospital	Seaford	43,576	17,387	289,397	142,825

# VULNERABILITY ASSESSMENT

SUSSEX COUNTY, DELAWARE  
MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

**Table 4.3-25  
Military Facilities**

Name of Military Facility	Immediate Response Zone (IRZ) 8 miles from each hospital		Protective Action Zone (PAZ) 20 miles from each hospital	
	Population	Buildings	Population	Buildings
U.S. Naval Reserve	29,758	26,019	287,550	142,133
Army Reserve Center	38,823	31,243	289,054	142,708
Delaware National Guard	32,588	30,818	241,475	125,650

## Biological Agents

The relative risk of Sussex County to Delaware in terms of the release of a biological agent is 6.28 percent. This is based on a risk formula of "VULNERABILITY x HAZARD x EXPOSURE." Vulnerability in this case is a measure of the speed at which infection will spread among the population. Population was studied based on general occupancy class: residential, commercial, industrial, education, government, agricultural and religious. The hazard component was considered to be a measure of the introduction of the disease among the population. This also was broken down by occupancy class, in this case residential, commercial, industrial, education, government and religious. The exposure was determined using HAZUS-MH data.

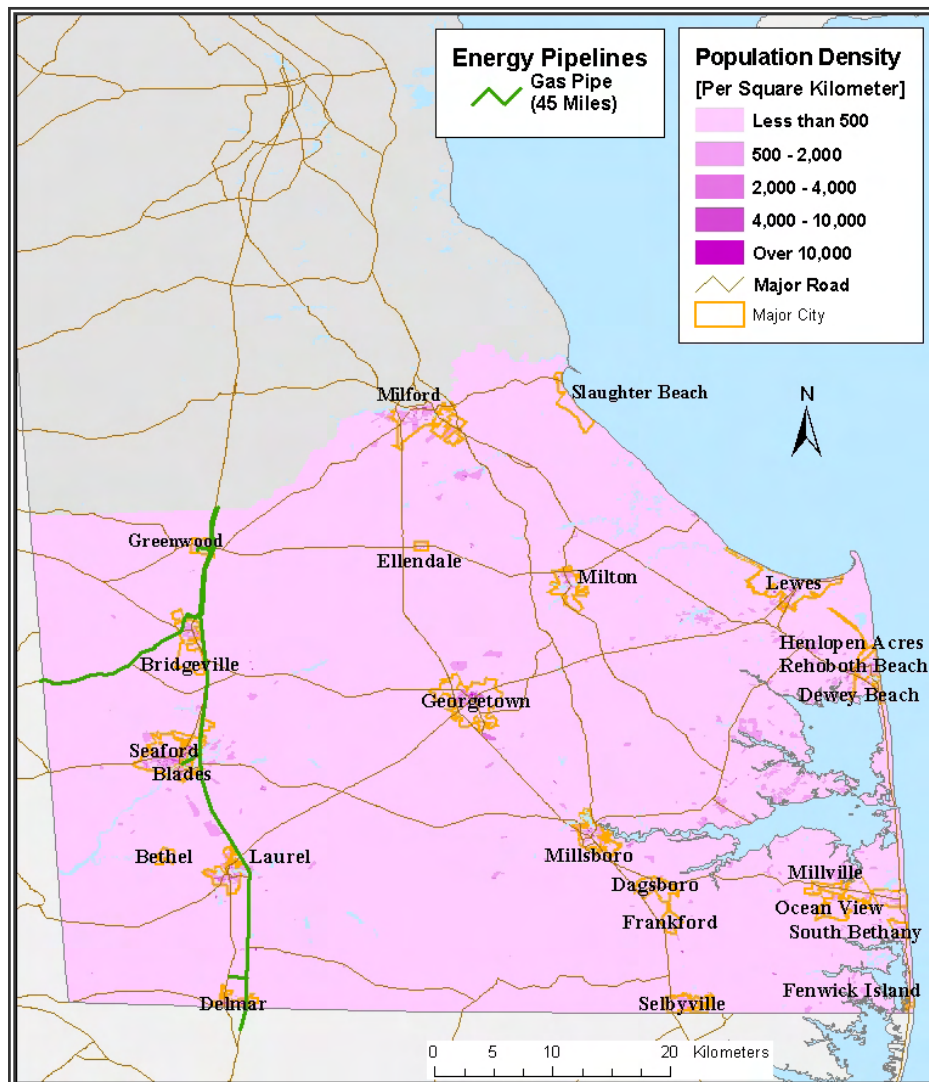
# VULNERABILITY ASSESSMENT

## SUSSEX COUNTY, DELAWARE MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

### *Energy Pipelines*

Energy pipelines cross most of the state of Delaware, including some of Sussex County. If any of these energy pipelines, oil or gas, were to rupture, such an event could endanger property and lives in the immediate area (within less than half a mile radius). **Figure 4.3-16** shows the location of 45 miles of energy pipelines within the county's boundaries in relation to population density and municipalities.

**Figure 4.3-16**  
**Energy Pipelines**





# VULNERABILITY ASSESSMENT

## SUSSEX COUNTY, DELAWARE MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

### *Hazardous Materials (HazMat)*

Assessing vulnerability to a hazardous materials (HazMat) release on a countywide scale can consist of a number of factors, such as the type(s) of hazardous materials present, the potential for mass casualties, potential consequences for the surrounding area, accessibility, public awareness, and the likelihood of being a terrorist target. The assessment conducted for Sussex County focuses on the first three of these factors, and a comprehensive study was undertaken to document information for 13 identified hazardous material sites from State of Delaware exposure data<sup>14</sup>. High consequence events were then selected (high material toxicity and population density), and ALOHA<sup>15</sup> was used for calculating the impact area. Affected population (based on Census 2000) and exposure value (HAZUS-MH) was then reported per selected events.

**Table 4.3-26** offers the results of this analysis for all 13 HazMat facilities.

**Table 4.3-26  
Hazardous Materials Facilities**

Facility Name	City	Chemical Name	Potential Residential Population at Risk	Clean-up Area (square kms)
Orient Corp. of America	Seaford	Aniline	192	3.118
Johnson Polymer	Seaford	Butyl Acrylate	143	2.325
Orient Corp. of America	Seaford	Nitrobenzene	65	0.856
Du Pont Seaford Plant	Seaford	Antimony Compounds **Reacts With Ater	19	0.447
Johnson Polymer	Seaford	Ammonia	8	0.096
Du Pont Seaford Plant	Seaford	Zinc Compounds	0	0.048
Du Pont Seaford Plant	Seaford	Hydrochloric Acid	0	0.028
Du Pont Seaford Plant	Seaford	Mercury Compounds	0	0.000
Du Pont Seaford Plant	Seaford	Sulfuric Acid	0	0.000
Du Pont Seaford Plant	Seaford	Chromium Compounds	0	0.000
Du Pont Seaford Plant	Seaford	Biphenyl	0	0.000
Du Pont Seaford Plant	Seaford	Chlorodifluoromethane	0	0.000
Green Tree Chemical Technologies, Inc., Aerosols Div.	Seaford	1,1-Dichloro-1-Fluoroethane	0	0.000

<sup>14</sup> If a facility houses more than one hazardous material, it is treated as a separate entry in this table, partially due to the fact that potential population at risk and projected clean-up area could vary depending on the chemical.

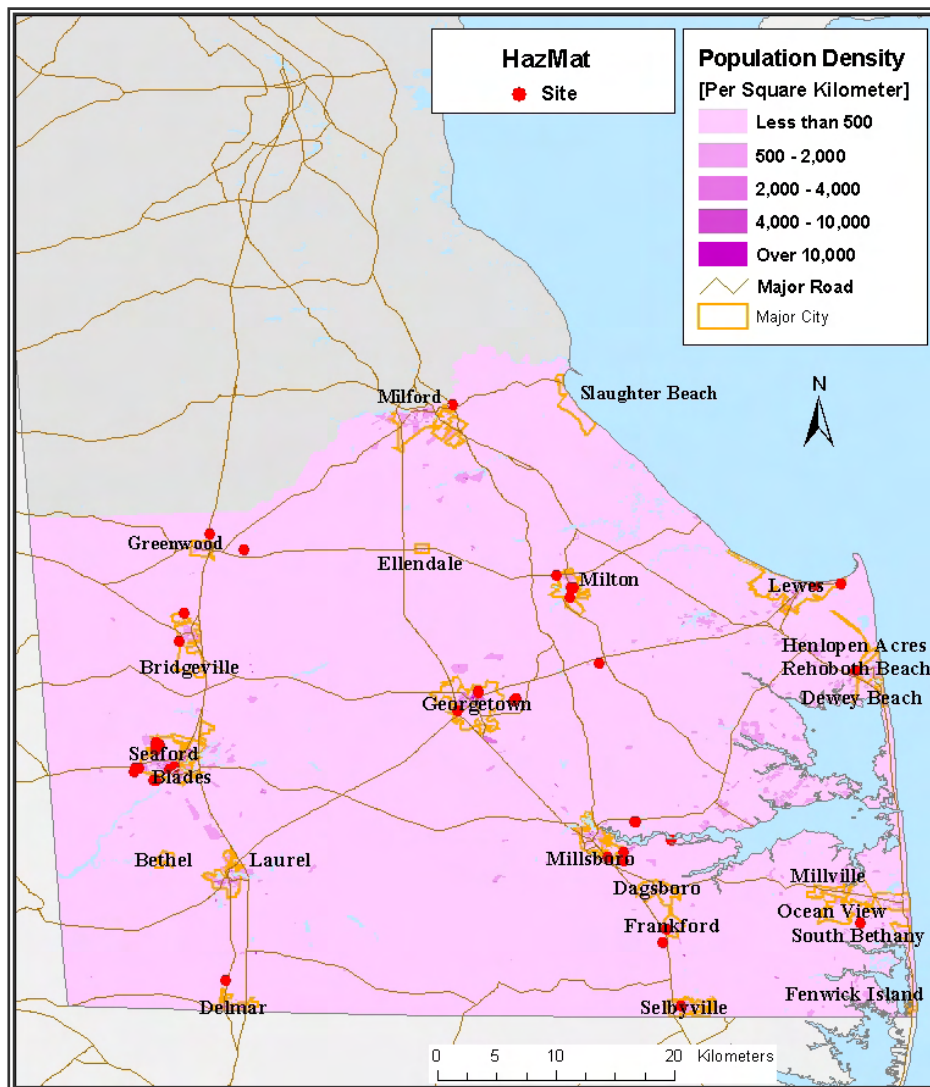
<sup>15</sup> ALOHA (Areal Locations of Hazardous Atmospheres) is a computer program that uses information provided by its operator and physical property data from its extensive chemical library to predict how a hazardous gas cloud might disperse in the atmosphere after an accidental chemical release.



# VULNERABILITY ASSESSMENT

SUSSEX COUNTY, DELAWARE  
MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

**Table 4.3-17**  
**Location of Hazardous Materials Facilities in Relation to Population Density**



# VULNERABILITY ASSESSMENT

---

SUSSEX COUNTY, DELAWARE  
MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

## *Other Hazards*

Though communities in the State of Delaware recognize that the state is vulnerable to other hazards such as wildfire, erosion, sinkholes, landslides and tsunamis, a high-level detailed risk assessment was not completed for Sussex County due to the low level of risk and/or vulnerability for these hazards within the area as a whole as compared with other hazards.

## *Conclusions on Hazard Risk*

**Table 4.3-27** summarizes the annualized expected losses presented for each natural hazard in this section. Based upon the methodologies described in the beginning of this section, the risk from natural hazards in Sussex County can be rated on a scale of Low, Moderate or High for each identified natural hazard based upon these annualized losses and an annualized loss ratio (**Table 4.3-28**)<sup>16</sup>. Because of the nature of human-caused hazards and the nature in which risk and vulnerability is presented for human-caused hazards, it is not possible to rank them fairly in direct comparison with natural hazards. In summary, all human-caused hazards addressed in this section—terrorism (chemical, radiological and biological agents), hazardous materials incidents (HazMat), and energy pipeline failures—warrant an overall rating of low risk for Sussex County.

In order to create a final overall risk ranking per hazard in Sussex County, the previous hazard analysis (Section 4.2) and the risk assessment are combined (**Table 4.3-29**). A number of analyzed hazards were deemed to be of little consequence to the County. They are added to the risk ranking as low risk but unranked. Other hazards, such as extreme heat/cold, generate no direct monetary losses and are excluded from the risk assessment. However, their frequency of occurrence and their potential to cause injuries and death warrants them to be ranked at a medium level of risk. The final risk ranking demonstrates that flooding and drought are the two most critical threats to Sussex County's population and built environment.

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<sup>16</sup> The annualized loss ratio is multiplied by 50,000 (x 500 for a proxy 500-year loss and x 100 for a percentage number.) Low risk equals 0 to 5 percent; Medium risk equals 6 to 20 percent, and High risk is any percentage over 20.

# VULNERABILITY ASSESSMENT

SUSSEX COUNTY, DELAWARE  
MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

**Table 4.3-27**  
**Potential Annualized Losses per Jurisdiction**

Jurisdiction	Flood	Tropical Storm Wind	Thunder-storm	Tornado	Drought	Hail	Winter Storm	Earthquake
Bethany Beach	\$8,221,887	\$11,377	Negligible	Negligible	\$17,626	Negligible	Negligible	Negligible
Bethel	\$76,408	Negligible	Negligible	Negligible	\$6,671	Negligible	Negligible	Negligible
Blades	\$115,000	Negligible	Negligible	Negligible	\$7,230	Negligible	Negligible	Negligible
Bridgeville	Negligible	Negligible	Negligible	Negligible	\$67,345	Negligible	Negligible	Negligible
Dagsboro	Negligible	Negligible	Negligible	Negligible	\$20,999	Negligible	Negligible	Negligible
Delmar	Negligible	Negligible	Negligible	Negligible	\$13,992	Negligible	Negligible	Negligible
Dewey Beach	\$1,430,177	Negligible	Negligible	Negligible	\$6,732	Negligible	Negligible	Negligible
Ellendale	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Fenwick Island	\$2,258,541	Negligible	Negligible	Negligible	\$7,536	Negligible	Negligible	Negligible
Frankford	\$63,925	Negligible	Negligible	Negligible	\$10,766	Negligible	Negligible	Negligible
Georgetown	Negligible	\$5,236	Negligible	Negligible	\$69,388	Negligible	Negligible	Negligible
Greenwood	\$7,101	Negligible	Negligible	Negligible	\$11,048	Negligible	Negligible	Negligible
Henlopen Acres	\$409,600	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Laurel	\$2,182,198	Negligible	Negligible	Negligible	\$40,473	Negligible	Negligible	Negligible
Lewes	\$700,624	\$7,481	Negligible	Negligible	\$65,458	Negligible	Negligible	Negligible
MCD Bridgeville-Greenwood	\$1,091,200	\$25,390	\$17,559	Negligible	\$1,530,281	Negligible	\$35,556	\$11,232
MCD Georgetown	\$255,801	\$48,865	\$11,452	Negligible	\$998,028	Negligible	\$23,189	\$12,767
MCD Laurel-Delmar	\$991,374	\$95,369	\$30,869	Negligible	\$2,690,299	Negligible	\$62,510	\$14,884
MCD Lewes	\$19,357,870	\$367,759	\$14,471	Negligible	\$1,261,154	Negligible	\$29,303	\$40,144
MCD Milford South	\$1,912,048	\$48,034	\$20,936	Negligible	\$1,824,606	Negligible	\$42,395	\$16,310
MCD Millsboro	\$36,640,370	\$616,112	\$16,369	Negligible	\$1,426,546	Negligible	\$33,146	\$16,409
MCD Milton	\$445,316	\$111,662	\$10,649	Negligible	\$928,101	Negligible	\$21,565	\$9,429
MCD Seaford	\$1,403,417	\$61,270	\$15,314	Negligible	\$1,334,655	Negligible	\$31,011	\$21,886
MCD Selbyville-Frankford	\$43,167,201	\$451,242	\$21,801	Negligible	\$1,900,032	Negligible	\$44,148	\$24,987
Milford	\$630,092	Negligible	Negligible	Negligible	\$142,649	Negligible	Negligible	Negligible
Millsboro	\$411,348	\$8,191	Negligible	Negligible	\$61,221	Negligible	Negligible	Negligible
Millville	\$124,808	\$10,358	Negligible	Negligible	\$35,871	Negligible	Negligible	Negligible
Milton	\$338,142	Negligible	Negligible	Negligible	\$24,765	Negligible	Negligible	Negligible
Ocean View	\$1,008,480	\$10,134	Negligible	Negligible	\$37,724	Negligible	Negligible	Negligible
Rehoboth Beach	\$499,965	\$5,387	Negligible	Negligible	\$24,588	Negligible	Negligible	Negligible
Seaford	\$560,861	\$9,739	Negligible	Negligible	\$75,703	Negligible	Negligible	\$5,284
Selbyville	\$148,809	\$8,370	Negligible	Negligible	\$50,804	Negligible	Negligible	Negligible
Slaughter Beach	\$333,152	Negligible	Negligible	Negligible	\$20,816	Negligible	Negligible	Negligible
South Bethany	\$4,017,172	\$5,155	Negligible	Negligible	\$7,933	Negligible	Negligible	Negligible
<b>TOTAL</b>	<b>\$129,520,000</b>	<b>\$1,926,244</b>	<b>\$168,211</b>	<b>\$11,000</b>	<b>\$14,659,834</b>	<b>\$7,560</b>	<b>\$340,625</b>	<b>\$190,778</b>

# VULNERABILITY ASSESSMENT

SUSSEX COUNTY, DELAWARE  
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**Table 4.3-28**  
**Estimated Level of Risk by Hazard (High, Moderate, Low)**

Flood	Hurricane Wind	Thunder storm	Tornado	Drought	Hail	Winter Storm	Earthquake
High	Low	Moderate	Low	High	Low	Moderate	Low

It should be noted that although some hazards may show Medium or Low risk, hazard occurrence is still possible. Also, any hazard occurrence could potentially cause a great impact and losses could be extremely high (i.e., an F5 tornado or a Category 5 hurricane).

**Table 4.3-29**  
**Overall Risk Ranking for Sussex County**

Hazard	Rank
Flood	1
Drought	2
Winter Storm	3
Thunderstorm	4
Extreme Heat/Cold	5
Earthquake	6
Tornado	7
Hurricane Wind	8
Hail	9
Wildfire	Unranked
Coastal Erosion	Unranked
Dam/Levee Failure	Unranked
Tsunami	Unranked
Volcano	Unranked
Terrorism	Unranked
HazMat Incident	Unranked
Pipeline Failure	Unranked

# UNIQUE RISKS FOR LOCAL JURISDICTIONS

In order to address unique risks within individual jurisdictions of the multi-jurisdictional planning area, the *Unique Risk for Local Jurisdictions* section documents responses gathered from local government officials by the Delaware Emergency Management Agency. Through this process, unique risks were identified for Bethany Beach, as well as all coastal communities within the county.

## **Town of Bethany Beach**

*Identified by Bethany Beach Police Department*

Bethany Beach experiences tidal flooding on the Back Bays, as well as flooding on all streets east of State Route 1 during severe storms and/or heavy rain. This includes all areas along the oceanfront on the Atlantic Ocean. This flooding is confined to a distinct geographic boundary—streets flood within the corporate limits of Bethany Beach in areas with poor drainage and low elevation. Approximately 650 homes are at risk within this area, as well as several motels on Boardwalk, a lifeguard building and other public facilities. The residential properties hold an estimated value of \$500,000 per structure. The 50 or so commercial structures are estimated to be valued at approximately \$250,000 to \$500,000 each. The lifeguard station and other public facilities have an estimated total value of \$500,000. No lifelines or infrastructure are known to be at risk.

## **Town of Ellendale**

*Identified by the Town of Ellendale Mayor's Office*

Wildfires have been known to have been caused by coal-fired train engines and loaded coal cars—sparks from the wheels and tracks have generated fires at least twice in the past two years that are reported to have burnt for more than three days causing damage to forestry and grasslands. No lives, homes, businesses, infrastructure or critical facilities are known to be at risk from this hazard.

## **All Coastal Communities**

*Identified by the Delaware Department of National Resources and Environmental Control*

One unique hazard affecting all coastal communities in Sussex County is the issue of long-term coastal erosion and sea level rise. Generally speaking, this hazard is confined to the distinct geographic boundaries of the Delaware Bay shore, the Atlantic Ocean coast and the inland bays.

# CAPABILITY ASSESSMENT

This section of the Plan discusses the capability of Sussex County and the participating municipal jurisdictions to implement hazard mitigation activities. It consists of four sections:

- What is a Capability Assessment?
- Capability Assessment Update;
- Capability Assessment Findings; and
- Conclusions on Local Capability.

## *What is a Capability Assessment?*

The purpose of conducting a capability assessment is to determine the ability of a local jurisdiction to implement a mitigation strategy, and to identify potential opportunities for establishing or enhancing specific mitigation policies, programs or projects.<sup>1</sup> As in any planning process, it is important to try to establish which goals, objectives and actions are feasible, based on an understanding of the organizational capacity of those agencies or departments tasked with their implementation. A capability assessment helps to determine which mitigation actions are practical and likely to be implemented over time given the fiscal, technical, administrative and political framework of the community.

A capability assessment has two primary components: an inventory of a local jurisdiction's relevant plans, programs or policies already in place; and an analysis of its capacity to carry them out. Careful examination of local capabilities will detect any existing gaps, shortfalls or weaknesses with ongoing government activities that could hinder proposed mitigation activities and possibly exacerbate community hazard vulnerability. A capability assessment also highlights the positive mitigation measures already in place or being implemented at the local government level, which should continue to be supported and enhanced if possible through future mitigation efforts.

The capability assessment completed for Sussex County serves as a critical part of the foundation for designing an effective hazard mitigation strategy. Coupled with the *Risk Assessment*, the *Capability Assessment* helps identify and target meaningful mitigation actions for incorporation in the *Mitigation Strategy* portion of the All Hazard Mitigation Plan. It not only helps establish the goals and objectives for Sussex County to pursue under this Plan, but also ensures that those goals and objectives are realistically achievable under given local conditions.

## *Capability Assessment Update*

**Requirement §201.6(b)(3):** *The planning process must include a review and incorporation, if appropriate, of existing plans, studies, reports, and technical information.*

<sup>1</sup> While the Final Rule for implementing the Disaster Mitigation Act of 2000 does not require a local capability assessment to be completed for local hazard mitigation plans, it is a critical step to develop a mitigation strategy that meets the needs of each jurisdiction while taking into account their own unique abilities. The Rule does state that a community's mitigation strategy should be "based on existing authorities, policies, programs and resources, and its ability to expand on and improve these existing tools" (44 CFR, Part 201.6(c) (3)).

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The original Capability Assessment survey distributed in 2003 to local government officials, asked specific questions about existing local plans, policies, programs or ordinances that contributed to and/or hindered the community's ability to implement hazard mitigation actions. In addition, a series of questions were asked concerning each jurisdiction's technical, fiscal, administrative and political capabilities to implement mitigation actions. The survey results provided an extensive inventory of existing local plans, policies, programs and ordinances and required local officials to conduct a self-assessment of their jurisdiction's specific capabilities.

The information provided by the participating jurisdictions in response to the survey questionnaire was incorporated into a database for further analysis. A general scoring methodology<sup>2</sup> was then applied to quantify and rank each jurisdiction's overall capability relative to one another. According to the scoring system, each plan, policy, ordinance or program was assigned a point value based on its relevance to hazard mitigation. Additional points were added based on each jurisdiction's self-assessment of their own fiscal, technical, administrative and political capability. A total score and general capability rating (High, Moderate or Limited) was then determined according to the total number of points received. The survey results also serve as a good source of introspection or those jurisdictions wishing to improve their capability, as identified gaps, weaknesses or conflicts may be recast as opportunities for specific mitigation actions.

During this Plan Update process the *Capability Assessment Survey* was redistributed to the municipalities. The 2003 surveys were updated by municipal officials and areas where plans, ordinances, and political, fiscal, or administrative and technical capability had changed were indicated. This information was shared at the Committee meeting and has been incorporated into the overall Capability Assessment.

In addition to the results of the *Capability Assessment Survey*, an inventory of some previously completed hazard mitigation projects in Sussex County is included as part of this assessment. This inventory provides information on past mitigation efforts taken in Sussex County to reduce the effect of identified hazards. Documenting past mitigation measures can also serve to help assess the degree to which local governments are willing to adopt future mitigation actions.

### *Capability Assessment Findings*

The findings of the capability assessment are summarized in this Plan to provide insight into relevant capacity of Sussex County's jurisdictions to implement hazard mitigation activities. All information is based upon the responses provided by local government officials to the *Capability Assessment Survey* and during meetings of the Mitigation Advisory Committee. The updated survey questionnaires that were received from the municipalities are available through Sussex County upon request.

**Table 5.1** provides a summary of the local plans and programs in place for Sussex County's participating local governments. An "X" indicates that the given plan or program is currently in place and being implemented by the local jurisdiction. A more detailed discussion follows, along with the incorporation of additional information based on the narrative comments provided by local officials in response to the survey questionnaire.

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<sup>2</sup> A copy of the survey and the scoring system used to assess county and municipal capabilities is available through Sussex County upon request. Due to the length of the survey and the number of participating jurisdictions, the completed surveys were not included in this document.

# CAPABILITY ASSESSMENT

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**Table 5.1  
Relevant Plans and Programs in Place**

Jurisdiction	HMP	DRP	CLUP	FMP	SMP	EOP	COOP	REP	SARA	TRANS	CIP	REG-PL	HPP	ZO	SO	FDPO	NFIP	CRS	BC
Sussex County	X		X	X		X		X	X	X		X	X	X	X	X	X		X
Bethany Beach	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X
Bethel									X			X	X	X		X	X		X
Blades			X						X					X	X	X	X		X
Bridgeville	X		X	X		X	X	X	X	X	X	X	X	X		X	X		X
Dagsboro			X						X		X	X		X	X	X	X		X
Delmar			X				X		X	X	X			X	X				X
Dewey Beach			X	X					X			X		X	X	X	X	X	X
Ellendale			X						X					X	X				X
Fenwick Island				X	X				X			X		X	X	X	X	X	X
Frankford			X	X					X		X			X	X	X	X		X
Georgetown			X	X					X			X		X	X	X	X		X
Greenwood				X					X					X	X	X	X		X
Henlopen Acres		X	X	X	X				X			X		X	X	X	X		X
Laurel			X						X		X			X	X	X	X		X
Lewes	X		X	X		X	X	X	X	X			X	X	X	X	X	X	X
Millsboro			X	X					X					X	X	X	X		X
Millville			X	X					X			X	X	X	X	X	X		X
Milton			X	X		X			X			X	X	X	X	X	X		X
Ocean View	X		X						X		X	X		X	X	X	X		X
Rehoboth Beach			X	X		X			X					X	X	X	X	X	X
Seaford			X	X		X			X	X		X	X	X	X	X	X	X	X
Selbyville	X		X	X	X				X		X	X	X	X	X	X	X		X
Slaughter Beach			X						X			X		X	X	X	X		X
South Bethany		X	X			X			X			X		X	X	X	X	X	X



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## Key to Table 5.1

**HMP** – Hazard Mitigation Plan  
**DRP** – Disaster Recovery Plan  
**CLUP** – Comprehensive Land Use Plan  
**FMP** – Floodplain Management Plan / Flood Mitigation Plan  
**SMP** – Stormwater Management Plan  
**EOP** – Emergency Operations Plan  
**COOP** – Continuity of Operations Plan  
**REP** – Radiological Emergency Plan  
**SARA** – SARA Title III Emergency Response Plan  
**TRANS** – Transportation Plan  
**CIP** – Capital Improvements Plan (that regulates infrastructure in hazard areas)  
**REG-PL** – Regional Planning  
**HPP** – Historic Preservation Plan  
**ZO** – Zoning Ordinance  
**SO** – Subdivision Ordinance  
**FDPO** – Flood Damage Prevention Ordinance  
**NFIP** – National Flood Insurance Program  
**CRS** – Community Rating System  
**BC** – Building Codes

## Emergency Management Capabilities

Hazard mitigation is widely recognized as one of the four primary phases of emergency management. Other phases include preparedness, response and recovery. In reality, each phase is interconnected with hazard mitigation as **Figure 5.1** suggests. Planning for each phase is a critical part of a comprehensive emergency management program and a key to the successful implementation of hazard mitigation actions. As a result, the *Capability Assessment Survey* asked several questions across a range of emergency management plans in order to assess the jurisdiction's willingness to plan and their level of technical planning proficiency.

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**Figure 5.1**  
**The Four Phases of Emergency Management**



*Hazard Mitigation Plan:* A Hazard Mitigation Plan represents a community's blueprint for how they intend 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.

- Survey results indicate that four jurisdictions have hazard mitigation plans.
  - Sussex County adopted a Flood Hazard Mitigation Plan in July 2000; this Plan did not address any other natural or human-caused hazards.
  - The Town of Bethany Beach adopted a Flood Mitigation Planning 1999, which according to local officials has been moderately effective in reducing hazard impacts. The Town has also completed a Wind Study on its critical facilities.
  - The City of Lewes completed and adopted a Flood Hazard Mitigation Plan in December 1999, which was designed to be compliant with floodplain management planning requirements under the Community Rating System (CRS). The City has also completed a *Hazard Vulnerability Study* in 2000 to serve as the basis for identifying and proposing local mitigation actions.
  - The Town of Selbyville has a Hazard Plan that only addresses water and wastewater chlorine storage. The Plan was completed and is in the process of being updated to meet DMA 2000 requirements.

*Disaster Recovery Plan:* A Disaster Recovery Plan serves to guide the physical, social, environmental and economic recovery and reconstruction process following a disaster. In many instances, hazard

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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.

- Survey results indicate that four jurisdictions have prepared a disaster recovery plan.
  - The Town of Henlopen Acres has a Disaster Recovery Plan that is being amended at this time. Human-caused hazards are being considered as part of the amendment process.
  - The Town of South Bethany adopted their Disaster Recovery Plan in October 1994. The Plan was updated in June of 2006 and now addresses all hazards the community could face.
  - The Town of Bridgeville adopted a Disaster Recovery Plan on March 17, 2008. The Plan addresses all natural and human-caused hazards facing the community.
  - The Town of Ocean View is adopting their Disaster Recovery Plan in 2010.
  - The Disaster Recovery Plan is part of the Town of Bethany Beach's Emergency Operations Plan.

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

- Survey results indicate that eight jurisdictions have an emergency operations plan.
  - Sussex County has an EOP that was adopted in July 1993 and last amended in January 2001.
  - The municipalities of Bethany, Bridgeville, Lewes, Milton, Rehoboth Beach, Seaford and South Bethany also have emergency operations plans covering their jurisdictions.
  - Many of the municipal officials indicated that their jurisdictions rely on the County for emergency operations planning and management.

*Continuity of Operation Plan:* A Continuity of Operations Plan establishes a chain of command, line of succession and plans for backup or alternate emergency facilities in case of an extreme emergency.

- Survey results indicate that four jurisdictions have a Continuity of Operations Plan.
  - The City of Lewes has a Continuity of Operations Plan, which has been included under the "Continuity of Government" section within the Lewes Emergency Operations Plan for delegating assignments and responsibilities of the various city departments.
  - Bethany Beach adopted a Continuity of Operations Plan in 2006 and it was amended in 2008. Bridgeville adopted their Plan on March 17, 2008. Delmar's Plan was completed and passed in May, 2009. All three town's Plans address both human and natural caused hazards.

*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.

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- Survey results indicate that three jurisdictions have a Radiological Emergency Plan.
  - Sussex County indicated that their Radiological Emergency Plan is a component of their Emergency Operations Plan adopted in July 1993 and last amended in January 2001.
  - Although not a stand-alone plan, the City of Lewes' radiological emergency planning procedures is included within the Lewes Emergency Operations Plan.
  - Bridgeville developed a Radiological Emergency Plan in March 2008.

*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), also known as the Emergency Planning and Community Right-to-Know Act (EPCRA).

- The Sussex County Local Emergency Planning Committee (LEPC) has developed an Emergency Response Plan for hazardous materials incidents throughout the county in coordination with the Delaware State Emergency Response Commission. The Plan was adopted in 1988 and is in the process of being updated.
  - Bridgeville has a Hazardous Material Facility Plan that was adopted in March 2008.
  - Many of the municipalities participate in the LEPC through town and city representatives.

### **General Planning Capabilities**

The implementation of hazard mitigation activities often involves agencies and individuals beyond the emergency management profession. Other stakeholders may include local planners, public works officials, economic development specialists and others. In many instances, concurrent local planning efforts will help to achieve or complement hazard mitigation goals even though they are not designed as such. Therefore, the *Capability Assessment Survey* also asked questions regarding each jurisdiction's general planning capabilities and to what degree hazard mitigation is integrated into other on-going planning efforts.

*Regional Planning:* Regional planning refers to any type of planning effort that involves a community working in conjunction with neighboring jurisdictions. For example, the development of this All Hazard Mitigation Plan is representative of a regional planning effort.

- Survey results indicate that fifteen jurisdictions participate in regional planning decisions.
  - Sussex County coordinates with its local municipalities on issues and projects related to the County's Comprehensive Plan and the State's *Livable Delaware* initiative.
  - Many local jurisdictions also coordinate on regional issues through the Sussex County Association of Towns (SCAT).
  - All of Sussex County's local jurisdictions are members of the Delaware League of Local Governments (DLLG). The DLLG is a statewide, nonprofit, nonpartisan association of city, town, and county governments established in 1963 to improve and assist local

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governments through legislative advocacy at the state and Federal level. The DLLG also serves as a clearinghouse for important governmental and business-oriented information.

*Comprehensive Plan:* A comprehensive plan establishes the overall vision for what a community wants to be and a guide to future governmental decision making. Typically a comprehensive plan is comprised of demographic conditions, land use, transportation elements and 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 enhance the likelihood of achieving risk reduction goals, objectives and actions.

- The State of Delaware requires its counties to adopt and regularly update comprehensive plans in conformity with the *Quality of Life Act of 1988*. The Act requires the plans to include the following elements: Economic Development, Housing, Conservation (including Agriculture), Historic Preservation, Recreation and Open Space, Accomplishments, Intergovernmental Coordination, Mobility, Water and Sewer, Community Facilities, and Future Land Use. An optional element is Community Design.
- More recently, State legislation (House Bill 255) has been passed in support of the State's *Livable Delaware* initiative to require all municipalities in Delaware to adopt and update comprehensive plans. *Livable Delaware* is a comprehensive strategy to get sprawl under control and direct intelligent growth to areas where the state, county and local governments are most prepared for new development in terms of infrastructure, services and thoughtful planning. Through this initiative the Delaware Office of State Planning Coordination has dedicated grant funding and professional staff assistance to help local governments develop their comprehensive plans.
- Sussex County's Comprehensive Plan was approved and adopted by the County Council in December 2002. The update was also reviewed and certified under the *Livable Delaware* guidelines.
- **Table 5.2** shows the progress made as of 2010 by the municipal jurisdictions in Sussex County to update their comprehensive plans according to the Delaware Office of State Planning Coordination.

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**Table 5.2**  
**Local Comprehensive Plan Updates**

Jurisdiction	Plan Status
Bethany Beach	Complete
Bethel	Contacted
Blades	Certified (2002)
Bridgeville	Certified (2001)
Dagsboro	Certified (2003)
Delmar	Complete (2005)
Dewey Beach	In Progress
Ellendale	Update in Progress (2009)
Fenwick Island	Contacted
Frankford	Complete (2009)
Georgetown	Certified (2001)
Greenwood	In Progress
Henlopen Acres	In Progress
Laurel	In Progress
Lewes	In Progress
Millsboro	Certified (2001)
Millville	In Progress
Milton	In Progress
Ocean View	Update in Progress
Odessa	Complete (2001)
Rehoboth Beach	Complete (2003)
Seaford	Certified (2003)
Selbyville	Certified (2007)
Slaughter Beach	In Progress
South Bethany	Complete

*Source: Delaware Office of State Planning Coordination*

- Survey results indicate that most jurisdictions do not address natural or human-caused hazards in their comprehensive plans.

*Transportation Plan:* A transportation plan identifies the means to gauge transportation demands and the options to meet those needs, while considering the social, economic and environmental characteristics of the area. The development of transportation networks can significantly impact the amount, type and location of future growth. As a result, transportation planning can have a dramatic effect on future hazard vulnerability.

- Survey results indicate that most jurisdictions do not have their own stand-alone transportation plan. Transportation planning (including emergency evacuation planning) is commonly addressed as an element to the local comprehensive plans and in coordination with the Delaware Department of Transportation.

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- Sussex County's Transportation Plan was adopted in 2001.
- The towns of Bridgeville, Delmar and Seaford have defined each of their Transportation Plans as distinct elements to their comprehensive plans.
- The City of Lewes has prepared a transportation plan that is currently under review. The plan has not yet been adopted.

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

- Survey results indicate that eight jurisdictions have capital improvement plans that regulate the provision or extension of infrastructure in hazard areas.

*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.<sup>3</sup> 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 easily be relocated out of harm's way.

- Survey results indicate that nine jurisdictions have historic preservation plans.
- The City of Lewes' Historic Preservation Plan is contained within the Comprehensive Plan.

*Zoning Ordinances:* Zoning represents the 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 of those in a given jurisdiction that maintains zoning authority. A zoning ordinance is the mechanism through which zoning is typically implemented. 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.

- Survey results indicate that twenty-five jurisdictions have a zoning ordinance.
- Sussex County's zoning ordinance was adopted in 1971 as a "Comprehensive Zoning Ordinance" and is periodically updated (Chapter 115 of the Sussex County Code).

*Subdivision Ordinances:* A subdivision ordinance is intended to regulate the development of housing, commercial, industrial or other uses, including associated public infrastructure, as land is subdivided into buildable lots for sale or future development. Subdivision design that accounts for natural hazards can dramatically reduce the exposure of future development.<sup>4</sup>

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<sup>3</sup> See Protecting the Past from Natural Disasters. 1989. Nelson, Carl. National Trust for Historic Preservation: Washington, D.C.

<sup>4</sup> For additional information regarding the use of subdivision regulations in reducing flood hazard risk, see Subdivision Design in Flood Hazard Areas. 1997. Morris, Marya. Planning Advisory Service Report Number 473. American Planning Association: Washington, D.C.

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- Survey results indicate that twenty-three jurisdictions have a subdivision ordinance.
- Sussex County's zoning ordinance was adopted in 1982 and is periodically updated through association with the zoning ordinance.

*Building Codes, Permitting and Inspections:* Building Codes regulate construction standards. In many communities, permits are issued for, and inspections of work take place on, new construction. Decisions regarding the adoption of building codes (that account for hazard risk), the type of permitting process required both before and after a disaster, and the enforcement of inspection protocols all affect the level of hazard risk faced by a community.

- Survey results indicate that all jurisdictions have adopted a local building code.

In addition to using survey results, the adoption and enforcement of building codes by local jurisdictions was assessed using the Building Code Effectiveness Grading Schedule (BCEGS) program developed by the Insurance Services Office, Inc. (ISO).<sup>5</sup> Under the BCEGS program, ISO assesses the building codes in effect in a particular community and how the community enforces its building codes, *with special emphasis on mitigation of losses from natural hazards*. The results of BCEGS assessments are routinely provided to ISO's member private insurance companies, which in turn may offer ratings credits for new buildings constructed in communities with strong BCEGS classifications. The concept is that communities with well-enforced, up-to-date codes should demonstrate better loss experience, and insurance rates can reflect that.

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

BCEGS grades for each of Sussex County's local jurisdictions are listed in **Table 5.3**.

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<sup>5</sup> Participation in BCEGS is voluntary and may be declined by local governments if they do not wish to have their local building codes evaluated.



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**Table 5.3**  
**BCEGS Grades for Sussex County Jurisdictions**

Jurisdiction	BCEGS Grade
Sussex County	8
Bethany Beach	<i>Declined Participation</i>
Bethel	8*
Blades	<i>Declined Participation</i>
Bridgeville	8*
Dagsboro	<i>Declined Participation</i>
Delmar	<i>Not Evaluated</i>
Dewey Beach	8*
Ellendale	8*
Fenwick Island	8*
Frankford	8*
Georgetown	8*
Greenwood	8*
Henlopen Acres	8*
Laurel	6
Lewes	9
Millsboro	7
Millville	8*
Milton	8*
Ocean View	8*
Odessa	8*
Rehoboth Beach	6
Seaford	6
Selbyville	8
Slaughter Beach	8*
South Bethany	<i>Declined Participation</i>

\* Building code administered and enforced by Sussex County.

Source: Insurance Services Office, Inc.

## Floodplain Management Capability

Flooding represents the greatest natural hazard facing the nation. At the same time, the tools available to reduce the impacts associated with flooding are among the most developed when compared to other hazard-specific mitigation techniques. In addition to approaches that cut across hazards, such as education, outreach, and the training of local officials, the *National Flood Insurance Program* (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 for local governments, but the program is promoted by FEMA and DEMA as a first basic step for implementing and sustaining an effective hazard mitigation program. It is therefore used as a key indicator for measuring local capability.

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In order for a county or municipality to join the NFIP, they must adopt a local flood damage prevention ordinance that requires jurisdictions to follow established minimum building standards in the floodplain. These standards require that all new buildings and substantial improvements to existing buildings will be protected from damage by the 100-year flood, and that new floodplain development will not aggregate existing flood problems or increase damage to other properties.

Another key service provided by the NFIP is the mapping of identified flood hazard areas. Once prepared, the Flood Insurance Rate Maps (FIRMs) are used to assess flood hazard risk, regulate construction practices and set flood insurance rates. FIRMs are an important source of information to educate residents, government officials and the private sector about the likelihood of flooding in their community. **Table 5.4** summarizes NFIP participation for each of Sussex County's local jurisdictions.

**Table 5.4**  
**NFIP Participation in Sussex County**

Jurisdiction	NFIP Entry Date	Current Effective Map
Sussex County	10/06/76	1/06/05
Bethany Beach	4/06/73	1/06/05
Bethel	1/16/81	1/06/05
Blades	1/16/81	1/06/05
Bridgeville	1/07/77	1/06/05
Dagsboro	6/01/81	1/06/05
Delmar	<i>Not in NFIP</i>	N/A
Dewey Beach	6/18/82	1/06/05
Ellendale	<i>Not in NFIP</i>	N/A
Fenwick Island	3/23/73	1/06/05
Frankford	9/16/81	1/06/05
Georgetown	5/05/03	1/06/05
Greenwood	2/24/78	1/06/05
Henlopen Acres	8/15/78	1/06/05
Laurel	1/16/81	1/06/05
Lewes	3/15/77	1/06/05
Millsboro	9/01/78	1/06/05
Millville	9/25/81	1/06/05
Milton	8/01/78	1/06/05
Ocean View	9/03/80	1/06/05
Rehoboth Beach	3/30/73	1/06/05
Seaford	2/01/79	1/06/05
Selbyville	7/16/91	1/06/05
Slaughter Beach	7/02/80	1/06/05
South Bethany	10/6/76	1/06/05

Source: Federal Emergency Management Agency- Community Status Book Report - <http://www.fema.gov/fema/csb.shtm>

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An additional indicator of floodplain management capability is the number of participants in the *Community Rating System* (CRS). The CRS is an incentive-based program that encourages counties and municipalities to undertake defined flood mitigation activities that go beyond the minimum requirements of the NFIP, adding extra local measures to provide protection from flooding. All of the 18 creditable CRS mitigation activities are assigned a range of point values. As points are accumulated and reach identified thresholds, communities can apply for an improved CRS class. Class ratings, which run from 10 to 1, are tied to flood insurance premium reductions as shown in **Figure 5.2**. As class ratings improve (decrease), the percent reduction in flood insurance premiums for NFIP policy holders in that community increases.

**Figure 5.2**  
**CRS Premium Discounts, By Class**

CRS Class	Premium Reduction
1	45%
2	40%
3	35%
4	30%
5	25%
6	20%
7	15%
8	10%
9	5%
10	0

*Source: FEMA*

Community participation in the CRS is voluntary. Any community that is in full compliance with the rules and regulations of the NFIP may apply to FEMA for a CRS classification better than class 10. The CRS application process has been greatly simplified over the past several years based on community comments to make the CRS more user friendly as possible, and extensive technical assistance is also available for communities who request it.

**Table 5.5** lists the current CRS communities in Sussex County. A total of seven municipalities belong to the Community Rating System. Of these seven, five municipalities are a class 8 and two municipalities are class 9 communities.

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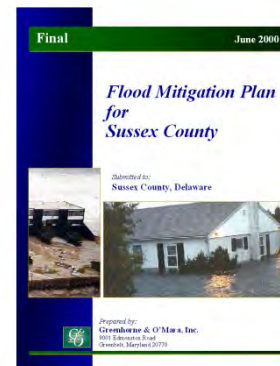
**Table 5.5**  
**CRS Communities in Sussex County**

Jurisdiction	CRS Entry Date	Current CRS Class
Bethany Beach	5/1/09	8
Dewey Beach	10/1/94	8
Fenwick Island	10/1/94	8
Lewes	10/1/92	9
Rehoboth Beach	10/1/95	8
Seaford	10/1/96	9
South Bethany	10/1/07	8

Source: FEMA- <http://www.fema.gov/business/nfip/crs.shtm>

*Floodplain Management Plan:* A floodplain management plan (or a flood mitigation plan) provides a framework for action regarding the corrective and preventative measures in place to reduce flood-related impacts.

- Survey results indicate that sixteen jurisdictions have a floodplain management plan or flood mitigation plan.
- Sussex County adopted a Flood Hazard Mitigation Plan in July 2000 and is now working toward implementation of the Plan's recommendations. The Plan covers Sussex County. It includes a flood vulnerability assessment, general and specific mitigation projects to pursue. Projects include structures for elevation projects, the revision of Sussex County's substantial damage/improvement definitions, improving flood hazard program and a variety of methods for creating more stringent re floodplain and coastal high hazard areas. These projects are in Sussex County Multi-jurisdictional All Hazard Mitigation Plan.
- The Town of Fenwick Island adopted their flood mitigation plan federal grant funding (HMGP and FMA) has been successful houses in their community.
- The Town of Henlopen Acres' code book includes a chapter on floodplain management. Part of its purpose is to promote the general health, welfare and safety of the community; minimize danger to public health and safety by protecting water supply, sanitary sewage disposal and natural drainage; encourage the utilization of appropriate construction practices.
- The City of Lewes adopted their Flood Mitigation Plan in 1999. Among other provisions, the Plan describes the funding for elevating structures with a minimum of one (1) foot of "free board" (e.g., clearance) above the required base flood elevation. The Plan targets critical facilities, drainage issues and berm restorations as potential mitigation projects. To date, the Plan has been moderately effective in reducing hazard impacts.



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*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 more frequently occurring minor urban flooding.

- Survey results indicate that four of the jurisdictions in Sussex County have a stormwater management plan.
- The Town of Fenwick Island adopted its stormwater management plan in August 2001. In addition, a Town Ordinance was adopted to limit the amount of impervious surfaces, thereby reducing stormwater runoff. By providing a well maintained stormwater system, the Town has reduced street flooding, making driving around town significantly safer during rainstorms.
- Bethany Beach adopted a storm water management plan in 2001. It was amended in 2003. The Town's storm water management is regulated by the Sussex Conservation District.

### County and Municipal Self Assessment

In addition to the inventory and analysis of existing plans, programs and policies, the *Capability Assessment Survey* required each local jurisdiction to conduct a self assessment of its capability to implement hazard mitigation activities. As part of this process, county and municipal officials were encouraged to consider the barriers implementing mitigation strategies in addition to the mechanisms that could further such strategies. In response to the survey questionnaire local officials classified the following capabilities as either "limited," "moderate" or "high":

- Technical capability
- Fiscal capability
- Administrative capability
- Political capability

**Table 5.6** summarizes the results of the self assessment process for technical, fiscal and administrative capabilities. An "L" indicates limited capability; an "M" indicated moderate capability; and an "H" indicates high capability. Further descriptions and discussions on each are provided below, in addition to some of general findings on political capability.

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**Table 5.6**  
**Self Assessment of Local Capability**

Jurisdiction	Technical Capability	Fiscal Capability	Administrative Capability
Sussex County	M	L	M
Bethany Beach	M	M	M
Bethel	L	L	L
Blades	L	L	L
Bridgeville	M	L	M
Dagsboro	L	L	L
Delmar	L	L	L
Dewey Beach	H	H	L
Ellendale	L	L	L
Fenwick Island	L	L	M
Frankford	M	L	M
Georgetown	L	M	L
Greenwood	L	L	L
Henlopen Acres	M	M	M
Laurel	L	L	M
Lewes	M	L	M
Millsboro	M	L	L
Millville	L	L	L
Milton	L	L	L
Ocean View	L	L	L
Rehoboth Beach	H	M	M
Seaford	M	L	L
Selbyville	L	L	M
Slaughter Beach	L	L	L
South Bethany	M	L	M

## Technical Capability

Technical capability can be defined as possessing the skills and tools needed to improve decision making, including the development and implementation of sound mitigation actions. For purposes of gauging the technical capability of Sussex County's local jurisdictions for mitigation planning purposes, the *Capability Assessment Survey* focused on the local availability and application of Geographic Information Systems (GIS).

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The analysis of the responses to the *Capability Assessment Survey* indicated that there is generally a *limited to moderate* technical capability of Sussex County's jurisdictions to implement mitigation strategies. Thirteen of the 24 jurisdictions surveyed indicated they had limited technical capability, nine indicated they had moderate technical capability, and two indicated they had high technical capability.

Sussex County maintains a GIS system, as do a good number of its municipalities. However the majority of cities and towns don't employ GIS staff or have direct access to GIS systems due to financial limitations. Many local officials indicated that they are interested in gaining better access to GIS and related technical resources for their jurisdiction. Many local officials also indicated that they rely on Sussex County and state agencies to provide technical capabilities and resources, when needed.

The City of Lewes increased its technical capability and mitigation awareness through participation in FEMA's *Project Impact* initiative, in addition to enlisting partnerships with over 50 state, county and local agencies, organizations, education institutions and businesses. These partnerships are being sustained throughout the year, and help facilitate increased public awareness activities such as newsletters, websites, mitigation workshops and small business contingency planning seminars. The City maintains and established a 10-member Mitigation Planning Team represented by various City departments to coordinate local mitigation activities.

*Recommendations:* While technical resources are somewhat limited across the county, the development of a systematic protocol for sharing resources could significantly increase the level of technical capability to analyze natural hazards and develop meaningful actions to reduce their impact. This includes additional training to undertake GIS-driven risk assessments to identify potential mitigation opportunities and enhancing the ability to use information technologies to facilitate the formulation, development, implementation and monitoring of mitigation plans.

The City of Lewes has established a strong local mitigation program, and through new partnerships and mentoring opportunities with other Sussex County jurisdictions could serve as an exemplary model for others to follow. The development of cooperative, countywide mitigation actions should also be used to assist in this effort.

### **Fiscal Capability**

The ability to take action is often closely associated with the amount of money available to implement policies and projects.<sup>6</sup> This may take the form of grants received or state and locally-based revenue. The costs associated with policy and project implementation vary widely. In some cases, policies are tied primarily to staff costs associated with the creation and monitoring of a given program. In other cases, money is linked to an actual project, like the acquisition of flood-prone homes, which can require a substantial commitment from local, state and federal funding sources.

The analysis of the responses to the *Capability Assessment Survey* indicated that there is a *limited to moderate* fiscal capability of Sussex County's jurisdictions to implement mitigation strategies. Nineteen

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<sup>6</sup> Gaining access to federal, state or other sources of funding is often an overriding factor driving the development of hazard mitigation plans. However, an important objective of local governments seeking a more sustainable future is the concept of self reliance. Over time, counties and municipalities should seek the means to become less dependent on federal assistance, developing a more diversified approach that assesses the availability of federal, state and locally-generated funding to implement mitigation actions. Additional assistance may be available from the business and corporate sector as well as certain non-profit groups. This should be coupled with an attempt to identify mitigation measures that cost little or no money, yet may compliment the larger array of actions identified in the plan.

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jurisdictions indicated they had limited fiscal capability, including Sussex County, while only four indicated they had moderate fiscal capability. Most of the jurisdictions in Sussex County have the ability to generate revenue for mitigation purposes (other than minor stormwater drainage projects), and most will continue to rely heavily upon monies available through state and federal grant programs. However, the City of Lewes has established a line item in the City's annual general budget to support their Mitigation Planning Team and its activities.

*Recommendations:* The results of the local capability assessment should be used as a general guide to help craft mitigation actions that are achievable. When considering the effect of fiscal capability on the implementation of mitigation policies and projects, jurisdictions should consider whether the actions require monetary commitment or staff resources. If so, consideration should be given to available grant funding sources, or perhaps combining resources with the county or other municipalities to offset costs of implementation. Consideration should also be made as to whether the jurisdiction is willing to commit local revenue on a sustained or one-time basis.

In most cases, in order to implement mitigation projects and policies, some monetary commitment or staff resources will be required. This may take the form of a non-federal match requirement or the costs associated with staff time devoted to policy development, implementation and monitoring. The identification of eligible Pre-Disaster Mitigation projects, as well as other federal funding sources identified in the Sussex County Multi-jurisdictional All Hazard Mitigation Plan, enables communities to compete nationally for available funding. The county and municipal governments should consider, whenever possible, combining financial and staff resources to address hazards, most of which tend to impact regions rather than individual jurisdictions.

Finally, if local governments have access to an ongoing source of revenue, rather than a strict reliance on grant funds, a more comprehensive and sustained mitigation effort can be achieved. Examples include the development of a stormwater utility fee or the development of a budgetary line item that specifically addresses hazard mitigation.

### **Administrative Capability**

Administrative capability was evaluated by reviewing county and municipal staffing and the existing organizational structure for local governments to implement mitigation strategies. 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.

The analysis of the responses to the *Capability Assessment Survey* indicated that there is generally a *limited to moderate* administrative capability of Sussex County's jurisdictions to implement mitigation strategies. Thirteen (13) jurisdictions indicated they had limited administrative capability, while eleven (11) indicated they had moderate administrative capability. Local municipal jurisdictions in Sussex County indicated that they work cooperatively with the county on many activities, helping to offset their administrative and staff limitations. This includes emergency-related activities coordinated by the Sussex County EOC and through mutual aid agreements between police and fire departments, but not specifically mitigation activities.

Some local municipal officials have attended courses at FEMA's Emergency Management Institute and gained valuable knowledge through the implementation of mitigation projects funded through federal and state grant programs. Many local officials indicated that they have very few full-time staff to implement local government programs, and rely heavily on volunteers, outside agencies and professional consultants.



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*Recommendations:* The results of the administrative capability assessment demonstrate that the county and larger municipalities tend to possess a stronger administrative capability than smaller communities. This is primarily due to fiscal limitations, as smaller jurisdictions by nature have a limited tax base to support local government services. The development of local administrative capability may best be achieved through enhanced intergovernmental cooperation, outreach, training and mentoring for smaller jurisdictions as well as the sharing of resources, when appropriate. Local governments wishing to improve their local internal staff's emergency management expertise should consider sending staff to the free or low-cost training seminars available through DEMA's Training Program and FEMA's Emergency Management Institute. In preparing local mitigation strategies, local governments should look to integrate hazard mitigation activities into routine governmental functions whenever possible, particularly when limited to only a few full-time employees.

### **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 future hazard events. Hazard mitigation may not be a local priority or could mistakenly be seen by local officials as an impediment to other goals of the community, such as growth and economic development. The local political climate must be considered in designing mitigation strategies as it could be the most difficult hurdle to overcome in accomplishing their adoption or implementation.

The analysis of responses to the *Capability Assessment Survey* indicated that there is generally a *moderate* political capability of Sussex County's jurisdictions to implement mitigation strategies. Other than coastal flooding and some isolated inland flood events, many jurisdictions indicated that hazards and disasters have not been a significant issue of concern in Sussex County. However, in general they indicated that the local political climate is favorable for implementing mitigation actions that are not in conflict with other community goals. Some responses to the survey indicated that local jurisdictions have been successful in aggressively improving their local floodplain management regulations beyond the minimum federal standards.

*Recommendations:* Increasing local political capability to implement mitigation strategies is most often achieved through a coordinated approach to loss reduction that includes: (1) gaining community support from a wide range of local interest groups (particularly those that may be affected by proposed actions); and (2) informing and educating the elected and executive officials of the community in advance of the formal decision making process.

Community support should be generated by identifying key stakeholders early in the process of designing and proposing mitigation strategies. For example, in considering the regulation of construction in floodplains of other hazard areas, the local building and development industry should be brought in to share their ideas and concerns for crafting mitigation strategies that can work. This will help eliminate or minimize potential impediments to acceptance before strategies become drafted or officially proposed.

Local elected and executive officials should become informed and educated on mitigation strategies in advance of any formal considerations or decisions. This will facilitate a greater understanding of specific mitigation objectives and expected outcomes, and lead to an indication as to whether proposed actions may need to be revised before moving forward. The information presented and shared with local officials should specifically target any known issues of concern and seek to alleviate those concerns.

### **Previously Implemented Mitigation Measures**

The success of future mitigation efforts in a community can be gauged by past efforts. Previously implemented mitigation measures indicate that there is, or has been, a desire to reduce the effects of

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natural hazards. Past success of these projects can also be influential in building support for new mitigation efforts.

### *Hazard Mitigation Grant Program (HMGP) Projects*

The Federal Emergency Management Agency's Hazard Mitigation Grant Program provides competitive funding to states and local governments for the implementation of long-term hazard mitigation measures following a presidential disaster declaration. According to DEMA, there have been 17 HMGP projects completed in Sussex County totaling \$1,372,790 in federal HMGP funds. These projects are listed in **Table 5.7** along with brief project descriptions. These numbers will increase substantially as HMGP projects associated with the Tropical Storm Henri and Hurricane Isabel disaster declarations are completed.<sup>7</sup>

**Table 5.7**  
**Completed HMGP Projects in Sussex County**

Project	Description	Completion Date	Declaration Number(S)	HMGP Funds	Total HMGP Funds
Flood Mitigation Planning	Developed Flood Mitigation Plans for New Castle and Sussex Counties, and Bethany Beach, Dewey Beach, Lewes, Wilmington and Delaware City.	Nov-99	DR-933	\$114,986	\$85,396
			DR-976	\$62,901	
Fire Weather Monitoring Stations	Install fire-weather monitoring stations at Redden State Forest and Blackbird State Forest to allow Forest Service to monitor and predict forest fire potential.	Dec-98	DR-1017	\$22,495	\$22,495
Coastal Sewer Floodproofing Near South Bethany	Elevate manhole openings, floodproof hatch-cover doors where opening are in roadways, elevate electrical components in water proof cabinets in sanitary sewer system.	Dec-97	DR-933	\$74,548	\$74,548
Dewey Beach Protective Dune	Project managed by DNREC to develop protective dune for Dewey Beach.	Sep-94	DR-933	\$64,834	\$64,834
South Bethany Emergency Pamphlet	Develop an emergency pamphlet for renters in South Bethany.	Aug-96	DR-933	\$2,162	\$2,162
Long Neck, Bethany Sewer Floodproofing	Elevate manhole openings, floodproof hatch-cover doors, elevate electrical components in water proof cabinets in sanitary sewer system.	Dec-96	DR-976	\$26,997	\$26,997

<sup>7</sup> DEMA has received a total of \$319,157 in HMGP funds following Tropical Storm Henri and Hurricane Isabel.

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**Table 5.7 (continued)**  
**Completed HMGP Projects in Sussex County**

Project	Description	Completion Date	Declaration Number(S)	HMGP Funds	Total HMGP Funds
South Bethany Ocean Drive Flood Protection	Construct rip-rap along Ocean Drive to protect homeowner's properties, Ocean Drive roadway, and infrastructure from future coastal storms.	March 2000	DR-933	\$55,353	\$60,524
			DR-976	\$5,171	
Bethany Beach Handicapped Ramp Retrofit	Retrofit Bethany Beach boardwalk for handicap access.	August 1996	DR-976	\$12,342	\$12,342
Primehook Electric Utilities	Bury overhead electric power lines to Primehook, DE by Delaware Electric Cooperative to protect the line from wind and ice damage.	November 1998	DR-1017	\$71,204	\$71,204
Fenwick Island Home Elevation	Elevation of two flood-prone structures onto properly elevated engineered foundations.	June 2000	DR-1017	\$41,690	\$41,690
Fenwick Island Home Elevation Phase II	Elevation of seven flood-prone structures onto properly elevated engineered foundations. Also funded under Disaster 1205.	April 2002	DR-1017	\$120,798	\$120,798
City of Lewes Home Elevation	Elevation of eight flood-prone structures onto properly elevated engineered foundations.	June 2000	DR-1017	\$326,848	\$161,556
Sussex County Home Elevation	Elevation of 11 flood-prone structures onto properly elevated engineered foundation.	December 2002	DR-1017	\$326,848	\$382,252
			DR-1205	\$55,404	
Fenwick Island Home Elevation Rescope	Elevation of four flood-prone structures onto properly elevated engineered foundation.	June 2002	DR-1205	\$84,432	\$84,432
City of Lewes Home Elevation Rescope	Elevation of five flood-prone structures onto properly elevated engineered foundations.	September 2002	DR-1205	\$138,562	\$138,562
City of Lewes Fire Department Wind Retrofit	Installation of hurricane strapping to Station #82, which also serves as the City's Emergency Operations Center.	September 2001	DR-1297	\$12,292	\$12,292
Wastewater Pump Mitigation Project	NA	December 2007	DR-1572	\$8,029	\$10,706

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*Source: Delaware Emergency Management Agency*

### *Flood Mitigation Assistance Program*

In the state of Delaware, the Department of the Environment and Natural Resources (DNREC) administers the FEMA Flood Mitigation Assistance program (FMA). The FMA is an annual pre-disaster mitigation grant program that provides funding for projects and plans that are aimed at reducing the number of insured properties that have incurred repetitive flood losses. According to DNREC, there have been five FMA projects completed in Sussex County totaling approximately \$1,145,000. These projects are listed in **Table 5.8** along with brief project descriptions.

**Table 5.8**  
**Completed FMA Projects in Sussex County**

Project	Description	Completion Date	FMA Funds
South Bethany Elevation Project	Elevate two oceanfront houses and two adjacent houses on pilings.	2000	NA
Bethany Beach Tideflex Valve Project	Install backflow valves to prevent tidal flooding from backing up through storm drains and flooding streets and businesses in downtown Bethany Beach.	2002	\$90,000
Fenwick Island Elevation Project	Elevate two flood-prone houses.	2003	\$100,000
Sussex County Home Elevation Project	Elevate three flood-prone houses to pile foundation in estuarine V Zone near Oak Orchard.	2003	\$205,000
Elevation/ Relocation of Residential Structures	Approximately fifteen residential structures were elevated or relocated.		\$750,000

*Source: Delaware Department of the Environment and Natural Resources*

### *Pre-Disaster Mitigation Program*

FEMA's Pre-Disaster Mitigation (PDM) program, authorized and established under the Disaster Mitigation Act of 2000, is designed to provide states and communities with annual funding to implement cost-effective hazard mitigation activities. Eligible activities may include the acquisition or elevation of flood-prone properties, retrofitting structures, education and outreach efforts, and mitigation planning. Although no PDM projects have been completed yet in Sussex County, PDM planning funds were utilized by DEMA on behalf of Sussex County in order to develop this All Hazard Mitigation Plan.

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### *Other Local Mitigation Measures*

Sussex County adopted a flood hazard mitigation plan and is working toward implementation of a variety of mitigation measures, including actions related to the following:

- Identifying high-risk, floodprone structures for elevation projects and work with owners to prepare funding applications.
- Requesting Flood Mitigation Assistance funding from DEMA to obtain surveyed lowest floor elevations for: (1) repetitive loss structure; and (2) other structures which may be at high risk.
- Modifying the definition of 'substantial improvement' and 'substantial damage' in Sussex County's Code to incorporate cumulative improvements and damages over 10-years.
- Creating an ordinance that would require enclosures in Coastal High Hazard Areas below the BFE to be rebuilt to meet the current Municipal Code if damaged by floodwaters. Sussex County should write an enforceable and clear definition of what would constitute 'damage by floodwaters' under this new ordinance.
- Enacting more stringent regulations for the elevation of manufactured housing in floodprone areas.
- Clarifying the regulations for the setup and installation of manufactured housing in floodprone areas so that it is apparent that regulations governing the use of pilings apply to manufactured homes in V zones.
- Creating a brochure to inform agricultural structure owners of the methods for having flood insurance rates for agricultural structures reduced.
- Developing BFEs for pre-FIRM structures currently mapped in approximate 'A' zones.
- Making Building Code Changes: Revising §115-189 (G) of Sussex County Code by eliminating misleading language.
- Modifying current Sussex County Code to enact stricter construction regulations in floodprone.
- Corrosion Resistant Requirements for Sheet-Metal Connectors.
- Coordinating with DeIDOT to investigate roadway elevation projects for flood evacuation routes.
- Becoming a member of FEMA's Community Rating System.
- Publishing and issue a brochure describing flooding hazards and evacuation procedures in Sussex County. Additionally issues related to building in the floodplain could also be addressed.
- Evaluating whether their existing staffing resources are adequate to handle local mitigation responsibilities.
- Sending appropriate County personnel to training programs at FEMA's Emergency Management Institute (EMI) in Emmitsburg, MD.

More detailed information on these actions can be found in the *Sussex County Flood Hazard Mitigation Plan*, adopted March 11, 2003.

As part of the *Capability Assessment Survey*, local municipal officials were asked to provide additional information on any on-going or completed mitigation projects in their jurisdictions. **Table 5.9** summarized many of their responses to the questionnaire. Most of the communities indicated that they hadn't completed any hazard mitigation projects.

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**Table 5.9**  
**Local Mitigation Measures**

Jurisdiction	Mitigation Measures
Sussex County	<ul style="list-style-type: none"> <li>Sussex County Sewer Mitigation Project</li> </ul>
Bethany Beach	None
Bethel	None
Blades	None
Bridgeville	None
Dagsboro	None
Delmar	None
Dewey Beach	None
Ellendale	None
Fenwick Island	<ul style="list-style-type: none"> <li>Elevated 12 homes</li> </ul>
Frankford	None
Georgetown	None
Greenwood	None
Henlopen Acres	<ul style="list-style-type: none"> <li>Upgrading storm drainage system</li> </ul>
Laurel	None
Lewes	<ul style="list-style-type: none"> <li>Retrofitted several critical facilities</li> <li>NOAA weather radios (community-wide distribution)</li> <li>Development of GIS system</li> <li>Hazard Vulnerability/Risk Assessment Study</li> <li>Model "Coastal Demonstration House"</li> <li>Elevated 13 residential structures</li> <li>Public Outreach Program</li> </ul>
Millsboro	<ul style="list-style-type: none"> <li>Generator at water treatment facility and engineering plans for one at wastewater facility along with pump stations</li> <li>Storm drainage improvements</li> </ul>
Millville	None
Milton	<ul style="list-style-type: none"> <li>Water Treatment Plan preparing for adoption.</li> </ul>
Ocean View	None
Rehoboth Beach	None
Seaford	None
Selbyville	None
Slaughter Beach	<ul style="list-style-type: none"> <li>Beach replenishment (DNREC)</li> </ul>
South Bethany	<ul style="list-style-type: none"> <li>Ordinance requiring bulkheads for properties along canals to prevent erosion</li> <li>Revetment project along Ocean Drive</li> </ul>

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## *Conclusions on Local Capability*

The capability of local governments in Sussex County varies greatly from jurisdiction to jurisdiction. **Table 5.10** shows the results of the capability assessment using the scoring methodology described previously in this section. The average capability score in Sussex County is 15.04, while the average score for all local governments in Delaware is 13.93.

**Table 5.10**  
**Capability Assessment Results**

Jurisdiction	Capability Score	Capability Rating
Sussex County	28	MODERATE
Bethany Beach	15	MODERATE
Bethel	9	LIMITED
Blades	7	LIMITED
Bridgeville	14	LIMITED
Dagsboro	13	LIMITED
Delmar	6	LIMITED
Dewey Beach	20	MODERATE
Ellendale	4	LIMITED
Fenwick Island	17	MODERATE
Frankford	14	LIMITED
Georgetown	13	LIMITED
Greenwood	9	LIMITED
Henlopen Acres	20	MODERATE
Laurel	12	LIMITED
Lewes	29	MODERATE
Millsboro	12	LIMITED
Millville	13	LIMITED
Milton	18	MODERATE
Ocean View	9	LIMITED
Rehoboth Beach	20	MODERATE
Seaford	24	MODERATE
Selbyville	21	MODERATE
Slaughter Beach	12	LIMITED
South Bethany	16	MODERATE

Sussex County's local governments should continue to work with each other beyond the development of this Plan in order to maximize existing resources and local capabilities. The City of Lewes has gained considerable knowledge and expertise in applying hazard mitigation principles through local government programs, and should serve as a mentor to its neighboring communities in Sussex County. As the above findings indicate, Sussex County has significantly more capability than its municipal jurisdictions and

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should serve as a clearinghouse for information while striving to enhance and maintain intergovernmental cooperation and coordination.

This All Hazard Mitigation Plan provides the vehicle to begin this process. However, in order to succeed, it will require clearly articulating the benefits of participating in and sustaining the countywide mitigation planning process. One of the best ways to obtain local buy-in and long-term success is to identify and implement achievable mitigation actions (as listed in this Plan's *Mitigation Strategy*) that will facilitate continued intergovernmental coordination not only across the county, but with state and federal agencies as well.

### *Linking the Capability Assessment, the Risk Assessment, and the Mitigation Strategy*

The conclusions of the *Capability Assessment* and *Risk Assessment* serve as the foundation for a meaningful hazard mitigation strategy. During the process of identifying the goals, objectives and mitigation actions, each jurisdiction must consider not only their level of hazard risk but also their existing capability to minimize or eliminate that risk. **Figure 5.3** shows a "Risk Versus Capability Matrix" that is used to illustrate each jurisdiction's overall hazard risk<sup>8</sup> in comparison to their overall capability. This matrix has been completed (with an "X") for each of Sussex County's participating jurisdictions and is included in each jurisdiction's separate and distinct *Mitigation Action Plan*.

**Figure 5.3**  
**Risk versus Capability Matrix**

		HAZARD RISK		
		Limited	Moderate	High
OVERALL CAPABILITY	High			
	Moderate			
	Limited			

In jurisdictions where the overall hazard risk is considered to be HIGH, and local capability is considered LIMITED, then specific mitigation actions that account for these conditions should be considered. This may include less costly actions such as minor ordinance revisions or public awareness activities. Further, if necessary, specific capabilities may need to be improved in order to better address recurring threats. Similarly, in cases where the hazard vulnerability is LIMITED and overall capability is HIGH, more emphasis can be placed on actions that may impact future vulnerability such as guiding development away from known hazard areas.

There has been no major changes that warranted a change in the hazard risk or overall capability for the county (unincorporated areas) or municipalities.

<sup>8</sup> Overall hazard risk was determined for each jurisdiction using the results of the risk assessment (estimated losses for all natural hazards) combined with specific information on the following factors: total population, population growth rate, land area, historical disaster declarations, NFIP participation, unique hazard risks and coastal hazard vulnerability. More information on the method used to determine overall hazard risk is available through DEMA upon request.



# MITIGATION STRATEGY

## *Introduction*

The intent of the *Mitigation Strategy* is to provide Sussex County and participating jurisdictions with the tools necessary to continue to reduce the impact of natural and human-caused hazards. In order to achieve these aims, this section was separated into the following components:

- Mitigation Goals;
- Identification and Analysis of Mitigation Measures; and
- Mitigation Action Plan

The Sussex County All Hazard Mitigation Plan Update provides a comprehensive review of hazards and identifies far-reaching policies and projects intended to not only reduce the future impacts of hazards, but also assist the county and municipalities achieve compatible economic, environmental and social goals. In addition, the plan is strategic, in that all policies and projects are linked to departments or individuals responsible for their implementation. When possible, funding sources are identified that can be used to assist in project implementation.

The crucial basis for action can be found in the Mitigation Action Plan (MAP), which lists specific prioritized actions, those responsible for their implementation, potential funding sources that may be used, and an estimated target date for completion. Each action was listed with the accompanying information. This approach provides those in charge of the plans' implementation with a clear roadmap that serves as an important monitoring tool. The collection of actions also serves as an easily understood menu of policies and projects for those decision makers who want to quickly review the Plan.

## **Planning Approach**

In order to guide the actions of those charged with implementation, the Plan follows a traditional planning approach, beginning with a mission statement that provides the overall guiding principle. Goals are intended to meet the intent of the mission statement. Next, mitigation actions serve to provide clear, measurable tasks. Actions may include policies or projects designed to reduce the impacts of future hazard events. Each hierarchical step is intended to provide a clearly defined set of policies and projects based on a rational framework for action. The components of the planning framework are explained in greater detail below.

<b>Mission Statement:</b>	Provides guiding principles of the Hazard Mitigation Plan.
<b>Goals:</b>	Goals represent broad statements that are achieved through the implementation of more specific, action-oriented objectives. Goals provide the framework for achieving the intent of the mission statement.
<b>Hazard Mitigation Policies:</b>	Policies are defined as a course of action agreed to by members of the Planning Team.
<b>Hazard Mitigation Projects:</b>	Projects are defined as specific actions taken to address defined vulnerabilities to existing buildings or systems. Potential funding sources are listed for each project.

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**Mitigation Action Plan:** Prioritized listing of actions (policies and projects), including a categorization of mitigation technique, hazards addressed, individual or organization responsible for implementation, estimated timeline for completion, and potential funding source.

### *Mission Statement*

*Develop and maintain a comprehensive pre- and post-disaster hazard mitigation program guided by the adoption of stormwater management practices, the implementation of codes and regulations, the protection of critical facilities and infrastructure, the adoption of education and outreach efforts, pre-event planning and preparedness and the identification of projects designed to reduce the vulnerability of individuals, families, households, businesses, infrastructure and critical facilities to the negative effects of natural and human-caused hazards.*

### *Mitigation Goals*

The following goals and mitigation actions of the Sussex County Hazard Mitigation Plan were updated at the Committee meeting on 24 February 2010 and represent a comprehensive approach taken by the County and its municipalities. The goals have remained unchanged for the most part since the 2004 Plan. However, the goals have been reworded to focus on natural hazards rather than natural and human caused hazards

- |         |   |
|---------|---|
| Goal #1 | <i>Sussex County and participating municipalities will continue to adopt enhanced stormwater management practices.</i>  |
| Goal #2 | <i>Sussex County and participating municipalities will continue to adopt and enforce codes and regulations designed to reduce the impact of natural hazards.</i>  |
| Goal #3 | <i>Sussex County and participating municipalities will continue to retrofit and protect critical facilities and infrastructure from natural hazards.</i>  |
| Goal #4 | <i>Sussex County and participating municipalities will continue to enhance education and outreach strategies to improve the dissemination of information to the public regarding hazards, including the steps that can be taken to reduce their impact.</i> |
| Goal #5 | <i>Sussex County and participating municipalities will continue to improve pre-event planning and preparedness activities.</i>  |
| Goal #6 | <i>Sussex County and participating municipalities will continue to identify and implement sound hazard mitigation projects.</i>   |

### *Identification and Analysis of Mitigation Measures*

In reformulating the Sussex County Mitigation Strategy, a wide range of activities were considered in order to help achieve the goals of participating jurisdictions. All actions chosen by county and municipal government officials fell into one of the broad categories of mitigation techniques listed below.

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## Mitigation Techniques

### 1. Prevention

Preventative activities are intended to keep hazard problems from getting worse. 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
- Hazard mapping
- Open space preservation
- Floodplain regulations
- Stormwater management
- Drainage system maintenance
- Capital improvements programming
- Shoreline / riverine / fault zone setbacks

### 2. Property Protection

Property protection measures enable structures to better withstand hazard events, remove structures from hazardous locations, or provide insurance to cover potential losses. Examples include:

- Acquisition
- Relocation
- Building elevation
- Critical facilities protection
- Retrofitting (i.e., wind proofing, flood proofing, seismic design standards, etc.)
- Insurance
- Safe room construction

### 3. Natural Resource Protection

Natural resource protection activities reduce the impact of hazards by preserving or restoring the function of natural systems. Examples of natural systems that can be classified as high hazard areas include floodplains, wetlands and barrier islands. Thus, natural resource protection can serve the dual purpose of protecting lives and property while enhancing environmental goals such as improved water quality or recreational opportunities. Parks, recreation or conservation agencies and organizations often implement these measures. Examples include:

- Floodplain protection
- Beach and dune preservation
- Riparian buffers
- Fire resistant landscaping
- Erosion and sediment control

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- Wetland restoration
- Habitat preservation
- Slope stabilization

### **4. Structural Projects**

Structural mitigation projects are intended to lessen the impact of hazards by modifying the environment or hardening structures. Structural projects are usually designed by engineers and managed or maintained by public works staff. Examples include:

- Reservoirs
- Levees, dikes, floodwalls, or seawalls
- Detention and retention basins
- Channel modification
- Beach nourishment
- Storm sewer construction

### **5. Emergency Services**

Although not typically considered a mitigation technique, emergency services minimize the impact of a hazard on people and property. Actions taken immediately prior to, during, or in response to a hazard event include:

- Warning systems
- Search and rescue
- Evacuation planning and management
- Flood fighting techniques

### **6. Public Information and Awareness**

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

- Outreach and education
- Training
- Speaker series, demonstration events
- Real estate disclosure
- Hazard expositions

### **Mitigation Techniques in the Sussex County Planning Area**

County and municipal officials reviewed the findings of the Capability Assessment and Risk Assessment in order to determine feasible and effective mitigation techniques. The Disaster Mitigation Act specifies that state and local governments should prioritize actions based on the level of risk a hazard poses to the lives and property of a given jurisdiction. The Mitigation Matrix in Section 6.2 assists local governments make sure they addressed, at a minimum, those hazards posing the greatest threat. Mitigation

## SUSSEX COUNTY MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

techniques, including prevention, property protection, natural resource protection, structural projects, emergency services and public information and awareness were noted in the matrix if adopted by a participating jurisdiction. It is important to note that local Mitigation Action Plans in the Sussex County planning area included an array of actions, not just those addressing high and moderate risk hazards.

Sussex County will continue to follow the guidelines set forth in the hazard mitigation Administrative Plan which detail the minimum project criteria

- Have a beneficial impact upon the designated disaster area, whether or not located in the designated area;
- Be in conformance with 44 CFR part 9, Floodplain Management and Protection of Wetlands, 44 CFR part 10, Environmental Considerations, and Executive Orders;
- Solve a problem independently or constitute a functional portion of a solution where there is assurance that the project as a whole will be completed. Projects that merely identify or analyze hazards or problems are not eligible;
  - Be cost-effective and substantially reduce the risk of future damage, hardship, loss, or suffering resulting from a major disaster; Benefit Cost Analysis will be developed per FEMA standards.
  - Not be eligible under another federal program or grant.

**Requirement: §201.6(c)(3)(ii):** *[The mitigation strategy] must also address the jurisdiction's participation in the National Flood Insurance Program (NFIP), and continued compliance with NFIP requirements, as appropriate.*

Participation in the NFIP is based on a voluntary agreement between a community and FEMA. Compliance with the NFIP, however, extends beyond mere participation in the program. The three basic components of the NFIP include 1) floodplain identification and mapping risk; 2) responsible floodplain management; and 3) flood insurance. Table 6.1 identifies the NFIP requirements and documents how the County addresses these requirements. The table is based on a list of questions developed by DEMA.

**Table 6.1 – Sussex County NFIP Compliance**

1. Floodplain Identification and Mapping			
Requirement	SHMO Recommended Action	Yes/No	County Action
a. Does the County maintain a copy effective FIRM (flood insurance rate map) maps and FIS (flood insurance study) that is accessible to the public?	Place these documents in the local libraries.	Yes	Maintained on file by the Sussex County Department of Planning and Zoning.
b. Has the County adopted the most current DFIRM or FIRM and FIS?	State date of adoption, if done.	Yes	Jan 6, 2005
c. Does the County support request for map updates?	If yes, state how.	No	Map changes, revisions, and amendments are reviewed by the

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			County CFM (Jeff Shockley), and submitted to FEMA for further study and determination.
d. Does the County share with FEMA any new technical or scientific data that could result in map revisions within 6 months of creation or identification of new data?	If yes, specify how.	No	Sussex County has not conducted any studies that have included new data for map revisions. Suggestions and ideas for certain areas have been offered.
e. Does the County provide assistance with local floodplain determinations?	If yes, specify how.	Yes	Sussex County Planning and Zoning Dept. assists property owners identify their location relative to the FIRMs.
f. Does the County maintain a record of approved Letters of Map Change?	If yes, specify the office that does it.	Yes	The Sussex County Department of Planning and Zoning maintain these files on record.
<b>2. Floodplain Management</b>			
Requirement	SHMO Recommended Action	Yes/No	County Action
a. Has the municipality adopted a compliant floodplain management ordinance that at a minimum regulates the following:	If yes answer, (1) through (4) below.	Yes	Yes
(1) Does the County issue permits for all proposed development in the SFHA?	If yes, specify the office.	Yes	Permits for proposed development and subdivision in the SFHA are issued by the Department of Planning and Zoning Commission and Sussex County Council.
(2) Does the County obtain, review and utilize any Base Flood Elevation and floodway data, and require BFE data for subdivision proposals and other development proposals larger than 50 lots or 5 acres?	If yes, specify the office that does it.	Yes	This is required by the Sussex County Department of Planning and Zoning for proposed subdivision application.
(3) Does the County identify measures to keep all new and substantially improved construction reasonably safe from flooding to or above the Base Flood Elevation, including anchoring, using flood resistant materials, designing or locating utilities and service facilities to prevent water damage?	If yes, specify the office that does it.	Yes	Inspection and enforcement done by the Sussex County Department of Planning and Zoning.
(4) Does the County document and maintain records of elevation data that document lowest floor elevation for new or substantially improved structures.	If yes, specify the office that does it.	Yes	Files on record and maintained by the Sussex County Department of Planning and Zoning.
b. If a compliant floodplain ordinance was adopted, does the County enforce the ordinance by monitoring compliance and taking remedial action to correct violations?	If yes, specify how.	Yes	Sussex County Planning and Zoning coordinates with DNREC and FEMA for community assessments; identifies properties in violation; and works with property owners to achieve compliance
<b>3. Flood Insurance</b>			
Requirement	SHMO Recommended Action	Yes/No	Sussex County Action

# MITIGATION STRATEGY

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a. Does the County educate community members about the availability and value of flood insurance?	If yes, specify how. See Note 1.	No	Sussex County focuses primarily on proposed development and construction requirements within the floodplain. The flood insurance issues are directed to DNREC.
b. Does the County inform community property owners about changes to the DFIRM/FIRM that would impact their insurance rates?	If yes, specify how.	Yes	The public is notified when the maps are updated and prior to Sussex County adoption of the maps.
c. Does the County provide general assistance to community members relating to insurance issues?		Yes	Sussex County offers preliminary assistance relating to flood insurance issues, but directs on to DNREC for finalization.

Note 1: Following flood disaster events: DEMA has worked with FEMA at the Joint Field Office to develop a Flood Smart brochure. This brochure addresses the availability of flood insurance and is distributed to every library in the State.

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**Requirement: §201.6(c)(3)(ii):** *[The mitigation strategy] must also address the jurisdiction's participation in the National Flood Insurance Program (NFIP), and continued compliance with NFIP requirements, as appropriate.*

There are a number of actions in Table 6.2B that support the National Flood Insurance Program in addition to what has been indicated in the previous chapter. They are indicated on Table 6.2B with \*\*.

## *Implementation Plan*

A detailed implementation plan for each mitigation action in Table 6.2B is included below. Mitigation actions in Table 6.2A (completed or cancelled actions) do not contain an implementation strategy for obvious reasons. Each action identifies:

- a. **Community Name:** Jurisdiction
- b. **Action Item:** Specific actions that, if accomplished, will reduce vulnerability and risk in the impact area. Actions are linked to the mitigation goals and objectives.
- c. **Hazard(s):** The hazard(s) the action attempts to mitigate.
- d. **Lead Agency/ Department Responsible:** The local agency, department or organization that is best suited to accomplish this action.
- e. **Estimated Cost:** The approximate cost to accomplish the mitigation action.
- f. **Funding Method:** How the cost to complete the action will be funded. For example, funds may be provided from existing operating budgets (General Revenue), a previously established contingency fund (Contingency/Bonds), or a federal or state grant (External Sources).
- g. **Implementation Schedule:** When the action will begin, and when the action is expected to be completed.
- h. **Priority:** 1) High priority—short-term immediate—reducing overall risk to life and property; 2) Moderate priority—an action that should be implemented in the near future due to political or community support or ease of implementation; 3) Low priority—an action that should be implemented over the long term that may depend on the availability of funds. This priority is based on a cost benefit review.

### **The Cost-Benefit Review**

The Cost Benefit Review comprises an analysis that compares the project cost to both tangible and non-tangible benefits. Tangible benefits are those benefits that could be considered in a comprehensive Benefit-Cost Analysis (BCA). Non-tangible benefits include public support, political will, and life safety.

# LOCALLY-SPECIFIC MITIGATION ACTIONS

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### The Benefit-Cost Analysis (BCA)

All mitigation projects that are considered for FEMA's Hazard Mitigation Assistance (HMA) program funding will have a comprehensive BCA completed using FEMA approved BCA software. Both the State Hazard Mitigation Officer (SHMO) and the Flood Mitigation Assistance program coordinator can provide assistance with the BCA. This analysis will be the basis by which the County either pursues a FEMA grant or seeks funding elsewhere. Only cost-effective eligible projects will be submitted for funding under the HMA program.

		HAZARD RISK		
		Low	Moderate	High
OVERALL CAPABILITY	High			X
	Moderate			
	Limited			

The mitigation actions from the 2004 Plan were reviewed at the Committee Meeting held on 24 February 2010 and edited as necessary. Tables 6.2A and 6.2B provide a listing of all mitigation actions, their adoption status, and timeline for completion, priority, and status. Table 6.2A contains all the actions that were either completed or cancelled while 6.2B lists the previous and newly developed actions that need to be implemented.

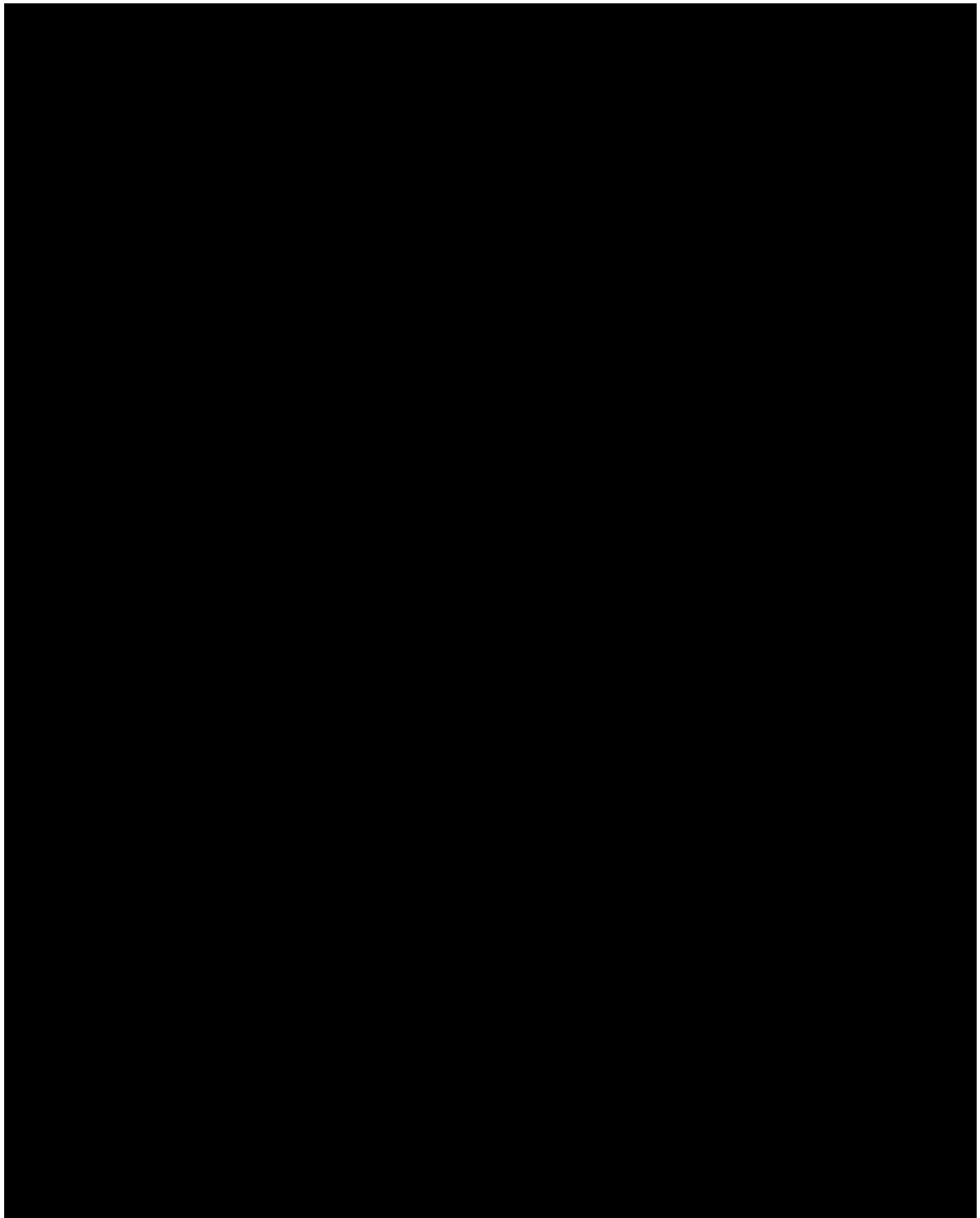
# LOCALLY-SPECIFIC MITIGATION ACTIONS

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**Requirement §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 effects of each hazard, with particular emphasis on new and existing buildings and infrastructure.*

**Table 6.2A – Completed and Cancelled Mitigation Actions**



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**Table 6.2B – Ongoing Mitigation Actions**

Action	Description	Adopted	Priority	Timeline for Completion	Status (delayed, started, cancelled)
<b>Unincorporated Areas</b>					
1	Work with DelDOT to improve all emergency access routes throughout the County.	Yes	High	4-5 years	In Progress
2	**Improve the County's Community Rating System rating. Review and update community plans and ordinances and incorporate updated information into the CRS update.	Yes	High	24 months	In Progress
3	**Encourage residents to elevate manufactured housing located on the coast to above the base flood elevation (BFE).	Yes	High	Ongoing	In Progress
4	**Work with homeowners to identify ways to elevate floodprone structures.	Yes	High	Ongoing	In Progress
5	Improve educational awareness through better notifications, training, and properly marked evacuation routes.	Yes	High	9 months	In Progress
6	Standardize Response Levels Plan and rewrite Emergency Operations Plan.	Yes	High	24 months	In Progress
7	Construct four-lane East/West emergency evacuation route to Maryland toll road (Routes 918 and 404).	Yes	Moderate	12 months	Not started
8	Distribute disaster preparedness and hazard mitigation-related information using brochures and website link.	Yes	Moderate	Ongoing	In Progress
9	Work with DelDOT to install storm drain of culvert on 1100 Block of South Bayshore Drive in Broadkill Beach.	Yes	High	24 months	Not started
10	Work with DNREC and DelDOT to endorse Federally funded restoration projects to restore portions of the Sussex County coastline that are experiencing significant coastal erosion, both from rising sea levels and coastal storms.	No	Moderate	Ongoing	In Progress
11	Work with DNREC to explore ways to finance beach restoration projects in private communities that are experiencing significant coastal erosion, both from rising sea levels and coastal storms.	No	Moderate	24 months	Not started
12	Develop a close working relationship between the county EOC and public utility companies. Identify a staff person from the utility companies to serve as a liaison to the County EOC for the inclusion of utility issues with emergency planning.	No	High	9 months	Not started
13	Work closely with unincorporated places, major subdivisions, and beach communities like Broadkill and Prime Hook, and manufactured home parks to more accurately allocate resources and plan for hazard mitigation, evacuation, etc. and make them more inclusive in the planning process.	No	High	Ongoing	Not started
14	Conduct a study to identify stormwater management systems that need to be retrofitted and channels that need to be improved in order to reduce flooding throughout the County.	No	Moderate	24 months	Not started
15	Work with DelDOT to identify possible elevation alternatives for the rebuilding of SR 38 (Prime Hook Road).	No	Moderate	24 months	Not started

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Bethany Beach					
1	Improve existing drainage system throughout the Town, particularly east of Route 1 and also include a plan maintenance schedule.	Yes	High	24 months	In Progress
2	**Consider purchasing an inflatable dam for Loop and Assawoman Canal to protect against incoming tide waters.	Yes	Moderate	12 months	Delayed due to funding.
3	Continue to educate residents and improve public awareness on being better prepared to face hazards.	Yes	High	Ongoing	In Progress
4	a. Create 2 new outfalls leading from large ditch that runs from Route 26 behind Lake Bethany to the marsh and install flap gates. b. Conduct Phase 2 of Bethany West drainage improvements. Replace and upgrade existing storm-water system between Collins Street and Tudor Court along Halfmoon Drive including Tudor Court, Sandstone Court, and Pebble Court. c. Conduct Phase 3 of Bethany West drainage improvements. Replace and upgrade existing storm-water facilities at West Side Development, enlarge outfall, replace driveway culverts, replace old pipe systems, regrade ditches.	No	High	3-5 years	Not started
Bethel					
1	Educate the public regarding preparedness and protection measures.	Yes	High	Ongoing	Delayed
2	Review County Office of Emergency Services plans regarding protective measures and evacuation procedures for hazardous materials incidents and share this information with citizens. Information should include ways to elevate and/or harden oil and gas storage tanks to avoid spills and contamination of surrounding areas.	Yes	High	12 months	Delayed
3	Educate the public on the necessity of periodic well testing, especially during periods of drought.	Yes	High	12 months	Delayed
4	Educate the public regarding special needs populations in the event of winter storms.	Yes	High	12 months	Delayed
5	Identify shelters and notify the public about their location.	Yes	High	12 months	Delayed
6	Educate the public concerning sheltering-in-place should a terrorist attack occur.	Yes	High	24 months	Delayed
7	Identify historic structures and develop mitigation strategies to protect any at-risk properties.	Yes	Moderate	24 months	Delayed
Blades					
1	Fix stormwater drainage problems with existing underground pipes and outfall areas to help prevent future flooding.	Yes	High	When funds become available	Delayed
2	Install new storm drains in strategic areas to allow removal of standing water during storms.	Yes	High	When funds become available	Delayed
Bridgeville					
1	Purchase mobile surveillance cameras for town use - protection for possible terrorist threats, drug activity, burglaries, etc.	No	High	12 months	Not started

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2	Currently the police department is housed separate from the other administrative offices in an old building. Relocate the police department and Town offices to one building to increase efficiency.	No	High	3-5 years	Not started
<b>Dagsboro</b>					
1	In coordination with Sussex County, fully participate in public outreach programs designed to promote hazard education and awareness for residents and businesses.	Yes	Moderate	Ongoing	Delayed
<b>Delmar</b>					
1	Conduct a vulnerability assessment of wastewater and stormwater management systems throughout the Town.	Yes	High	3-5 years	Unknown
2	Develop an Emergency Operations Plan to include identifying additional local hazards.	Yes	High	12-24 months	Unknown
<b>Dewey Beach</b>					
1	Develop a Disaster Warning System to notify the community of an impending disaster.	No	High	12-24 months	Not started
2	Consider reconstructing the Rehoboth Bay shoreline which has been eroded due to heavy flooding from seawater and drainage from Nor' Easter storms.	No	Moderate	24-36 months	Not started
3	Prepare and stock handouts of what to do in case of a disaster.	No	High	12 months	Not started
4	Prepare an update to the Town's Emergency Operation Plan.	No	High	12-24 months	Not started
<b>Ellendale</b>					
1	Develop an Emergency Transportation Plan for the Town that addresses Route 16 and the railroad crossing through the Town. Identify what other evacuation routes are available if Route 16 is closed due to a railroad problem.	Yes	High	12 months	Delayed due to funding.
2	Evaluate the Town's storm drainage systems to identify problem areas.	No	High	12 months	Not started
3	Continue to educate residents and improve public awareness on being better prepared to face hazards.	No	High	Ongoing	Not started
<b>Fenwick Island</b>					
1	Continue retrofitting drainage system and back water valves.	Yes	High	24 months	Unknown
2	Educate property owners of water runoff-to bulkhead should be the responsibility of the homeowner.	Yes	Moderate	6 months	Unknown
3	Adopt a stormwater management ordinance that regulates private property water runoff.	Yes	Moderate	9 months	Unknown
4	Re-grade street ends at intersections along Bunting Avenue to direct the flow of water towards Coastal Highway.	No	Moderate	36 months	Not started
<b>Frankford</b>					
1	Identify private and county owned ditches, determine drainage patterns and what should be done to reduce flood related impacts.	Yes	High	24-36 months	Delayed
2	Conduct stormwater drainage assessment for the Town.	Yes	High	24-36 months	Delayed
3	Create and distribute material targeted to Frankford residents to include contact numbers and "What to do in the event of ..."	Yes	High	As funds become	Not started

# LOCALLY-SPECIFIC MITIGATION ACTIONS

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	information.			available	
4	Update the county's web page to address emergency contact information for individuals and departments specific to the Town of Frankford.	Yes	Moderate	As funds become available	Not started
<b>Georgetown</b>					
1	Develop an Emergency transportation plan that addresses railroad activity on both sides of the tracks.	Yes	High	12 months	Unknown
2	Develop a Continuity of Government Plan.	Yes	High	12 months	Unknown
3	Establish critical facility emergency back-up power (police and fire stations).	Yes	High	12 months	Unknown
4	Install or provide portable back-up pumps for wastewater treatment facility (bypass pump).	Yes	High	24 months	Unknown
5	Develop a brochure for the public dealing with emergency situations.	Yes	Moderate	9 months	Unknown
6	Develop emergency generator back-up capability for production and distribution of potable water.	Yes	Moderate	12 months	Unknown
7	Develop corrective actions for Route 9, Route 113 and Route 18/404 that tend to bottleneck during the evacuation of residents, college students and transients.	Yes	Low	12 months	Unknown
<b>Greenwood</b>					
1	Dredge Cart Branch ditch.	Yes	High	12 months	Unknown
<b>Henlopen Acres</b>					
1	Develop a marina plan for the Town.	Yes	High	12 months	Delayed
2	Develop a tree maintenance program in coordination with Ocean View.	Yes	Moderate	12 months	Delayed
3	Develop an Emergency Management Plan for the Town.	Yes	Moderate	6 months	In Progress
4	Maintain beach dune system.	Yes	Moderate	Ongoing	Ongoing
<b>Laurel</b>					
1	Create a service road to the wastewater manholes on West Sixth Street.	Yes	High	18 months	Delayed due to funding.
2	Replace bulkhead on the north side of Broad Creek, between Popular Street and the railroad bridge.	Yes	High	24 months	Delayed due to funding.
3	Consider closing the well at 10th & Deshields street and replace waterlines on 10th Street.	Yes	Moderate	Ongoing	In Progress
4	Relocate the Town Hall, Public Works and Police Departments.	Yes	Low	24 months	Delayed due to funding.
<b>Lewes</b>					
1	Review and update evacuation and notification procedures for the City.	Yes	High	12-24 months	Unknown
2	Improve stormwater management throughout the City.	Yes	Moderate	3-5 years	Delayed due to funding.
3	**Increase participation in the National Flood Insurance Program.	Yes	Moderate	1-3 years	Unknown
4	Minimize damages from high wind events.	Yes	Moderate	Ongoing	Unknown

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5	Implement a community outreach program.	Yes	Moderate	Ongoing	Unknown
6	Reduce vulnerability to wildfires.	Yes	Moderate	1-3 years	Unknown
7	**Continue data acquisition and enhancements to the GIS.	Yes	Moderate	1-5 years	Unknown
8	Enlist the services of City service organizations in implementing a disaster preparedness outreach program.	No	High	Ongoing	Not started
9	Facilitate the coordination of response procedures related to events.	No	High	12 months	Not started
10	Develop response plans (including evacuation and sheltering procedures) related to special needs populations and pets. Also include a "Refuge of Last Resort" Plan and a plan to transport City residents to county designated shelters.	No	High	12-24 months	Not started
<b>Millsboro</b>					
1	Improve stormwater drainage within the Town.	Yes	High	24 months	Delayed
2	Conduct a study to identify roads that need to be elevated and culverts that need to be widened.*	Yes	Moderate	24 months	Delayed
3	Retrofit two pump stations.*	Yes	Moderate	24 months	Delayed
4	Retrofit civic center with shutters (Red Cross emergency shelter).	Yes	Low	12 months	Delayed
<b>Millville</b>					
1	Retrofit the Millville Town Hall to include back up power supply. Install a propane powered generator.	Yes	High	24 months	Delayed
2	Conduct an assessment of all culverts to include proper size and design based on current infrastructure and future development.	Yes	Moderate	12 months	Delayed
<b>Milton</b>					
1	Relocate the Town's wastewater treatment plant.	Yes	High	3-5 months	Delayed
2	Promote emergency shelter information.	Yes	Moderate	12 months	Delayed
3	Secure water towers and wellheads by enclosing them with approximately 1,200 feet of fence.	Yes	Moderate	12 months	Delayed
4	**Join the Community Rating System.	Yes	Moderate	12 months	Delayed
5	**Improve GIS mapping capabilities.	Yes	Moderate	12 months	Delayed
6	**Provide dry flood protection techniques for the main well control building on Chandler Street.	No			Not started
7	Conduct a study to identify measures to mitigate flooding on Magnolia Street.	No	High	3-5 years	Delayed
<b>Ocean View</b>					
1	Improve the Town's stormwater management system in some of the older sections of the Town (County Village, County Estates, Meyle Estates, Corner of Daisy and Woodland Avenue, West View Development, and Cottages on Whites Creek). These improvements would include engineering costs to redesign or improve the drainage systems, and the costs to reconstruct and repair swales, drains and culvert piping, and ditches.	Yes	High	Ongoing	In Progress
2	Improve evacuation routes throughout the Town.	Yes	High	12 months	Not started



# LOCALLY-SPECIFIC MITIGATION ACTIONS

## SUSSEX COUNTY, DELAWARE MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

3	Implement public education and awareness activities to advise residents and visitors about hazards, hazardous areas and mitigation techniques they can use to protect about hazards, hazardous areas and mitigation techniques they can use to protect themselves and their property.	Yes	Moderate	Ongoing	In Progress
4	Adopt a tree management ordinance and maintenance program.	Yes	Moderate	Ongoing	In Progress
5	Purchase and install GIS to map hazardous areas and events.	Yes	Low	2-3 years	Delayed due to funding.
6	Adopt a building code ordinance for the Town.	Yes	Low	12-24 months	In Progress
<b>Rehoboth Beach</b>					
1	Build retaining wall along boardwalk to prevent damage to businesses, the boardwalk and our street ends.	Yes	High	When funds become available	Not started
2	Conduct drainage improvements on First Street to increase efficiency by increasing piping capacity.	No	Moderate	When funds become available	Not started
<b>Seaford</b>					
1	Conduct computer modeling of key drainage in and around the City to identify restrictions and/or potential problems. Also identify necessary modification or repairs to improve functionality.	Yes	High	24 months	Started
2	Address street flooding in the Washington and State Street area- identify necessary modification or repairs to improve functionality.	Yes	High	24 months	Started
3	Ensure security of water production sites and storage facilities.	Yes	High	24 months	Delayed
4	Develop agreements with local businesses to assist during emergencies (i.e., provide items such as heavy equipment and other resources).	Yes	Moderate	12 months	Delayed
5	Identify key personnel to manage a crisis.	Yes	Moderate	12 months	Delayed
6	Construct storm drain improvements on Washington Street to increase the drainage capacity of the area and prevent future flooding.	No	Moderate	12 months	Not started
7	Construct stormwater drains on Porter Street to increase the drainage capacity of the area and prevent future flooding.	No	Moderate	12 months	Not started
<b>Selbyville</b>					
1	Replace deteriorating bridge and culverts on Railroad Avenue over major storm water management ditch.	No	High	6 months	Delayed due to funding.
2	Educate residents and improve public awareness on being better prepared to face hazards.	No	High	Ongoing	Not started
<b>Slaughter Beach</b>					
1	Improve stormwater drainage throughout the Town.	Yes	High	24 months	Delayed
2	**Flood-proof water pumping stations.	Yes	High	24 months	Delayed
3	Elevate access and evacuation roads that flood (Route 224 - Slaughter Beach Road approximately 1' - 4' from intersection of Bay Avenue to west boundary of Prime Hook National Wildlife Refuge (± 1 mile).	Yes	High	24 months	Delayed
4	Elevate flood-prone homes.	Yes	High	24 months	Delayed

# LOCALLY-SPECIFIC MITIGATION ACTIONS

## SUSSEX COUNTY, DELAWARE MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

5	Perform regular beach re-nourishment.	Yes	High	Ongoing	Delayed
6	Develop automated telephone warning system.	Yes	High	When funds become available	Not started
7	Restore and/or renourish beach and protective dunes.	Yes	High	When funds become available	Not started
8	**Develop a strategy to improve NFIP enforcement processes to include local permitting processes.	Yes	High	6 months	Delayed
9	Provide building/zoning/flood zone ordinances to public via Web site or other electronic means.	Yes	Moderate	When funds become available	Not started
10	Initiate stormwater management system improvements along ± 1 mile of North Bay	Yes	Low	When funds become available	Not started
<b>South Bethany</b>					
1	Implement regular and emergency beach replenishment or re-nourishment as part of the DNREC/ Corps of Engineers 50-year plan.	Yes	High	Ongoing	In Progress
2	Improve stormwater drainage throughout the Town.	Yes	High	Ongoing	In Progress
3	Continue to identify and promote flood-proofing/elevation solutions to at-risk homes throughout the Town in accordance with current FEMA regulations.	Yes	Moderate	Ongoing	In Progress
4	Upgrade the Town's Building and Zoning Ordinances to reflect NFIP and ISO requirements.	Yes	Moderate	12 months	In Progress
** Actions supporting the NFIP (national flood insurance program strategy)					

Adoption status – 'Yes', if the action was included in the 2004 plan and 'No' if it is an action included after the 2004 Plan was adopted.

Timeline for completion – Not applicable for completed actions.

Priority – High, medium, or low. Not applicable for completed actions.

Status - Delayed, started, in progress, completed, ongoing, or cancelled.

### *Mitigation Action Plan*

**Requirement: §201.6(c)(3)(iii):** [The mitigation strategy section **shall** include] an action plan describing how the actions identified in section (c)(3)(ii) will be prioritized, implemented, and administered by the local jurisdiction. Prioritization **shall** include a special emphasis on the extent to which benefits are maximized according to a cost benefit review of the proposed projects and their associated costs.

# LOCALLY-SPECIFIC MITIGATION ACTIONS

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## SUSSEX COUNTY, DELAWARE MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

A detailed implementation plan for each mitigation action in Table 6.2B is included below. Mitigation actions in Table 6.2A (completed or cancelled actions) do not contain implementation plan. Each action identifies:

- a. **Community Name:** Jurisdiction
- b. **Action Item:** Specific actions that, if accomplished, will reduce vulnerability and risk in the impact area. Actions are linked to the mitigation goals and objectives.
- c. **Hazard(s):** The hazard(s) the action attempts to mitigate.
- d. **Lead Agency/ Department Responsible:** The local agency, department or organization that is best suited to accomplish this action.
- e. **Estimated Cost:** The approximate cost to accomplish the mitigation action.
- f. **Funding Method:** How the cost to complete the action will be funded. For example, funds may be provided from existing operating budgets (General Revenue), a previously established contingency fund (Contingency/Bonds), or a federal or state grant (External Sources).
- g. **Implementation Schedule:** When the action will begin, and when the action is expected to be completed.
- h. **Priority:** 1) High priority—short-term immediate—reducing overall risk to life and property; 2) Moderate priority—an action that should be implemented in the near future due to political or community support or ease of implementation; 3) Low priority—an action that should be implemented over the long term that may depend on the availability of fund

**Requirement §201.6(c)(3)(iv):** For multi-jurisdictional plans, there **must** be identifiable action items specific to the jurisdiction requesting FEMA approval or credit of the plan.

Local Mitigation Action Plans are organized alphabetically by individual jurisdiction. Mitigation actions are categorized by priority (high, moderate or low) within each jurisdiction. Mitigation actions listed within each prioritization category are not rank ordered. The following municipalities submitted local Mitigation Actions:

# LOCALLY-SPECIFIC MITIGATION ACTIONS

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SUSSEX COUNTY, DELAWARE  
MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

## Sussex County Mitigation Action Plans

Jurisdiction	Page Number	Status
Sussex County (unincorporated areas)	13	15 actions submitted
Bethany Beach	19	4 actions submitted
Bethel	21	7 actions submitted
Blades	24	2 actions submitted
Bridgeville	25	2 actions submitted
Dagsboro	26	1 action submitted
Delmar	27	2actions submitted
Dewey Beach	28	4actions submitted
Ellendale	30	3 actions submitted
Fenwick Island	32	4- actions submitted
Frankford	34	4 actions submitted
Georgetown	36	7 actions submitted
Greenwood	39	1 action submitted
Henlopen Acres	40	4 actions submitted
Laurel	42	4 actions submitted
Lewes	44	10 actions submitted
Millsboro	49	4 actions submitted
Millville	51	2 actions submitted
Milton	52	7 actions submitted
Ocean View	55	6 actions submitted
Rehoboth Beach	58	2 actions submitted
Seaford	59	7 actions submitted
Selbyville	62	2 actions submitted
Slaughter Beach	63	10 actions submitted
South Bethany	67	4 actions submitted

# LOCALLY-SPECIFIC MITIGATION ACTIONS

SUSSEX COUNTY, DELAWARE  
MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

## Sussex County

		HAZARD RISK		
		Low	Moderate	High
OVERALL CAPABILITY	High			
	Moderate			X
	Limited			

**Note:** Sussex County has developed a Flood Mitigation Plan (June 2000) for the unincorporated areas of the County. The Flood Mitigation Plan includes a flood-specific mitigation strategy that should be use in conjunction with the actions identified in this Plan.

Sussex County Mitigation Action 1	Work with DeIDOT to improve all emergency access routes.
Category:	Emergency Services
Hazard(s) Addressed:	Hurricane, Flood, Winter Storm, Human-caused
Priority (High, Moderate, Low):	High
Estimated Cost:	Unknown
Potential Funding Sources:	Delaware Department of Transportation, 406 Public Assistance (following federally declared disaster), Pre-Disaster Mitigation Grant Program
Lead Agency/Department Responsible:	DeIDOT, Sussex County Emergency Operations Center
Implementation Schedule:	3-5 years

Sussex County Mitigation Action 2	Improve the County's Community Rating System rating. Review and update community plans and ordinances and incorporate update information into the CRS update.
Category:	
Hazard(s) Addressed:	Flood, Hurricane, other natural hazards
Priority (High, Moderate, Low):	High
Estimated Cost:	Staff time and resources
Potential Funding Sources:	NA
Lead Agency/Department Responsible:	Planning and Zoning
Implementation Schedule:	24 months

# LOCALLY-SPECIFIC MITIGATION ACTIONS

## SUSSEX COUNTY, DELAWARE MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

<b>Sussex County Mitigation Action 3</b>	<b>Encourage residents to elevate manufactured housing located on the coast to above the base flood elevation.</b>
Category:	Prevention
Hazard(s) Addressed:	Flood, Hurricane
Priority (High, Moderate, Low):	High
Estimated Cost:	Staff time and resources
Potential Funding Sources:	NA
Lead Agency/Department Responsible:	Planning and Zoning
Implementation Schedule:	Ongoing

<b>Sussex County Mitigation Action 4</b>	<b>Work with homeowners to identify ways to elevate flood-prone structures.</b>
Category:	Property Protection
Hazard(s) Addressed:	Flood
Priority (High, Moderate, Low):	High
Estimated Cost:	Unknown
Potential Funding Sources:	Pre-Disaster Mitigation, Flood Mitigation Assistance Program, Hazard Mitigation Grant Program, Community Development Block Grant Program, Housing and Urban Development – Disaster Recovery Initiative, National Flood Insurance Program – Increased Cost of Compliance
Lead Agency/Department Responsible:	Planning and Zoning, Environmental Services
Implementation Schedule:	Ongoing

<b>Sussex County Mitigation Action 5</b>	<b>Improve educational awareness through better notifications, training, and properly marked evacuation routes</b>
Category:	Public Information and Awareness
Hazard(s) Addressed:	All Hazards
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	\$20,000
Potential Funding Sources:	FEMA – Hurricane Local Grant Program, Educational materials available through FEMA and Red Cross, Delaware Department of Transportation (signage), training (DEMA), FEMA – 1 <sup>st</sup> Responder Counter Terrorism Training Assistance, FEMA – Assistance to Firefighter Grant, Department of Justice – State and Local Domestic Preparedness Technical Assistance
Lead Agency/Department Responsible:	Sussex County EOC, Public Information
Implementation Schedule:	Ongoing

# LOCALLY-SPECIFIC MITIGATION ACTIONS

SUSSEX COUNTY, DELAWARE  
MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

<b>Sussex County Mitigation Action 6</b>	<b>Standardize Response Levels Plan and rewrite Emergency Operations Plan.</b>
Category:	Emergency Services
Hazard(s) Addressed:	Hurricane, Flood, Human-caused
Priority (High, Moderate, Low):	High
Estimated Cost:	Unknown
Potential Funding Sources:	DHS grants
Lead Agency/Department Responsible:	Sussex County EOC
Implementation Schedule:	24 months

<b>Sussex County Mitigation Action 7</b>	<b>Construct four-lane East/West emergency evacuation route to Maryland toll road (Routes 918 and 404).</b>
Category:	Emergency Services, Structural Project
Hazard(s) Addressed:	Hurricane, Flood, Human-caused
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	To be determined
Potential Funding Sources:	DelDOT
Lead Agency/Department Responsible:	DelDOT
Implementation Schedule:	36 months

<b>Sussex County Mitigation Action 8</b>	<b>Distribute disaster preparedness and hazard mitigation-related information using brochures and website link.</b>
Category:	Public Information and Awareness
Hazard(s) Addressed:	All Hazards
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	\$10,000
Potential Funding Sources:	Hazard Mitigation Grant Program, FEMA and Red Cross materials free of charge, FEMA - Hurricane Local Grant Program,
Lead Agency/Department Responsible:	Sussex County Library 1
Implementation Schedule:	Ongoing

# LOCALLY-SPECIFIC MITIGATION ACTIONS

## SUSSEX COUNTY, DELAWARE MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

<b>Sussex County Mitigation Action 9</b>	<b>Work with DeIDOT to install storm drain of culvert on 1100 Block of South Bayshore Drive in Broadkill Beach.</b>
Category:	Structural Project
Hazard(s) Addressed:	Flood
Priority (High, Moderate, Low):	High
Estimated Cost:	Unknown
Potential Funding Sources:	US Army Corps of Engineers – Floodplain Management Services, 406 Public Assistance (following federally declared disaster), Natural Resources Conservation Service – Emergency Watershed Protection Program, Natural Resources Conservation Service – Watershed Protection and Flood Prevention Program
Lead Agency/Department Responsible:	DeIDOT, DNREC, Environmental Services
Implementation Schedule:	24 months

<b>Sussex County Mitigation Action 10</b>	<b>Work with DNREC and DeIDOT to endorse Federally funded restoration projects to restore portions of the Sussex County coastline that are experiencing significant coastal erosion, both from rising sea levels and coastal storms.</b>
Category:	Natural resources protection
Hazard(s) Addressed:	Flood, erosion
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	To be determined
Potential Funding Sources:	DeIDOT/DNREC
Lead Agency/Department Responsible:	DeIDOT, DNREC, Environmental Services
Implementation Schedule:	Ongoing

<b>Sussex County Mitigation Action 11</b>	<b>Work with DNREC to explore ways to finance beach restoration projects in private communities that are experiencing significant coastal erosion, both from rising sea levels and coastal storms.</b>
Category:	Natural resources protection
Hazard(s) Addressed:	Flood, erosion
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	To be determined
Potential Funding Sources:	DNREC
Lead Agency/Department Responsible:	DNREC, Environmental Services
Implementation Schedule:	24 months



# LOCALLY-SPECIFIC MITIGATION ACTIONS

## SUSSEX COUNTY, DELAWARE MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

<b>Sussex County Mitigation Action 12</b>	<b>Develop a close working relationship between the County EOC and public utility companies. Identify a staff person from the utility companies to serve as a liaison to the County EOC for the inclusion of utility issues with emergency planning.</b>
Category:	Emergency Services
Hazard(s) Addressed:	All hazards
Priority (High, Moderate, Low):	High
Estimated Cost:	No cost
Potential Funding Sources:	No funding required
Lead Agency/Department Responsible:	Sussex County EOC, Utility Engineering, Utility Planning
Implementation Schedule:	9 months

<b>Sussex County Mitigation Action 13</b>	<b>Work closely with unincorporated places, major subdivisions, beach communities like Broadkill and Prime Hook, and manufactured home parks to more accurately allocate resources and plan for hazard mitigation, evacuation, etc. and make them more inclusive in the planning process.</b>
Category:	Emergency Services
Hazard(s) Addressed:	All hazards
Priority (High, Moderate, Low):	High
Estimated Cost:	Unknown
Potential Funding Sources:	No funding required
Lead Agency/Department Responsible:	Sussex County EOC, Public Information
Implementation Schedule:	Ongoing

<b>Sussex County Mitigation Action 14</b>	<b>Conduct a study to identify stormwater management systems that need to be retrofitted and channels that need to be improved in order to reduce flooding throughout the County.</b>
Category:	Structural Project
Hazard(s) Addressed:	Flood
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	\$50,000-\$60,000
Potential Funding Sources:	DNREC
Lead Agency/Department Responsible:	DNREC, Environmental Services, Engineering
Implementation Schedule:	24 months

# LOCALLY-SPECIFIC MITIGATION ACTIONS

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SUSSEX COUNTY, DELAWARE  
MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

Sussex County Mitigation Action 15	Work with DeIDOT to identify possible elevation alternatives for the rebuilding of SR 38 (Prime Hook Road).
Category:	Structural Project
Hazard(s) Addressed:	Flood
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	To be determined
Potential Funding Sources:	DeIDOT
Lead Agency/Department Responsible:	DeIDOT
Implementation Schedule:	24 months

# LOCALLY-SPECIFIC MITIGATION ACTIONS

SUSSEX COUNTY, DELAWARE  
MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

## Bethany Beach

		HAZARD RISK		
		Low	Moderate	High
OVERALL CAPABILITY	High			
	Moderate			X
	Limited			

**Note:** Bethany Beach has developed a Flood Mitigation Plan (March 2001) that includes a flood-specific mitigation strategy that should be used in conjunction with the actions identified in this Plan.

Bethany Beach Mitigation Action 1	Improve existing drainage system throughout the Town, particularly east of Route 1 and also include a plan maintenance schedule.
Category:	Prevention
Hazard(s) Addressed:	Flood
Priority (High, Moderate, Low):	High
Estimated Cost:	\$2,000,000
Potential Funding Sources:	Hazard Mitigation Grant Program, US Army Corps of Engineers – Floodplain Management Services, 406 Public Assistance (following federally declared disaster), Natural Resources Conservation Service – Emergency Watershed Protection Program, Natural Resources Conservation Service – Watershed Protection and Flood Prevention Program
Lead Agency/Department Responsible:	Public Works
Implementation Schedule:	24 months

Bethany Beach Mitigation Action 2	Consider purchasing an inflatable dam for Loop and Assawoman Canal to protect against incoming tide waters.
Category:	Emergency Services
Hazard(s) Addressed:	Flood
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	Unknown
Potential Funding Sources:	Local funds, Pre-Disaster Mitigation Grant Program, SBA – Pre-Disaster Mitigation Loans, Hazard Mitigation Grant Program
Lead Agency/Department Responsible:	Town of Bethany Beach
Implementation Schedule:	12 months

# LOCALLY-SPECIFIC MITIGATION ACTIONS

SUSSEX COUNTY, DELAWARE  
MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

<b>Bethany Beach Mitigation Action 3</b>	<b>Continue to educate residents and improve public awareness on being better prepared to face hazards.</b>
Category:	Public Information and Awareness
Hazard(s) Addressed:	Flood
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	\$10,000
Potential Funding Sources:	FEMA – Hurricane Local Grant Program, Hazard Mitigation Grant Program, existing FEMA and Red Cross materials
Lead Agency/Department Responsible:	Town of Bethany Beach
Implementation Schedule:	Ongoing

<b>Bethany Beach Mitigation Action 4</b>	<b>Create 2 new outfalls leading from the large ditch that runs from Route 26 behind Lake Bethany to the marsh and install flap gates. Conduct Phase 2 of Bethany West drainage improvements. Replace and upgrade existing stormwater system between Colins Street and Tudor Court along Halfmoon Drive including Tudor Court, Sandstone Court, and Pebble Court. Conduct Phase 3 of Bethany West drainage improvements. Replace and upgrade existing stormwater facilities at West Side Development, enlarge outfall, replace driveway culverts, replace old pipe systems, regrade ditches.</b>
Category:	Structural Project
Hazard(s) Addressed:	Flood
Priority (High, Moderate, Low):	High
Estimated Cost:	To be determined
Potential Funding Sources:	Local funds, Pre-Disaster Mitigation Grant Program, SBA – Pre-Disaster Mitigation Loans, Hazard Mitigation Grant Program
Lead Agency/Department Responsible:	County Public Works, Engineering, Environmental Services departments, Town of Bethany Beach
Implementation Schedule:	3-5 years

# LOCALLY-SPECIFIC MITIGATION ACTIONS

SUSSEX COUNTY, DELAWARE  
MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

## Bethel

		HAZARD RISK		
		Low	Moderate	High
OVERALL CAPABILITY	High			
	Moderate			
	Limited	X		

Bethel Mitigation Action 1	Educate the public regarding preparedness and protection measures.
Category:	Public Information and Awareness
Hazard(s) Addressed:	All Hazards
Priority (High, Moderate, Low):	High
Estimated Cost:	Staff time and resources
Potential Funding Sources:	Materials about preparedness and protective measures are available free of charge from FEMA and the Red Cross, Hazard Mitigation Grant Program
Lead Agency/Department Responsible:	Bethel Town Council
Implementation Schedule:	Ongoing

Bethel Mitigation Action 2	Review County Office of Emergency Services plans regarding protective measures and evacuation procedures for hazardous materials incidents and share this information with citizens. Information should include ways to elevate and/or harden oil and gas storage tanks to avoid spills and contamination of surrounding areas.
Category:	Public Information and Awareness, Emergency Services
Hazard(s) Addressed:	Hazardous Materials
Priority (High, Moderate, Low):	High
Estimated Cost:	Staff time and resources
Potential Funding Sources:	Partnership with Sussex County Health Department and Sussex County OES, FEMA – Hazardous Materials Assistance Program, FEMA - Emergency Management Performance Grant
Lead Agency/Department Responsible:	Bethel Town Council
Implementation Schedule:	12 months

# LOCALLY-SPECIFIC MITIGATION ACTIONS

## SUSSEX COUNTY, DELAWARE MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

<b>Bethel Mitigation Action 3</b>	<b>Educate the public on the necessity of periodic well testing, especially during periods of drought.</b>
Category:	Public Information and Awareness
Hazard(s) Addressed:	Disease/Epidemics, Drought
Priority (High, Moderate, Low):	High
Estimated Cost:	Staff time and resources
Potential Funding Sources:	Partnership with Sussex County Health Department and Sussex County OES.
Lead Agency/Department Responsible:	Bethel Town Council
Implementation Schedule:	12 months

<b>Bethel Mitigation Action 4</b>	<b>Educate the public regarding special needs populations in the event of winter storms.</b>
Category:	Public Information and Awareness
Hazard(s) Addressed:	Winter Storms
Priority (High, Moderate, Low):	High
Estimated Cost:	Staff time and resources
Potential Funding Sources:	Materials about special needs populations are available free of charge from FEMA and the Red Cross, FEMA – Emergency Management Performance Grant
Lead Agency/Department Responsible:	Bethel Town Council
Implementation Schedule:	12 months

<b>Bethel Mitigation Action 5</b>	<b>Identify shelters and notify the public about their location.</b>
Category:	Public Information and Awareness
Hazard(s) Addressed:	All Hazards
Priority (High, Moderate, Low):	High
Estimated Cost:	Staff time and resources
Potential Funding Sources:	Partnership with Sussex County Health Department and Sussex County OES, FEMA – Hurricane Local Government Grant Program, Red Cross provides shelter guidelines free of charge
Lead Agency/Department Responsible:	Bethel Town Council
Implementation Schedule:	12 months

# LOCALLY-SPECIFIC MITIGATION ACTIONS

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SUSSEX COUNTY, DELAWARE  
MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

<b>Bethel Mitigation Action 6</b>	<b>Educate the public concerning sheltering-in-place should a terrorist attack occur.</b>
Category:	Public Information and Awareness
Hazard(s) Addressed:	Terrorism (chemical agents)
Priority (High, Moderate, Low):	High
Estimated Cost:	Staff time and resources, \$5,000
Potential Funding Sources:	Partnership with Sussex County Health Department and Sussex County OES, Materials regarding shelter-in-place available from FEMA free of charge, Department of Justice – State Homeland Security Program
Lead Agency/Department Responsible:	Bethel Town Council
Implementation Schedule:	24 months

<b>Bethel Mitigation Action 7</b>	<b>Identify historic structures and develop mitigation strategies to protect any at-risk properties.</b>
Category:	Prevention
Hazard(s) Addressed:	All Hazards
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	\$20,000, staff time and resources
Potential Funding Sources:	Pre-Disaster Mitigation, Hazard Mitigation Grant Program, Partnership with Sussex County Health Department and Sussex County OES, Historic Preservation Organizations, Flood Mitigation Assistance Program
Lead Agency/Department Responsible:	Bethel Town Council
Implementation Schedule:	24 months

# LOCALLY-SPECIFIC MITIGATION ACTIONS

SUSSEX COUNTY, DELAWARE  
MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

## Blades

		HAZARD RISK		
		Low	Moderate	High
OVERALL CAPABILITY	High			
	Moderate			
	Limited		X	

Blades Mitigation Action 1	Fix stormwater drainage problems with existing underground pipes and outfall areas to help prevent future flooding.
Category:	Prevention
Hazard(s) Addressed:	Flood
Priority (High, Moderate, Low):	High
Estimated Cost:	Unknown
Potential Funding Sources:	Hazard Mitigation Grant Program, US Army Corps of Engineers – Floodplain Management Services, 406 Public Assistance (following federally declared disaster), Natural Resources Conservation Service – Emergency Watershed Protection Program, Natural Resources Conservation Service – Watershed Protection and Flood Prevention Program
Lead Agency/Department Responsible:	Delaware Department of Transportation
Implementation Schedule:	As soon as feasible or as funding becomes available

Blades Mitigation Action 2	Install new storm drains in strategic areas to allow removal of standing water during storms.
Category:	Prevention
Hazard(s) Addressed:	Flood
Priority (High, Moderate, Low):	High
Estimated Cost:	Unknown
Potential Funding Sources:	Hazard Mitigation Grant Program, US Army Corps of Engineers – Floodplain Management Services, 406 Public Assistance (following federally declared disaster), Natural Resources Conservation Service – Emergency Watershed Protection Program, Natural Resources Conservation Service – Watershed Protection and Flood Prevention Program
Lead Agency/Department Responsible:	Delaware Department of Transportation
Implementation Schedule:	As soon as feasible or as funding becomes available



# LOCALLY-SPECIFIC MITIGATION ACTIONS

SUSSEX COUNTY, DELAWARE  
MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

## Bridgeville

		HAZARD RISK		
		Low	Moderate	High
OVERALL CAPABILITY	High			
	Moderate			
	Limited		X	

Bridgeville Mitigation Action 1	Purchase mobile surveillance cameras for town use - protection for possible terrorist threats, drug activity, burglaries, etc.
Category:	Emergency Services
Hazard(s) Addressed:	Human caused hazards
Priority (High, Moderate, Low):	High
Estimated Cost:	To be determined
Potential Funding Sources:	
Lead Agency/Department Responsible:	Town of Bridgeville
Implementation Schedule:	12 months

Bridgeville Mitigation Action 2	Relocate the Police Department and Town offices to one building to increase efficiency.
Category:	Emergency Services
Hazard(s) Addressed:	All hazards
Priority (High, Moderate, Low):	High
Estimated Cost:	To be determined
Potential Funding Sources:	Local funds
Lead Agency/Department Responsible:	Town of Bridgeville
Implementation Schedule:	3-5 years

# LOCALLY-SPECIFIC MITIGATION ACTIONS

SUSSEX COUNTY, DELAWARE  
MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

## Dagsboro

		HAZARD RISK		
		Low	Moderate	High
OVERALL CAPABILITY	High			
	Moderate			
	Limited		X	

<b>Dagsboro Mitigation Action 1</b>	<b>In coordination with Sussex County, fully participate in public outreach programs designed to promote hazard education and awareness for residents and businesses.</b>
Category:	Public Information and Awareness
Hazard(s) Addressed:	All Hazards
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	\$10,000
Potential Funding Sources:	Local government, business or non-profit organizations. Publications free of charge from FEMA (1-800-480-2520), Hazard Mitigation Grant Program, Red Cross provides preparedness and prevention brochures free of charge
Lead Agency/Department Responsible:	Town of Dagsboro
Implementation Schedule:	Ongoing

# LOCALLY-SPECIFIC MITIGATION ACTIONS

SUSSEX COUNTY, DELAWARE  
MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

## Delmar

		HAZARD RISK		
		Low	Moderate	High
OVERALL CAPABILITY	High			
	Moderate			
	Limited		X	

Delmar Mitigation Action 1	Conduct a vulnerability assessment of waste water and stormwater management systems throughout the Town.
Category:	Structural Project
Hazard(s) Addressed:	Flood
Priority (High, Moderate, Low):	High
Estimated Cost:	\$50,000
Potential Funding Sources:	FEMA – Hazard Mitigation Grant Program, Pre-Disaster Mitigation, USDA - Water and Waste Disposal Systems for Rural Communities
Lead Agency/Department Responsible:	Delmar/DELDOT/DNREC
Implementation Schedule:	3 – 5 years

Delmar Mitigation Action 2	Develop an Emergency Operations Plan to include identifying additional local hazards.
Category:	Prevention
Hazard(s) Addressed:	All Hazards
Priority (High, Moderate, Low):	High
Estimated Cost:	\$20,000
Potential Funding Sources:	Department of Justice – State and Local Preparedness Technical Assistance, Department of Justice - State and Local Domestic Preparedness Training Program, Department of Justice - State and Local Domestic Preparedness Exercise Support, FEMA – Emergency Management Performance Grants, FEMA – All Hazards Emergency Operational Planning
Lead Agency/Department Responsible:	Town of Delmar
Implementation Schedule:	12-24 months

# LOCALLY-SPECIFIC MITIGATION ACTIONS

SUSSEX COUNTY, DELAWARE  
MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

## Dewey Beach

		HAZARD RISK		
		Low	Moderate	High
OVERALL CAPABILITY	High			
	Moderate			X
	Limited			

**Note:** Dewey Beach has developed a Flood Mitigation Plan (March 2001) that includes a flood-specific mitigation strategy that should be used in conjunction with the actions identified in this Plan.

Dewey Beach Mitigation Action 1	Develop a Disaster Warning System to notify the community of an impending disaster.
Category:	Emergency Services
Hazard(s) Addressed:	All hazards
Priority (High, Moderate, Low):	High
Estimated Cost:	Unknown
Potential Funding Sources:	Department of Homeland Security funds
Lead Agency/Department Responsible:	Town of Dewey Beach
Implementation Schedule:	12-24 months

Dewey Beach Mitigation Action 2	Consider reconstructing the Rehoboth Bay Shoreline which has been affected by heavy flooding from seawater and drainage from Nor'easter storms.
Category:	Natural Resources Protection
Hazard(s) Addressed:	All hazards
Priority (High, Moderate, Low):	High
Estimated Cost:	Unknown
Potential Funding Sources:	DNREC
Lead Agency/Department Responsible:	Town of Dewey Beach
Implementation Schedule:	24-36 months

# LOCALLY-SPECIFIC MITIGATION ACTIONS

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SUSSEX COUNTY, DELAWARE  
MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

<b>Dewey Beach Mitigation Action 3</b>		<b>Prepare and stock handouts on what to do in case of a disaster.</b>
Category:	Public Information	
Hazard(s) Addressed:	All hazards	
Priority (High, Moderate, Low):	High	
Estimated Cost:	No funding necessary	
Potential Funding Sources:	Local government, business or non-profit organizations. Publications free of charge from FEMA (1-800-480-2520), Hazard Mitigation Grant Program, Red Cross provides preparedness and prevention brochures free of charge	
Lead Agency/Department Responsible:	Town of Dewey Beach	
Implementation Schedule:	12 months	

<b>Dewey Beach Mitigation Action 4</b>		<b>Prepare an update to the Town's Emergency Operations Plan.</b>
Category:	Emergency Services	
Hazard(s) Addressed:	All hazards	
Priority (High, Moderate, Low):	High	
Estimated Cost:	Unknown	
Potential Funding Sources:	Department of Homeland Security funds	
Lead Agency/Department Responsible:	Town of Dewey Beach	
Implementation Schedule:	12-24 months	

# LOCALLY-SPECIFIC MITIGATION ACTIONS

## SUSSEX COUNTY, DELAWARE MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

### Ellendale

		HAZARD RISK		
		Low	Moderate	High
OVERALL CAPABILITY	High			
	Moderate			
	Limited		X	

Ellendale Mitigation Action 1	Develop an Emergency Transportation Plan for the Town of Ellendale specifically addressing Route 16 and the railroad crossing through the Town. Identify what other evacuation routes are available if Route 16 is closed due to a railroad problem.
Category:	Emergency Services
Hazard(s) Addressed:	All Hazards
Priority (High, Moderate, Low):	High
Estimated Cost:	\$20,000
Potential Funding Sources:	Delaware Department of Transportation, Department of Justice – State and Local Preparedness Technical Assistance, Department of Justice - State and Local Domestic Preparedness Training Program, Department of Justice - State and Local Domestic Preparedness Exercise Support, FEMA – Emergency Management Performance Grants, FEMA – All Hazards Emergency Operational Planning
Lead Agency/Department Responsible:	DelDOT
Implementation Schedule:	12 months

Ellendale Mitigation Action 2	Evaluate the Town's storm drainage systems to identify problem areas.
Category:	Structural projects
Hazard(s) Addressed:	Flood
Priority (High, Moderate, Low):	High
Estimated Cost:	\$30,000-\$40,000
Potential Funding Sources:	DNREC
Lead Agency/Department Responsible:	DNREC, Town of Ellendale
Implementation Schedule:	12 months

# LOCALLY-SPECIFIC MITIGATION ACTIONS

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SUSSEX COUNTY, DELAWARE  
MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

<b>Ellendale Mitigation Action 3</b>	<b>Continue to educate residents and improve public awareness on being better prepared to face hazards.</b>
Category:	Public Information
Hazard(s) Addressed:	All hazards
Priority (High, Moderate, Low):	High
Estimated Cost:	Nominal cost
Potential Funding Sources:	Local funds
Lead Agency/Department Responsible:	Town of Ellendale
Implementation Schedule:	Ongoing

# LOCALLY-SPECIFIC MITIGATION ACTIONS

## SUSSEX COUNTY, DELAWARE MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

### Fenwick Island

		HAZARD RISK		
		Low	Moderate	High
OVERALL CAPABILITY	High			
	Moderate			X
	Limited			

Fenwick Island Mitigation Action 1	Continue to retrofit the drainage system and back water valves.
Category:	Prevention
Hazard(s) Addressed:	Flood
Priority (High, Moderate, Low):	High
Estimated Cost:	Unknown
Potential Funding Sources:	Hazard Mitigation Grant Program, US Army Corps of Engineers – Floodplain Management Services, 406 Public Assistance (following federally declared disaster), Natural Resources Conservation Service – Emergency Watershed Protection Program, Natural Resources Conservation Service – Watershed Protection and Flood Prevention Program
Lead Agency/Department Responsible:	Public Works Department
Implementation Schedule:	24 months

Fenwick Island Mitigation Action 2	Educate property owners on water runoff to the bulkhead vs. the street.
Category:	Public Information and Awareness
Hazard(s) Addressed:	Flood
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	Staff time and resources
Potential Funding Sources:	Local staff, FEMA - Community Assistance Program
Lead Agency/Department Responsible:	Public Works Department
Implementation Schedule:	6 months



# LOCALLY-SPECIFIC MITIGATION ACTIONS

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SUSSEX COUNTY, DELAWARE  
MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

<b>Fenwick Island Mitigation Action 3</b>	<b>Adopt a stormwater management ordinance that addresses water runoff from private properties.</b>
Category:	Prevention
Hazard(s) Addressed:	Flood
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	Staff time and resources
Potential Funding Sources:	Local staff, FEMA - Community Assistance Program
Lead Agency/Department Responsible:	Public Works Department
Implementation Schedule:	9 months

<b>Fenwick Island Mitigation Action 4</b>	<b>Regrade street ends at intersections along Bunting Avenue to direct the flow of water towards Coastal Highway.</b>
Category:	Property Protection
Hazard(s) Addressed:	Flood
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	To be determined
Potential Funding Sources:	DeIDOT
Lead Agency/Department Responsible:	DeIDOT
Implementation Schedule:	36 months

# LOCALLY-SPECIFIC MITIGATION ACTIONS

SUSSEX COUNTY, DELAWARE  
MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

## Frankford

		HAZARD RISK		
		Low	Moderate	High
OVERALL CAPABILITY	High			
	Moderate			
	Limited		X	

Frankford Mitigation Action 1	Identify private and county owned ditches, determine drainage patterns, and identify measures to reduce flood related impacts.
Category:	Property protection/structural project
Hazard(s) Addressed:	Flood
Priority (High, Moderate, Low):	High
Estimated Cost:	Unknown
Potential Funding Sources:	Town budget, 406 Public Assistance (following federally declared disaster), NRCS - Watershed Surveys and Planning, ACE - Snagging and Clearing for Flood Control, Flood Plain Management Services
Lead Agency/Department Responsible:	DNREC/DELDOT
Implementation Schedule:	2-3 years

Frankford Mitigation Action 2	Conduct a stormwater drainage assessment for the Town.
Category:	Property protection/structural project
Hazard(s) Addressed:	Flood
Priority (High, Moderate, Low):	High
Estimated Cost:	Unknown
Potential Funding Sources:	Town budget, 406 Public Assistance (following federally declared disaster), NRCS - Watershed Surveys and Planning, ACE - Snagging and Clearing for Flood Control, Flood Plain Management Services
Lead Agency/Department Responsible:	DELDOT
Implementation Schedule:	2-3 years

# LOCALLY-SPECIFIC MITIGATION ACTIONS

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SUSSEX COUNTY, DELAWARE  
MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

<b>Frankford Mitigation Action 3</b>	<b>Create and distribute material targeted to Frankford residents to include contact numbers and information on what to do in the event of a disaster.</b>
Category:	Prevention
Hazard(s) Addressed:	All Hazards
Priority (High, Moderate, Low):	High
Estimated Cost:	\$2,000
Potential Funding Sources:	Town budget, FEMA – Citizen Corps, Community Emergency Response Team, State and Local Domestic Preparedness Technical Assistance
Lead Agency/Department Responsible:	Frankford
Implementation Schedule:	As funding becomes available

<b>Frankford Mitigation Action 4</b>	<b>Update the county web page to address emergency contact information for individuals and departments specific to the Town of Frankford.</b>
Category:	Public Awareness and Education
Hazard(s) Addressed:	All Hazards
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	Staff time and resources
Potential Funding Sources:	Town budget
Lead Agency/Department Responsible:	Frankford
Implementation Schedule:	As funding becomes available

# LOCALLY-SPECIFIC MITIGATION ACTIONS

SUSSEX COUNTY, DELAWARE  
MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

## Georgetown

		HAZARD RISK		
		Low	Moderate	High
OVERALL CAPABILITY	High			
	Moderate			
	Limited		X	

Georgetown Mitigation Action 1	Develop an emergency transportation plan that specifically addresses railroad activity on both sides of the tracks.
Category:	Emergency Services
Hazard(s) Addressed:	All Hazards
Priority (High, Moderate, Low):	High
Estimated Cost:	\$20,000
Potential Funding Sources:	FEMA - All Hazards Emergency Operational Planning, Norfolk Southern Railroad, FEMA – Hazardous Materials Assistance Program, Department of Justice – State and Local Domestic Preparedness Technical Assistance, Department of Transportation – Grants-in-Aid for Railroad Safety, Department of Justice – State and Local Domestic Preparedness Technical Assistance
Lead Agency/Department Responsible:	DeIDOT
Implementation Schedule:	12 months

# LOCALLY-SPECIFIC MITIGATION ACTIONS

SUSSEX COUNTY, DELAWARE  
MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

<b>Georgetown Mitigation Action 2</b>	<b>Develop a Continuity of Government Plan.</b>
Category:	Emergency Services
Hazard(s) Addressed:	All Hazards
Priority (High, Moderate, Low):	High
Estimated Cost:	\$20,000
Potential Funding Sources:	Town funds, Department of Justice – State and Local Domestic Preparedness Technical Assistance, Delaware Department of Transportation (Transportation Incident Event Management Plan), FEMA –All Hazards Emergency Operational Planning, FEMA – Emergency Management Performance Grants, Department of Justice – State and Local Domestic Preparedness Technical Assistance
Lead Agency/Department Responsible:	State, County, and Town of Georgetown
Implementation Schedule:	12 months

<b>Georgetown Mitigation Action 3</b>	<b>Establish critical facility emergency back-up power (police and fire stations).</b>
Category:	Emergency Services
Hazard(s) Addressed:	All Hazards
Priority (High, Moderate, Low):	High
Estimated Cost:	\$50,000
Potential Funding Sources:	Hazard Mitigation Grant Program (generator quick-connects), FEMA – Assistance to Fire Fighters Grant, OJP - State Domestic Preparedness Equipment Support Program
Lead Agency/Department Responsible:	Town of Georgetown
Implementation Schedule:	12 months

<b>Georgetown Mitigation Action 4</b>	<b>Install or provide portable back-up pumps for wastewater treatment facility (bypass pump).</b>
Category:	Emergency Services
Hazard(s) Addressed:	Flood
Priority (High, Moderate, Low):	High
Estimated Cost:	Unknown
Potential Funding Sources:	USDA - Water and Waste Disposal Systems for Rural Communities, Water and Waste Disposal Loans and Grants (Section 306C), FEMA – Hazard Mitigation Grant
Lead Agency/Department Responsible:	Town of Georgetown
Implementation Schedule:	24 months

# LOCALLY-SPECIFIC MITIGATION ACTIONS

SUSSEX COUNTY, DELAWARE  
MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

<b>Georgetown Mitigation Action 5</b>	<b>Create and distribute material to include contact numbers and information on what to do in the event of a disaster.</b>
Category:	Public Awareness and Education
Hazard(s) Addressed:	All Hazards
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	\$10,000
Potential Funding Sources:	FEMA – Citizen Corps, Community Emergency Response Team, Hazard Mitigation Grant Program, FEMA and Red Cross provide preparedness and prevention brochures free of charge
Lead Agency/Department Responsible:	State or County Emergency Management
Implementation Schedule:	9 months

<b>Georgetown Mitigation Action 6</b>	<b>Develop an emergency generator back-up capability for the production and distribution of potable water.</b>
Category:	Emergency Services
Hazard(s) Addressed:	All Hazards
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	\$25,000
Potential Funding Sources:	Hazard Mitigation Grant Program (generator quick-connects), FEMA – Assistance to Fire Fighters Grant, OJP - State Domestic Preparedness Equipment Support Program, EPA - Water Protection Grants to the States
Lead Agency/Department Responsible:	Town of Georgetown
Implementation Schedule:	12 months

<b>Georgetown Mitigation Action 7</b>	<b>Develop corrective actions for Route 9, Route 113 and Route 18/404 that tend to bottleneck during the evacuation of residents, college students, and transients.</b>
Category:	Emergency Services
Hazard(s) Addressed:	All Hazards
Priority (High, Moderate, Low):	Low
Estimated Cost:	Unknown
Potential Funding Sources:	FEMA – All Hazards Emergency Operational Planning, FEMA provides evacuation guidance materials free of charge, Pre-Disaster Mitigation Grant Program, FEMA – Emergency Management Performance Grant, Flood Mitigation Assistance Program, Hazard Mitigation Grant Program, USDA – Environmental Quality Incentives Program
Lead Agency/Department Responsible:	DELDOT
Implementation Schedule:	12 months

# LOCALLY-SPECIFIC MITIGATION ACTIONS

SUSSEX COUNTY, DELAWARE  
MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

## Greenwood

		HAZARD RISK		
		Low	Moderate	High
OVERALL CAPABILITY	High			
	Moderate			
	Limited		X	

Greenwood Mitigation Action 1	Dredge Cart Branch ditch.
Category:	Prevention
Hazard(s) Addressed:	Flood
Priority (High, Moderate, Low):	High
Estimated Cost:	\$50,000 - \$75,000
Potential Funding Sources:	USDA Natural Resources Conservation Service – Watershed Protection and Flood Prevention Program, US Army Corps of Engineers – Clearing and Snagging Projects, US Army Corps of Engineers – Small Flood Control Projects, USDA Natural Resources Conservation Service – Emergency Watershed Protection
Lead Agency/Department Responsible:	Division of Soil and Water
Implementation Schedule:	12 months

# LOCALLY-SPECIFIC MITIGATION ACTIONS

SUSSEX COUNTY, DELAWARE  
MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

## Henlopen Acres

		HAZARD RISK		
		Low	Moderate	High
OVERALL CAPABILITY	High			
	Moderate			X
	Limited			

Henlopen Acres Mitigation Action 1	Develop a marina plan for the Town.
Category:	Prevention
Hazard(s) Addressed:	Flood, Hazardous Materials
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	\$25,000
Potential Funding Sources:	Town and Marina Slip Fees, Delaware Coastal Management
Lead Agency/Department Responsible:	Marina Department
Implementation Schedule:	12 months

Henlopen Acres Mitigation Action 2	Develop a tree maintenance program in coordination with Ocean View.
Category:	Property Protection, Natural Resource Protection
Hazard(s) Addressed:	Hurricane, Thunderstorm, Winter Storm
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	\$5,000 per year
Potential Funding Sources:	Town funds, Delaware Forest Service Fire Prevention and Protection Program
Lead Agency/Department Responsible:	Streets Department
Implementation Schedule:	12 months



# LOCALLY-SPECIFIC MITIGATION ACTIONS

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SUSSEX COUNTY, DELAWARE  
MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

<b>Henlopen Acres Mitigation Action 3</b>		<b>Develop an Emergency Management Plan for the Town.</b>
Category:	Emergency Services	
Hazard(s) Addressed:	All Hazards	
Priority (High, Moderate, Low):	High	
Estimated Cost:	Unknown	
Potential Funding Sources:	Town funds, Department of Justice – State and Local Domestic Preparedness Technical Assistance, Delaware Department of Transportation (Transportation Incident Event Management Plan), FEMA –All Hazards Emergency Operational Planning, FEMA – Emergency Management Performance Grants, Department of Justice – State and Local Domestic Preparedness Technical Assistance	
Lead Agency/Department Responsible:	Town Administration	
Implementation Schedule:	12 months	

<b>Henlopen Acres Mitigation Action 4</b>		<b>Maintain a beach dune system.</b>
Category:	Property Protection, Natural Resource Protection	
Hazard(s) Addressed:	Nor'easters, Hurricanes, Tropical Storms	
Priority (High, Moderate, Low):	Moderate	
Estimated Cost:	Unknown	
Potential Funding Sources:	Town and property owners, Corps of Engineers – Beach Erosion Control Projects, Delaware Coastal Management	
Lead Agency/Department Responsible:	Homeowners Association and Henlopen Acres Streets Department	
Implementation Schedule:	Ongoing and when needed	

# LOCALLY-SPECIFIC MITIGATION ACTIONS

SUSSEX COUNTY, DELAWARE  
MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

## Laurel

		HAZARD RISK		
		Low	Moderate	High
OVERALL CAPABILITY	High			
	Moderate			
	Limited		X	

Laurel Mitigation Action 1	Create a service road to the wastewater manholes on West Sixth Street.
Category:	Prevention
Hazard(s) Addressed:	Flood
Priority (High, Moderate, Low):	High
Estimated Cost:	Unknown
Potential Funding Sources:	DNREC grant & Loan, FEMA – Hazard Mitigation Grant, Pre-disaster Mitigation
Lead Agency/Department Responsible:	DNREC
Implementation Schedule:	18 months

Laurel Mitigation Action 2	Replace bulkhead on the north side of Broad Creek, between Popular Street and the railroad bridge.
Category:	Structure project and natural resource protection
Hazard(s) Addressed:	Flood
Priority (High, Moderate, Low):	High
Estimated Cost:	\$350,000 - \$400,000
Potential Funding Sources:	Army Corps of Engineers - Protection of Essential Highways, Highway Bridge Approaches, and Public Works, FEMA – Hazard Mitigation Grant, Pre-Disaster Mitigation, USDA - Soil and Water Conservation, Watershed Protection and Flood Prevention,
Lead Agency/Department Responsible:	Environmental Protection Agency & DNREC
Implementation Schedule:	24 months

# LOCALLY-SPECIFIC MITIGATION ACTIONS

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SUSSEX COUNTY, DELAWARE  
MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

<b>Laurel Mitigation Action 3</b>	<b>Consider closing the well at 10th &amp; Deshields Street and replace waterlines on 10th Street.</b>
Category:	Natural Resource Protection
Hazard(s) Addressed:	Man-made
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	\$100,000
Potential Funding Sources:	USDA - Water and Waste Disposal Systems for Rural Communities, Water and Waste Disposal Loans and Grants (Section 306C), FEMA – Hazard Mitigation Grant, Town general fund
Lead Agency/Department Responsible:	Department of Public Health & DNREC
Implementation Schedule:	5 years

<b>Laurel Mitigation Action 4</b>	<b>Relocate the Town Hall, Public Works and Police Departments.</b>
Category:	Property Protection/Emergency Services
Hazard(s) Addressed:	Man-made
Priority (High, Moderate, Low):	Low
Estimated Cost:	\$1,900,000
Potential Funding Sources:	FEMA – Hazard Mitigation Grant Program, Flood Mitigation Assistance, Pre-Disaster Mitigation, State Domestic Preparedness Equipment Support Program
Lead Agency/Department Responsible:	DELDOT, Federal Department of Transportation, & FEMA
Implementation Schedule:	24 months

# LOCALLY-SPECIFIC MITIGATION ACTIONS

SUSSEX COUNTY, DELAWARE  
MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

## Lewes

		HAZARD RISK		
		Low	Moderate	High
OVERALL CAPABILITY	High			
	Moderate			X
	Limited			

**Note:** Lewes has developed a Flood Mitigation Plan (March 2001) that includes a flood-specific mitigation strategy that should be used in conjunction with the actions identified in this Plan.

Lewes Mitigation Action 1	Review and update evacuation and notification procedures for the City.
Category:	Emergency Services
Hazard(s) Addressed:	All Hazards
Priority (High, Moderate, Low):	High
Estimated Cost:	\$125,000 for all tasks
Potential Funding Sources:	Pre-Disaster Mitigation Grant Program, United States Department of Justice - Office of Domestic Preparedness Program, General Funds, Cash Contributions from "Project Impact" partners, FEMA – Hurricane Local Grant Program, FEMA – Emergency Management Performance Grant, Flood Mitigation Assistance Program, Hazard Mitigation Grant Program, USDA – Environmental Quality Incentives Program, FEMA – Emergency Performance Grants, FEMA – All Hazards Operational Planning, FEMA – Hazardous Materials Assistance Program. FEMA – Fire Management Assistance Grants
Lead Agency/Department Responsible:	Lewes Fire Department, Inc./Administration
Implementation Schedule:	1 to 2 years

# LOCALLY-SPECIFIC MITIGATION ACTIONS

SUSSEX COUNTY, DELAWARE  
MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

<b>Lewes Mitigation Action 2</b>		<b>Improve stormwater capabilities throughout the City.</b>
Category:	Prevention	
Hazard(s) Addressed:	Flood	
Priority (High, Moderate, Low):	Moderate	
Estimated Cost:	Total for all tasks: \$2,250,000	
Potential Funding Sources:	Pre-Disaster Mitigation Grant Program, Hazard Mitigation Grant Program, Flood Mitigation Assistance Program, US Army Corps of Engineers – Floodplain Management Services, 406 Public Assistance (following federally declared disaster), Natural Resources Conservation Service – Emergency Watershed Protection Program, Natural Resources Conservation Service – Watershed Protection and Flood Prevention Program or the possible implementation of a City Stormwater Utility with a fee structure to provide funding for stormwater maintenance and mitigation actions (under consideration)	
Lead Agency/Department Responsible:	Lewes Board of Public Works (BPW)	
Implementation Schedule:	3 to 5 years (	

<b>Lewes Mitigation Action 3</b>		<b>Increase participation in the National Flood Insurance Program.</b>
Category:	Public Information and Awareness	
Hazard(s) Addressed:	Flood	
Priority (High, Moderate, Low):	Moderate	
Estimated Cost:	Total for all tasks: \$2,500	
Potential Funding Sources:	Pre-Disaster Mitigation Grant Program, Hazard Mitigation Grant Program, Flood Mitigation Assistance Program, General funds	
Lead Agency/Department Responsible:	Administration (NFIP Coordinator)	
Implementation Schedule:	1 to 3 years	

<b>Lewes Mitigation Action 4</b>		<b>Minimize damages from high wind events.</b>
Category:	Prevention	
Hazard(s) Addressed:	Hurricanes, Nor'easters, Thunderstorms, Tornadoes	
Priority (High, Moderate, Low):	Moderate	
Estimated Cost:	Total for all tasks: \$2,500	
Potential Funding Sources:	Pre-Disaster Mitigation Grant Program, Hazard Mitigation Grant Program (5% set aside)	
Lead Agency/Department Responsible:	Administration (Building Official/Projects Coordinator)	
Implementation Schedule:	Ongoing	

# LOCALLY-SPECIFIC MITIGATION ACTIONS

SUSSEX COUNTY, DELAWARE  
MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

<b>Lewes Mitigation Action 5</b>	<b>Implement a community outreach program.</b>
Category:	Public Information and Awareness
Hazard(s) Addressed:	All Hazards
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	\$2,500 for all tasks
Potential Funding Sources:	FEMA – Hurricane Local Grant Program, Pre-Disaster Mitigation Grant Program, National Weather Service, General Funds
Lead Agency/Department Responsible:	Administration (Projects Coordinator) , Sussex County EOC
Implementation Schedule:	Ongoing

<b>Lewes Mitigation Action 6</b>	<b>Reduce vulnerability to wildfires: Task 1—Implement the “Firewise Communities” Program. Task 2—Develop a Vegetation Management Plan. Task 3—Develop an evacuation plan specific to Lewes Beach area where majority of invasive vegetation exists. Task 4—Reduce hazardous fuels by spraying, mowing, pruning, burning, etc. Task 5—Establish a barrier of defensible open space (50’—100’) between marshes inhabited by phragmites and homes and businesses in those areas.</b>
Category:	Natural Resource Protection
Hazard(s) Addressed:	Wildfires
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	\$75,000 for all tasks
Potential Funding Sources:	Pre-Disaster Mitigation Grant Program, FEMA – Fire Management Assistance Grants, Hazard Mitigation Grant Program, U.S. Department of Agriculture, Forest Service Grant, U.S. Fish and Wildlife Service Delaware Coastal Management, FEMA – Hurricane Local Grant Program, FEMA – Emergency Management Performance Grant, Flood Mitigation Assistance Program, USDA – Environmental Quality Incentives Program, FEMA – Emergency Performance Grants, FEMA – All Hazards Operational Planning, FEMA – Hazardous Materials Assistance Program. FEMA – Fire Management Assistance Grants, Natural Resources Conservation Service – Emergency Watershed Protection Program
Lead Agency/Department Responsible:	Lewes Fire Department, Inc.
Implementation Schedule:	1 to 3 years

# LOCALLY-SPECIFIC MITIGATION ACTIONS

SUSSEX COUNTY, DELAWARE  
MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

<b>Lewes Mitigation Action 7</b>	<b>Continue data acquisition and enhancements to the City's GIS: Task 1—Continue data acquisition to support disaster planning, mitigation, response and recovery activities. Task 2—Work with Lewes Board of Public Works (BPW) and other City Departments (i.e., Fire, Police, etc.) to identify uses of GIS data within their departments. Task 3—Coordinate BPW (and other departments, if applicable) to conduct GIS Needs Assessments and Implementation Plans. Task 4—Provide training as needed to department personnel who will access data and reports using GIS.</b>
Category:	Prevention
Hazard(s) Addressed:	All Hazards
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	\$50,000 for all tasks
Potential Funding Sources:	Pre-Disaster Mitigation Grant Program, Hazard Mitigation Grant Program, Department of Justice – State and Local Domestic Preparedness Technical Assistance
Lead Agency/Department Responsible:	Administration (GIS Coordinator)
Implementation Schedule:	1 to 5 years (

<b>Lewes Mitigation Action 8</b>	<b>Enlist the services of City service organizations in implementing a disaster preparedness outreach program.</b>
Category:	Public Outreach and Awareness
Hazard(s) Addressed:	All hazards
Priority (High, Moderate, Low):	
Estimated Cost:	\$2,500
Potential Funding Sources:	FEMA – Hurricane Local Grant Program, Pre-Disaster Mitigation Grant Program, National Weather Service, General Funds
Lead Agency/Department Responsible:	Sussex County EOC, City of Lewes
Implementation Schedule:	Ongoing

<b>Lewes Mitigation Action 9</b>	<b>Facilitate the coordination of response procedures related to events.</b>
Category:	Emergency Services
Hazard(s) Addressed:	All hazards
Priority (High, Moderate, Low):	High
Estimated Cost:	No significant cost
Potential Funding Sources:	No funding required
Lead Agency/Department Responsible:	City of Lewes, Sussex County EOC
Implementation Schedule:	Ongoing

# LOCALLY-SPECIFIC MITIGATION ACTIONS

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SUSSEX COUNTY, DELAWARE  
MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

<b>Lewes Mitigation Action 10</b>	<b>Develop response plans (including evacuation and sheltering procedures) related to special needs populations and pets. Also include a "Refuge of Last Resort" Plan and a plan to transport City residents to county designated shelters.</b>
Category:	Emergency Services
Hazard(s) Addressed:	All hazards
Priority (High, Moderate, Low):	High
Estimated Cost:	To be determined
Potential Funding Sources:	Department of Homeland Security grants
Lead Agency/Department Responsible:	City of Lewes, Sussex County EOC
Implementation Schedule:	24 months



# LOCALLY-SPECIFIC MITIGATION ACTIONS

SUSSEX COUNTY, DELAWARE  
MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

## Millsboro

		HAZARD RISK		
		Low	Moderate	High
OVERALL CAPABILITY	High			
	Moderate			
	Limited		X	

Millsboro Mitigation Action 1	Improve stormwater drainage within the Town.
Category:	Prevention
Hazard(s) Addressed:	Flood
Priority (High, Moderate, Low):	High
Estimated Cost:	\$70,000
Potential Funding Sources:	U S Army Corps of Engineers - Aquatic Habitat and Wetlands Program, US Army Corps of Engineers - Beach Erosion Control Projects, US Army Corps of Engineers – Emergency Streambank and Shoreline Protection, Pre-Disaster Mitigation Grant Program, Hazard Mitigation Grant Program, Flood Mitigation Assistance Program
Lead Agency/Department Responsible:	Millsboro Town Hall
Implementation Schedule:	24 months

Millsboro Mitigation Action 2	Conduct a study to identify roads that need to be elevated and culverts that need to be widened.
Category:	Prevention
Hazard(s) Addressed:	Flood
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	\$400,000
Potential Funding Sources:	406 Public Assistance (following federally declared disaster), Hazard Mitigation Grant Program, Delaware Department of Transportation, Pre-disaster Mitigation
Lead Agency/Department Responsible:	Millsboro Town Hall
Implementation Schedule:	24 months

# LOCALLY-SPECIFIC MITIGATION ACTIONS

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SUSSEX COUNTY, DELAWARE  
MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

<b>Millsboro Mitigation Action 3</b>	<b>Retrofit two pump stations.</b>
Category:	Property Protection
Hazard(s) Addressed:	Flood
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	\$40,000
Potential Funding Sources:	406 Public Assistance (following federally declared disaster), FEMA – Emergency Management Performance Grants, Environmental Protection Agency – Water Quality Cooperative Agreements, USDA - Water and Waste Disposal Systems for Rural Communities
Lead Agency/Department Responsible:	Millsboro Town Hall
Implementation Schedule:	24 months

<b>Millsboro Mitigation Action 4</b>	<b>Retrofit civic center with shutters (Red Cross emergency shelter).</b>
Category:	Property Protection
Hazard(s) Addressed:	Hurricane, Tornado
Priority (High, Moderate, Low):	Low
Estimated Cost:	\$100,000
Potential Funding Sources:	FEMA - Pre-Disaster Mitigation Grant Program, Hazard Mitigation Grant Program
Lead Agency/Department Responsible:	Millsboro Town Hall
Implementation Schedule:	24 months

# LOCALLY-SPECIFIC MITIGATION ACTIONS

SUSSEX COUNTY, DELAWARE  
MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

## Millville

		HAZARD RISK		
		Low	Moderate	High
OVERALL CAPABILITY	High			
	Moderate			
	Limited		X	

Millville Mitigation Action 1	Retrofit the Millville Town Hall to include back up power supply.	
Category:	Property Protection	
Hazard(s) Addressed:	All Hazards	
Priority (High, Moderate, Low):	High	
Estimated Cost:	\$20,000 generator quick connect	
Potential Funding Sources:	FEMA - Pre-Disaster Mitigation Grant Program, Hazard Mitigation Grant Program	
Lead Agency/Department Responsible:	Town of Millville	
Implementation Schedule:	24 months	

Millville Mitigation Action 2	Conduct an assessment of all culverts to include proper size and design based on current infrastructure and future development.	
Category:	Structural Project	
Hazard(s) Addressed:	Flood	
Priority (High, Moderate, Low):	Moderate	
Estimated Cost:	To be determined	
Potential Funding Sources:	US Army Corps of Engineers - Protection of Essential Highways, Highway Bridge Approaches, and Public Works, DOT, FEMA- Hazard Mitigation Grant, Pre-disaster Mitigation	
Lead Agency/Department Responsible:	DelDOT and DNREC	
Implementation Schedule:	12 months	

# LOCALLY-SPECIFIC MITIGATION ACTIONS

SUSSEX COUNTY, DELAWARE  
MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

## Milton

		HAZARD RISK		
		Low	Moderate	High
OVERALL CAPABILITY	High			
	Moderate		X	
	Limited			

Milton Mitigation Action 1	Relocate the Town's wastewater treatment plant.
Category:	Property Protection, Natural Resource Protection
Hazard(s) Addressed:	Flood, Hazardous Materials
Priority (High, Moderate, Low):	High
Estimated Cost:	Unknown, Millions
Potential Funding Sources:	Hazard Mitigation Grant Program, Pre-Disaster Mitigation Grant Program, 406 Public Assistance (following federally declared disaster)
Lead Agency/Department Responsible:	Town of Milton, DNREC, County, State
Implementation Schedule:	3-7 years

Milton Mitigation Action 2	Promote emergency shelter information.
Category:	Public Information and Awareness
Hazard(s) Addressed:	All Hazards
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	\$1,000 – \$2,000 (mailing costs and brochures)
Potential Funding Sources:	FEMA – Hurricane Local Grant Program, Free Red Cross and FEMA shelter materials, Hazard Mitigation Grant Program
Lead Agency/Department Responsible:	Town of Milton
Implementation Schedule:	Link timing to CRS program

# LOCALLY-SPECIFIC MITIGATION ACTIONS

SUSSEX COUNTY, DELAWARE  
MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

<b>Milton Mitigation Action 3</b>	<b>Secure water towers and wellheads by enclosing them with approximately 1,200 feet of fence.</b>
Category:	Property Protection
Hazard(s) Addressed:	Terrorism
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	\$5,000 - \$15,000 depending on style of fencing and installation crew (Town install or private contractor)
Potential Funding Sources:	Environmental Protection Agency - Water Protection Coordination Grants, Department of Justice – State Homeland Security Program, FEMA – Hazardous Materials Assistance Program, Department of Justice – State and Local Domestic Preparedness Technical Assistance
Lead Agency/Department Responsible:	Town of Milton
Implementation Schedule:	6-12 months after funding available

<b>Milton Mitigation Action 4</b>	<b>Join the Community Rating System.</b>
Category:	Public Information and Awareness
Hazard(s) Addressed:	Flood
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	Staff time and resources
Potential Funding Sources:	NA
Lead Agency/Department Responsible:	Town of Milton
Implementation Schedule:	12 months

<b>Milton Mitigation Action 5</b>	<b>Improve GIS mapping capabilities.</b>
Category:	Prevention
Hazard(s) Addressed:	All Hazards
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	Unknown
Potential Funding Sources:	GIS software companies often supply grants to local governments, FEMA - Map Modernization Program, FEMA - Flood Hazard Mapping Program, FEMA – Emergency Management Performance Grant, FEMA – Flood Recovery Mapping, Hazard Mitigation Grant Program, Pre-Disaster Mitigation Grant Program
Lead Agency/Department Responsible:	Town of Milton
Implementation Schedule:	12 months

# LOCALLY-SPECIFIC MITIGATION ACTIONS

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SUSSEX COUNTY, DELAWARE  
MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

<b>Milton Mitigation Action 6</b>	<b>Provide dry flood protection techniques for the main well control building on Chandler Street.</b>
Category:	Property Protection
Hazard(s) Addressed:	Flood
Priority (High, Moderate, Low):	
Estimated Cost:	Unknown
Potential Funding Sources:	Hazard Mitigation Grant Program, Pre-Disaster Mitigation Grant Program
Lead Agency/Department Responsible:	Town of Milton
Implementation Schedule:	12 months

<b>Milton Mitigation Action 7</b>	<b>Conduct a study to identify measures to mitigate flooding on Magnolia Street.</b>
Category:	Prevention
Hazard(s) Addressed:	Flood
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	\$50,000-\$60,000
Potential Funding Sources:	Hazard Mitigation Grant Program, Pre-Disaster Mitigation Grant Program
Lead Agency/Department Responsible:	Town of Milton
Implementation Schedule:	3-5 years

# LOCALLY-SPECIFIC MITIGATION ACTIONS

SUSSEX COUNTY, DELAWARE  
MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

## Ocean View

		HAZARD RISK		
		Low	Moderate	High
OVERALL CAPABILITY	High			
	Moderate			
	Limited			X

<b>Ocean View Mitigation Action 1</b>	<b>Improve the Town's stormwater management system in some of the older sections of town (County Village, County Estates, Corner of Daisy and Woodland Avenue, West View Development, and Cottages on Whites Creek). These improvements would include engineering costs to redesign or improve the drainage systems, and the costs to reconstruct and repair drainage swales, drains and culvert piping, and ditches.</b>
Category:	Prevention
Hazard(s) Addressed:	Flood
Priority (High, Moderate, Low):	High
Estimated Cost:	\$350,000
Potential Funding Sources:	Hazard Mitigation Grant Program, Environmental Protection Agency - Water Quality Cooperative Agreements, US Army Corps of Engineers – Floodplain Management Services, 406 Public Assistance (following federally declared disaster), Natural Resources Conservation Service – Emergency Watershed Protection Program, Natural Resources Conservation Service – Watershed Protection and Flood Prevention Program
Lead Agency/Department Responsible:	Town of Ocean View with help from various Federal and State agencies
Implementation Schedule:	24 months

# LOCALLY-SPECIFIC MITIGATION ACTIONS

SUSSEX COUNTY, DELAWARE  
MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

<b>Ocean View Mitigation Action 2</b>	<b>Improve evacuation routes throughout the Town.</b>
Category:	Structural Projects
Hazard(s) Addressed:	Hurricanes, Flood, Nor'easter
Priority (High, Moderate, Low):	High
Estimated Cost:	\$1,000,000
Potential Funding Sources:	Delaware Department of Transportation, 406 Public Assistance (following federally declared disaster), FEMA Hurricane Local Grant Program
Lead Agency/Department Responsible:	Delaware Department of Transportation
Implementation Schedule:	24 months

<b>Ocean View Mitigation Action 3</b>	<b>Implement public education and awareness activities to advise residents and visitors about hazards, hazardous areas and mitigation techniques they can use to protect about hazards, hazardous areas and mitigation techniques they can use to protect themselves and their property.</b>
Category:	Public Outreach and Awareness
Hazard(s) Addressed:	All hazards
Priority (High, Moderate, Low):	High
Estimated Cost:	\$10,000, staff time and resources
Potential Funding Sources:	FEMA – Hurricane Local Grant Program, FEMA - Emergency Management Performance Grants, FEMA and Red Cross materials are free of charge
Lead Agency/Department Responsible:	Town of Ocean View, Sussex County EOC
Implementation Schedule:	Ongoing

<b>Ocean View Mitigation Action 4</b>	<b>Adopt a tree management ordinance and maintenence program.</b>
Category:	Prevention
Hazard(s) Addressed:	Hurricane, Winter Storms, Flooding, Thunderstorms, Nor'easter
Priority (High, Moderate, Low):	High
Estimated Cost:	Start up cost \$10,000, \$8,000 annual cost
Potential Funding Sources:	Delaware Forest Service Fire Prevention and Protection Program
Lead Agency/Department Responsible:	Town of Ocean View, Delaware Forest Service
Implementation Schedule:	Ongoing



# LOCALLY-SPECIFIC MITIGATION ACTIONS

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SUSSEX COUNTY, DELAWARE  
MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

<b>Ocean View Mitigation Action 5</b>		<b>Purchase and install GIS to map hazardous areas and events.</b>
Category:	Prevention	
Hazard(s) Addressed:	All Hazards	
Priority (High, Moderate, Low):	Low	
Estimated Cost:	\$35,000	
Potential Funding Sources:	GIS software companies often supply grants to local governments, FEMA - Map Modernization Program, FEMA - Flood Hazard Mapping Program, FEMA – Emergency Management Performance Grant, FEMA – Flood Recovery Mapping, Hazard Mitigation Grant Program, Pre-Disaster Mitigation Grant Program	
Lead Agency/Department Responsible:	Town of Ocean View	
Implementation Schedule:	2-3 years	

<b>Ocean View Mitigation Action 6</b>		<b>Adopt a building code ordinance for the Town.</b>
Category:	Prevention	
Hazard(s) Addressed:	High Winds, Thunderstorms, Winter Storms, Hurricanes and Nor'easter	
Priority (High, Moderate, Low):	Low	
Estimated Cost:	\$50,000 includes ordinance drafting	
Potential Funding Sources:	Future operating budgets, Pre-Disaster Mitigation Grant Program, Hazard Mitigation Grant Program (planning)	
Lead Agency/Department Responsible:	Town of Ocean View	
Implementation Schedule:	1-2 years	

# LOCALLY-SPECIFIC MITIGATION ACTIONS

SUSSEX COUNTY, DELAWARE  
MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

## Rehoboth Beach

		HAZARD RISK		
		Low	Moderate	High
OVERALL CAPABILITY	High			
	Moderate			X
	Limited			

Rehoboth Beach Mitigation Action 1	Build retaining wall along boardwalk to prevent damage to businesses, the boardwalk and street ends.
Category:	Structural Projects
Hazard(s) Addressed:	Hurricane, Flood
Priority (High, Moderate, Low):	High
Estimated Cost:	\$1,000,000
Potential Funding Sources:	US Army Corps of Engineers - Emergency Streambank and Shoreline Protection, US Army Corps of Engineers - Floodplain Management Services, US Army Corps of Engineers - Planning Assistance to States, US Army Corps of Engineers - Small Flood Control Projects,
Lead Agency/Department Responsible:	City of Rehoboth Beach
Implementation Schedule:	As soon as funding is available

Rehoboth Beach Mitigation Action 2	Conduct drainage improvements on First Street to increase efficiency by increasing piping capacity.
Category:	Structural Projects
Hazard(s) Addressed:	Hurricane, Flood
Priority (High, Moderate, Low):	High
Estimated Cost:	\$325,000
Potential Funding Sources:	Pre-disaster mitigation
Lead Agency/Department Responsible:	City of Rehoboth Beach
Implementation Schedule:	As soon as funding is available

# LOCALLY-SPECIFIC MITIGATION ACTIONS

SUSSEX COUNTY, DELAWARE  
MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

## Seaford

		HAZARD RISK		
		Low	Moderate	High
OVERALL CAPABILITY	High			
	Moderate		X	
	Limited			

<b>Seaford Mitigation Action 1</b>	<b>Conduct computer modeling of key drainage in and around the City to identify restrictions and/or potential problems. Also identify necessary modification or repairs to improve functionality.</b>
Category:	Prevention
Hazard(s) Addressed:	Flood
Priority (High, Moderate, Low):	High
Estimated Cost:	Costs based on findings of study
Potential Funding Sources:	US Army Corps of Engineers - Floodplain Management Services, Natural Resource and Conservation Service - Watershed Surveys and Planning, Natural Resource and Conservation Service - Watershed Protection and Flood Prevention Program, US Army Corps of Engineers – Small Flood Control Projects
Lead Agency/Department Responsible:	City of Seaford, Sussex County, NRCS, Department of Transportation, Delaware Emergency Management Agency
Implementation Schedule:	24 months

# LOCALLY-SPECIFIC MITIGATION ACTIONS

SUSSEX COUNTY, DELAWARE  
MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

<b>Seaford Mitigation Action 2</b>	<b>Address street flooding in the Washington and State Street area—Identify necessary modification or repairs to improve functionality.</b>
Category:	Prevention
Hazard(s) Addressed:	Flood
Priority (High, Moderate, Low):	High
Estimated Cost:	\$500,000 - \$1,000,000
Potential Funding Sources:	US Army Corps of Engineers - Floodplain Management Services, Natural Resource and Conservation Service - Watershed Surveys and Planning, Natural Resource and Conservation Service - Watershed Protection and Flood Prevention Program, US Army Corps of Engineers – Small Flood Control Projects
Lead Agency/Department Responsible:	City of Seaford/Sussex County/Department of Transportation
Implementation Schedule:	24 months

<b>Seaford Mitigation Action 3</b>	<b>Ensure security of water production sites and storage facilities.</b>
Category:	Property Protection
Hazard(s) Addressed:	Terrorism
Priority (High, Moderate, Low):	High
Estimated Cost:	Unknown
Potential Funding Sources:	Department of Justice – State and Local Domestic Preparedness Technical Assistance, Department of Justice – State and Local Domestic Preparedness Exercise Support, FEMA All Hazards Emergency Operational Planning, Environmental Protection Agency - Water Protection Coordination Grants, Department of Justice – State Homeland Security Program
Lead Agency/Department Responsible:	City of Seaford, Delaware Rural Water Association, DEMA
Implementation Schedule:	24 months

<b>Seaford Mitigation Action 4</b>	<b>Develop agreements with local businesses to assist during emergencies (i.e., provide items such as heavy equipment and other resources).</b>
Category:	Emergency Services
Hazard(s) Addressed:	All Hazards
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	Staff time and resources
Potential Funding Sources:	NA
Lead Agency/Department Responsible:	City of Seaford, DEMA
Implementation Schedule:	12 months

# LOCALLY-SPECIFIC MITIGATION ACTIONS

SUSSEX COUNTY, DELAWARE  
MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

<b>Seaford Mitigation Action 5</b>	<b>Identify key personnel to manage a crisis.</b>
Category:	Emergency Services
Hazard(s) Addressed:	All Hazards
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	Staff time and resources, Hazard Mitigation Grant Program (planning) Department of Justice – State and Local Domestic Preparedness Training Program
Potential Funding Sources:	NA
Lead Agency/Department Responsible:	City of Seaford, DEMA
Implementation Schedule:	12 months

<b>Seaford Mitigation Action 6</b>	<b>Construct storm drain improvements on Washington Street to increase the drainage capacity of the area and prevent future flooding.</b>
Category:	Property Protection
Hazard(s) Addressed:	Flooding
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	Pre-disaster mitigation grant
Potential Funding Sources:	\$867,000
Lead Agency/Department Responsible:	City of Seaford, Sussex County Public Works
Implementation Schedule:	12 months

<b>Seaford Mitigation Action 7</b>	<b>Construct stormwater drains on Porter Street to increase the drainage capacity of the area and prevent future flooding.</b>
Category:	Property Protection
Hazard(s) Addressed:	Flooding
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	Pre-disaster mitigation grant
Potential Funding Sources:	\$915,000
Lead Agency/Department Responsible:	City of Seaford, Sussex County Public Works
Implementation Schedule:	12 months

# LOCALLY-SPECIFIC MITIGATION ACTIONS

SUSSEX COUNTY, DELAWARE  
MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

## Selbyville

		HAZARD RISK		
		Low	Moderate	High
OVERALL CAPABILITY	High			
	Moderate		X	
	Limited			

Selbyville Mitigation Action 1	Replace deteriorating bridge and culverts on Railroad Avenue over major storm water management ditch.
Category:	Prevention
Hazard(s) Addressed:	All Hazards
Priority (High, Moderate, Low):	High
Estimated Cost:	Staff time and resources
Potential Funding Sources:	N/A
Lead Agency/Department Responsible:	Town of Selbyville, Sussex County Public Works
Implementation Schedule:	6 months

Selbyville Mitigation Action 2	Educate residents and improve public awareness on being better prepared to face hazards.
Category:	Public Outreach and Awareness
Hazard(s) Addressed:	All hazards
Priority (High, Moderate, Low):	High
Estimated Cost:	\$10,000, staff time and resources
Potential Funding Sources:	FEMA – Hurricane Local Grant Program, FEMA - Emergency Management Performance Grants, FEMA and Red Cross materials are free of charge
Lead Agency/Department Responsible:	Town of Selbyville
Implementation Schedule:	Ongoing

# LOCALLY-SPECIFIC MITIGATION ACTIONS

SUSSEX COUNTY, DELAWARE  
MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

## Slaughter Beach

		HAZARD RISK		
		Low	Moderate	High
OVERALL CAPABILITY	High			
	Moderate			
	Limited			X

Slaughter Beach Mitigation Action 1	Improve stormwater drainage throughout the Town.
Category:	Prevention
Hazard(s) Addressed:	Flood
Priority (High, Moderate, Low):	High
Estimated Cost:	Unknown
Potential Funding Sources:	US Army Corps of Engineers - Floodplain Management Services, Natural Resource and Conservation Service - Watershed Surveys and Planning, Natural Resource and Conservation Service - Watershed Protection and Flood Prevention Program, US Army Corps of Engineers – Small Flood Control Projects
Lead Agency/Department Responsible:	Town of Slaughter Beach
Implementation Schedule:	24 months

Slaughter Beach Mitigation Action 2	Flood-proof water pumping stations.
Category:	Property Protection
Hazard(s) Addressed:	Flood
Priority (High, Moderate, Low):	High
Estimated Cost:	Unknown
Potential Funding Sources:	406 Public Assistance (following federally declared disaster), Hazard Mitigation Grant Program, Environmental Protection Agency – Water Quality Cooperative Agreements, USDA - Water and Waste Disposal Systems for Rural Communities
Lead Agency/Department Responsible:	Town of Slaughter Beach
Implementation Schedule:	24 months

# LOCALLY-SPECIFIC MITIGATION ACTIONS

SUSSEX COUNTY, DELAWARE  
MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

<b>Slaughter Beach Mitigation Action 3</b>	<b>Elevate access and evacuation roads that flood (Route 224 - Slaughter Beach Road approximately 1' - 4' from intersection of Bay Avenue to west boundary of Prime Hook National Wildlife Refuge (± 1 mile)).</b>
Category:	Property Protection
Hazard(s) Addressed:	Flood
Priority (High, Moderate, Low):	High
Estimated Cost:	Unknown
Potential Funding Sources:	DelDOT, FEMA- Hazard Mitigation Grant, Pre-disaster Mitigation, ACE - Protection of Essential Highways, Highway Bridge Approaches, and Public Works
Lead Agency/Department Responsible:	Delaware Department of Transportation
Implementation Schedule:	24 months

<b>Slaughter Beach Mitigation Action 4</b>	<b>Elevate flood-prone homes.</b>
Category:	Property Protection
Hazard(s) Addressed:	Flood
Priority (High, Moderate, Low):	High
Estimated Cost:	Unknown
Potential Funding Sources:	Pre-Disaster Mitigation Grant Program, Hazard Mitigation Grant Program, Flood Mitigation Assistance Program, Community Development Block Grant Program, HUD – Disaster Recovery Initiative
Lead Agency/Department Responsible:	Town of Slaughter Beach
Implementation Schedule:	24 months

<b>Slaughter Beach Mitigation Action 5</b>	<b>Perform regular beach renourishment.</b>
Category:	Structural Projects
Hazard(s) Addressed:	Flood
Priority (High, Moderate, Low):	High
Estimated Cost:	Unknown
Potential Funding Sources:	US Army Corps of Engineers - Beach Erosion Control Projects, US Army Corps of Engineers - Emergency Streambank and Shoreline Protection, Delaware Coastal Management
Lead Agency/Department Responsible:	Town of Slaughter Beach
Implementation Schedule:	Ongoing



# LOCALLY-SPECIFIC MITIGATION ACTIONS

SUSSEX COUNTY, DELAWARE  
MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

<b>Slaughter Beach Mitigation Action 6</b>	<b>Develop automated telephone warning system</b>
Category:	Emergency Services
Hazard(s) Addressed:	All Hazards
Priority (High, Moderate, Low):	High
Estimated Cost:	\$30,000
Potential Funding Sources:	FEMA - State Domestic Preparedness Equipment Support Program, Hazard Mitigation Grant, NOAA - Integrated Flood Observing and Warning System (IFLOWS),
Lead Agency/Department Responsible:	Town of Slaughter Beach
Implementation Schedule:	Contingent upon funding; 2 month set-up period

<b>Slaughter Beach Mitigation Action 7</b>	<b>Restore and/or renourish beach and protective dunes.</b>
Category:	Natural Resource Protection and Structural Project
Hazard(s) Addressed:	Flood
Priority (High, Moderate, Low):	High
Estimated Cost:	\$1,854,000
Potential Funding Sources:	US Army Corps of Engineers - Beach Erosion Control Projects, US Army Corps of Engineers - Emergency Streambank and Shoreline Protection, Delaware Coastal Management FEMA – Hazard Mitigation Grant
Lead Agency/Department Responsible:	DNREC
Implementation Schedule:	Contingent upon funding; 4-6 month construction period

<b>Slaughter Beach Mitigation Action 8</b>	<b>Develop a strategy to improve NFIP enforcement processes to include local permitting processes.</b>
Category:	Property Protection
Hazard(s) Addressed:	Flood
Priority (High, Moderate, Low):	High
Estimated Cost:	Staff time and resources
Potential Funding Sources:	NA
Lead Agency/Department Responsible:	Town of Slaughter Beach
Implementation Schedule:	6 months

# LOCALLY-SPECIFIC MITIGATION ACTIONS

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SUSSEX COUNTY, DELAWARE  
MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

<b>Slaughter Beach Mitigation Action 9</b>	<b>Provide building/ zoning/ flood zone ordinances to public via website or other electronic means.</b>
Category:	Public Education and Awareness
Hazard(s) Addressed:	Flood and wind
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	\$2,000 - \$5,000, Staff time and resources
Potential Funding Sources:	Local funds, FEMA – Hazard Mitigation Grant
Lead Agency/Department Responsible:	Town of Slaughter Beach
Implementation Schedule:	Dependent upon funding; 2-3 months after funding

<b>Slaughter Beach Mitigation Action 10</b>	<b>Initiate stormwater management system improvements along <math>\pm</math> 1 mile of North Bay Avenue.</b>
Category:	Structural Project
Hazard(s) Addressed:	Flood
Priority (High, Moderate, Low):	Low
Estimated Cost:	\$250,000
Potential Funding Sources:	FEMA – Hazard Mitigation Grant, Pre-disaster Mitigation, Flood Mitigation Assistance, ACE - Flood Control Projects, NCRS - Watershed Protection and Flood Prevention
Lead Agency/Department Responsible:	DeIDOT
Implementation Schedule:	Contingent upon funding 3 month construction period

# LOCALLY-SPECIFIC MITIGATION ACTIONS

SUSSEX COUNTY, DELAWARE  
MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

## South Bethany

		HAZARD RISK		
		Low	Moderate	High
OVERALL CAPABILITY	High			
	Moderate			X
	Limited			

South Bethany Mitigation Action 1	Implement regular and emergency beach replenishment or re-nourishment as part of the DNREC/ Corps of Engineers 50-year plan.
Category:	Natural Resource Protection
Hazard(s) Addressed:	Flood
Priority (High, Moderate, Low):	High
Estimated Cost:	To be determined
Potential Funding Sources:	DNREC
Lead Agency/Department Responsible:	Town of South Bethany, Sussex County Environmental Services
Implementation Schedule:	Ongoing

South Bethany Mitigation Action 2	Improve storm drainage throughout the Town.
Category:	Property Protection
Hazard(s) Addressed:	Flood
Priority (High, Moderate, Low):	High
Estimated Cost:	To be determined
Potential Funding Sources:	Flood Mitigation Assistance Program, Pre-Disaster Mitigation Grant Program, Hazard Mitigation Grant Program
Lead Agency/Department Responsible:	Town of South Bethany, Sussex County Environmental Services
Implementation Schedule:	Ongoing

# LOCALLY-SPECIFIC MITIGATION ACTIONS

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SUSSEX COUNTY, DELAWARE  
MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

<b>South Bethany Mitigation Action 3</b>	<b>Continue to identify and promote floodproofing/elevation solutions to at-risk homes throughout the Town in accordance with current FEMA regulations.</b>
Category:	Property Protection
Hazard(s) Addressed:	Flood
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	To be determined
Potential Funding Sources:	Flood Mitigation Assistance Program, Pre-Disaster Mitigation Grant Program, Hazard Mitigation Grant Program
Lead Agency/Department Responsible:	Town of South Bethany
Implementation Schedule:	Ongoing

<b>South Bethany Mitigation Action 4</b>	<b>Upgrade the Town's Building and Zoning Ordinances to reflect NFIP and ISO requirements.</b>
Category:	Property Protection
Hazard(s) Addressed:	Flood
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	Unknown
Potential Funding Sources:	Flood Mitigation Assistance Program, Pre-Disaster Mitigation Grant Program, Hazard Mitigation Grant Program, Community Development Block Grant
Lead Agency/Department Responsible:	Town of South Bethany, Department of Natural Resources and Environmental Control, Delaware and International Building Code
Implementation Schedule:	12 months

# PLAN MAINTENANCE PROCEDURES

This section discusses how the Mitigation Strategy will be implemented by participating jurisdictions and how the overall All Hazard Mitigation Plan will be evaluated and enhanced over time. This section also discusses how the public will continue to be involved in the hazard mitigation planning process.

The long-term success of the Sussex County All Hazard Mitigation Plan depends in large part on routine monitoring, evaluating and updating of the plan so that it will remain a valid tool for the community to use. The plan activities will be implemented by the Sussex Office of Emergency Management and Sussex Mitigation Advisory Committee.

The Mitigation Advisory Committee will monitor the efficiency and effectiveness of various mitigation strategies and will make recommendation for additional improvements. The Sussex Office of Emergency Management and The Mitigation Advisory Council will review the year's local hazard events and impacts, community actions that may help or hinder mitigation capabilities, and the progress of mitigation activities. Any changes will be noted in the planning document accordingly, along with a summary of their findings and associated changes in a memorandum to the Sussex County Council and the Delaware Emergency Management Agency.

An annual report will be made available to the governing body (Sussex County Council, Municipal /Mayors and Councils) in order to report progress on the actions identified in the Plan and to provide information on the latest legislative requirements and/or changes. The Mitigation Advisory Committee will be responsible for working with the Sussex County Council to determine the best schedule for these updates. A potential timeframe for these annual updates is just before the annual hurricane season begins on June 1. Reviewing the Plan at a time when media coverage and community awareness tends to be high may help serve as a reminder to local officials that the community needs to be prepared for hurricanes and other disasters.

## *Implementation*

Each jurisdiction participating in this Plan is responsible for implementing specific mitigation actions as prescribed in their locally adopted Mitigation Action Plan. In the Mitigation Action Plan, each proposed action is assigned to a specific local department or agency in order to increase accountability and the likelihood of implementation. This approach enables individual jurisdictions to update their unique mitigation strategy as needed without altering the broader focus of the countywide plan elements. The separate adoption of locally specific actions also ensures that each jurisdiction is not held responsible for the actions of every other jurisdiction involved in the planning process.

In addition the specific local department or agency, an implementation time period or a specific implementation date has been assigned in order to assess whether actions are being implemented in a timely fashion. Sussex County and its jurisdictions will seek outside funding sources to implement mitigation projects in both the predisaster and post-disaster environments. Whenever possible, a funding source has been identified for proposed actions listed in the Mitigation Action Plan.

# PLAN MAINTENANCE PROCEDURES

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## SUSSEX COUNTY, DELAWARE MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

It will be up to each participating jurisdiction to determine additional implementation procedures beyond their Mitigation Action Plan. This includes integrating the requirements of the All Hazard Mitigation Plan into other planning documents, processes or mechanisms such as comprehensive or capital improvement plans, when appropriate.

### *Evaluation and Enhancement*

Periodic revisions and updates of the All Hazard Mitigation Plan are required to ensure that the goals and objectives of the Plan are kept current, taking into account potential changes in hazard vulnerability and mitigation priorities. In addition, revisions may be necessary to ensure that the Plan is in full compliance with applicable Federal regulations or State statutes. Periodic evaluation of the Plan will also ensure that specific mitigation actions are being reviewed and carried out according to each jurisdiction's individual Mitigation Action Plan.

#### **Five (5) Year Plan Review**

The Plan will undergo a comprehensive reviewed and evaluation process every five years by the Sussex Mitigation Advisory Committee under the authority of the Sussex County Council to determine whether there have been any significant changes in the County necessitating 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. This Plan Update represents the first revision since the Sussex County Plan was approved and adopted in 2005. The 5-year plan review, for the most part, was conducted in accordance with what was laid out in the 2004/2005 Plan. This Update provided 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. In addition to the FEMA-required 5-year review, the Mitigation Advisory Committee will continue to meet bi-annually and after major events occur. This will ensure that the Plan is continuously kept current to reflect changing conditions within the jurisdiction. The knowledge gained from this process allowed the County to produce an even more comprehensive and effective plan. In addition to this, the annual report form from DEMA's annual update cycle has proved to be effective; DEMA's engagement with the municipalities on an annual basis encouraged them to revisit their mitigation actions and provide an update on the status.

A copy of the Executive Summary of the 2005 Plan is included in the appendix of this Plan to provide an overview of the contents and highlights from the initial plan.

#### **Disaster Declaration**

Following a disaster declaration, the Plan may need to be revised to reflect lessons learned, or to address specific circumstances arising from the event.

#### **Reporting Procedures**

The results of the five year review will be summarized by the Mitigation Advisory 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 an evaluation of implementation progress for each of the proposed mitigation actions, identifying reasons for delays or obstacles to their completion along with recommended strategies to overcome them.

# PLAN MAINTENANCE PROCEDURES

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## SUSSEX COUNTY, DELAWARE MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

Changes to the Plan will be assigned to appropriate local officials with pre-determined timelines for completion. If changes are required of individual Mitigation Action Plans, the appropriate local designee will assign responsibility for the completion of the task.<sup>1</sup>

### **Plan Amendment Process**

Upon the initiation of the amendment process, Sussex County and its municipalities will forward information on the proposed change to all interested parties including, but not limited to, all affected county and municipal departments, residents, and businesses. Information will also be forwarded to DEMA. This information will be disseminated in order to seek input on the proposed amendment for not less than a 45-day review and comment period. If no comments are received from the reviewing parties within the specified review period, such will be noted accordingly.

At the end of the 45-day review and comment period, the proposed amendment and all comments will be forwarded to Hazard Mitigation Advisory Committee for consideration. The Committee will review the proposed amendment along with the comments received from other parties, and submit a recommendation to the appropriate governing body within 60 days.

In determining whether to recommend approval or denial of a Plan amendment request, the following factors will be considered:

- There are errors or omissions made in the identification of issues or needs during the preparation of the Plan;
- New issues or needs have been identified which were not adequately addressed in the Plan;
- There has been a change in information, data, or assumptions from those on which the Plan was based.

Upon receiving the recommendation of the designee, the governing body will hold a public hearing. The governing body will review the recommendation (including the factors listed above) and any oral or written comments received at the public hearing. Following that review, the governing body will take one of the following actions:

- Adopt the proposed amendment as presented;
- Adopt the proposed amendment with modifications;
- Refer the amendments request back to the designee for further consideration; or
- Defer the amendment request for further consideration and/or hearing.

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<sup>1</sup> Local jurisdictions do have the authority to approve/adopt changes to their own Mitigation Action Plans without approval from the County; however, the County should be advised of all changes as a courtesy and for consideration for changes or modifications to the countywide Plan. Changes to either the multi-jurisdictional plan or local Mitigation Action Plans will necessitate the adoption of these changes by the appropriate governing body. Ultimately, the updated Plan or plan component(s) will be submitted to DEMA.

# PLAN MAINTENANCE PROCEDURES

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SUSSEX COUNTY, DELAWARE  
MULTI-JURISDICTIONAL ALL HAZARD MITIGATION PLAN

## *Continued Public Involvement*

Efforts to obtain public input was an integral part of the Plan Update and will continue to be essential as this Plan changes over time. As is the case with any officially adopted plan or ordinance, significant changes to this Plan shall require a public hearing.

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

- Advertising meetings of the Hazard Mitigation Advisory Committee in the local newspaper, public bulletin boards and/or City and County office buildings;
- Utilizing local media to update the public of any maintenance and/or periodic review activities taking place;
- Utilizing City and County Web sites to advertise any maintenance and/or periodic review activities taking place; and
- Keeping copies of the updated Plan in public libraries.



APPENDIX A  
SUSSEX COUNTY  
ADOPTION RESOLUTION

MUNICIPAL  
ADOPTION  
RESOLUTION

# APPENDIX B

## SUSSEX COUNTY ALL HAZARD MITIGATION PLAN LOCAL CROSSWALK

A review check list used by FEMA to ensure consistency with the "Disaster Mitigation Act of 2000 (P.L. 106-390), enacted October 20, 2000 and 44 CFR Part 201 - mitigation Planning Interim Rule (the Rule), published February 26, 2002.

## LOCAL MITIGATION PLAN REVIEW CROSSWALK

### INSTRUCTIONS FOR USING THE PLAN REVIEW CROSSWALK FOR REVIEW OF LOCAL MITIGATION PLANS

Attached is a Plan Review Crosswalk based on the **Local Multi-Hazard Mitigation Planning Guidance**, published by FEMA in July, 2008. This Plan Review Crosswalk is consistent with the *Robert T. Stafford Disaster Relief and Emergency Assistance Act* (Stafford Act), as amended by Section 322 of the *Disaster Mitigation Act of 2000* (P.L. 106-390), the *National Flood Insurance Act of 1968*, as amended by the *National Flood Insurance Reform Act of 2004* (P.L. 108-264) and *44 Code of Federal Regulations (CFR) Part 201 – Mitigation Planning*, inclusive of all amendments through October 31, 2007.

#### SCORING SYSTEM

**N – Needs Improvement:** The plan does not meet the minimum for the requirement. Reviewer's comments must be provided.

**S – Satisfactory:** The plan meets the minimum for the requirement. Reviewer's comments are encouraged, but not required.

Each requirement includes separate elements. All elements of a requirement must be rated "Satisfactory" in order for the requirement to be fulfilled and receive a summary score of "Satisfactory." A "Needs Improvement" score on elements shaded in gray (recommended but not required) will not preclude the plan from passing.

When reviewing single jurisdiction plans, reviewers may want to put an N/A in the boxes for multi-jurisdictional plan requirements. When reviewing multi-jurisdictional plans, however, all elements apply. States that have additional requirements can add them in the appropriate sections of the *Local Multi-Hazard Mitigation Planning Guidance* or create a new section and modify this Plan Review Crosswalk to record the score for those requirements. Optional matrices for assisting in the review of sections on profiling hazards, assessing vulnerability, and identifying and analyzing mitigation actions are found at the end of the Plan Review Crosswalk.

The example below illustrates how to fill in the Plan Review Crosswalk.:

Assessing Vulnerability: Overview				
<b>Requirement §201.6(c)(2)(ii):</b> [The risk assessment <b>shall</b> include a] description of the jurisdiction's vulnerability to the hazards described in paragraph (c)(2)(i) of this section. This description <b>shall</b> include an overall summary of each hazard and its impact on the community.				
Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE	
			N	S
A. Does the <b>new or updated</b> plan include an <b>overall summary</b> description of the jurisdiction's <b>vulnerability</b> to each hazard?	Section II, pp. 4-10	The plan describes the types of assets that are located within geographically defined hazard areas as well as those that would be affected by winter storms.		
B. Does the <b>new or updated</b> plan address the <b>impact</b> of each hazard on the jurisdiction?	Section II, pp. 10-20	The plan does not address the impact of two of the five hazards addressed in the plan. <b>Required Revisions:</b> <ul style="list-style-type: none"> <li>Include a description of the impact of floods and earthquakes on the assets.</li> </ul> <b>Recommended Revisions:</b> This information can be presented in terms of dollar value or percentages of damage.		
SUMMARY SCORE				

# LOCAL MITIGATION PLAN REVIEW CROSSWALK

## LOCAL MITIGATION PLAN REVIEW SUMMARY

The plan cannot be approved if the plan has not been formally adopted. Each requirement includes separate elements. All elements of the requirement must be rated "Satisfactory" in order for the requirement to be fulfilled and receive a score of "Satisfactory." Elements of each requirement are listed on the following pages of the Plan Review Crosswalk. A "Needs Improvement" score on elements shaded in gray (recommended but not required) will not preclude the plan from passing. Reviewer's comments must be provided for requirements receiving a "Needs Improvement" score.

### Prerequisite(s) (Check Applicable Box)

1. Adoption by the Local Governing Body:  
§201.6(c)(5) OR

NOT MET	MET

2. Multi-Jurisdictional Plan Adoption: §201.6(c)(5)  
**AND**

NOT MET	MET

3. Multi-Jurisdictional Planning Participation: §201.6(a)(3)

NOT MET	MET

### Planning Process

4. Documentation of the Planning Process: §201.6(b)  
and §201.6(c)(1)

N	S

### Risk Assessment

5. Identifying Hazards: §201.6(c)(2)(i)

N	S

6. Profiling Hazards: §201.6(c)(2)(i)

N	S

7. Assessing Vulnerability: Overview: §201.6(c)(2)(ii)

N	S

8. Assessing Vulnerability: Addressing Repetitive  
Loss Properties. §201.6(c)(2)(ii)

N	S

9. Assessing Vulnerability: Identifying Structures,  
Infrastructure, and Critical Facilities: §201.6(c)(2)(ii)(B)

N	S

10. Assessing Vulnerability: Estimating Potential Losses:  
§201.6(c)(2)(ii)(B)

N	S

11. Assessing Vulnerability: Analyzing Development  
Trends: §201.6(c)(2)(ii)(C)

N	S

12. Multi-Jurisdictional Risk Assessment: §201.6(c)(2)(iii)

N	S

\*States that have additional requirements can add them in the appropriate sections of the *Local Multi-Hazard Mitigation Planning Guidance* or create a new section and modify this Plan Review Crosswalk to record the score for those requirements.

## SCORING SYSTEM

Please check one of the following for each requirement.

**N – Needs Improvement:** The plan does not meet the minimum for the requirement. Reviewer's comments must be provided.

**S – Satisfactory:** The plan meets the minimum for the requirement. Reviewer's comments are encouraged, but not required.

### Mitigation Strategy

13. Local Hazard Mitigation Goals: §201.6(c)(3)(i)

14. Identification and Analysis of Mitigation Actions:  
§201.6(c)(3)(ii)

15. Identification and Analysis of Mitigation  
Actions: NFIP Compliance. §201.6(c)(3)(ii)

16. Implementation of Mitigation Actions:  
§201.6(c)(3)(iii)

17. Multi-Jurisdictional Mitigation Actions:  
§201.6(c)(3)(iv)

N	S

### Plan Maintenance Process

18. Monitoring, Evaluating, and Updating the Plan:  
§201.6(c)(4)(ii)

19. Incorporation into Existing Planning  
Mechanisms: §201.6(c)(4)(ii)

20. Continued Public Involvement: §201.6(c)(4)(iii)

N	S

### Additional State Requirements\*

Insert State Requirement

Insert State Requirement

Insert State Requirement

N	S

## LOCAL MITIGATION PLAN APPROVAL STATUS

PLAN NOT APPROVED

☐

See Reviewer's Comments

PLAN APPROVED

☐

## LOCAL MITIGATION PLAN REVIEW CROSSWALK

### Local Mitigation Plan Review and Approval Status

<b>Jurisdiction:</b> Sussex County and municipalities	<b>Title of Plan:</b> Sussex County All-Hazards Mitigation Plan Update	<b>Date of Plan:</b> March 2010
<b>Local Point of Contact:</b> Joe Thomas	<b>Address:</b> Sussex County EOC 21911 Rudder Lane P.O. Box 589 Georgetown, DE 19947-0589	
<b>Title:</b> Director		
<b>Agency:</b> Sussex County EOC		
<b>Phone Number:</b> 302-855-7801	<b>E-Mail:</b> jthomas@sussexcountymde.gov	

<b>State Reviewer:</b>	<b>Title:</b>	<b>Date:</b>
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<b>FEMA Reviewer:</b>	<b>Title:</b>	<b>Date:</b>
<b>Date Received in FEMA Region [Insert #]</b>		
<b>Plan Not Approved</b>		
<b>Plan Approved</b>		
<b>Date Approved</b>		

Jurisdiction:	DFIRM		NFIP Status*			
	In Plan	NOT in Plan	Y	N	N/A	CRS Class
1. Sussex County		x	x			7munis – 5 are class 8 2 are class 9
3.						
4.						

**LOCAL MITIGATION PLAN REVIEW CROSSWALK**

5. [ATTACH PAGE(S) WITH ADDITIONAL JURISDICTIONS]						
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**\* Notes:**                      **Y = Participating**                      **N = Not Participating**                      **N/A = Not Mapped**

## LOCAL MITIGATION PLAN REVIEW CROSSWALK

### PREREQUISITE(S)

#### 1. Adoption by the Local Governing Body

**Requirement §201.6(c)(5):** [The local hazard mitigation plan **shall** include] documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval of the plan (e.g., City Council, County Commissioner, Tribal Council).

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE	
			NOT MET	MET
A. Has the local governing body adopted <b>new or updated</b> plan?	Pending upon DEMA/FEMA approval			
B. Is supporting documentation, such as a resolution, included?	Pending upon DEMA/FEMA approval			
SUMMARY SCORE				

#### 2. Multi-Jurisdictional Plan Adoption

**Requirement §201.6(c)(5):** For multi-jurisdictional plans, each jurisdiction requesting approval of the plan **must** document that it has been formally adopted.

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE	
			NOT MET	MET
A. Does the <b>new or updated</b> plan indicate the specific jurisdictions represented in the plan?	Section 1: Page 1			
B. For each jurisdiction, has the local governing body adopted the <b>new or updated</b> plan?	Pending upon adopting of plan by county commission			
C. Is supporting documentation, such as a resolution, included for each participating jurisdiction?	Pending upon adopting of plan by county commission			
SUMMARY SCORE				

#### 3. Multi-Jurisdictional Planning Participation

**Requirement §201.6(a)(3):** Multi-jurisdictional plans (e.g., watershed plans) may be accepted, as appropriate, as long as each jurisdiction has participated in the process ... Statewide plans will not be accepted as multi-jurisdictional plans.

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE	
			NOT MET	MET
A. Does the <b>new or updated</b> plan describe <b>how</b> each	Section 2: Page			



## LOCAL MITIGATION PLAN REVIEW CROSSWALK

jurisdiction participated in the plan's development?	11: Table 2.2			
B. Does the updated plan identify all participating jurisdictions, including new, continuing, and the jurisdictions that no longer participate in the plan?	Section 2: Page 11: Table 2.2			
SUMMARY SCORE				

**PLANNING PROCESS:** §201.6(b): *An open public involvement process is essential to the development of an effective plan.*

### 4. Documentation of the Planning Process

**Requirement §201.6(b):** *In order to develop a more comprehensive approach to reducing the effects of natural disasters, the planning process **shall** include:*

- (1) *An opportunity for the public to comment on the plan during the drafting stage and prior to plan approval;*
- (2) *An opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development, as well as businesses, academia and other private and non-profit interests to be involved in the planning process; and*
- (3) *Review and incorporation, if appropriate, of existing plans, studies, reports, and technical information.*

**Requirement §201.6(c)(1):** *[The plan **shall** document] 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.*

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE	
			N	S
A. Does the plan provide a narrative description of the process followed to prepare the <b>new or updated</b> plan?	Section 2: Pages 2 - 4			
B. Does the <b>new or updated</b> plan indicate who was involved in the <b>current</b> planning process? (For example, who led the development at the staff level and were there any external contributors such as contractors? Who participated on the plan committee, provided information, reviewed drafts, etc.?)	Section 2: Pages 1 and 4 - 5: Table 2.1			
C. Does the <b>new or updated</b> plan indicate how the public was involved? (Was the public provided an opportunity to comment on the plan during the drafting stage and prior to the plan approval?)	Section 2: Pages 7 - 8			
D. <b>Does the new or updated plan discuss the</b> opportunity for neighboring communities, agencies, businesses, academia, nonprofits, and other interested parties to be involved in the planning process?	Section 2: Pages 8 – 10			
E. Does the planning process describe the review and incorporation, if appropriate, of existing plans, studies, reports, and technical information?	Section 5: Pages 2 - 16: Table 5.1			

## LOCAL MITIGATION PLAN REVIEW CROSSWALK

### 4. Documentation of the Planning Process

**Requirement §201.6(b):** In order to develop a more comprehensive approach to reducing the effects of natural disasters, the planning process **shall** include:

- (1) An opportunity for the public to comment on the plan during the drafting stage and prior to plan approval;
- (2) An opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development, as well as businesses, academia and other private and non-profit interests to be involved in the planning process; and
- (3) Review and incorporation, if appropriate, of existing plans, studies, reports, and technical information.

**Requirement §201.6(c)(1):** [The plan **shall** document] 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.

F. Does the updated plan document how the planning team reviewed and analyzed each section of the plan and whether each section was revised as part of the update process?	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE	
			N	S
	Section 2: Pages 2 - 4			
SUMMARY SCORE				

**RISK ASSESSMENT:** §201.6(c)(2): The plan shall include a risk assessment that provides the factual basis for activities proposed in the strategy to reduce losses from identified hazards. Local risk assessments must provide sufficient information to enable the jurisdiction to identify and prioritize appropriate mitigation actions to reduce losses from identified hazards.

### 5. Identifying Hazards

**Requirement §201.6(c)(2)(i):** [The risk assessment **shall** include a] description of the type ... of all natural hazards that can affect the jurisdiction.

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE	
			N	S
A. Does the <b>new or updated</b> plan include a <b>description</b> of the types of <b>all natural hazards</b> that affect the jurisdiction?	Section 4.1: Pages 2 - 31			
SUMMARY SCORE				

### 6. Profiling Hazards

**Requirement §201.6(c)(2)(i):** [The risk assessment **shall** include a] description of the ... 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.

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE	
			N	S
A. Does the risk assessment identify the <b>location</b> (i.e., geographic area affected) of each natural hazard	Section 4.1: Pages 2 - 31			

## LOCAL MITIGATION PLAN REVIEW CROSSWALK

addressed in the <b>new or updated</b> plan?				
B. Does the risk assessment identify the <b>extent</b> ( <i>i.e.</i> , magnitude or severity) of each hazard addressed in the <b>new or updated</b> plan?	Section 4.2: Pages 2 - 37			
C. Does the plan provide information on <b>previous occurrences</b> of each hazard addressed in the <b>new or updated</b> plan?	Section 4.2: Pages 2 - 37			
D. Does the plan include the <b>probability of future events</b> ( <i>i.e.</i> , chance of occurrence) for each hazard addressed in the <b>new or updated</b> plan?	Section 4.2: Pages 37 - 38			
SUMMARY SCORE				

## LOCAL MITIGATION PLAN REVIEW CROSSWALK

### 7. Assessing Vulnerability: Overview

**Requirement §201.6(c)(2)(ii):** [The risk assessment **shall** include a] description of the jurisdiction's vulnerability to the hazards described in paragraph (c)(2)(i) of this section. This description **shall** include an overall summary of each hazard and its impact on the community.

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE	
			N	S
A. Does the <b>new or updated</b> plan include an <b>overall summary</b> description of the jurisdiction's <b>vulnerability</b> to each hazard?	Chapter 4.3: Pages 7 - 48			
B. Does the <b>new or updated</b> plan address the <b>impact</b> of each hazard on the jurisdiction?	Chapter 4.3: Pages 7 - 48			
SUMMARY SCORE				

### 8. Assessing Vulnerability: Addressing Repetitive Loss Properties

**Requirement §201.6(c)(2)(ii):** [The risk assessment] **must** also address National Flood Insurance Program (NFIP) insured structures that have been repetitively damaged floods.

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE	
			N	S
A. Does the <b>new or updated</b> plan describe vulnerability in terms of the types and numbers of <b>repetitive loss properties</b> located in the identified hazard areas?	Section 4.3: Pages 15 – 16: Table 4.3 – 3 and Figure 4.3 - 7	<b>Note: This requirement becomes effective for all local plans approved after October 1, 2008.</b>		
SUMMARY SCORE				

### 9. Assessing Vulnerability: Identifying Structures

**Requirement §201.6(c)(2)(ii)(A):** The plan **should** describe vulnerability in terms of the types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard area ... .

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE	
			N	S
A. Does the <b>new or updated</b> plan describe vulnerability in terms of the <b>types and numbers</b> of <b>existing</b> buildings, infrastructure, and critical facilities located in the identified hazard areas?	Section 4.3: Pages 12 – 14: Tables 4.3 – 1 and 4.3 - 2	<b>Note: A "Needs Improvement" score on this requirement will not preclude the plan from passing.</b>		
B. Does the <b>new or updated</b> plan describe vulnerability in terms of the <b>types and numbers</b> of <b>future</b> buildings, infrastructure, and critical facilities located in the identified hazard areas?	Section 4.3: Pages 12 - 14	<b>Note: A "Needs Improvement" score on this requirement will not preclude the plan from passing.</b>		
SUMMARY SCORE				

## LOCAL MITIGATION PLAN REVIEW CROSSWALK

### 10. Assessing Vulnerability: Estimating Potential Losses

**Requirement §201.6(c)(2)(ii)(B):** [The plan **should** describe vulnerability in terms of an] estimate of the potential dollar losses to vulnerable structures identified in paragraph (c)(2)(ii)(A) of this section and a description of the methodology used to prepare the estimate ... .

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE	
			N	S
A. Does the <b>new or updated</b> plan estimate <b>potential dollar losses</b> to vulnerable structures?	Section 4.3: Page 49: Table 4.3 - 27	<b>Note: A "Needs Improvement" score on this requirement will not preclude the plan from passing.</b>		
B. Does the <b>new or updated</b> plan describe the <b>methodology</b> used to prepare the estimate?	Section 4.3: Page 48	<b>Note: A "Needs Improvement" score on this requirement will not preclude the plan from passing.</b>		
SUMMARY SCORE				

### 11. Assessing Vulnerability: Analyzing Development Trends

**Requirement §201.6(c)(2)(ii)(C):** [The plan **should** describe vulnerability in terms of] providing a general description of land uses and development trends within the community so that mitigation options can be considered in future land use decisions.

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE	
			N	S
A. Does the <b>new or updated</b> plan describe land uses and development trends?	Section 4.3: Pages 5 – 6	<b>Note: A "Needs Improvement" score on this requirement will not preclude the plan from passing.</b>		
SUMMARY SCORE				

### 12. Multi-Jurisdictional Risk Assessment

**Requirement §201.6(c)(2)(iii):** For multi-jurisdictional plans, the risk assessment **must** assess each jurisdiction's risks where they vary from the risks facing the entire planning area.

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE	
			N	S
A. Does the <b>new or updated</b> plan include a risk assessment for each participating jurisdiction as needed to reflect unique or varied risks?	Section 4.3: Page 49: Table 4.3 - 27			
SUMMARY SCORE				

## LOCAL MITIGATION PLAN REVIEW CROSSWALK

**MITIGATION STRATEGY:** §201.6(c)(3): *The plan shall include a mitigation strategy that provides the jurisdiction's blueprint for reducing the potential losses identified in the risk assessment, based on existing authorities, policies, programs and resources, and its ability to expand on and improve these existing tools.*

### 13. Local Hazard Mitigation Goals

**Requirement §201.6(c)(3)(i):** *[The hazard mitigation strategy **shall** include a] description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards.*

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE	
			N	S
A Does the <b>new or updated</b> plan include a description of mitigation <b>goals</b> to reduce or avoid long-term vulnerabilities to the identified hazards?	Section 6.1: Page 2			
SUMMARY SCORE				

### 14. Identification and Analysis of Mitigation Actions

**Requirement §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 effects of each hazard, with particular emphasis on new and existing buildings and infrastructure.*

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE	
			N	S
A. Does the <b>new or updated</b> plan identify and analyze a <b>comprehensive range</b> of specific mitigation actions and projects for each hazard?	Section 6.2: Pages 4 – 10: Table 6.2 B			
B Do the identified actions and projects address reducing the effects of hazards on <b>new</b> buildings and infrastructure?	Section 6.2: Pages 4 – 10: Table 6.2 B			
C. Do the identified actions and projects address reducing the effects of hazards on <b>existing</b> buildings and infrastructure?	Section 6.2: Pages 4 – 10: Table 6.2 B			
SUMMARY SCORE				

## LOCAL MITIGATION PLAN REVIEW CROSSWALK

### 15. Identification and Analysis of Mitigation Actions: National Flood Insurance Program (NFIP) Compliance

**Requirement: §201.6(c)(3)(ii):** [The mitigation strategy] must also address the jurisdiction's participation in the National Flood Insurance Program (NFIP), and continued compliance with NFIP requirements, as appropriate.

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE	
			N	S
A. Does the new or updated plan describe the jurisdiction (s) participation in the NFIP?	Section 6.1: Pages 5 – 7: Table 6.1	<b>Note: This requirement becomes effective for all local mitigation plans approved after October 1, 2008.</b>		
B. Does the mitigation strategy identify, analyze and prioritize actions related to continued compliance with the NFIP?	Section 6.2: Pages 4 – 10: Table 6.2 B	<b>Note: This requirement becomes effective for all local mitigation plans approved after October 1, 2008.</b>		
SUMMARY SCORE				

### 16. Implementation of Mitigation Actions

**Requirement: §201.6(c)(3)(iii):** [The mitigation strategy section **shall** include] an action plan describing how the actions identified in section (c)(3)(ii) will be prioritized, implemented, and administered by the local jurisdiction. Prioritization **shall** include a special emphasis on the extent to which benefits are maximized according to a cost benefit review of the proposed projects and their associated costs.

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE	
			N	S
A. Does the <b>new or updated</b> mitigation strategy include how the actions are <b>prioritized</b> ? (For example, is there a discussion of the process and criteria used?)	Section 6.2: Pages 11 - 68			
B. Does the <b>new or updated</b> mitigation strategy address how the actions will be implemented and administered, including the responsible department , existing and potential resources and the timeframe to complete each action?	Section 6.2: Pages 11 - 68			
C. Does the <b>new or updated</b> prioritization process include an emphasis on the use of a <b>cost-benefit review</b> to maximize benefits?	Section 6.2: Page 1			
D. Does the <b>updated</b> plan identify the completed, deleted or deferred mitigation actions as a benchmark for progress, and if activities are unchanged (i.e., deferred), does the updated plan describe why no changes occurred?	Section 6.2: Page 3: Table 6.2 A			
SUMMARY SCORE				

## LOCAL MITIGATION PLAN REVIEW CROSSWALK

### 17. Multi-Jurisdictional Mitigation Actions

**Requirement §201.6(c)(3)(iv):** For multi-jurisdictional plans, there **must** be identifiable action items specific to the jurisdiction requesting FEMA approval or credit of the plan.

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE	
			N	S
A. Does the <b>new or updated</b> plan include identifiable <b>action items</b> for each jurisdiction requesting FEMA approval of the plan?	Section 6.2: Pages 4 – 10: Table 6.2 B			
B. Does the <b>updated</b> plan identify the completed, deleted or deferred mitigation actions as a benchmark for progress, and if activities are unchanged ( <i>i.e.</i> , deferred), does the updated plan describe why no changes occurred?	Section 6.2: Page 3: Table 6.2 A			
SUMMARY SCORE				

### PLAN MAINTENANCE PROCESS

### 18. Monitoring, Evaluating, and Updating the Plan

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

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE	
			N	S
A. Does the <b>new or updated</b> plan describe the method and schedule for <b>monitoring</b> the plan, including the responsible department?	Section 7: Page 1			
B. Does the <b>new or updated</b> plan describe the method and schedule for <b>evaluating</b> the plan, including how, when and by whom ( <i>i.e.</i> the responsible department)?	Section 7: Pages 2 - 4			
C. Does the <b>new or updated</b> plan describe the method and schedule for <b>updating</b> the plan within the five-year cycle?	Section 7: Page 2			
SUMMARY SCORE				



## LOCAL MITIGATION PLAN REVIEW CROSSWALK

### 19. Incorporation into Existing Planning Mechanisms

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

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE	
			N	S
A. Does the <b>new or updated</b> plan identify other local planning mechanisms available for incorporating the mitigation requirements of the mitigation plan?	Section 7: Page 2			
B. Does the <b>new or updated</b> plan include a process by which the local government will incorporate the mitigation strategy and other information contained in the plan (e.g., risk assessment) into other planning mechanisms, when appropriate?	Section 7: Page 2			
C. Does the <b>updated</b> plan explain how the local government incorporated the mitigation strategy and other information contained in the plan (e.g., risk assessment) into other planning mechanisms, when appropriate?	Section 7: Page 2			
SUMMARY SCORE				

### Continued Public Involvement

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

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE	
			N	S
A. Does the <b>new or updated</b> plan explain how <b>continued public participation</b> will be obtained? (For example, will there be public notices, an on-going mitigation plan committee, or annual review meetings with stakeholders?)	Section 7: Page 4			
SUMMARY SCORE				

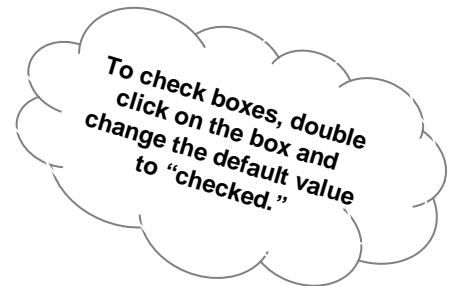
## LOCAL MITIGATION PLAN REVIEW CROSSWALK

### MATRIX A: PROFILING HAZARDS

This matrix can assist FEMA and the State in scoring each hazard. Local jurisdictions may find the matrix useful to ensure that their plan addresses each natural hazard that can affect the jurisdiction. **Completing the matrix is not required.**

**Note:** First, check which hazards are identified in requirement §201.6(c)(2)(i). Then, place a checkmark in either the N or S box for each applicable hazard. An “N” for any element of any identified hazard will result in a “Needs Improvement” score for this requirement. List the hazard and its related shortcoming in the comments section of the Plan Review Crosswalk.

Hazard Type	Hazards Identified Per Requirement §201.6(c)(2)(i)	A. Location		B. Extent		C. Previous Occurrences		D. Probability of Future Events	
	Yes	N	S	N	S	N	S	N	S
Avalanche	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Coastal Erosion	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Coastal Storm	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Dam Failure	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Drought	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Earthquake	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Expansive Soils	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Levee Failure	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Flood	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Hailstorm	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Hurricane	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Land Subsidence	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Landslide	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Severe Winter Storm	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Tornado	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Tsunami	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Volcano	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Wildfire	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Windstorm	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>



Legend:

§201.6(c)(2)(i) Profiling Hazards

- A. Does the risk assessment identify the location (*i.e.*, geographic area affected) of each hazard addressed in the **new or updated** plan?
- B. Does the risk assessment identify the extent (*i.e.*, magnitude or severity) of each hazard addressed in the **new or updated** plan?
- C. Does the plan provide information on previous occurrences of each natural hazard addressed in the **new or updated** plan?
- D. Does the plan include the probability of future events (*i.e.*, chance of occurrence) for each hazard addressed in the plan?

# LOCAL MITIGATION PLAN REVIEW CROSSWALK

## MATRIX B: ASSESSING VULNERABILITY

This matrix can assist FEMA and the State in scoring each hazard. Local jurisdictions may find the matrix useful to ensure that the new or updated plan addresses each requirement. **Completing the matrix is not required.**

*Note: First, check which hazards are identified in requirement §201.6(c)(2)(i). Then, place a checkmark in either the N or S box for each **applicable** hazard. An “N” for any element of any identified hazard will result in a “Needs Improvement” score for this requirement. List the hazard and its related shortcoming in the comments section of the Plan Review Crosswalk. Note: Receiving an N in the shaded columns will not preclude the plan from passing.*

To check boxes, double click on the box and change the default value to “checked.”

Hazard Type	Hazards Identified Per Requirement §201.6(c)(2)(i)		A. Overall Summary Description of Vulnerability		B. Hazard Impact			A. Types and Number of Existing Structures in Hazard Area (Estimate)		B. Types and Number of Future Structures in Hazard Area (Estimate)			A. Loss Estimate		B. Methodology	
	Yes		N	S	N	S		N	S	N	S		N	S	N	S
Avalanche	<input type="checkbox"/>	§201.6(c)(2)(ii) Assessing Vulnerability: Overview	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	§201.6(c)(2)(ii) Assessing Vulnerability: Identifying Structures	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	§201.6(c)(2)(ii) Assessing Vulnerability: Estimating Potential Losses	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Coastal Erosion	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Coastal Storm	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Dam Failure	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Drought	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Earthquake	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Expansive Soils	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Levee Failure	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Flood	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Hailstorm	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Hurricane	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Land Subsidence	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Landslide	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Severe Winter Storm	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Tornado	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Tsunami	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Volcano	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Wildfire	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Windstorm	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Other _____	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
Other _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			

### Legend:

§201.6(c)(2)(ii) Assessing Vulnerability: Overview

- Does the **new or updated** plan include an overall summary description of the jurisdiction's vulnerability to each hazard?
- Does the **new or updated** plan address the impact of each hazard on the jurisdiction?

- Does the **new or updated** plan describe vulnerability in terms of the types and numbers of future buildings, infrastructure, and critical facilities located in the identified hazard areas?

§201.6(c)(2)(ii)(A) Assessing Vulnerability: Identifying Structures

- Does the **new or updated** plan describe vulnerability in terms of the types and numbers of existing buildings, infrastructure, and critical facilities located in the identified hazard areas?

§201.6(c)(2)(ii)(B) Assessing Vulnerability: Estimating Potential Losses

- Does the **new or updated** plan estimate potential dollar losses to vulnerable structures?
- Does the **new or updated** plan describe the methodology used to prepare the estimate?

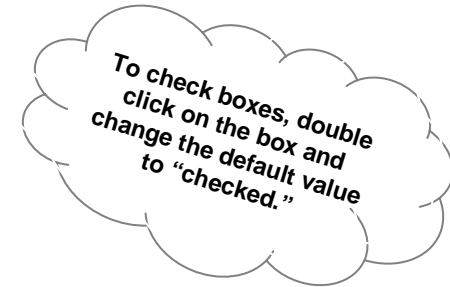
## LOCAL MITIGATION PLAN REVIEW CROSSWALK

### MATRIX C: IDENTIFICATION AND ANALYSIS OF MITIGATION ACTIONS

This matrix can assist FEMA and the State in scoring each hazard. Local jurisdictions may find the matrix useful to ensure consideration of a range of actions for each hazard. **Completing the matrix is not required.**

*Note: First, check which hazards are identified in requirement §201.6(c)(2)(i). Then, place a checkmark in either the N or S box for each **applicable** hazard. An “N” for any identified hazard will result in a “Needs Improvement” score for this requirement. List the hazard and its related shortcoming in the comments section of the Plan Review Crosswalk.*

Hazard Type	Hazards Identified Per Requirement §201.6(c)(2)(i)	A. Comprehensive Range of Actions and Projects	
	Yes	N	S
Avalanche	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Coastal Erosion	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Coastal Storm	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Dam Failure	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Drought	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Earthquake	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Expansive Soils	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Levee Failure	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Flood	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Hailstorm	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Hurricane	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Land Subsidence	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Landslide	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Severe Winter Storm	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Tornado	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Tsunami	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Volcano	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Wildfire	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Windstorm	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>



**Legend:**

§201.6(c)(3)(ii) Identification and Analysis of Mitigation Actions

A. Does the **new or updated** plan identify and analyze a comprehensive range of specific mitigation actions and projects for each hazard?

# APPENDIX C

## SUPPORTING INFORMATION

## HAZARD MITIGATION ASSISTANCE PROGRAM WORKSHOP

### Sign In

### Sussex County Mitigation Workshop

DATE: 7/30/09 HOSTING AGENCY: DEMA / SUSSEX EMA / DNREC RESPONSIBLE PERSON: DAVE CARLSON / MIKE POWELL  
Joe Thomas

PLEASE PRINT ALL INFORMATION LEGIBLY

NAME	AGENCY	EMAIL	PHONE NUMBER
STAN MILLS	CITY OF REHOBOTH	Smills@CITYOFREHOBOTH.com	227-4641
Susan Webb	Sussex County	Swebb@sussexcountyde.gov	855-7741
Gary Ferrrese	CITY of Rehoboth	G.Ferrrese@CITYofRehoboth.com	227-4641
Robert Dickerson	Town of Selbyville	TMSELBY@MCHSI.COM	302-436-8314
Jenny Massey	SUSSEX COUNTY - EMAL	JMASSEY@sussexcountyde.gov	(302) 555-1299
BILL FASANO	TOWN OF LAUREL	laurelbf@comcast.net	815-2277
Woody Vickers	Town of Laurel	laurelwp@comcast.net	302-875-2277
HAL GODWIN	SUSSEX COUNTY	hgodwin@sussexcountymd.com	854-5060
CHARLES ANDERSON	CITY OF SEAFORD	CAnderson@Seafordde.com	629-9173
Delores Slatcher	City of Seaford	dslatcher@seafordde.com	629-9173
Gilbert Holt	Lewis BPO	GILBERTHOLT@lewisbpo.com	302-645-1651
Michael J. Smith	Town of Blades	MJS1HSS3@MSN.COM	302-629-7366
Cathy Gray	Town of Cambridge	cgray@cambridgeva.net	301-537-9197
GARY JAYNE	Town of Seabrook	gjayne@verizon.net	302-537-7340

## Sussex County Mitigation Workshop

DATE: 7/30/09 HOSTING AGENCY: DEMA/Sussex EMA/ENREC RESPONSIBLE PERSON: Dave Carlson, Mike Poull  
Joe Thomas

PLEASE PRINT ALL INFORMATION LEGIBLY

NAME	AGENCY	EMAIL	PHONE NUMBER
MICHAEL CUSICK	TOWN OF SOUTH BETHANY	TOWNMANAGER@SOUTHBETHANY.CG	302-539-3653
ROBIN DAVIES	TOWN OF MELTON	RDANIES@CI.MELTON.DE.US	302-654-4110
ALLEN ATKINS	TOWN OF MILTON	AATKINS@CI.MILTON.DE.US	302-654-4110
Staine Pease	City of Lewes	epease@ci.Lewes.de.us	302-645-7777 x100
Delores Price	Town of Ellendale	dprice@ellendale.gov	302-422-6787
L. Chatham Mursch	LEWES	leonard.mursch@NJState.DE.us	302-645-6264
PAUL ECKRICH	City of Lewes	peckrich@ci.Lewes.de.us	302-645-7777 (109)
RALPH MITCHELL	TOWN OF BETHANY DE	RMITCHELL@TOWNOFBETHANYDE.US	302-539-7117
Joe Thomas	Sussex County EDC	jthomas@sussexcountyde.gov	302-855-7801
Dave Carlson	DEMA	Dave.carlson@state.de.us	302-659-2213
DON KNOX	DEMA	DON.KNOX@state.de.us	302-659-2204

# First Committee Meeting

## Sign-in

### HAZARD MITIGATION PLAN MEETING Wednesday, February 03, 2010

2pm meeting  
Pg 1 of 2

NAME	ORGANIZATION	ADDRESS	E-MAIL ADDRESS	PHONE NUMBER
Michael Scott	ESRIC/SC	Salisbury MD	mscott@salisbury.gov	410-543-6456
Michael Mitchell	Town of Georgetown Team of Harrisburg Acres	314 GAREFIELD RD BENTLEY HILL, DE 19308 104 Tidewater Dr Harrisburg, PA 17111	AMW@ESRIC.ORG DEPARTMENT OF GEOGRAPHIC INFORMATION SYSTEMS townmgr@harrisburgpa.gov	302-539-1000 302-227-6411
Thomas Lott	Town of Harrisburg Acres	Harrisburg, PA 17111	townmgr@harrisburgpa.gov	302-227-6411
Wanda Davis	Town of Harrisburg Acres	3A Pine Road Harrisburg, PA 17111	wadavis@harrisburgpa.gov	302-227-6411
Jeff Shockey	S.C. Planning and Zoning S.C. Building Conc	Georgetown DE #2 The Circle Georgetown, DE	jshockey@sussexcountypa.gov	855-7862
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Bob Johnson	Town of Selbyville	201 Sunset Ave. Selbyville, DE	tmj@SELBYVILLE-DE.MIL	436-8314
Penney Gregory	Town of Georgetown	P.O. Box 217 300 NE DARTMOUTH AVE, 20004	dp@georgetownde.com	302-422-6727
Michael J. Smith	Town of Georgetown	ST. 15573	ms@HSSB+MSU.COM	302-629-7866
Eze Buley	City of Baltimore	414 HANCOCK ST	bat@ESSB+MSU.COM	302-629-7866
Paul Eckard	City of Lancaster	P.O. Box 232 Lancaster, DE 19380	peckard@cityoflancaster.com	645-7777
Leonard Chatham Marsh	City of Lancaster	P.O. Box 227 Lancaster, DE 19380	leonard.marsh@cityoflancaster.com	645-6264
Gene Dvornick	Georgetown	39 THE CIRCLE GEORGETOWN, DE 1997	gdvornick@georgetownde.com	856-7391



2 pm meeting  
Pg 2 of 2

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**FIRST PUBLIC MEETING**

**Meeting Announcement**

*Sussex County*

**Sussex County to host all-hazards plan meeting**

***Document serves as plan of action to cope in wake of natural, man-made disasters***

**FOR IMMEDIATE 1200 Hours, Thursday**

**RELEASE Jan. 21, 2010**

The Sussex County Emergency Operations Center invites residents and property owners to attend two upcoming public meetings to offer ideas and comments on a federally required update to the County's All Hazard Multi-Jurisdictional Mitigation Plan.

The first meeting will be held Wednesday, Feb. 3, 2010, at the Sussex County EOC, 21911 Rudder Lane, east of Georgetown. The second meeting will be held Wednesday, Feb. 10, at the same location. Both meetings will begin at 6 p.m.

The hazard mitigation plan, first adopted in 2005, serves as a comprehensive, long-term planning tool used to identify various strategies local emergency planners would use in the event of a disaster. The overall goal of the effort is to reduce or eliminate the loss of human life and damage to property as a result of hazards, both natural and man-made.

Local jurisdictions must update their plans every five years. As part of that process, the public has the opportunity to review the plan, offer input, and help shape the update. County emergency planners intend to present updated mitigation actions for the plan revision at the second meeting, on Feb. 10.

For more information, contact EOC Director Joseph L. Thomas at (302) 855-7801.

###

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AMBULANCE CALLBOARD-LEPC**

# HAZARD MITIGATION PLAN MEETING

## Wednesday, February 03, 2010

NAME	ORGANIZATION	ADDRESS	E-MAIL ADDRESS	PHONE NUMBER
Roger Thompson	Milton Wright	206 Greist Mize Milton DE 19968	RogThom25@Verizon.NET	302-684-1001
Joseph H. Thompson	Indian River Vol. Fire Company	3222 Oak Orchard Rd Millsboro, DE 19966	Joseph.H.Thompson@IEAFPC.com	302-858-8580
Richard S. Allan	Prime Hook Beach Organization	9170 Shore Drive Wilmington DE 19963	rsallan@comcast.net	301-758-0477
Twila Burton	EARL FREEMAN COMMUNITIES	36097 Sand Covey, Seabrook DE 19715	twilg@cmf.com	436-3000
Kevin E Burdette	Artesian Water	28322 Leves-6' from Highway Milton, DE 19968	KBURDETTE@ARTESIANWATER.COM	302-745-8800
Frank Fetterhake	Artesian water	400 Washington Ave Hudsonville MI 49423	FFETTERHAK@ARTESIANWATER.COM	302-453-2510
Jeff Rice	Artesian Water	28382 Leves Milton DE 19968	JRICE@ARTESIANWATER.COM	302-218-0470
Carl Davis	Sussex Co Fire Dept	P.O. Box 585 Georgetown	CDavis@SussexCountyDel.gov	858-5302

Sign In

## **Material Presented**

PowerPoint Presentation: Meeting #1

# Hazard Identification and Vulnerability Assessment of Environmental Hazards in Sussex County, DE

Michael S. Scott, PhD, GISP

Eastern Shore Regional GIS Cooperative  
at Salisbury University



## Outline

- Definitions
- Review of process
- Hazard Identification
- Vulnerability Assessment
- What happens next?



## Definitions

- Asset – an object of value to a community
- Hazard – a threat to an asset
- Risk – probability that a hazard event may occur
- Vulnerability – potential for loss
- Mitigation – reducing the occurrence or the impact of a hazard event



## Review of Planning Process

- Goal: Review the 2004 Hazard Mitigation Plan and recommend updates and corrections
- Organize work group and facilitate the process
- Hazard assessment and vulnerability analysis
- Assess local capabilities
- Develop goals and objectives and mitigation actions
- Write mitigation plan and prioritize projects
- Implement the plan



## Hazard Identification & Profiling

- Data Sources
  - Federal Emergency Management Agency
  - National Climatic Data Center
  - US Army Corps of Engineers (Philadelphia)
  - US Geological Survey
  - US Department of Agriculture
  - Delaware DataMil



## Hazards to be Updated

- Floods
  - Riverine and Coastal
- Coastal Storm Wind
  - Tropical or Nor'easter
- Tornadoes
- Thunderstorm Wind
- Hail
- Winter Storms
- Extreme Heat/Cold
- Earthquakes
- Droughts



## Hazards Reviewed, Not Updated

- Low Level of Vulnerability
  - Wildfires
  - Erosion
  - Sinkholes
  - Landslides
  - Volcanoes
  - Tsunamis
- Not Required by FEMA
  - Dam/Levee Failures
  - Weapons of Mass Destruction
  - Pipelines
  - Hazardous materials



## Assessment Method

- HAZUS-MH MR<sub>3</sub>
  - Flood
  - Earthquake
  - Hurricane Wind
- Area Averages
  - Tornado
  - Severe Thunderstorm
  - Hail
  - Winter Storm
  - Extreme Temperatures



## Flood: Definition

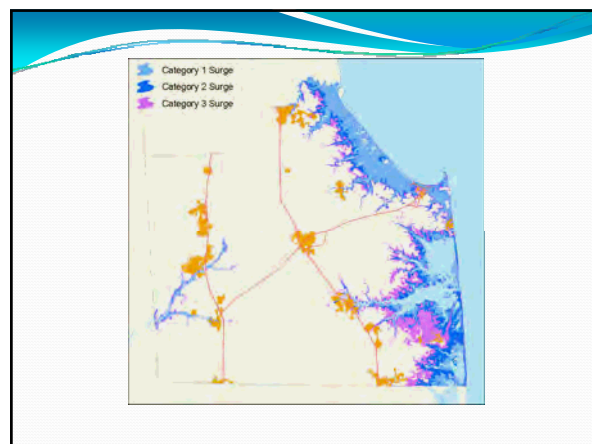
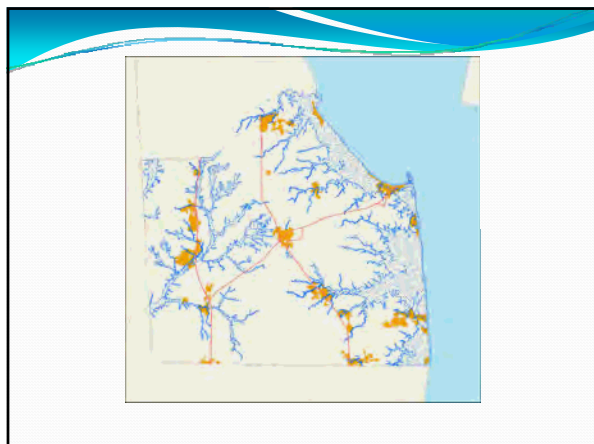
- Most frequent and costly natural hazard in the US
- Flood categories
  - General flood – excessive precipitation over a given river basin for a long period of time
  - Flash flood – excessive precipitation in a small area over a short period time
- Types of general flooding
  - Riverine – function of excessive precipitation within a river watershed
  - Coastal – result of storm surge, wind-driven waves, and heavy rainfall produced by coastal storms
  - Urban flooding – natural flow of water is obstructed by development



## Flood: Definition

- Periodic flooding is a natural and inevitable occurrence
- Recurrence intervals is the average time expected between flood events of a similar magnitude
- Thus, a 100-year floodplain is the area covered by a flood magnitude that should occur, on average, once every hundred years.
  - Also means that flood magnitude has a 1% chance of happening in any given year

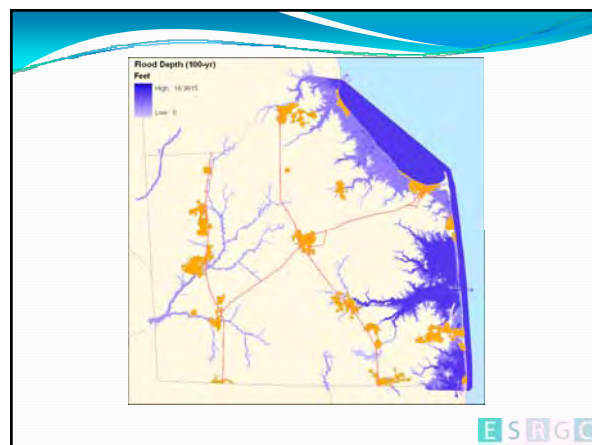




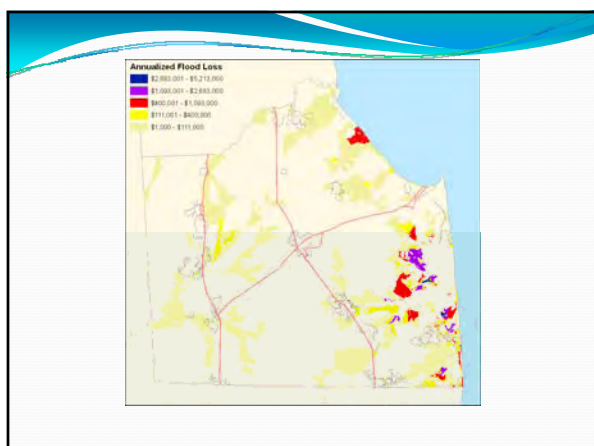
## Vulnerability to Flooding

- Intersection of expected depth of 100-year flood with the value of the buildings in the floodplain
- HAZUS-MH MR3
  - Hazard loss estimation software
  - Generated flood depth map from predicted elevation of flood water and height of land surface
  - Overlays flood depth with building information
  - Generates maps of potential damage and reports

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## Potential Flood Loss: MCD

MCD	Annualized Losses
Bridgeville-Greenwood	\$1,091,200
Georgetown	\$255,801
Laurel-Delmar	\$991,374
Lewes	\$19,357,870
Milford South	\$1,912,048
Millsboro	\$36,640,370
Milton	\$445,316
Seaford	\$1,403,417
Selbyville-Frankford	\$43,167,201
MCD Total	\$105,264,598
Sussex County Total	\$129,520,000

## Potential Flood Loss: Munis

Municipalities	Annualized Losses	Municipalities	Annualized Losses
Bethany Beach	\$8,221,887	Fenwick Island	\$2,258,541
Bethel	\$76,408	Frankford	\$63,925
Blades	\$115,000	Georgetown	\$0
Bridgeville	Negligible	Greenwood	\$7,101
Dagsboro	Negligible	Henlopen Acres	\$409,600
Delmar	\$0	Laurel	\$2,182,198
Dewey Beach	\$1,430,177	Lewes	\$700,624
Ellendale	\$0	Milford	\$630,092

## Potential Flood Loss: Munis

Municipalities	Annualized Losses
Millsboro	\$411,348
Millville	\$124,808
Milton	\$338,142
Ocean View	\$1,008,480
Rehoboth Beach	\$499,965
Seaford	\$560,861
Selbyville	\$148,809
Slaughter Beach	\$333,152
South Bethany	\$4,017,172
Muni Total	\$23,543,670
Sussex Total	\$129,520,000

## Coastal Storm Wind: Definition

- Hurricanes, tropical storms, & nor'easters
- Severe low-pressure center
- Generate high-level sustained winds, heavy precipitation, tornadoes, storm surge, wind-driven waves, & tidal flooding
- Hurricane season is from June 1 to Nov 30 and peaks in mid-September
- Saffir-Simpson Scale

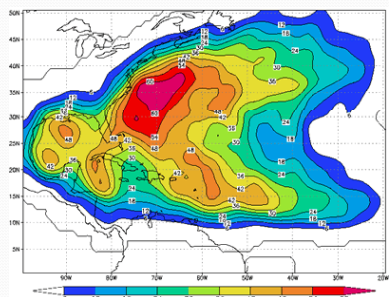
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## Saffir-Simpson Scale

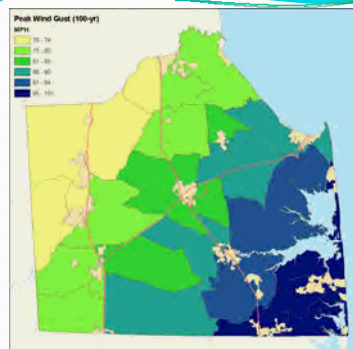
Category	Maximum Sustained Wind Speed (MPH)	Minimum Surface Pressure (Millibars)	Storm Surge (Feet)
1	74—95	Greater than 980	3—5
2	96—110	979—965	6—8
3	111—130	964—945	9—12
4	131—155	944—920	13—18
5	155+	Less than 920	19+

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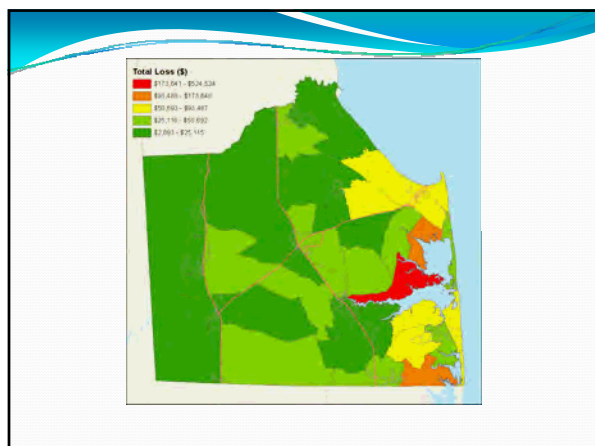
## Probability of a named storm



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## Potential Wind Loss: MCD

MCD	Annualized Losses
Bridgeville-Greenwood	\$25,390
Georgetown	\$48,865
Laurel-Delmar	\$95,369
Lewes	\$367,759
Milford South	\$48,034
Millsboro	\$616,112
Milton	\$111,662
Seaford	\$61,270
Selbyville-Frankford	\$451,242
MCD Total	\$1,825,707
Sussex County Total	\$1,926,244

## Potential Wind Loss: Munis

Municipalities	Annualized Losses
Bethany Beach	\$11,377
Bethel	Negligible
Blades	Negligible
Bridgeville	Negligible
Dagsboro	Negligible
Delmar	Negligible
Dewey Beach	Negligible
Ellendale	Negligible

Municipalities	Annualized Losses
Fenwick Island	Negligible
Frankford	Negligible
Georgetown	\$5,236
Greenwood	Negligible
Henlopen Acres	Negligible
Laurel	Negligible
Lewes	\$7,481
Milford	Negligible

## Potential Wind Loss: Munis

Municipalities	Annualized Losses
Millsboro	\$8,191
Millville	\$10,358
Milton	Negligible
Ocean View	\$10,134
Rehoboth Beach	\$5,387
Seaford	\$9,739
Selbyville	\$8,370
Slaughter Beach	Negligible
South Bethany	\$5,155
Muni Total	\$98,994
Sussex Total	\$1,926,244

## Tornado: Definition

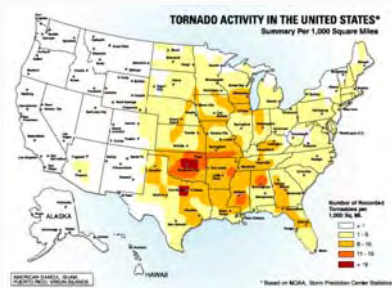
- A tornado is a violent windstorm characterized by a twisting, funnel-shaped cloud extending to the ground.
- Tornado wind speeds range from 40 to 300 miles per hour
- Most likely to occur in spring and early summer, or with a landfalling hurricane
- Fujita-Pearson Scale

## Fujita-Pearson Scale

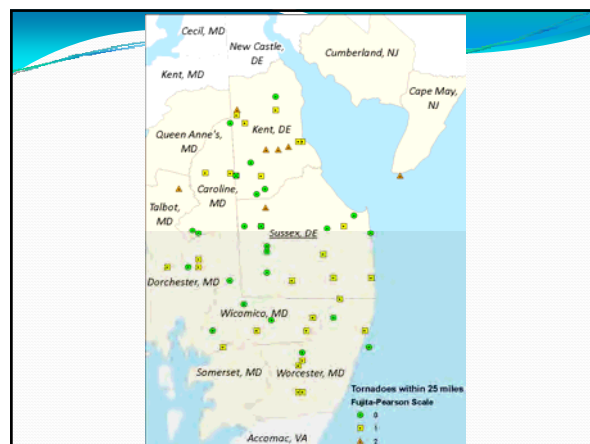
F-Scale Number	Intensity Phrase	Wind Speed
F0	Gale tornado	40-72 MPH
F1	Moderate tornado	73-112 MPH
F2	Significant tornado	113-157 MPH
F3	Severe tornado	158-206 MPH
F4	Devastating tornado	207-260 MPH
F5	Incredible tornado	261-318 MPH
F6	Inconceivable tornado	319-379 MPH

Source: The Tornado Project, 2000.

## Tornado Activity in the US



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## Tornado: Annualized Loss

County	Events	Loss	Years	Annual Events	Annual Loss	Death	Injuries
Sussex County, DE	18	\$594,000	54	0.33	\$11,000	0	11
Kent County, DE	18	\$4,908,000	45	0.40	\$109,067	2	54
Caroline County, MD	6	\$375,000	57	0.11	\$6,579	0	0
Dorchester County, MD	11	\$5,722,000	25	0.44	\$228,880	1	16
Wicomico County, MD	8	\$133,000	47	0.17	\$2,830	0	2
Worcester County, MD	10	\$250,000	51	0.20	\$4,902	0	0
Average	11.8	\$1,997,000	46.5	0.275	\$60,543	0.5	13.8

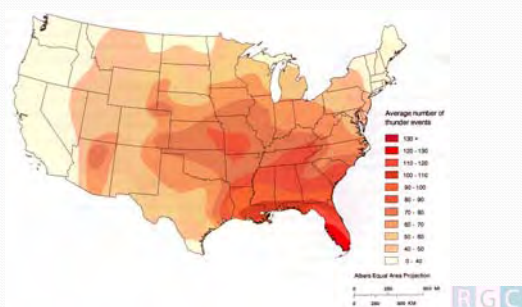
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## Severe Thunderstorms: Definition

- More than 10,000 severe thunderstorms each year
- Caused when air masses of varying temperatures meet
- Rapid uplift of warm moist air causes thunder, lightning, hail, strong winds, and heavy precipitations
- Often referred to as "straight-line winds"
- Lightning – discharge of electrical energy from a thunderstorm
  - Bolt of lightning can reach 50,000°F

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## Annual Average Number of Thunder Events



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## Severe Thunderstorms: Annualized Loss

County	Events	Loss	Years	Annual Events	Annual Loss	Deaths	Injuries
Sussex County, DE	286	\$8,747,000	52	5.50	<b>\$168,211</b>	2	10
Kent County, DE	239	\$4,153,000	51	4.69	\$81,431	2	5
Caroline County, MD	147	\$1,426,000	53	2.77	\$26,905	0	0
Dorchester County, MD	65	\$10,451,000	41	1.59	\$254,902	0	2
Wicomico County, MD	89	\$5,255,000	51	1.75	\$103,039	0	0
Worcester County, MD	59	\$6,605,000	53	1.11	\$124,622	0	0
Average	147.5	\$6,106,167	50.2	2.90	\$126,518	0.67	2.83

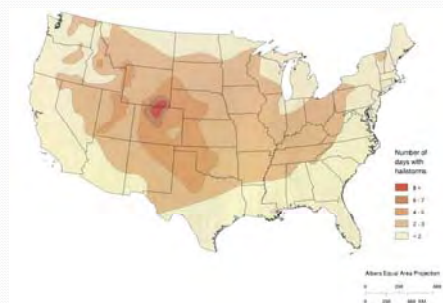
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## Hail: Definition

- Outgrowth of severe thunderstorms
- Rapid warming and cooling of ice crystals within a thunderstorm causes layers of ice to accumulate
- The accumulated ice balls fall as hail
- Size of the hailstone is correlated to the strength of the thunderstorm

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## Annual Frequency of Hailstorms



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## Hail: Annualized Loss

County	Events	Loss	Years	Annual Events	Annual Loss	Deaths	Injuries
Sussex County, DE	28	\$310,000	41	0.68	\$7,560	0	0
Kent County, DE	22	\$105,000	41	0.54	\$2,561	0	0
Caroline County, MD	10	\$50,000	18	0.56	\$2,778	0	0
Dorchester County, MD	23	\$0	51	0.45	\$0	0	0
Wicomico County, MD	26	\$0	42	0.62	\$0	0	0
Worcester County, MD	25	\$3,000	51	0.49	\$59	0	0
Average	22.3	\$78,000	41	0.56	\$2,160	0.0	0.0

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## Winter Storms: Definition

- Combination hazard that includes snow, sleet, freezing rain, strong winds, and below normal temperatures
- Sleet – raindrops that freeze into ice pellets before reaching the ground
  - Usually accumulates like snow
- Freezing rain – rain that falls onto a surface that is below 32°F, forming a glaze of ice

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## Winter Storms – Annualized Loss

County	Events	Loss	Years	Annual Events	Annual Loss	Deaths	Injuries
Sussex County, DE	66	\$5,450,000	16	4.13	\$340,625	0	65
Kent County, DE	78	\$5,500,000	16	4.87	\$343,750	1	60
Caroline County, MD	67	\$1,400,000	16	4.19	\$87,500	0	0
Dorchester County, MD	42	\$5,000,000	16	2.63	\$312,500	0	0
Wicomico County, MD	39	\$5,000,000	16	2.44	\$312,500	0	0
Worcester County, MD	37	\$5,020,000	16	2.31	\$313,750	0	0
Average	54.8	\$4,561,667	16.0	3.43	\$285,104	0.2	20.8

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## Extreme Temperatures: Definition

- Extreme cold or freeze – weather marked by temperatures below 32°F that are significantly below normal for the area and lasts an extended period of time
- Extreme heat – weather marked by temperatures are more than 10° higher than normal for an area, lasts an extended period of time, and is often accompanied by high humidity
- Both cause the most deaths of any natural hazard in the US

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## Extreme Temperatures: Annualized Loss

County	Events	Loss	Years	Annual Events	Annual Loss	Deaths	Injuries
Sussex County, DE	78	\$0	14	5.57	\$0	8	42
Kent County, DE	78	\$0	14	5.57	\$0	8	42
Caroline County, MD	78	\$0	14	5.57	\$0	3	35
Dorchester County, MD	3	\$0	14	0.21	\$0	1	0
Wicomico County, MD	2	\$0	14	0.14	\$0	0	0
Worcester County, MD	3	\$4,700,000	14	0.21	\$335,714	0	0
Average	40.3	\$783,333	14	2.879	\$55,952	3.3	19.8

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## Earthquakes: Definition

- Motion or trembling of the ground produced by sudden displacement of rock in the Earth's crust
- Caused by crustal strain, volcanism, landslides, and cavern collapse
- Most property damage is caused by failure and collapse of structures. Level of damage depends on amplitude and duration of shaking
- Earthquakes are most common along tectonic plate boundaries and intra-plate weak points
- Richter Scale

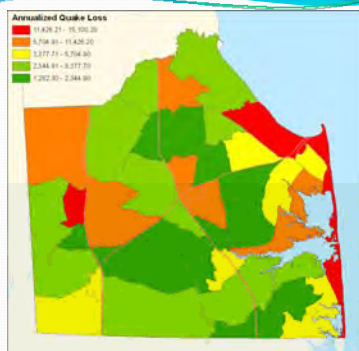
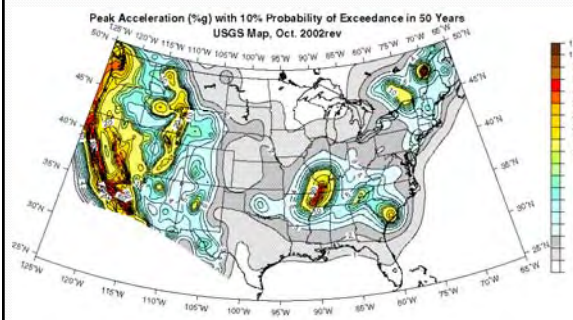
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## Richter Scale

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.

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## Peak Acceleration with 10% probability of exceeding in 50 years



## Potential Earthquake Loss: MCD

MCD	Annualized Losses
Bridgeville-Greenwood	\$11,232
Georgetown	\$12,767
Laurel-Delmar	\$14,884
Lewes	\$40,144
Milford South	\$16,310
Millsboro	\$16,409
Milton	\$9,429
Seaford	\$21,886
Selbyville-Frankford	\$24,987
MCD Total	\$168,048
Sussex County Total	\$190,778

## Potential Earthquake Loss: Munis

Municipalities	Annualized Losses	Municipalities	Annualized Losses
Bethany Beach	Negligible	Fenwick Island	Negligible
Bethel	Negligible	Frankford	Negligible
Blades	Negligible	Georgetown	Negligible
Bridgeville	Negligible	Greenwood	Negligible
Dagsboro	Negligible	Henlopen Acres	Negligible
Delmar	Negligible	Laurel	Negligible
Dewey Beach	Negligible	Lewes	Negligible
Ellendale	Negligible	Milford	Negligible

## Potential Earthquake Loss: Munis

Municipalities	Annualized Losses
Millsboro	Negligible
Millville	Negligible
Milton	Negligible
Ocean View	Negligible
Rehoboth Beach	Negligible
Seaford	\$5,284
Selbyville	Negligible
Slaughter Beach	Negligible
South Bethany	Negligible
Muni Total	\$22,410
Sussex Total	\$190,778

## Drought: Definition

- Climatic condition caused by an extended period of limited rainfall beyond that which occurs naturally in a broad geographic area
- Caused by lack of precipitation combined with excessive water demand
- Four types
  - Meteorological
  - Agricultural
  - Hydrological
  - Socio-economic

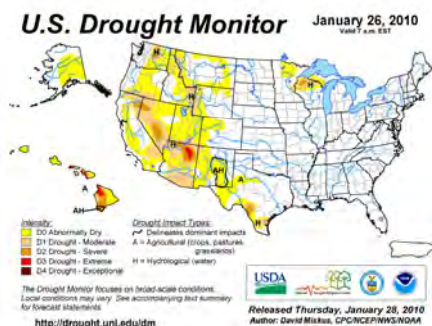
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## Drought Severity Classification

Category	Description	Possible Impacts
D0	Abnormally dry	Short-term dryness slowing planting, growth of crops or pastures.
D1	Moderate drought	Some damage to crops, pastures; streams, reservoirs, or wells low, some water shortages developing or imminent; voluntary water-use restrictions requested
D2	Severe drought	Crop or pasture losses likely; water shortages common; water restrictions imposed
D3	Extreme drought	Major crop/pasture losses; widespread water shortages or restrictions
D4	Exceptional drought	Exceptional and widespread crop/pasture losses; shortages of water in reservoirs, streams, and wells creating water emergencies
A or H	Agricultural or Water Supplies	Effects either crops, pastures, and grasslands or rivers, groundwater, and reservoirs

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## Recent US Drought Intensity



## Drought: Annualized Loss

County	Events	Loss	Years	Annual Events	Annual Loss	Deaths	Injuries
Sussex County, DE	45	\$29,100,000	14	3.21	\$2,078,571	0	0
Kent County, DE	46	\$29,100,000	14	3.29	\$2,078,571	0	0
Caroline County, MD	50	\$0	14	3.57	\$0	0	0
Dorchester County, MD	2	\$6,000,000	14	0.14	\$428,571	0	0
Wicomico County, MD	1	\$6,000,000	14	0.07	\$428,571	0	0
Worcester County, MD	0	\$0	14	0.00	\$0	0	0
Average	24.0	\$11,700,000	14	1.71	\$835,714	0.0	0.0

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## Ranking of Hazards for Vulnerability Assessment

- Not all hazards pose the same level of threat – there is a need focus efforts on those hazards that pose the greatest threat to the County
- Hazards are ranked (low, medium, high) according to:
  - Expected annualized loss
  - Expected frequency
  - Potential for loss of life



## Annualized Expected Losses per Hazard

Hazard	Annualized Losses
Flood	\$129,520,000
Hurricane Wind	\$1,926,244
Tornado	\$11,000
Severe Thunderstorm	\$168,211
Hail	\$7,560
Winter Storm	\$340,625
Extreme Temperatures	\$0
Earthquake	\$190,778
Drought	\$2,078,571



## Overall Risk Ranking

Hazard	Rank
Coastal Flood	1
Riverine Flood	2
Drought	3
Hurricane Wind	4
Winter Storm	5
Severe Thunderstorm	6
Earthquake	7
Extreme Temperatures	8
Tornado	9
Hail	10



## What to do now?

- Please review the maps
- Point out areas that you think are vulnerable to hazards so that we can investigate them
- Ask lots of questions
- Stay involved
- On February 10<sup>th</sup>, there will be a public meeting regarding mitigation actions
- Contact me with any thoughts or concerns (msscott@salisbury.edu)



**SECOND HAZARD MITIGATION ADVISORY COMMITTEE MEETING**

**Sussex County all-hazard plan meeting rescheduled**

***Latest meeting now set for 6 p.m. Feb. 24***

**FOR IMMEDIATE 1500 Hours, Wednesday**

**RELEASE Feb. 17, 2010**

The Sussex County Emergency Operations Center invites residents and property owners to attend an upcoming public meeting to offer ideas and submit comments on a federally required update to the County's All Hazard Multi-Jurisdictional Mitigation Plan.

The meeting, canceled last week because of the region's most recent blizzard, is now set for 6 p.m. Wednesday, Feb. 24, 2010, at the EOC, 21911 Rudder Lane, east of Georgetown. The rescheduled meeting is a follow-up session to another held earlier in the month.

The hazard mitigation plan, first adopted in 2005, is a document that serves as a comprehensive, long-term planning tool used to identify various strategies local emergency planners would use in the event of a disaster. The overall goal of the effort is to reduce or eliminate the loss of human life and damage to property as a result of hazards, both natural and man-made.

Local jurisdictions must update their plans every five years. As part of that process, the public has the opportunity to review the plan, offer input, and help shape the update.

For more information on the all-hazard plan, contact EOC Director Joseph L. Thomas at (302) 855-7801.

###

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AMBULANCE CALLBOARD-LEPC

## **Agenda**

Mar 01 10 12:33p

owner

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**Sussex County**  
**ALL HAZARDS MITIGATION PLAN UPDATE**

**Committee Meeting #2**  
**24 February 2010**  
**2pm-4:30pm**  
**AGENDA**

Discussion of Relevant Plans, Ordinances, and Programs (Table 5.1)

Discussion and Review of Goals

Mitigation Actions

- Discussion
- Review/comments by Committee

Prioritization of Actions

- Review of prioritization criteria

Overview of Draft Plan

Wrap-up

- Next steps
- Discuss Public Meeting #2
- Questions

Adjournment



# Hazard Mitigation Plan Meeting Wednesday, February 24, 2010

p.1

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## Sign In

NAME	ORGANIZATION	ADDRESS	E-MAIL ADDRESS	PHONE NUMBER
Robert Dickerson	Town of Shelbyville	168 West Church St Shelbyville, TN 37175	TDICKERSON@SHELBYVILLE.TN.GOV	302-436-8314
Lonny Gregory	Town of Danville	201 Central Ave. Danville, VA 23042	LGREGORY@TOWNOFDANVILLE.VA.GOV	302-539-9797
MELVIN CURICK	SOUTH BETHANY	402 EVERGREEN RD S. BETHANY 19380	MCURICK@SOUTHBETHANY.PA.GOV	302-579-3653
Carlson, David K	PEMA	105 W. K Street Smyrna, GA 30080	DKCARLSON@PEMA.GA.GOV	(303) 659-2213
ASHLEY MITCHELL	Town of Bethany Beach	PO Box 214 Bethany Beach, DE 19312	AMITCHELL@TOWNOFBETHANYBEACH.DE.GOV	302-539-1000
Paul Eckrich	Leves, DE	PO Box 277 Leves, DE 19958	PECKRICH@LEVES.DE.US	302-645-7777 (109)
JOHN SIMMONS	Town of LaVerne	205 MEADOW ST LAVERNE, DE 19956	JOHNSIMMONS@TOWNOFLAVERNE.DE.US	302-875-2244
Woody Vickers	Town of Laurel	201 Medicine St Laurel, DE 19556	WVICKERS@TOWNOFLAUREL.DE.US	302-875-2277
Iain Bailey	Geothhill Beach	401 N. Bayshore Dr Milton, DE 19121	IBAILEY@GEOTHILLBEACH.DE.US	302-684-4013
Jeff Shockey	Sussex County Planning and Zoning	Georgetown, DE	JSHOCKEY@SUSSEXCOUNTY.DE.GOV	302-855-7484
Laurence Lank	Sussex County Planning and Zoning	Box 589 Georgetown, DE 19947	LLANK@SUSSEXCOUNTY.DE.GOV	302-855-7883
Andy Wright	Sussex County Building Code Dept.	PO Box 589 Georgetown, DE 19947	AWRIGHT@SUSSEXCOUNTY.DE.GOV	302-855-7883
Debbie Price	Town of Ellendale	PO Box 204 Ellendale, DE 19941	DPRICE34@COUNSILLOR.ELLENDALE.DE.US	302-245-7664

## Material Presented

Table 5.1  
Relevant Plans and Programs in Place

Jurisdiction	HMP	DRP	OSP	FMP	SMP	EOP	OSP	REP	SEA	NS	CIP	PL	HPP	ZO	SO	FO	NFIP	CRS	BC
Sussex County	X		X	X		X		X	X	X		X	X	X	X	X	X		X
Bethany Beach	X			X	X	X	X		X			X		X	X	X	X		X
Bethel									X			X	X	X		X	X		X
Blades			X						X					X	X	X	X		X
Bridgeville	X		X	X		X	X	X	X	X	X	X	X	X		X	X		X
Dagsboro			X						X		X	X		X	X	X	X		X
Delmar			X				X		X	X	X			X	X				X
Dewey Beach			X	X					X			X		X	X	X	X	X	X
Ellendale			X						X					X	X				X
Fenwick Island				X	X				X			X		X	X	X	X	X	X
Frankford			X	X							X			X	X	X	X		X
Georgetown			X	X					X			X		X	X	X	X		X
Greenwood				X					X					X	X	X	X		X
Henlopen Acres		X	X	X	X				X			X		X	X	X	X		X
Laurel			X						X		X			X	X	X	X		X
Lewes	X		X	X		X	X	X	X	X				X	X	X	X	X	X
Millsboro			X	X					X					X	X	X	X		X
Millville			X	X					X			X	X	X	X	X	X		X
Milton			X	X		X			X			X	X	X	X	X	X		X
Ocean View			X						X					X	X	X	X		X
Rehoboth Beach			X	X		X			X					X	X	X	X	X	X
Seaford			X	X		X			X	X		X	X	X	X	X	X	X	X
Selbyville	X		X	X	X				X		X	X	X	X	X	X	X		X
Slaughter Beach			X						X			X		X	X	X	X		X
South Bethany		X	X			X			X			X		X	X	X	X		X

Sussex County 2010 All-Hazards Mitigation Plan Update						
Action	Description	Adopted	Completed	Priority	Timeline for Completion	Status (delayed, started, cancelled)
<b>Bethany Beach</b>						
1	Elevate flood-prone roadways E/O SR 1.	Yes	No	High	When funds become available	Cancelled
2	Improve existing drainage system.*	Yes	No	High	24 months	In Progress
3	Adopt the International Building Code (IBC/IRC).	Yes	Yes	High	12 months	Completed
4	Purchase inflatable dam for Loop and Assawoman Canal to protect against incoming tide waters.	Yes	No	Moderate	12 months	Delayed
5	Improve public outreach.	Yes	Yes	Moderate	6 months	Completed
6	Install flap gates on two out-falls at end of Evans Ave. Remove tide flexvalves, which are ineffective, and replace with 12" Waterman Flap gates.	No	Yes			Completed
7	Install new drainage system on North Pennsylvania Avenue.	No	No			Delayed
8	Create 2 new outfalls leading from large ditch that runs from Route 26 behind Lake Bethany to the marsh. Outfalls will travel from drainage ditch in Lake Bethany to the lake in Lake Bethany. Flap gates will be installed.	No	No			Delayed
9	Phase 2 of Bethany West drainage improvements. Replace and upgrade existing storm-water system between Collins Street and Tudor Court along Halfmoon Drive. This also includes Tudor Court, Sandstone Court, and Pebble Court.	No	No			Delayed
10	Phase 3 of Bethany West drainage improvements. Replace and upgrade existing storm-water facilities at West Side Development, enlarge outfall, replace driveway culverts, replace old pipe systems, regrade ditches.	No	No			Delayed
11	Conduct improvements on Pennsylvania Avenue and reconstruct street to enhance drainage and resurface. Reconstruct curbs, ramps and sidewalks throughout the project area.	No	No			Not started
<b>Bethel</b>						
1	Educate the public regarding preparedness and protection measures.	Yes	No	High	Ongoing	
2	Review County Office of Emergency Services plans regarding protective measures and evacuation procedures for hazardous materials incidents and share this information with citizens. Information should include ways to elevate and/or harden oil and gas storage tanks to avoid spills and contamination of surrounding areas.	Yes	No	High	12 months	
3	Educate the public on the necessity of periodic well testing, especially during periods of drought.	Yes	No	High	12 months	
4	Educate the public regarding special needs populations in the event of winter storms.	Yes	No	High	12 months	

Action	Description	Adopted	Completed	Priority	Timeline for Completion	Status (delayed, started, cancelled)
5	Identify shelters and notify the public about their location.	Yes	No	High	12 months	
6	Educate the public concerning sheltering-in-place should a terrorist attack occur.	Yes	No	High	24 months	
7	Identify historic structures and develop mitigation strategies to protect any at-risk properties.	Yes	No	Moderate	24 months	
<b>Blades</b>						
1	Fix stormwater drainage problems with existing underground pipes and outfall areas to help prevent future flooding.	Yes	No	High	When funds become available	Delayed
2	Install new storm drains in strategic areas to allow removal of standing water during storms.	Yes	No	High	When funds become available	Delayed
<b>Bridgeville</b>						
1	Protect wastewater treatment plant, well house and manholes from acts of terrorism and flood related damages.	Yes	Yes	High	24 months	Completed
2	Purchase mobile surveillance cameras for town use - protection for possible terrorist threats, drug activity, burglaries, etc.	No	No			
3	Conduct a preliminary analysis for the relocations of the Town Hall and Police Department to	No	No			
<b>Dagsboro</b>						
1	In coordination with Sussex County, fully participate in public outreach programs designed to promote hazard education and awareness for residents and businesses.	Yes	No	Moderate	Ongoing	Delayed
<b>Delmar</b>						
1	Conduct a vulnerability assessment of wastewater and stormwater management systems.	Yes	No	High	3-5 years	
2	Update topographical, aerial and land use maps for the Town of Delmar and surrounding community.	Yes	Yes	High	12-24 months	Completed
3	Develop an Emergency Operations Plan to include identifying additional local hazards.	Yes	No	High	12-24 months	
4	Install surveillance systems for selected critical facilities in Delmar.	Yes	Yes	Moderate	18 months	Completed
5	Conduct a vulnerability assessment of waste water and storm-water management systems.	No	No			
6	Develop an Emergency Operations Plan to include identifying additional local hazards.	No	No			
<b>Dewey Beach</b>						
1	Develop a coastal area evacuation plan for the town.	Yes	Yes	High	6 months	Completed

Action	Description	Adopted	Completed	Priority	Timeline for Completion	Status (delayed, started, cancelled)
2	Introduce a Disaster Warning System to notify the community of an impending disaster.	No	No			
3	Consider reconstructing the Rehoboth Bay shoreline which has been eroded due to heavy flooding from seawater and drainage from Nor' Easter storms.	No	No			
4	Develop public handouts of what to do in case of a disaster.	No	No			
5	Update the Town's Emergency Operation Plan.	No	No			
<b>Ellendale</b>						
1	Develop an Emergency Transportation Plan for the Town of Ellendale that addresses Route 16 and the railroad crossing through the Town.	Yes	No	High	12 months	
2	Develop an Emergency Operations Plan for the Town.	Yes	No	High	12 months	
3	Determine the amount of Ellendale's land area and number of properties that are located in the floodplain.	Yes	No	High	9 months	
4	Perform a study to determine what other evacuation routes are available if Route 16 is closed due to a railroad problem.	Yes	No	Moderate	12 months	
<b>Fenwick Island</b>						
1	Install 20 12" backwater check valves (Series TF2).	Yes	Yes	High	Completed	Completed
2	Continue retrofitting drainage system and back water valves.	Yes	No	High	24 months	
3	Educate property owners of water runoff-to bulkhead should be the responsibility of the homeowner.	Yes	No	Moderate	6 months	
4	Adapt a stormwater management ordinance that regulates private property water runoff.	Yes	No	Moderate	9 months	
5	Re-grade street ends at intersections along Bunting Avenue to direct the flow of water towards Coastal Highway.	No	No			
<b>Frankford</b>						
1	Identify private and county owned ditches, determine drainage patterns and what should be done to reduce flood related impacts.	Yes	No	High	24-36 months	
2	Conduct stormwater drainage assessment for the Town.	Yes	No	High	24-36 months	
3	Create and distribute material targeted to Frankford residents to include contact numbers and "What to do in the event of ..." information.	Yes	No	High	As funds become available	
4	Update the county's web page to address emergency contact information for individuals and departments specific to the Town of Frankford.	Yes	No	Moderate	As funds become available	
<b>Georgetown</b>						
1	Develop an Emergency transportation plan that addresses railroad activity on both sides of the tracks.	Yes	No	High	12 months	

Action	Description	Adopted	Completed	Priority	Timeline for Completion	Status (delayed, started, cancelled)
2	Develop a Continuity of Government Plan.	Yes	No	High	12 months	
3	Establish critical facility emergency back-up power (police and fire stations).	Yes	No	High	12 months	
4	Install or provide portable back-up pumps for wastewater treatment facility (bypass pump).	Yes	No	High	24 months	
5	Develop a brochure for the public dealing with emergency situations.	Yes	No	Moderate	9 months	
6	Develop emergency generator back-up capability for production and distribution of potable water.	Yes	No	Moderate	12 months	
7	Develop corrective actions for Route 9, Route 113 and Route 18/404 that tend to bottleneck during the evacuation of residents, college students and transients.	Yes	No	Low	12 months	
<b>Greenwood</b>						
1	Dredge Cart Branch ditch.	Yes	No	High	12 months	
<b>Henlopen Acres</b>						
1	Secure well and water plant. *	Yes	No	High	12 months	
2	Develop a marina plan for the Town.	Yes	No	High	12 months	
3	Implement a drainage maintenance program for the Town.	Yes	No	High	24 months	
4	Develop a tree maintenance program in coordination with Ocean View.	Yes	No	High	12 months	
5	Develop an emergency contingency plan for the Town.	Yes	No	High	6 months	
6	Maintain beach dune system. *	Yes	No	High	Ongoing	
7	Retrofit town buildings to better withstand high winds.	Yes	No	Moderate	24 months	
8	Improve evacuation services and procedures for the Town.	Yes	No	Moderate	12 months	
9	Implement a warning and notification system for the Town.	Yes	No	Moderate	18 months	
10	Improve storm drainage system by implementing Phase III (Phase I and II have been completed).	Yes	No	Moderate	Completed??	
<b>Laurel</b>						
1	Raise and seal manhole covers to above flood zone along Front Street, between Willow and Delaware Avenue and West Sixth Street. Create a service road to the wastewater manholes on West Sixth Street.	Yes	No	High	18 months	
2	Replace bulkhead on the north side of Broad Creek, between Popular Street and the railroad bridge.	Yes	No	High	24 months	
3	Demolish and acquire the Hignutt property on Chipman Street.	Yes	No	High	24 months	
4	Consider closing the pond/cell #3 at the Town's wastewater treatment plant.	Yes	No	Moderate	18 months	
5	Consider closing the well at 10th & Deshields street and replace waterlines on 10th Street.	Yes	No	Moderate	5 years	

Action	Description	Adopted	Completed	Priority	Timeline for Completion	Status (delayed, started, cancelled)
6	Relocate the Town Hall, Public Works and Police Department.	Yes	No	Low	24 months	
<b>Lewes</b>						
1	Review and update evacuation and notification procedures.	Yes	No	High	12-24 months	
2	Develop response procedures for terrorist events.	Yes	Yes	High	Completed	Completed
3	Improve stormwater management.	Yes	No	Moderate	3-5 years	
4	Increase participation in the National Flood Insurance Program.	Yes	No	Moderate	1-3 years	
5	Minimize damages from high wind events.	Yes	No	Moderate	Ongoing	
6	Implement a community outreach program.	Yes	Yes	Moderate	Ongoing	
7	Reduce vulnerability to wildfires.	Yes	No	Moderate	1-3 years	
8	Continue data acquisition and enhancements to the GIS.	Yes	No	Moderate	1-5 years	
9	Enlist the services of City service organizations in implementing a disaster preparedness outreach program.	No	No			
10	Facilitate the coordination of response procedures related to events.	No	No			
11	Develop response plans (including evacuation and sheltering procedures) related to special needs populations and pets.	No	No			
12	Develop a "Refuge of Last Resort" Plan and a plan to transport City residents to county designated shelters.	No	No			
<b>Millsboro</b>						
1	Improve stormwater drainage.	Yes	No	High	24 months	Delayed
2	Conduct a study to identify roads that need to be elevated and culverts that need to be widened.*	Yes	No	Moderate	24 months	Delayed
3	Develop a tree maintenance program.	Yes	Yes	Moderate	Completed	Completed
4	Retrofit two pump stations.*	Yes	No	Moderate	24 months	Delayed
5	Retrofit civic center with shutters (Red Cross emergency shelter).	Yes	No	Low	12 months	Delayed
<b>Millville</b>						
1	Retrofit the Millville Town Hall to include back up power supply.	Yes	No	High	24 months	
2	Conduct an assessment of all culverts to include proper size and design based on current infrastructure and future development.	Yes	No	Moderate	12 months	
<b>Milton</b>						
1	Relocate the Town's wastewater treatment plant.	Yes	No	High	3-5 months	
2	Promote emergency shelter information.	Yes	No	Moderate	12 months	
3	Identify key personnel, including call-out list.	Yes	Yes	Moderate	Completed	Completed

Action	Description	Adopted	Completed	Priority	Timeline for Completion	Status (delayed, started, cancelled)
4	Secure water towers and wellheads by enclosing them with approximately 1,200 feet of fence.	Yes	No	Moderate	12 months	
5	Join the Community Rating System.	Yes	No	Moderate	12 months	
6	improve GIS mapping capabilities.	Yes	No	Moderate	12 months	
7	Provide dry flood protection techniques for the main well control building on Chandler Street.	No	No			
8	Conduct a study to identify measures to mitigate flooding on Magnolia Street.	No	No	High	3-5 years	
<b>Ocean View</b>						
3	Adopt a tree management program ordinance.	Yes	No	High	12 months	
4	Develop an evacuation plan for the town.	Yes	No	High	12 months	
3	Retrofit Town Hall with storm shutters, generators and a safe room.	Yes	No	High	12 months	
4	Implement public education and awareness activities to advise residents and visitors about hazards, hazardous areas and mitigation techniques they can use to protect about hazards, hazardous areas and mitigation techniques they can use to protect themselves and their property.	Yes	No	Moderate	Ongoing	
5	Develop a tree maintenance program coordination with Henlopen Acres.	Yes	No	Moderate	12 months	
6	Retrofit town buildings.	Yes	No	Moderate	24 months	
7	Purchase and install GIS to map hazardous areas and events.	Yes	No	Low	2-3 years	
8	Adopt a building code ordinance for the Town.	Yes	No	Low	12-24 months	
<b>Rehoboth Beach</b>						
1	Build retaining wall along boardwalk to prevent damage to businesses, the boardwalk and our street ends.	Yes	Yes	High	When funds become available	
2	Conduct drainage improvements on First Street to increase efficiency by increasing piping capacity.	No	No			Not started
<b>Seaford</b>						
1	Develop a railroad security plan for the Town.	Yes	No	High	12 months	Delayed
2	Develop Reverse 911 capability for the Town.	Yes	No	High	24 months	Cancelled
3	Conduct computer modeling of key drainage in and around the City to identify restrictions and/or potential problems. Also identify necessary modification or repairs to improve functionality.	Yes	No	High	24 months	Started
4	Address street flooding in the Washington and State Street area-identify necessary modification or repairs to improve functionality.	Yes	No	High	24 months	Started



Action	Description	Adopted	Completed	Priority	Timeline for Completion	Status (delayed, started, cancelled)
5	Ensure security of water production sites and storage facilities.	Yes	No	High	24 months	Delayed
6	Develop agreements with local businesses to assist during emergencies (i.e., provide items such as heavy equipment and other resources).	Yes	No	Moderate	12 months	Delayed
7	Identify key personnel to manage a crisis.	Yes	Yes	Moderate	12 months	Delayed
8	Construct storm drain improvements on Washington Street to increase the drainage capacity of the area and prevent future flooding.	No	No			Not started
9	Construct stormwater drains on Porter Street to increase the drainage capacity of the area and prevent future flooding.	No	No			Not started
<b>Selbyville</b>						
1	Replace deteriorating bridge and culverts on Railroad Avenue over major storm water management ditch.	No	No	High	6 months	Delayed
<b>Slaughter Beach</b>						
1	Improve stormwater drainage throughout the Town.	Yes	No	High	24 months	
2	Flood-proof water pumping stations.	Yes	No	High	24 months	
3	Elevate access and evacuation roads that flood.	Yes	No	High	24 months	
4	Elevate flood-prone homes.	Yes	No	High	24 months	
5	Perform regular beach re-nourishment.	Yes	No	High	Ongoing	
6	Develop automated telephone warning system.	Yes	No	High	When funds become available	
7	Restore and/or renourish beach and protective dunes.	Yes	No	High	When funds become available	
8	Flood-proof public water system pump stations	Yes	No	High	When funds become available	
9	Develop a strategy to improve NFIP enforcement processes to include local permitting processes.	Yes	No	High	6 months	
10	Elevate Road 224 (Slaughter Beach Road) approximately 1' - 4' from intersection of Bay Avenue to west boundary of Prime Hook National Wildlife Refuge (± 1 mile).	Yes	No	Moderate	When funds become available	
11	Provide building/zoning/flood zone ordinances to public via Web site or other electronic means.	Yes	No	Moderate	When funds become available	

Action	Description	Adopted	Completed	Priority	Timeline for Completion	Status (delayed, started, cancelled)
12	Initiate stormwater management system improvements along ± 1 mile of North Bay	Yes	No	Low	When funds become available	
<b>South Bethany</b>						
1	Create and implement an Emergency Evacuation Plan for all residents with particular attention to identify "shut-ins" during a weather event including nor'easters, hurricanes and snow emergencies.	Yes	Yes	High	Completed	Completed
2	Create and implement a Post Hurricane/ Nor'easter Recovery and Restoration plan.	Yes	Yes	High	Completed	Completed
3	Implement regular and emergency beach replenishment or re-nourishment as part of the DNREC/ Corps of Engineers 50-year plan.	Yes	Yes	High	Completed	Completed
4	Improve stormwater drainage.	Yes	Yes	High	Completed	Completed
5	Flood-proof water and sewer pump stations.	Yes	No	Moderate	12 months	
6	Develop Critical Infrastructure "Risk Assessment Plan".	Yes	Yes	Moderate	12 months	
7	Flood-proof at-risk homes throughout the town in accordance with current FEMA regulations.	Yes	No	Moderate	12 months	
8	Upgrade the Town's Building and Zoning Ordinances to reflect NFIP and ISO requirements.	Yes	Yes	Moderate	12 months	
9	Elevate existing residence to prevent frequent flooding.	No	No			
<b>Unincorporated Areas</b>						
1	Improve all emergency access routes.	Yes	No	High	12 months	
2	Improve Community Rating System rating.	Yes	No	High	12 months	
3	Increase elevation requirements for manufactured housing located on the coast.	Yes	No	High	12 months	
4	Dualize East to West routes.*	Yes	No	High	12 months	
5	Consider the elevation of flood-prone structures.	Yes	No	High	Ongoing	
6	Raise educational awareness through better notifications, training, and properly marked roadways.	Yes	No	Moderate	9 months	
6	Standardize Response Levels Plan.	Yes	No			
7	Construct four-lane East/West emergency evacuation route to Maryland toll road.	Yes	No	Moderate	12 months	
8	Distribute disaster preparedness and hazard mitigation-related information using brochures and website link.	Yes	No	Moderate	9 months	
9	Provide meeting room space for educational gatherings in the West Annex Building and Library.	Yes	No	Moderate	Ongoing	
10	Install storm drain of culvert on 1100 Block of South Bayshore Drive in Broadkill Beach.	Yes	No	High	24 months	

Action	Description	Adopted	Completed	Priority	Timeline for Completion	Status (delayed, started, cancelled)
11	Continue to endorse Federally funded restoration projects to restore portions of the Sussex County coastline that are experiencing significant coastal erosion, both from rising sea levels and coastal storms.	No	No	Moderate	24 months	Not started
12	Explore ways to finance beach restoration projects in private communities that are experiencing significant coastal erosion, both from rising sea levels and coastal storms.	No	No	Moderate	24 months	Not started
13	Develop a close working relationship between the county EOC and staff from Artesian. Identify a staff person from Artesian to serve as a liaison to the County EOC for the inclusion of utility issues with emergency planning.	No	No	High	9 months	Not started
14	Work closely with unincorporated places, major subdivisions, beach communities like Broadkill and Prime Hook, and manufactured home parks to more accurately allocate resources and plan for hazard mitigation, evacuation, etc. and make them more inclusive in the planning process.	No	No	High	9 months	Not started
15	Conduct a study to identify stormwater management systems that need to be retrofitted and channels that need to be improved in order to reduce flooding throughout the County.	No	No	Moderate	24 months	Not started

FY 2010 PDM mitigation project list from DEMA

## **SECOND PUBLIC MEETING**

### **Meeting Announcement**

# **Sussex County all-hazard plan meeting rescheduled**

***Latest meeting now set for 6 p.m. Feb. 24***

**FOR IMMEDIATE 1500 Hours, Wednesday**

**RELEASE Feb. 17, 2010**

The Sussex County Emergency Operations Center invites residents and property owners to attend an upcoming public meeting to offer ideas and submit comments on a federally required update to the County's All Hazard Multi-Jurisdictional Mitigation Plan.

The meeting, canceled last week because of the region's most recent blizzard, is now set for 6 p.m. Wednesday, Feb. 24, 2010, at the EOC, 21911 Rudder Lane, east of Georgetown. The rescheduled meeting is a follow-up session to another held earlier in the month.

The hazard mitigation plan, first adopted in 2005, is a document that serves as a comprehensive, long-term planning tool used to identify various strategies local emergency planners would use in the event of a disaster. The overall goal of the effort is to reduce or eliminate the loss of human life and damage to property as a result of hazards, both natural and man-made.

Local jurisdictions must update their plans every five years. As part of that process, the public has the opportunity to review the plan, offer input, and help shape the update.

For more information on the all-hazard plan, contact EOC Director Joseph L. Thomas at (302) 855-7801.

###

COMMUNICATIONS SUPPORT • EMERGENCY MANAGEMENT • FIRE AND  
AMBULANCE CALLBOARD-LEPC

**Sign In**

# Hazard Mitigation Plan Update

2<sup>nd</sup> Steering Committee Mtg. - 02 Feb 2010  
 Pubhe

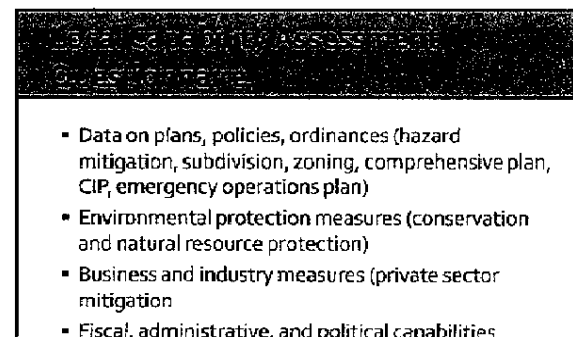
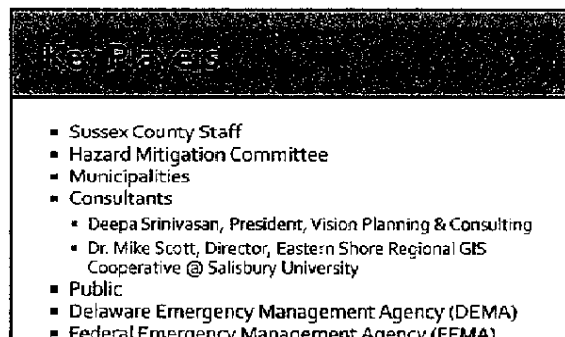
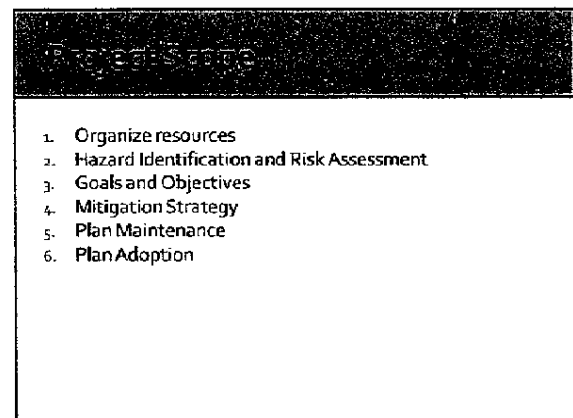
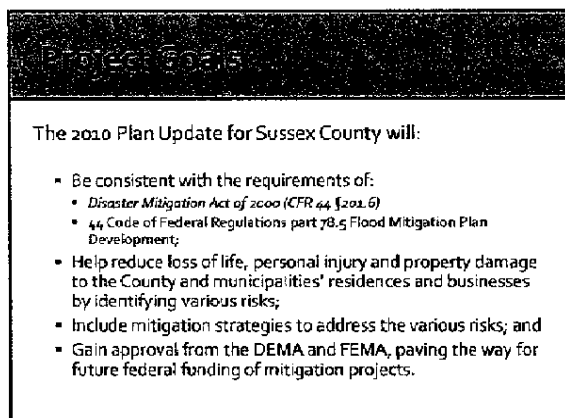
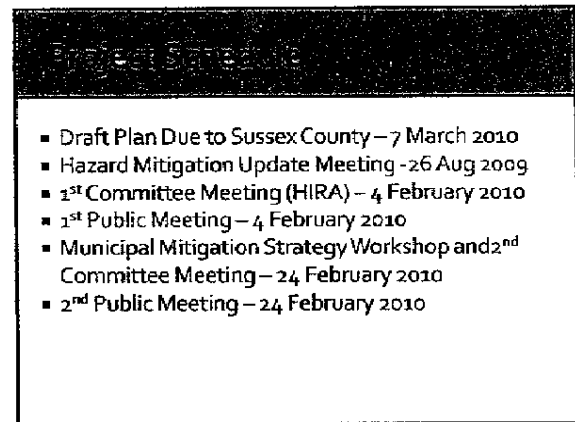
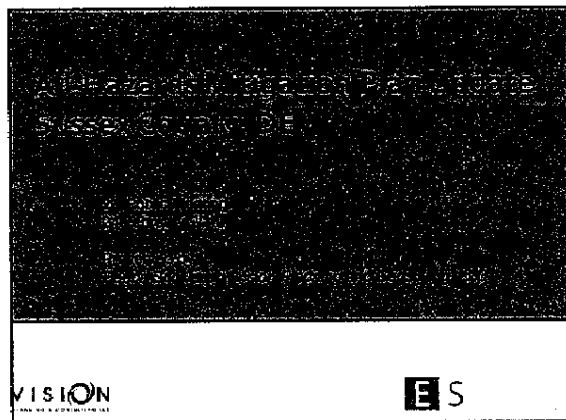
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JOHN CHIRTEA *	PRIME HOOK BEACH	302-684-4025	TRAINSTER@AOL.COM
Rick Allan	PRIME HOOK BEACH	302 684-2725	rsalby@comcast.net
LAWRENCE FOLLY	ANGOLA BY THE BAY	302-745-0414	lmf@mchsi.com
Joseph H. Thompson	Indian River Vol. Fire Co.	302-858-8580	joseph.thompson@irvfc.com
JOHN T. NICHOLS	A.R.C.	302-856-7703	TDRIZZANT@Verizon NRT
TWIG BURTON *	CARL M. FREEMAN COMMUNITIES	302.436-3000	TWIG@CMFA.COM
Chip	Gunn Co.	302-855-7801	

Email ppt

## **Material Presented**

PowerPoint Presentation: Meeting #2

3/4/2010

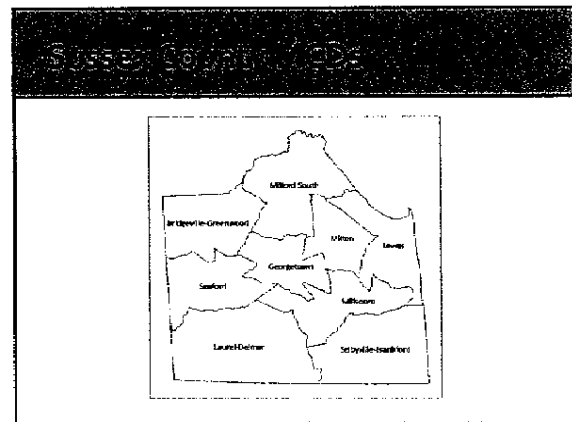


3/4/2010

### HAZARD PARTICIPATION

Sussex County - Municipality Participation

Hazard	Delaware	DuPont	Kent	Lebanon	Lincoln	Marshall	Queen Anne's	Sussex	Worcester
Earthquake									
Flood									
Coastal Storm Wind									
Tropical or Nor'easter									
Tornadoes									
Thunderstorm Wind									
Hail									
Winter Storms									
Extreme Heat/Cold									
Earthquakes									
Drought									
Low Level of Vulnerability									
Not Required by FEMA									
Dam/Levee Failures									
Weapons of Mass Destruction									
Pipelines									
Hazardous materials									



- ### HAZARDS NOT REQUIRED BY FEMA
- Floods
    - Riverine and Coastal
  - Coastal Storm Wind
    - Tropical or Nor'easter
  - Tornadoes
  - Thunderstorm Wind
  - Hail
  - Winter Storms
  - Extreme Heat/Cold
  - Earthquakes
  - Drought

- ### HAZUS-MH MR3
- HAZUS-MH MR3
    - Flood
    - Earthquake
    - Hurricane Wind
  - Area Averages – non spatially specific hazards – relative risk to surrounding counties (25 miles) – all occurrences
    - Tornado
    - Severe Thunderstorm
    - Hail
    - Winter Storm
    - Extreme Temperatures

- ### HAZARDS PARTICIPATED NOT REQUIRED
- Low Level of Vulnerability
    - Wildfires
    - Erosion
    - Sinkholes
    - Landslides
    - Volcanoes
    - Tsunamis
  - Not Required by FEMA
    - Dam/Levee Failures
    - Weapons of Mass Destruction
    - Pipelines
    - Hazardous materials

- ### HAZUS DATA SOURCES
- Federal Emergency Management Agency
  - National Climatic Data Center
  - US Army Corps of Engineers (Philadelphia)
  - US Geological Survey
  - US Department of Agriculture
  - Delaware DataMil

3/4/2010

POVERTY RISK LOSS - MCD	
MCD	Annualized Losses
Bridgeville-Greenwood	\$1,091,200
Georgetown	\$255,801
Laurel-Delmar	\$991,374
Lewes	\$19,357,870
Milford South	\$1,912,048
Millsboro	\$36,640,370
Milton	\$445,316
Seaford	\$1,403,417
Selbyville-Frankford	\$43,167,201
MCD Total	\$105,264,998
Sussex County Total	\$129,520,000

POVERTY RISK LOSS - ALL LOSS							
County	Events	Loss	Years	Annual Events	Annual Loss	Deaths	Injuries
Sussex County, DE	18	\$594,000	54	0.33	\$11,000	0	11
Kent County, DE	18	\$1,908,000	45	0.40	\$109,067	2	34
Caroline County, MD	6	\$375,000	57	0.11	\$6,579	0	0
Dorchester County, MD	11	\$5,722,000	25	0.44	\$228,880	1	15
Wilcomco County, MD	8	\$193,000	47	0.17	\$2,836	0	2
Worcester County, MD	10	\$250,000	51	0.20	\$4,901	0	0
Average	11.8	\$1,997,000	46.5	0.275	\$60,543	0.5	13.8

POVERTY RISK LOSS - MUNICIPALITIES			
Municipalities	Annualized Losses	Municipalities	Annualized Losses
Bethany Beach	\$8,221,887	Fenwick Island	\$2,258,541
Bethel	\$75,408	Frankford	\$63,925
Blades	\$115,000	Georgetown	\$0
Bridgeville	Negligible	Greenwood	\$7,101
Daysboro	Negligible	Hendopen Acres	\$409,600
Delmar	\$0	Laurel	\$2,182,198
Dewey Beach	\$1,430,177	Lewes	\$700,624
Ellendale	\$0	Milford	\$630,092

POVERTY RISK LOSS - SUSSEX COUNTY							
County	Events	Loss	Years	Annual			
				Events	Annual Loss	Deaths	Injuries
Sussex County, DE	236	\$8,747,000	52	5.50	\$168,211	2	10
Kent County, DE	249	\$4,113,000	51	4.89	\$81,431	2	5
Caroline County, MD	147	\$1,426,000	53	2.77	\$26,905	0	0
Dorchester County, MD	55	\$10,451,000	41	1.59	\$254,802	0	2
Wicomico County, MD	89	\$5,258,000	51	1.75	\$103,039	0	0
Worcester County, MD	59	\$5,605,000	53	1.11	\$124,622	0	0
Average	147.5	\$5,196,167	50.2	2.90	\$126,516	0.67	2.83

POVERTY RISK LOSS - MUNICIPALITIES	
Municipalities	Annualized Losses
Millsboro	\$411,348
Milville	\$124,808
Milton	\$338,142
Ocean View	\$1,008,490
Rehoboth Beach	\$489,965
Seaford	\$560,861
Selbyville	\$148,809
Slaughter Beach	\$333,152
South Bethany	\$4,017,172
Muni Total	\$23,543,670
Sussex Total	\$129,520,000

POVERTY RISK LOSS - MUNICIPALITIES							
County	Events	Loss	Years	Annual Events	Annual Loss	Deaths	Injuries
Sussex County, DE	66	\$3,450,000	16	4.13	\$158,625	0	65
Kent County, DE	78	\$5,500,000	16	4.87	\$343,750	1	60
Caroline County, MD	67	\$1,400,000	16	4.19	\$87,500	0	0
Dorchester County, MD	42	\$5,600,000	16	2.63	\$312,500	0	0
Wilcomco County, MD	39	\$5,600,000	16	2.44	\$312,500	0	0
Worcester County, MD	37	\$5,600,000	16	2.31	\$313,750	0	0
Average	54.8	\$4,561,147	16.0	3.43	\$285,104	0.1	20.8



3/4/2010

### Expected Annualized Losses

County	Events	Loss	Years	Annual Events	Annual Loss	Deaths	Injuries
Sussex County, DE	78	\$0	14	5.57	\$0	8	42
Kent County, DE	78	\$0	14	5.57	\$0	8	42
Caroline County, MD	78	\$0	14	5.57	\$0	1	25
Dorchester County, MD	3	\$0	14	0.21	\$0	1	0
Wicomico County, MD	2	\$0	14	0.14	\$0	0	0
Worcester County, MD	1	\$4,760,000	14	0.21	\$339,714	0	0
Average	40.3	\$283,333	14	2.879	\$53,962	3.3	19.6

### Expected Annualized Losses

Hazard	Rank
Drought	3
Hurricane Wind	4
Winter Storm	5
Severe Thunderstorm	6
Earthquake	7
Extreme Temperatures	8
Tornado	9
Hail	10

- ### Ranking Hazards by Expected Annualized Losses
- Not all hazards pose the same level of threat – there is a need to focus efforts on those hazards that pose the greatest threat to the County
  - Hazards are ranked (low, medium, high) according to:
    - Expected annualized loss
    - Expected frequency
    - Potential for loss of life

- ### Goals
- Adopt enhanced stormwater management practices.
  - Adopt and enforce codes and regulations designed to reduce the impact of natural hazards.
  - Retrofit and protect critical facilities and infrastructure from natural hazards.
  - Enhance education and outreach strategies to improve the dissemination of information to the public regarding hazards, including the steps that can be taken to reduce their impact.
  - Improve pre-event planning and preparedness activities.
  - Identify and implement sound hazard mitigation projects.

### Annualized Expected Losses per Hazard

Hazard	Annualized Losses
Flood	\$129,520,000
Hurricane Wind	\$1,926,244
Tornado	\$11,000
Severe Thunderstorm	\$168,211
Hail	\$7,560
Winter Storm	\$340,625
Extreme Temperatures	\$0
Earthquake	\$180,778
Drought	\$2,078,571

- ### Next Steps
- Preparation of Plan Update chapters
  - Deliverables due – 7 March 2010

## **2004 Executive Summary**

### **Introduction**

The purpose of the Sussex County All Hazard Mitigation Plan (hereinafter referred to as the "Plan") is to provide guidance for hazard mitigation in Sussex County. It identifies hazard mitigation goals, objectives and recommended actions and initiatives for county and municipal government to reduce injury and damage from natural and human-caused hazards. A Mitigation Action Plan (MAP) provides strategies for participating agencies that will improve their resistance to any hazard-caused disaster. The MAP is not included as part of this document, but is being developed separately.

This Plan meets the requirements for a local hazard mitigation plan under Interim Final Rule, 44 CFR 201.4, published by the Federal Emergency Management Agency (FEMA) on February 28, 2002.

This Plan keeps Sussex County qualified to obtain all disaster assistance to include all categories of Public Assistance, Individual Assistance and Hazard Mitigation grants available through the Robert T. Stafford Disaster Relief and Emergency Assistance Act, P.L. 93-288, as amended. Future enhancements of the State All Hazard Mitigation Plan will allow the State to obtain greater funding for hazard mitigation planning and projects (20 percent of federal Stafford Act disaster expenditures versus 7.5 percent for a standard state plan). It also keeps the state eligible for the annually funded Pre-Disaster Mitigation Program, and the Flood Mitigation Assistance Program.

*Without this plan, all eligible local jurisdictions – would be ineligible to receive a variety of disaster recovery programs, including the Public Assistance Program to repair or replace damaged public facilities, and the Fire Management Assistance Program to help the state and communities recover the costs of major disasters. However, the State and local communities would remain eligible for certain emergency assistance and Human Services programs available through the Stafford Act* .

### **The Planning Process**

This Plan is the product of thousands of hours of work and the effort of people from many organizations. The plan builds on a number of mitigation planning initiatives since 2000.

Staff from the Natural Hazards Section of the Delaware Emergency Management Agency led the development effort of the new Sussex County All Hazard Mitigation Plan. The Project Manager for Hazard Mitigation (Planner IV) directed the planning effort.

The Sussex County Hazard Mitigation Advisory Committee, assembled by the Sussex Office of Emergency Management and DEMA Natural Hazards Section, provided guidance and assisted with development of the All Hazard Mitigation Plan, including review of previous hazard mitigation planning initiatives, development of mitigation strategies, and an action plan. The 59 members of the advisory committee provided expertise and perspective to all aspects of the planning process, including, land-use planning, building codes, transportation, and infrastructure, to name a few. Representation included members from the local government, law enforcement, fire service, Licensing & Inspections, emergency management community, state agencies, Public Works, emergency medical professionals, building officials, and private industry.

Once the Plan is promulgated by the Levy Court, and approved by (FEMA), the Committee will function as an advisor to the State Hazard Mitigation Officer on hazard mitigation efforts, including future reviews and revisions.

Participation of local agencies was critical in the development of the Plan. Thirty-five stakeholders (listed below) participated by identifying potential vulnerable facilities along with agency-specific goals to address their vulnerabilities through mitigation actions and initiatives.

Bethany Beach, Town of  
Bethel, Town of  
Blades, Town of  
Bridgeville, Town of  
Dagsboro, Town of  
Delmar, Town of  
Dewey Beach, Town of  
Ellendale, Town of  
Fenwick Island, Town of  
Frankford, Town of  
Georgetown, Town of  
Greenwood, Town of  
Henlopen Acres, Town of  
Laurel, Town of  
Lewes, City of  
Millsboro Town of  
Millville, Town of  
Milton, Town of  
Ocean View, Town of  
Rehoboth Beach, City of  
Seaford, City of  
Selbyville, Town of  
Slaughter Beach, Town of  
South Bethany, Town of  
Bell Atlantic  
Department of Natural Resources and Environmental Control  
FEMA  
PBS&J Consultant  
Sussex OEM  
Sussex County Planning & Zoning  
Sussex County Sheriff's Office  
Sussex County Economic Development  
Sussex County Tax Assessor  
Sussex County EMS  
Sussex County Administration

These 35 agencies and stakeholders own or lease facilities of the hundreds tracked by Sussex County.

### **Coordination of Local Planning**

The Natural Hazards Section of the Delaware Emergency Management Agency worked with all 54 local jurisdictions (100% participation) to encourage their support of local hazard mitigation planning. The section's staff provided assistance in a number of ways, including on-site visits; training; planning grants; hazard and socio-economic information; local capability and risk assessments; and coordination of information requests between state government, consultants, and participation in local plan development activities.

The State and local government agreed to simultaneously develop mitigation plans at the county level. This approach facilitated the integration of the planning processes. County-level goals and actions were linked, to the goals established in the state Plan. This allowed more effective coordination of municipal, county and state goals. County goals provided valuable feedback to state officials as they developed broader state-level mitigation goals. This bottom-up approach allowed state officials to tailor their mitigation strategies to reflect the needs identified at the local level. County-level risk assessments were conducted in a manner that, when combined, served as the basis for the state-level risk assessment. This approach further linked local vulnerabilities to actions proposed at the state level. The number of local plans, and the areas they represented, provided adequate information influencing both the risk assessment and the mitigation strategies of the state plan.

### **Prioritizing Recipients for Hazard Mitigation Grants**

The process used to review, evaluate and select projects for hazard mitigation grants is built on years of public participation. The state's Hazard Mitigation Grant Program uses a competitive system where both federal and state criteria are used to evaluate and recommend projects for funding. Projects recommended for funding are those that best document their ability to reduce future impacts of natural disasters as well as demonstrate cost-effectiveness through a benefit-cost analysis. Only projects with a minimum benefit-cost ratio of 1-to-1 receive further consideration by a review committee. Typically, hazard mitigation funds following a disaster are available on a competitive basis to all eligible agencies and organizations statewide.

### **Maintaining the Plan**

The Sussex County All Hazard Mitigation Plan is a living document and will be reviewed, updated and adopted by county officials and submitted to FEMA for approval every Five years. The plan will be revised more frequently if conditions under which the plan was developed materially change as a result of new or revised policy, a major disaster, or availability of funding.

Participants in the maintenance of this plan include the State Hazard Mitigation Council and representatives of local jurisdictions whose hazard mitigation plans influenced the development of the Sussex County Plan.

Review of the Plan can take place in three ways:

- .        ∂        Annually, for progress made on mitigation actions and projects identified in the Mitigation Strategy.
- .        ∂        After each presidentially declared disaster, to look for areas where the Plan should be refocused due to the impact of the disaster.
- .        ∂        Every five years before the county plan is resubmitted for approval to FEMA.

The process used to monitor mitigation measures is similar to the one used to monitor, evaluate and update the content of the plan. Actions and projects identified in the mitigation strategies will be reviewed annually. Local agencies will submit brief progress reports annually. DEMA will track the overall progress of actions and projects identified in the plan.

### **Risk Assessment**

The *State Hazard Identification, Analysis, and Vulnerability Assessment, completed in February 2004* identified nine natural and three human-caused hazards that have the greatest potential to adversely affect the people, environment, economy and property of Delaware. Hazards that were considered include: Flood, Severe Winds, Thunderstorms, Tornadoes, Drought, Hail, Winter Storms, Earthquake, Dam/Levee Failure, Terrorism, Hazardous Materials, and Energy Pipeline Failures. The state has received 10 Presidential Disaster Declarations for natural hazard events since 1965. Below are synopses of these hazards and the risks they pose.

**Flood (Riverine and Coastal)** – New Castle, Kent and Sussex counties are all at risk and vulnerable to flooding validated by structures in the floodplain, number of flood insurance policies in effect and flood insurance claims paid. Flooding has resulted in 2 deaths, 13 injuries and more than \$13 million in property damage. Of the 102 recorded events by the National Climatic Data Center, four events were considered notable based on such criteria as magnitude, number of deaths and amount of property damage.

The total overall exposure within the state is estimated around \$108,329,660,000, with the greatest portion of that exposure being in New Castle County. In a 100 year flood event, as many as 5,481 facilities could sustain slight damage and 412 facilities could sustain moderate damage.

**Severe Winds** – The potential annualized losses from hurricane winds is \$83,149,276. 2,720 critical facilities would sustain light wind damage while 1,594 would sustain moderate damage from winds.

**Thunderstorms** – All buildings and facilities are exposed to thunderstorms and could potentially be impacted. It is not possible to estimate the number of residential, commercial, and other buildings or facilities that may experience losses. The potential annualized loss from thunderstorms is \$2,354,203.

**Tornadoes** – It cannot be predicted where a tornado may touch down. All buildings and facilities are considered to be exposed to this hazard and could potentially be impacted.

**Drought** – Although the State of Delaware as a whole is vulnerable to drought, it causes little damage to the built environment, mostly affecting crops and farmland. The potential annualized losses from drought are \$20,907,690.

**Hail** - All buildings and facilities are exposed to hail and could potentially be impacted, so estimated annualized losses cannot be broken down into distinct categories (residential, commercial, etc.). The potential annualized losses from hail are \$641,343.

**Winter Storms** - Expected annualized losses were extrapolated through non-linear regression of historical data. Potential annualized losses from winter storms are \$278,447.

**Earthquake** – The earthquake threat mostly occurs in New Castle County Delaware. The Peak Ground Acceleration for a 100 year event is greater than .0075. Potential annualized losses from an earthquake are \$2,147,940. Of the 5,551 potentially affected critical facilities statewide, they all would sustain less than 1% damage.

**Dam/Levee Failure** - The approach for determining vulnerability to dam and/or levee failure consists of a number of factors. Data from the USACE National Inventory of Dams (NID)<sup>1</sup> in addition to the HAZUS-MH demographic inventory was used, with an assumption that dam breaks most likely will occur at the time of maximum capacity.<sup>2</sup> Estimated exposure of people to dam failure by county is:

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<sup>1</sup> With the National Dam Inspection Act of 1972, the U.S. Congress authorized the U.S. Army Corps of Engineers (USACE) to inventory dams located in the United States. The Water Resources Development Act of 1986 authorized USACE to maintain and periodically publish an updated National Inventory of Dams (NID).

<sup>2</sup>Downstream quarter-circle buffer proportional to the maximum capacity of dams are assumed to represent the maximum impact area.

- New Castle 4,991
- Kent 6,110
- Sussex 5,816

**Terrorism** – A vulnerability assessment was conducted for Weapons of Mass Destruction (WMDs) in order to expand the scope of the hazard mitigation planning process to include vulnerability to acts of terrorism. Due to the sensitivity of the data and conclusions, more in-depth discussion is available in the complete risk assessment maintained at DEMA.

Facility	Threat	Percent Comparison
<b>Maximum Score in FEMA 426 Model</b>	<b>14.400</b>	<b>100%</b>
Hospitals	6.630	46%
Military Facilities	6.120	43%
Day Care Centers	5.865	41%
Hazardous Material Sites	5.610	39%
Dams	5.610	39%
Reservoirs	5.355	37%
Major Bridges	4.488	31%
All Gas Pipelines	0.867	6%
U.S. Roads	0.816	6%
State Roads	0.816	6%

**Hazardous materials** - Assessing vulnerability to a hazardous material (HazMat) release on a statewide scale consisted of the type(s) of hazardous material(s) present, the potential for mass casualties, and potential consequences for the surrounding area. The assessment documented information for 101 identified hazardous material sites from the States exposure data<sup>3</sup>. High consequence events were then selected (high material toxicity and population density), and ALOHA<sup>4</sup> was used for calculating the impact area.

**Energy Pipeline Failure** - Energy pipelines cross most of the State of Delaware. If any of these energy pipelines, oil or gas, were to rupture, such an event could endanger property and lives in the immediate area (within less than half a mile radius)

**Overall Risk Ranking for Sussex County**

Hazard	Rank
Drought	1
Flood	2
Severe Winds	3
Thunderstorm	4
Hail	5
Tornado	6
Earthquake	7
Winter Storm	8

### Mitigation Goals and Objectives

The Hazard Mitigation Advisory Committee supported the preparation of the goals, objectives, mitigation actions, and initiatives (mitigation strategy).

The mitigation actions address or solve local mitigation issues or problems. The Sussex County Hazard Mitigation Advisory

<sup>3</sup> If a facility houses more than one hazardous material, it is treated as a separate entry in this table, partially due to the fact that potential population at risk and projected clean-up area could vary depending on the chemical.

<sup>4</sup> ALOHA (Aerial Locations of Hazardous Atmospheres) is a computer program that uses information provided by its operator and physical property data from its extensive chemical library to predict how a hazardous gas cloud might disperse in the atmosphere after an accidental chemical release.

Committee developed the following mission statement for the Sussex County All Hazard Mitigation Plan and the following goals and for hazard mitigation.

Mission: Develop and maintain a comprehensive pre- and post-disaster hazard mitigation program guided by the adoption of stormwater management practices, the implementation of codes and regulations, the protection of critical facilities and infrastructure, the adoption of education and outreach efforts, pre-event planning and preparedness and the identification of projects designed to reduce the vulnerability of individuals, families, households, businesses, infrastructure and critical facilities to the negative effects of natural and human-caused hazards.

- |         |  |
|---------|--|
| Goal #1 | Sussex County and participating municipalities will adopt enhanced stormwater management practices.  |
| Goal #2 | Sussex County and participating municipalities will adopt and enforce codes and regulations designed to reduce the impact of natural and human-caused hazards.   |
| Goal #3 | Sussex County and participating municipalities will retrofit and protect critical facilities and infrastructure from natural and human-caused hazards.   |
| Goal #4 | Sussex County and participating municipalities will enhance education and outreach strategies to improve the dissemination of information to the public regarding hazards, including the steps that can be taken to reduce their impact. |
| Goal#5  | Sussex County and participating municipalities will improve pre-event planning and preparedness activities.  |
| Goal#6  | Sussex County and participating municipalities will identify and implement sound hazard mitigation projects.   |

Work continues with local agencies and departments to develop projected timelines and potential funding sources for the actions identified in the mitigation strategy. Specific mitigation actions are contained in Section 6.2 of the Plan.

#### **Disaster Resilient State Initiative**

In February 2003, Governor Ruth Ann Minner signed Executive Order #38 designating Delaware as a disaster resilient state. The executive order is significant for a number of reasons:

- 1) Hazard mitigation efforts of DEMA and other state agencies are codified,
- 2) Specific tasks are assigned, including the development of a strategic hazard mitigation planning process, and
- 3) The process is sanctioned by the Governor's Office.

Key directives in the Executive Order includes: creating of a State Hazard Mitigation Council; developing a five-year strategic mitigation plan; fostering relationships with public, private, and community partners in hazard mitigation related activities; sustaining county and local hazard mitigation planning efforts; encouraging participation in the National Flood Insurance Program (NFIP); and increasing public awareness regarding hazards and the steps that can be taken to reduce their impact.

#### **Executive Order #38 Establishing the State of Delaware as a Disaster Resilient State through a Comprehensive Mitigation Program against Natural and Technological Hazards**

WHEREAS, the State of Delaware, like all other states, is vulnerable to hurricanes, tornadoes, flooding, and other natural and technological disasters including terrorism and weapons of mass destruction that in the past have or could cause extensive loss of life and property, and severe disruption to essential human services; and

WHEREAS, the Stafford Act was recently amended by the Disaster Mitigation Act of 2000 Section 322 (DMA2K) (P.L. 106-390) which provides new and revitalized approaches to mitigation planning and emphasizes the need for state, local, and tribal entities to closely coordinate mitigation planning and implementation efforts; and

WHEREAS, two-thirds of the population lives in a single county; and

WHEREAS, during warmer months, tourists who visit the state's 90 miles of coastline, often coming from other states, may not fully understand the potential for hazards associated with coastal weather-related disruptive events; and

WHEREAS, in the past ten years, disasters have caused the loss of lives, personal injuries and more than \$49 million (in today's dollars) in property damage; and

WHEREAS, hurricane-associated storms alone have caused more than \$29 million in agricultural loss; and

WHEREAS, billions of dollars worth of residential, commercial, and coastal property in Delaware are at risk from hurricanes and weather-related damages; and

WHEREAS, partnerships with all levels of government, the private sector, and the residents of Delaware can reduce the impact of future events through hazard mitigation planning; and

WHEREAS, compliance with the new mitigation plan requirements will position the State of Delaware to receive pre- and post-disaster mitigation funding.

NOW, THEREFORE, I, RUTH ANN MINNER, ON THIS 28<sup>TH</sup> DAY OF FEBRUARY, 2003, DO HEREBY ORDER:

1. The State of Delaware's initiative to improve disaster resistance and resilience will be led by the Delaware Emergency Management Agency (DEMA).
2. In cooperation with public and private partners, DEMA will work to demonstrate the benefits of taking specific, creative steps to help Delaware communities reduce deaths, injuries, property damage, economic losses and human suffering caused by natural and technological disasters.
3. DEMA shall create a Statewide Hazard Mitigation Council (the Council), comprised of representatives from all levels of government and the private sector to act as a steering committee to further develop and implement State and local hazard mitigation strategies.
4. DEMA shall identify state agencies and private sector entities responsible and accountable for implementing actions in each of the areas listed below. Executives with authority and accountability in these areas will be asked to help the Council develop a five-year strategic plan and a first-year action plan. The plan shall include the following areas:
  - a. Completing and periodically updating a state-wide risk and vulnerability assessment of its natural and technological hazards to include terrorism and weapons of mass destruction;
  - b. Developing partnerships with businesses to provide a public-private link, resulting in a coordinated approach across all phases of emergency management, including mitigation, preparedness, response and recovery. Partnerships should include critical businesses involved in recovery from natural and technological hazard events (e.g., financial, utilities, communications, food suppliers, and medical facilities) and those businesses that would impact the local and state economy;
  - c. Obtaining agreement to address relevant hazards and the risks they pose in any state-level land use decisions, including plans for state-owned property. The Council will also encourage municipalities to participate in the creation of county level hazard mitigation plans that help guide day to day decision making;
  - d. Developing and sustaining local all hazard mitigation plans that take into account state mitigation priorities;
  - e. Encouraging communities to participate in the National Flood Insurance Program (NFIP) and the Community Rating System (CRS) and improve the rating of those communities that currently participate. DEMA will provide technical assistance for the preparation of CRS applications;
  - f. Incorporating protective measures into public and private lifelines, infrastructure and critical facilities;
  - g. Developing and supporting existing and future programs to increase the public's awareness of natural and technological hazards, including ways to reduce or prevent damage through a coordinated effort lead by the Statewide Hazard Mitigation Council;
  - h. Supporting the incorporation of natural hazard awareness and reduction programs into school curricula through appropriate means, including the use of the state Department of Education, state university system, community



colleges, and other educational institutions;

- i. Supporting mitigation training for county and municipal planners, developers, architects, engineers, surveyors, and other government and private sector professionals. Encouraging the participation of government industry and professional organizations in this effort.
- J. Identifying existing incentives and disincentives for hazard loss reduction initiatives, and developing and implementing new incentives to further this effort;
- k. Encouraging the development of disaster resilient communities within the State through a collaborative partnership with the Federal Emergency Management *Agency*