



NATURAL HAZARD AND CLIMATE CHANGE ADAPTATION TOOL KIT FOR DELAWARE COMMUNITIES

JANUARY 2014

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OVERVIEW

Delaware communities are susceptible to a variety of natural hazards: floods, severe thunderstorms, coastal storms, winter storms, tornadoes, wildfires and drought.

These natural events can happen anywhere, whether a rural

town, a large city or a coastal community on the Delaware Bay, Atlantic Ocean or Inland Bays.

Additionally, communities face an increasing degree of uncertainty related to the impacts that future climatic conditions may have on their areas. Increases in the number of extreme precipitation events may result in more frequent flooding due to drainage and stormwater issues; increases in storm surge flooding that occurs during extreme events may have even greater impacts when combined with increasing water elevations related to sea level rise.

The economic costs associated with natural hazards and the potential exacerbation of these hazards by climate change can be staggering. In addition to financial costs, natural hazards and associated climate impacts can endanger lives and wreak social and emotional devastation in a community. However, action can be taken ahead of time to prevent or minimize future damages. Local decision-makers have the greatest capacity to influence the resiliency of their communities. Typically they are the first to respond to a disaster, and they also have the authority to ensure the health, safety and welfare of their constituents. Increasingly, communities are moving from a strategy of response to a proactive stance of planning, public education and disaster preparedness.

This tool kit was developed to assist communities in identifying planning, mitigation and adaptation opportunities that will help reduce vulnerabilities



Natural hazards and associated climate impacts can endanger lives and property and wreak social and emotional devastation in a community.

to natural hazards and climate impacts. Local leaders can identify means to improve community resilience through existing planning, mitigation, response and outreach mechanisms. Adaptation in the context of planning for existing and future hazards often involves adjusting existing programs and policies to minimize current impacts, while also considering new options that can be flexibly implemented over time. An effective plan will not only improve a community's ability to deal with natural disasters and climate change, but will also document valuable local knowledge on the most efficient and effective ways to reduce risk and improve community resilience.

The tool kit is designed to guide community officials and residents through a planning process that promotes coordination with other community needs and relies on public input. Because every community differs in terms of economics, size, governance, land uses and hazards, the planning process will help identify the unique problems and solutions for your area. Developing an adaptation action plan can help a community take a comprehensive approach to finding the best solutions, solve more than one problem with a single solution and even maintain or improve local environmental and economic integrity.

Much of what your community is doing now may be helping to reduce the impacts of natural hazards and climate change. Local governments throughout Delaware have many land use regulations, conservation measures and flood control initiatives in place that go a long way towards minimizing future disaster losses. Evaluation of these measures to see where they can be coordinated or strengthened and development of a long-term hazards/climate adaptation action plan allow

communities to identify additional actions that can be taken now to reduce the future impacts of disasters.

In partnership with DNREC and FEMA, the town of Bowers Beach has created a new municipal park on private property. The property had been repeatedly inundated with flood waters that damaged the owner's home. Actions that benefit a community in multiple ways are considered to be "win-win strategies."



ACKNOWLEDGMENTS

This tool kit was developed as a component of Delaware Sea Grant's resilient coastal communities initiative, with a focus on providing assistance to communities as they tackle common problems and develop comprehensive solutions to plan for natural hazards and climate change. The importance of preparing for climate change and the understanding that local governments can play a key role in building resilience towards hazard and climate impacts is underscored not only by this specific project, but also in Delaware Sea Grant's strategic plan (2014–2017).

The tool kit was prepared by Daniella Hirschfeld (The Resiliency Place) and Wendy Carey (Delaware Sea Grant), with review comments and suggestions provided by Dave Carlson and Don Knox (Delaware Emergency Management Agency). Editing, layout and design support were provided by Katy O'Connell, Teresa Messmore, Tammy Beeson and Pam Donnelly (Delaware Sea Grant Environmental Public Education Office). Photographs were provided courtesy of Delaware Sea Grant and Delaware Department of Natural Resources and Environmental Control.

It is our hope that the information contained within this tool kit will be widely used by Delaware communities as they become engaged in effective climate change adaptation and hazard mitigation planning, action and activities.

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Online Resources

Throughout this tool kit, we reference materials that are readily available online. In order to provide you with rapid online access to these resources, we have compiled a list that is available on the Delaware Sea Grant website.

Please visit www.deseagrant.org for the online version of this publication and list of associated links.





SECTION 1

PROCESS-ORIENTED MATERIALS

This three-part section covers all of the information needed to develop a full natural hazards and climate change adaptation planning process that best matches your community's needs. A review of this section and full use of the tools and resources included should result in a deeper understand of the steps ahead.

In Part I, the tool kit covers different possible approaches and methods for planning. Part II is focused on committee selection and design. Part III provides information and tools for hosting workshops and meetings.

Part I: Choosing a Planning Approach and Level of Community Engagement

Introduction

There are many reasons why communities are concerned about natural hazards and/or climate change. Some communities have been recently impacted by hurricanes, heat waves or other extreme weather events. Other communities worry that infrastructure in place today will be insufficient to handle projected increases in flooding, higher intensity storms and rising sea levels. Regardless of the reason, many communities are creating plans to prepare for future natural hazards and projected impacts of climate change—and so can yours!

In this part of the tool kit, you will learn:

- Essential steps in hazard mitigation and climate change adaptation planning
- Options for hazard mitigation and climate change adaptation planning approaches
- How to select a level of public engagement appropriate for your community
- Timelines and resources needed for your chosen planning approach

Resources for this part of the tool kit include:

- A general overview of the overall hazard mitigation and climate change adaptation planning process; a sample timeline for the process is provided in Appendix I
- A worksheet to identify the plans, codes and ordinances targeted for the integration of hazard mitigation and climate change adaptation considerations

Essential Steps in Hazard Mitigation Planning and Climate Change Adaptation

While there are many ways to approach hazards and climate change adaptation planning, as discussed later in this section, the basic steps are the same:

- Identify government staff, stakeholder groups, committees and individuals who will lead and contribute to the planning process
- Identify baseline and future scenarios and then determine local vulnerabilities
- Identify and select actions to increase the resiliency of your community
- Create a focused plan and then implement selected actions

To help create a local plan, Appendix I contains an example step-by-step process for an integrated hazard mitigation and climate change adaptation plan development. Additionally, this process includes estimated timelines. Parts II–VII of this tool kit discuss each step in detail. These steps can be incorporated into existing planning processes, such as hazard mitigation or waterfront revitalization plans, or can be used to guide the development of a standalone climate change adaptation plan.

Selecting a Hazard Mitigation and Climate Change Adaptation Planning Approach

Three planning approaches typically used by local governments include:

- **Independent Hazard Mitigation and Climate Change Adaptation Planning**—Creating and implementing a plan focused specifically on hazard mitigation and climate change adaptation. This plan is not part of any other plan or process. Its sole purpose is to outline strategies for increasing the community’s resilience to extreme weather and climate change impacts.
- **Integrative Planning**—Incorporating climate change into existing planning processes, such as comprehensive plans, water and sewer infrastructure plans, waterfront revitalization plans, etc. The Worksheet A (on page 4) provides a complete list of possible plans to consider when looking to integrate hazard mitigation and climate change adaptation into key elements of the local government’s systems and processes.

- **Collaborative Planning**—Designing a plan to meet the needs of a region. Examples include a hazard mitigation plan written by a county with a city’s participation or a group of cities and towns working together to identify vulnerabilities and implement strategies that increase the resilience of the entire region. Elements of collaborative planning, such as including non-local stakeholders and neighboring communities in the planning process, can be incorporated into integrative and independent hazard mitigation and climate change adaptation planning efforts.

It is important to note that most communities use a combination of these three approaches. For example, a community undergoing an independent local hazard mitigation and climate change adaptation planning process may ask for input from neighboring communities or state agencies. Likewise, a community could use a collaborative planning approach within an existing regional planning process, thereby creating a hybrid integrative/collaborative planning approach. Moreover, communities that conduct an independent hazard mitigation and climate change adaptation planning efforts may decide the integration into other planning efforts is a necessary next step for the community. Lewes, Del., found through the independent hazard mitigation and climate change adaptation planning effort that the comprehensive plan, zoning plan and building code would benefit from the integration of natural hazards and climate adaptation. Table 1 outlines the benefits of each planning approach.

Table 1. Benefits of Independent, Integrative and Collaborative Hazard Mitigation and Climate Change Adaptation Planning Approaches

Planning Approach Type		
Independent	Integrative	Collaborative
<p>Focus on Hazard Mitigation and Climate Change Adaptation—100 percent of the planning process is focused on natural hazard mitigation and climate change adaptation. In an integrative process, hazard mitigation and climate change adaptation is only one consideration in the plan.</p>	<p>Resource Efficiency—Adding natural hazard mitigation and climate change adaptation into an existing planning process is less resource intensive than starting a new planning process. However, less focus may be given to natural hazard mitigation and climate change adaptation and than in an independent planning process.</p> <p>Easy Participation—Staff and community members may be more willing to participate in the adaptation planning process if it is tied to workshops or committee meetings that they already plan to attend.</p> <p>Implementation Success—Communities may be more likely to implement adaptation strategies if they are contained in a plan already in use by the government.</p>	<p>Addresses Trans-boundary Climate Hazards—Infrastructure (transportation networks; communication, power and sewer systems; etc.), floodplain management and healthcare issues may be more effectively addressed at the regional level. However, a regional entity may lack the authority necessary to implement certain strategies at the local level.</p>

Worksheet A. Plans, Ordinances and Codes to Consider for Natural Hazards and Climate Change Adaptation Integration

	Developed by Community (Y/N)	Desired for Integration (Y/N)	Update Frequency	Point of Contact
Specific Plans, Ordinances and Codes	Municipal Master Plan			
	All-Hazards Mitigation Plan			
	Floodplain Management Plan			
	Evacuation Plan			
	Emergency Response Plan			
	Continuity of Operations Plan			
	Disaster Recovery Plan			
	Post-Disaster Redevelopment Plan			
	Capital Improvement Plan			
	Economic Development Plan			
	Coastal Plan			
	Shoreline Restoration Plan			
	Open Space Plan			
	Stormwater Management Plan			
	Historic Preservation Plan			
	Zoning Ordinance			
	Flood Damage Prevention Ordinance			
	Subdivision Ordinance			
Building Code				

Selecting a Level of Public Engagement for Your Planning Process

Because sea level rise, storm surge and other climate change impacts will cause damages that cross community sectors and departmental boundaries, it is important that the hazard mitigation and climate change adaptation planning process be an inclusive one. However, every community is different in terms of resource availability and interest in public participation. Therefore, the resources in this tool kit are tailored for three different levels of community engagement:

- **Extensive Community Participation**—Citizens attend workshops and answer surveys to help identify vulnerabilities, select and prioritize actions and learn about the final plan. Citizens also serve on committees related to the plan development.
- **Limited Community Participation**—Citizens attend public workshops, but do not serve on formal committees.
- **Minimal Community Participation**—Citizens do not participate in identifying vulnerabilities nor are citizens directly involved in selecting and prioritizing actions. All workshops and committees

Table 2. Comparison of Community Participation Levels in Climate Adaptation Planning

	Community Participation Level		
	Extensive	Limited	Minimal
Citizen and Business Involvement			
Serve on committees tasked with developing the plan	X		
Respond to surveys	X		
Attend workshops	X	X	Once
Benefits of Community Engagement Type			
Community Buy In —reduces barriers to plan implementation	X	X	
Community Priorities Reflected in Plan	X	X	
Education —creates opportunities to educate the public on climate change	X	X	
Volunteers —allows government staff can delegate responsibilities to citizens	X		
Expediency —shortens the timeframe of the planning process			X
Public Participation			
Number of Public Workshops	4	5	1
Number of Public Surveys (optional)	1+	0	0
Government Staff and Committee Effort			
Number of Committee Meetings or Workshops	About 5	About 6	About 4
Timeframe (months)	7–12	12–18	2–4
Example Community Using Engagement Approach			
Community Name	Lewes, Del. (2011)	Delaware City, Del. (2014)	San Mateo County, Calif.

are attended/staffed by local government staff and officials. Citizens are presented a near final draft and given an opportunity to provide public comment.

Table 2 (above) outlines the different levels of public engagement and highlights the differences between each.

Next Steps

Having used this section to design your community’s natural hazard and climate adaptation planning approach, use Part II of this tool kit to learn more about selecting individuals to participate in your hazard mitigation climate change adaptation planning process.

Public engagement and citizen participation at workshops can provide important input related to assessing and prioritizing vulnerabilities and identifying actions to be considered.



Part II: Committee Selection

Introduction

The next step after choosing your planning approach and level of community engagement is to select a local taskforce and/or advisory committee to aid in the development of your plan. Committee members will provide assistance with public outreach, identify future vulnerabilities and hazard mitigation and/or climate change adaptation strategies and possibly even develop content for the plan. Because the impacts of natural hazards and climate change affect many aspects of a community and a government's operations, it is important to select a diverse group of people to serve on your committees.

In this part of the tool kit, you will learn about:

- The role of committees in hazard mitigation and climate change adaptation planning
- Types of committees
- Suggested individuals to serve on committees

Resources in this part of the tool kit include:

- A table to help select individuals to serve on committees
- A sample letter inviting individuals to join your taskforce or advisory committee

Role of Committees in Hazard Mitigation and Climate Change Adaptation Planning

Committees serve many roles in the hazard mitigation and climate change adaptation planning process.

These include:

- **Content or Knowledge Experts**—Committee members from different disciplines and sectors, such as infrastructure, public health, public safety, academia, etc. will have unique knowledge sets to contribute to the process.
- **Workshop Participants**—Members will participate in workshops (see Part III) designed to identify vulnerabilities and develop and prioritize hazard mitigation and adaptation strategies.
- **Plan Development**—Members will provide feedback on components of the plan and may help develop content. Members may also form subcommittees to focus on specific topics within the plan.

- **Public Outreach**—Members may be tasked with educating the public and individuals within their departments about the plan or help collect feedback from individuals outside of the committee.
- **Legitimize the Plan**—Having a committee of task force representatives from different government departments and community sectors helps create awareness about the plan. It also makes the plan more likely to be successful in the implementation stage by having multiple parties invested in the plan's success.

Committee Types

Communities undertaking a hazard mitigation and climate change adaptation planning process may find it useful to have two types of committees:

- A local community task force
- An external expert advisory committee

In some cases, communities may choose to merge these two types of committees into one group. The following sections describe these committee types in more detail. They also provide sample lists of who should be invited to serve on each committee type, as well as sample invitation letters for potential members.

Local Community Task Force

Obtaining a commitment from the community ensures that local staff and/or volunteers will be able to spend time planning and implementing activities that will minimize risk and improve resiliency. A community-based planning team or task force is essential to the hazard mitigation and climate adaptation planning effort. What will a community planning team do to improve the plan?

- Help ensure better solutions, since no one person in the community has all the answers
- Help gain community acceptance for the plan, since many viewpoints are represented
- Help ensure important information and assistance isn't overlooked or left out

The community task force should be composed of individuals with a variety of different skills and areas of expertise. A local community task force is highly engaged with the development of the plan and is responsible for:

- Attending workshops to help identify vulnerabilities, select adaptation strategies and prioritize strategies for implementation
- Providing detailed feedback on drafts, proposed initiatives and suggested frameworks for the plan
- Contributing knowledge on how projected changes in climate may affect government services, population or other entities represented by the committee
- Potentially drafting sections of the plan
- Potentially forming subcommittees to focus on specific subjects, such as transportation, utilities or public health

A local community task force often consists of local government staff (city manager), officials (city council or commissioner) and key community stakeholders. If your planning process includes extensive or limited community participation, this committee should also include community members (residents, businesses and other local stakeholders). Within the government, individuals from multiple departments and agencies should be represented (public works, emergency management, building official, conservation commission, schools, health, transportation, planning, etc.). Table 3 contains a suggested list of individuals who should be invited to serve on your local community taskforce.

External Expert Advisory Committee

The purpose of the external advisory committee is to lend expert knowledge to the hazard mitigation and climate change adaptation planning process. The expert advisory committee is typically called upon for its:

- **Technical Expertise**—Members can provide knowledge and answers to questions that are outside the expertise of the local community taskforce.
- **Experience**—Having worked on similar or related projects outside experts can help to guide and shape the process and the plan.
- **Institutional Knowledge**—Sharing information on programs and projects at the state or regional level can help in recognizing additional opportunities for action and collaboration.
- **Connection to Resources**—Putting local officials in touch with the right state or regional funding opportunity can make a significant difference in terms of plan implementation.

- Inform the local community task force of regional/ state/or federal initiatives that may be of concern to the local hazard mitigation and climate change adaptation planning project.

Examples of individuals who typically serve on the advisory committee include: individuals from county/ state/or federal agencies, regional planning commission staff, regional non-profit staff, state government representatives and academics. Table 3 contains a suggested list of individuals who should be invited to serve on your external expert advisory committee.

Combined Local Community Taskforce and External Expert Advisory Committee

In some cases, a community may opt to combine the local community taskforce with the external expert advisory committee. A community may choose to do this for several reasons, including:

- Interest by the expert advisory committee members to be more involved in the hazard mitigation and climate change adaptation planning process
- Streamlining the committee facilitation by local government staff leading the planning effort
- A high density of local staff, citizens or other stakeholders with expert-level knowledge who could double as local taskforce members and expert advisory committee staff

Table 3 contains a suggested list of individuals who should be invited to serve on your combined local community taskforce and expert advisory committee.

Suggested Individuals to Serve on Committees

Table 3 (on page 8) contains a list of individuals to invite to serve on the local community taskforce and the external expert advisory committee. Although representing a diversity of stakeholder groups is important, vulnerabilities and local concerns will vary between communities. As such, some stakeholder groups listed in Table 3 will not be relevant in certain communities. Through public workshops and outreach to individual stakeholders, it is possible to obtain input from large groups of stakeholders while keeping committees limited to a smaller and more manageable group size (10–30 participants).

Table 3. Hazard Mitigation and Climate Change Adaptation Planning Committee Selection Guide

		Community Engagement Level			Committee Type	
		Extensive	Limited	None	Local Community Taskforce	Expert Advisory Committee
Stakeholder Group	Public Safety					
	Local emergency planning officials	X	X	X	X	
	Local floodplain management officials	X	X	X	X	
	Local hazard mitigation planners	X	X	X	X	
	Local police, fire and emergency responders officials	X	X	X	X	
	County or state-level staff or officials	X	X	X		X
	Transportation					
	Local highway planning and maintenance officials	X	X	X	X	
	Local/regional transit authorities (public transportation, airports, etc.)	X	X	X	X	X
	Metropolitan planning organization (MPO)	X				X
	State department of transportation officials	X	X	X		X
	Building and Housing					
	Building regulation and inspection officials	X	X	X	X	
	Public works, utilities, engineering officials	X	X	X	X	
	Public housing authority	X	X	X	X	
	Local developers and builders associations	X			X	
	Local realtors associations	X			X	
	Local engineering and architects associations	X			X	
	Community and Economic Development					
	Local community development and economic development officials	X			X	
	Nonprofit community development	X			X	X
	Chambers of commerce	X			X	X
	Major business interests (largest employers, local business associations)	X			X	X
	Education					
	Local school district officials	X	X	X	X	
	Local colleges and universities	X			X	X
	Extension agents	X			X	
	Nonprofit education and education advocacy	X			X	X

		Community Engagement Level			Committee Type	
		Extensive	Limited	None	Local Community Taskforce	Expert Advisory Committee
Stakeholder Group	Planning and Environment					
	Local planning officials	X	X	X	X	
	Local environmental/coastal planning and management officials	X	X	X	X	
	Local water and wastewater management officials	X	X	X	X	
	Local sustainability planning officials	X	X	X	X	
	County/state/federal coastal/environmental/planning and management officials	X	X	X		X
	Land conservation organizations	X			X	X
	Nonprofit planning and environmental organizations	X			X	X
	Recreation and Cultural Resources					
	Local recreation and cultural resource officials	X	X	X	X	
	Nonprofit recreation groups and organizations	X			X	X
	Cultural resource groups (historic preservation, arts, museums)	X			X	X
	Human and Social Services					
	Local public health officials	X	X	X	X	
	County/state public health officials	X	X	X		X
	Social service agencies and providers	X			X	X
	Private and nonprofit local health care and mental health organizations	X			X	X
	Elderly and child advocacy organizations	X			X	X
	Neighborhood and community associations	X			X	X
	Religious and charitable organizations	X			X	X
Governance						
City or town manager	X	X	X	X		
Local elected officials (mayor, council persons, selectmen, etc.)	X	X	X	X		

Sample Invitation Letter

Dear **[Enter Name]**,

On behalf of **[Enter Inviting Organizations]**, we are delighted to invite you to participate in a project to help **[Enter City or Town]** develop a plan for adapting to existing and future natural hazards and climate change impacts. The ultimate intent of this project is to chart a course for how **[Enter City or Town]** will prepare for and be resilient to natural hazards and climate change.

The effort to develop the city's plan to improve community sustainability and resiliency will take approximately **[Enter Amount of Time]**, starting in **[Enter Date]** and ending in **[Enter Date]**. A key component of this work will be the integration of thoughts and ideas from **[Enter Desired Stakeholders]**.

To initiate this process, we will be holding a meeting on **[Enter Date and Location]**. This first meeting will provide an overview of the project's development process as well as an opportunity for various stakeholders to share their thoughts about existing and forecasted hazards the City should be planning for.

Given the important role you currently play or are likely to play in helping **[Enter City or Town]** increase its resilience towards natural hazards and climate change, we would be delighted if you could join us for the meeting on **[Enter Date]**.

Participation in this event is open to all interested parties, but we do ask that you kindly let us know about your availability to participate in the meeting no later than **[Enter Date]** so we can plan accordingly.

For more information about the event, please see the enclosed registration form and preliminary agenda. If you have any questions or would like to recommend additional individuals that should be invited to attend this event, please contact **[Enter Contact]**.

We sincerely hope you'll be able to join us for this exciting and extremely important workshop.

Sincerely,

[Enter Contact]

Next Steps

Once you have decided on the type(s) of committees you want to guide your community's adaptation planning process, you must begin planning the

necessary workshops for your groups. Proceed to Part III of this tool kit to learn more about hosting workshops, including sample agendas, to help identify vulnerabilities and identify and prioritize adaptation strategies for your plan.

Part III: Hosting Workshops

Introduction

Workshops provide government staff, elected officials and the public opportunities to participate in the hazard mitigation and climate change adaptation planning process. The individuals invited to attend each workshop will depend on the level of community participation (see Part I of this tool kit). For example, communities with high community participation will host workshops open to the public. A community that chooses to conduct an internal planning process would limit workshop participation to members of the local community taskforce. In certain situations, a community may decide that it is not necessary or practical to host one or all of the workshops described in this tool kit. In these cases, the community may decide to contact individuals directly through phone, email, or small in-person meetings to obtain the information required to achieve the workshop goal.

In this part of the tool kit, you will learn about hosting workshops and can access resources focused on the following:

- Project overview and current natural hazards and associated vulnerabilities
- Identifying future climate vulnerabilities
- Selecting actions to reduce vulnerability
- Prioritizing selected actions

Resources in this part of the tool kit include:

- Sample workshop agendas

General Workshop Hosting Considerations

There are many factors and details to consider when looking to host a series of workshops. Below are several key areas where critical decisions must be made. This tool kit includes some brief guidance on each topic.

Facilitation

There are two options when it comes to the facilitation of meetings and workshops. One is to use internal staff

resources, while the other is to work with an external facilitator. Working internally can cut back on planning costs and can help ensure that there's full staff buy-in. However, it can be difficult for internal staff to guide a committee through difficult decisions and controversial topics.

Outside Presenters

Whether using a facilitator or not, having outside presenters can greatly enhance the workshops and meetings. Outside presenters bring additional expertise to the planning process and can provide new insights and inspirations to the final plan. Communities should consider looking to state and federal experts for presentations. Additionally, universities scientists can often be a good resource.

Location and Timing

As much interest as there might be in a specific topic, people cannot attend if it conflicts with their existing commitments. Therefore, it's critical to schedule meetings for the right time and place. Daytime meetings are ideal for those who can consider the meeting part of their regular work schedule. However in the case of volunteer committee members, it is often necessary to host evening meetings to accommodate a full work schedule.

Getting the Word Out

The success of a meeting or a workshop is partially dependent on the attendees. It's critical that the many different voices are heard and the full participation be allowed. In order to enable this, high attendance levels are necessary. Thus when organizing a workshop, be sure to use several different ways of spreading the message about the event. Some options include

- Fliers in public spaces
- Community calendars
- Online outlets—Facebook, Twitter or local websites
- Printed publications—local newspaper or a flier in mail

Workshop 1: Project Overview and Current Natural Hazards and Climate Vulnerabilities

Goals

Workshop 1 serves as your project kickoff meeting. Participants are likely unfamiliar with the concept of hazard mitigation and climate change adaptation, so this is an opportunity to provide education. This workshop should give an overview of the hazard mitigation and/or climate change adaptation planning process you intend to follow. It should also outline the roles and responsibilities of taskforce or committee members. This first workshop is also a good opportunity to engage the public and/or committee members in identifying hazards currently facing your community. Workshop 2 will focus on identifying future climate vulnerabilities, so the vulnerability identification exercise in this workshop can remain focused on current conditions. Part IV of this tool kit contains information on identifying and prioritizing natural hazard and climate change vulnerabilities.

Agenda

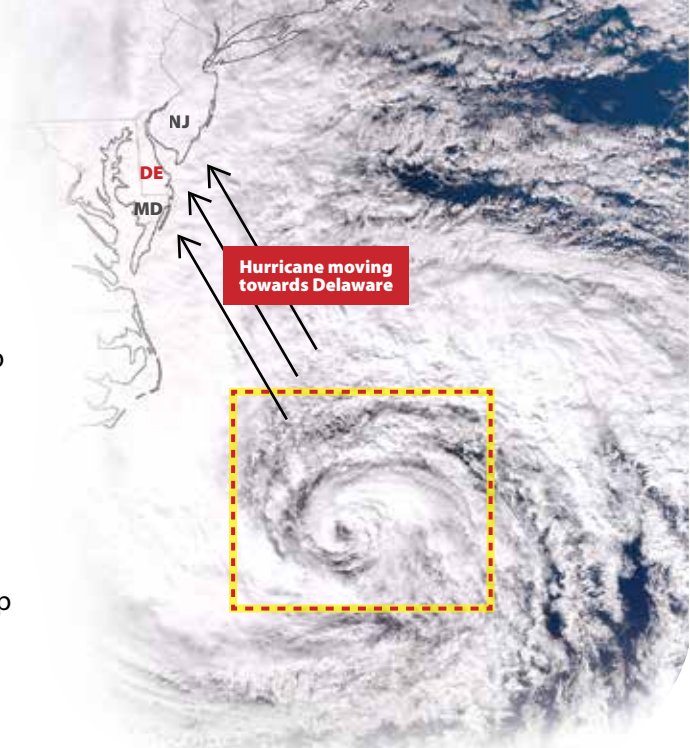
Below is a sample agenda for Workshop 1 held as a half-day meeting. This workshop could be paired down to accommodate a two-hour evening meeting.

9:00 a.m.	Welcome and Participant Introductions (Presenter names)
9:15 a.m.	Overview of Project and Committee Roles (Presenter names) include overview of risk and vulnerability assessments
9:30 a.m.	Historic and Current Natural Hazards (Presenter names)
10:00 a.m.	Preparing for Future Changes (Presenter names)
10:45 a.m.	Break
11:00 a.m.	Group Exercise—Visualizing Vulnerabilities (Facilitator names)
11:45 p.m.	Report Back from Visualization Exercise (Facilitator names)
12:15 p.m.	Closing and Next Steps (Presenter names)
12:30 p.m.	Adjourn

Other Considerations

Communities with high or limited community participation may want to host two workshops covering this content. One “Workshop 1” would be geared towards members of the public interested in learning about the adaptation planning process and how they can become involved. This workshop would offer an opportunity for communities with high or limited community participation to recruit members of the public to serve on the local community taskforce or expert advisory committee. It could also be used as recruitment event to make individuals interested in attending future workshops. The second “Workshop 1” meeting would be specifically for local community taskforce members and would have greater emphasis on the roles and expectations of taskforce members.

Communities may want to conduct a preliminary vulnerability assessment in order to prepare for a public meeting on the topic. Part V of this tool kit provides extensive information on vulnerability assessments including a worksheet for conducting a preliminary vulnerability assessment.



Use visuals to provide natural hazard, climate change and adaptation information. Showing an example as above can help the public to visualize vulnerabilities.

Workshop 1 Goals:

- ① Provide an overview of hazard mitigation and climate change adaptation
- ② Identify existing hazards and vulnerabilities
- ③ Ensure that roles and expectations are defined and articulated to committee members

Workshop 2: Identify Future Hazards and Climate Vulnerabilities

Goals

The goal of Workshop 2 is to expand on the vulnerability identification exercise from the first workshop. In Workshop 2, participants will identify how current vulnerabilities could be worsened by projected changes in climate and help identify any new vulnerabilities that the community should expect. For example, how might current flood risks change based on projected increases in precipitation or storm frequency? Are there pieces of infrastructure, populations or natural resources that could be differently affected by climate impacts in the future? See Section Two of this tool kit for resources and exercises focused on identifying vulnerabilities to natural hazards and climate change impacts.



Coastal flooding is a chronic problem that may be exacerbated with more intense coastal storms and rising sea levels.

Agenda

Below is a sample agenda for Workshop 2 held as a half-day meeting. This workshop could be paired down to accommodate a two-hour evening meeting.

9:00 a.m.	Welcome and Participant Introductions (Presenter names)
9:15 a.m.	Overview of Project (Presenter names) include update from prior workshop and preliminary vulnerabilities identified
9:30 a.m.	Expected natural hazard and climate change impacts (Presenter names)
10:00 a.m.	Group Exercise—Vulnerability Identification and Prioritization (Facilitator names)
11:00 a.m.	Break
11:15 a.m.	Report Back from Group Exercise (Facilitator names)
11:45 p.m.	Vulnerability Reduction Dialogue and Best Practices (Presenter names)
12:15 p.m.	Closing and Next Steps (Presenter names)
12:30 p.m.	Adjourn

Workshop 2 Goals:

- ① Identify vulnerabilities from projected climate change; use the assessment of current climate hazards from Workshop 1 as a starting point
- ② Begin exploring potential actions to address these vulnerabilities

Other Considerations

Communities with high or limited public engagement may want to host two workshops: one for the public and the other for local community taskforce members. While in-person meetings are often beneficial, communities opting not to engage the public may decide to skip this workshop. Instead, these communities could use questionnaires to gather information on vulnerabilities unique to each government department.

Workshop 3: Select Actions to Reduce Vulnerability

Goals

The goal of this workshop is to identify actions to help reduce the vulnerabilities identified during the first two workshops. This workshop should include an overview of hazard mitigation and climate change adaptation best practices. Participants should then select a list of actions they think would best address these vulnerabilities. Part VII of this tool kit contains information on selecting and prioritizing hazard mitigation and climate change adaptation strategies. Workshop 4 is where the final prioritization of actions for inclusion in a plan will occur.

Agenda

Below is a sample agenda for Workshop 3 held as a half-day meeting. This workshop could be paired down to accommodate a two-hour evening meeting.

9:00 a.m.	Welcome and Participant Introductions (Presenter names)
9:15 a.m.	Overview of Project (Presenter names) include update from prior workshops and primary vulnerabilities identified
9:30 a.m.	Best Practices for Increasing Resilience (Presenter names)
10:00 a.m.	Group Exercise—Natural Hazard and Climate Adaptation Actions Identification and Selection (Facilitator names)
11:00 a.m.	Break
11:15 a.m.	Group Exercise Continued
11:45 a.m.	Report Back from Group Exercise (Facilitator names)
12:15 p.m.	Closing and Next Steps (Presenter names)
12:30 p.m.	Adjourn

Other Considerations

After this workshop, many communities call on their expert advisory committee members to review the list of actions. The advisory committee provides feedback on the feasibility of different options and may contribute strategies missing from the list. Communities with high or limited public engagement may want to host a public workshop separately from their local community taskforce workshop. While in-person meetings are often beneficial, communities opting not to engage the public may decide to distribute questionnaires instead of holding an in-person meeting.



FEMA/ Rosanna Arias

Volunteers can assist with rating exercises and activities to help the community prioritize actions and strategies for the plan.

Workshop 3 Goals:

- ① Continue identifying specific climate change adaptation and hazard mitigation actions that address the vulnerabilities identified in Workshops 1 and 2
- ② Select a set of actions to potentially include in a plan

Workshop 4: Prioritize Selected Actions

Goals

This workshop aims to prioritize the list of hazard mitigation and climate change adaptation actions that were developed in Workshop 3. Participants will then develop a final list of adaptation strategies that can be included in the final plan, pending any final approval necessary from government staff or officials.

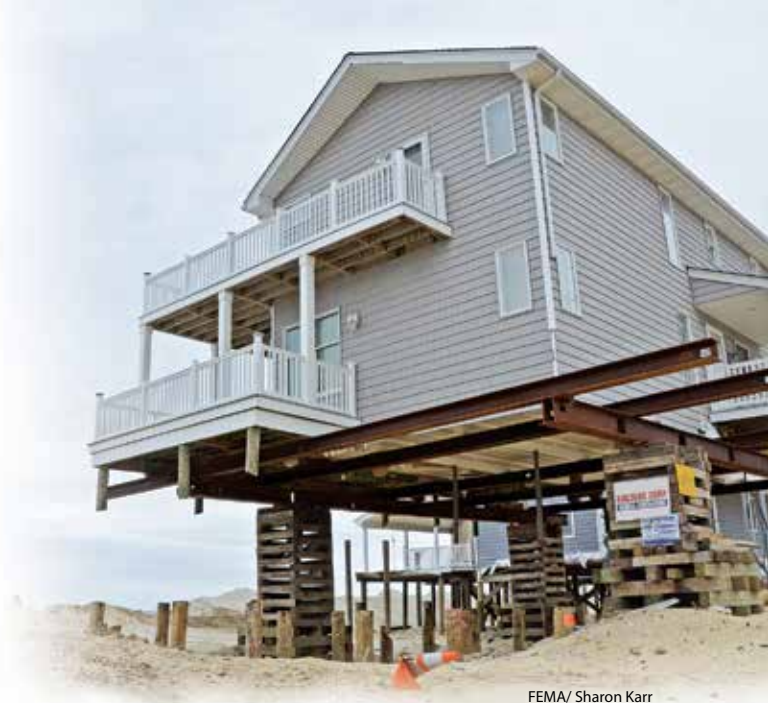
Agenda

Below is a sample agenda for Workshop 4 held as a half-day meeting. This workshop could be paired down to accommodate a two-hour evening meeting.

9:00 a.m.	Welcome and Participant Introductions (Presenter names)
9:15 a.m.	Overview of Project—include update from prior workshops primary vulnerabilities identified and actions selected (Presenter names)
9:30 a.m.	Best Practices in Action—Implementation Examples (Presenter names)
10:00 a.m.	Group Exercise—Selected Action Prioritization (Facilitator names)
11:00 a.m.	Break
11:10 a.m.	Report Back from Group Exercise (Facilitator names)
11:30 a.m.	Funding from State and Federal Agencies (Presenter names)
12:15 p.m.	Closing and Next Steps (Presenter names)
12:30 p.m.	Adjourn

Other Considerations

If resources are limited, communities hosting public workshops can decide to skip this workshop and rely on their local community taskforce to make the final recommendations on actions to include in a plan. As with the other workshops, communities opting not to engage the public may decide to distribute questionnaires instead of conducting an in-person workshop.



FEMA/ Sharon Karr

Relocating, raising, or elevating infrastructures could be possible strategies to protect property from flooding.

Workshop 4 Goals:

- ① Prioritize the list of actions identified in Workshop 3
- ② Create a finalized set of actions to include in a plan (pending government approval)
- ③ Understand realities of action implementation

Next Steps

This marks the end of the *Process-Oriented Materials* section of the tool kit. To learn about the basics of climate science and how to identify natural hazards and climate change vulnerabilities, see Section 2 (Parts IV and V) of this tool kit. Continue to Section 3 (Part VII) for resources on selecting and prioritizing hazard mitigation and climate change adaptation actions.



SECTION 2

KNOWLEDGE-ORIENTED MATERIALS

This two-part section covers key information needed to understand the threats communities are facing and the methods available to communities to identify local vulnerabilities. A full read-through of this section and full use of the tools and resources included should allow a community leader to initiate a hazard mitigation and climate change adaptation planning process. However, outside scientific expertise could greatly enhance local knowledge.

In Part IV the tool kit covers basic scientific information on natural hazards and climate change. Then Part V provides information and tools for conducting vulnerability assessments.

Part IV: The Basics of Natural Hazards and Climate Science

Introduction

A natural hazard and climate change vulnerability assessment (see Part V) seeks to identify the infrastructure, populations, economic areas and natural resources most at risk from impacts of natural hazards and climate change. In a traditional hazard mitigation plan, communities study past climate trends and natural disasters and use those findings as a basis to plan for the future. However, the climate is changing and communities must also incorporate projections of future natural hazard and climate scenarios into their plans.

In this part of the tool kit, you will learn about:

- Past and current natural hazard and climate data
- Projected changes in natural hazards and climate
- Mapping flood and coastal inundation scenarios

Resources in this part of the tool kit include links to:

- Natural hazard and climate records
- Reports and projections related to climate change in Delaware
- Tools and methodologies for projecting and mapping future flood scenarios in Delaware

Past and Current Natural Hazard and Climate Data

There are many different data sources available to Delaware communities seeking natural hazard and climate data. Climate data are typically reported annually for temperature, precipitation and sea level or sea level rise. Temperature readings are often available as an average for an entire year, month or season. Precipitation totals are also reported on an annual, monthly or seasonal basis. Current and historic tidal gauge readings are available to communities interested in tracking changes in sea level over time. Information on the damages incurred by extreme weather events, such as heat waves, floods and hurricanes is also accessible to communities.

Below is information on natural hazards and climate in Delaware; *links to these resources can be found in the online version of this publication at www.deseagrant.org:*

- **Local Hazard Mitigation Plans**—Communities who have completed a hazard mitigation plan may have already compiled information pertaining to

temperature, precipitation, sea level and natural hazard frequency and intensity. Check existing hazard mitigation plans first to avoid unnecessary data collection.

- **Delaware Emergency Management Agency (DEMA)**—In Delaware, state hazard mapping and mitigation planning is coordinated primarily by DEMA. DEMA prepares the State Multi-Hazard Mitigation Plan and supports and oversees the completion of local mitigation plans required by FEMA under the Disaster Mitigation Act of 2000. The State Mitigation Plan includes community profiles, an analysis of the hazards, a capability assessment and the state’s mitigation strategy for a three-year period. As part of the state hazard mitigation planning process, each of the three counties in Delaware, along with the City of Wilmington, coordinate with municipalities within their jurisdictions to develop local mitigation plans. Information related to hazard mitigation plans developed and adopted by Kent and New Castle counties, as well as the City of Wilmington, can be obtained by contacting DEMA.
- **FEMA’s Map Service Center (MSC)**—The MSC is the official government distribution center for digital flood hazard mapping products. In order to help communities, the public and other FEMA stakeholders manage and reduce flood risk, FEMA provides a suite of user-friendly tools that support the needs of the public in viewing, analyzing and printing flood hazard maps.
- **Flood Insurance Rate Maps (FIRMs) and Flood Insurance Study (FIS) reports**—Produced by the Federal Emergency Management Agency (FEMA), these data and tools are the foundation for most local coastal hazard identification and mapping efforts. As a part of the National Flood Insurance Program (NFIP), the Federal Emergency Management Agency (FEMA) periodically conducts Flood Insurance Studies (FISs) and uses the results of these studies to produce FIS reports and Flood Insurance Rate Maps (FIRMs). FIRMs show the estimated extent of flooding during a hypothetical “100-year storm” (also called a 1 percent storm)—a storm that has an estimated 1 percent chance of being equaled or exceeded during any given year. *(Note: A 100-year storm can occur more than once a century.)*
Updated flood hazard maps for New Castle, Kent and Sussex counties have been generated using new flood information and topographic data. Information about the mapping process and map revisions can be found at FEMA’s Risk Assessment, Mapping, and Planning Partners (RAMPP) website. The FEMA flood information portal is a site that enables property owners to enter an address and compare effective (2005) and preliminary (2013) flood maps in all three Delaware counties.

- **Delaware Department of Natural Resources and Environmental Control (DNREC)**—DNREC maintains an Environmental Navigator site that can be used to explore the many types of information collected by DNREC such as permitted facilities, enforcement actions and environmental monitoring. The site also features, among other resources, data for FEMA flood maps, Sussex preliminary special flood hazard areas, natural areas, wellhead protection areas, ocean/bay building lines, state wetlands, hazardous waste sites and DNREC inspections, permits and enforcement actions.
- **The Office of the Delaware State Climatologist (ODSC)**—The ODSC is the principal scientific extension service for weather and climate information for the State of Delaware. The ODSC makes Delaware specific weather and climate information accessible to the citizens of Delaware through its web page, media interviews, monthly publications and through other outreach activities.
- **The Delaware Environmental Observing System (DEOS)**—DEOS serves as a support tool for decision makers involved with emergency management, natural resource monitoring, transportation and other activities throughout the State of Delaware, providing 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.
- **Delaware StormSmart Coasts**—The StormSmart Coasts Network is a web resource dedicated to helping decision makers in coastal communities address the challenges of storms, flooding, sea level rise and climate change. The network provides a menu of information, tools and resources for mitigation, adaptation and management strategies. The Delaware StormSmart Coast site gives coastal decision makers a definitive place to find and share the best resilience-related resources available and provides tools for collaboration.
- **County-Level Hazard Overview**—For general information on your county’s hazard exposure, have a look at the NOAA Coastal Services Center’s Coastal County Snapshots. There, you can find PDF overviews of population, infrastructure and development trends in floodplain areas for Kent, New Castle and Sussex counties.
- **NOAA Coastal Service Center’s Digital Coasts**—This website couples data and tools together to help inform coastal decision makers. The site also includes examples on how some communities (including several in the region) are using the site.
- **Shoreline Change History**—Shoreline change maps are used to understand the long-term effect of storm hazards and sea level rise on Delaware’s coasts. DNREC uses shoreline change maps to understand

beach erosion trends and coastal processes in Delaware. The U.S. Geological Survey has recently released a study on shoreline change in New England and the Mid-Atlantic.

- **National Climatic Data Center (NCDC)**—The NCDC, operated by the National Oceanic and Atmospheric Administration (NOAA), allows users to search for annual local temperature and precipitation data. Annual data is accessible by going to the “Data” tab and selecting “Annual Summary” in Step 2. This data includes the total number of high heat and high precipitation days each year. Temperature and precipitation extremes for Delaware can also be accessed by going here on the NCDC website.
- **NOAA Tides and Currents**—NOAA’s Tides and Currents website contains sea level rise trends for coastal states, including Delaware.
- **Spatial Hazard Events and Losses Database for the United States (SHELDUS)**—SHELDUS is a tool designed by the Hazards and Vulnerability Research Institute at the University of South Carolina. According to its website, “SHELDUS™ is a county-level hazard data set for the U.S. for 18 different natural hazard events types such as thunderstorms, hurricanes, floods, wildfires and tornadoes. For each event the database includes the beginning date, location (county and state), property losses, crop losses, injuries and fatalities that affected each county.”

Projected Changes in Natural Hazards and Climate

Climate change is expected to lead to more intense storms, flooding, sea level rise and extreme heat events. The resources below contain information explaining the science behind climate change and its impact on Delaware from a social, infrastructural and environmental perspective. These resources also contain projections on changes in temperature, precipitation and sea level rise.

- **Delaware Department of Natural Resources and Environmental Control (DNREC)**—The DNREC climate change website contains a general overview of climate change science, information on expected impacts of climate change in Delaware and the Mid-Atlantic and the results of sea level rise and statewide climate change vulnerability assessments.
- **The Delaware Climate Change Impact Assessment**—To better understand Delaware’s current and future vulnerabilities and risks to climate change, DNREC’s Division of Energy and Climate has conducted a statewide climate change impact and risk assessment. This assessment reflects the best available climate science, climate

modeling and projections to illustrate the range of potential vulnerabilities that Delaware may face from the impacts of climate change. The assessment will provide a strong scientific foundation for the development of the state’s adaptation planning and strategy.

- **Sea Level Rise Projections**—Delaware-specific information on projections for sea level rise is available via the following sites:
 - Delaware DNREC has developed a **Statewide Adaptation Plan for Sea Level Rise**. A general overview of DNREC’s sea level adaptation planning process and the **Delaware Sea Level Rise Advisory Committee** is available on Delaware Coastal Program’s website.
 - A statewide sea level rise map is available, and **digital sea level rise maps** can be accessed for inundation mapping visualization.
 - The Delaware Sea Level Rise Advisory Committee has published a **final report** and developed a **public engagement** session overview presentation and website with information available in PDF format.
 - The National Oceanographic and Atmospheric Administration’s **Sea Levels Online** graphs recent trends from Delaware Bay. Long-term records from the Lewes tide gauge show that relative local sea levels have been rising at about 1.05 feet per century.
- **Climate Change and the Delaware Estuary**—This 2010 publication, produced by the Partnership for the Delaware Estuary, details three climate change vulnerability assessment case studies in the Delaware Estuary Region. It also contains a section summarizing predictions related to changing temperature, precipitation and extreme weather.
- **HAZUS**—According to the Federal Emergency Management Agency (FEMA), “Hazardus is a nationally applicable standardized methodology that contains models for estimating potential losses from earthquakes, floods and hurricanes. Hazardus uses Geographic Information Systems (GIS) technology to estimate physical, economic and social impacts of disasters.” The Hazardus software is available free of charge from the FEMA website.
- **SLAMM**—The Sea Level Affecting Marshes Model (SLAMM) creates maps of predicted future distributions of wetlands under different sea level rise scenarios. SLAMM is a free tool developed for the EPA by Warren Pinnacle Consulting, Inc.
- **SLOSH**—The Sea, Lake and Overland Surges from Hurricanes (SLOSH) tool, developed by National Weather Service (NWS), is a model that estimates storm surge heights from hurricanes. SLOSH can be run to estimate the storm surge heights of past storms as well as hypothetical future storms.

Mapping Flood and Coastal Inundation Hazards

GIS is a valuable tool for visualizing coastal flooding and inundation from sea level rise. Many communities conducting a natural hazard and climate change vulnerability assessment (see Part V) use GIS to identify infrastructure, populations, economic areas and natural resources vulnerable to coastal flooding and inundation. Most of the GIS data necessary to model the effects of coastal storms and sea level rise can be accessed through the municipality or county GIS office. GIS data are also available from the **Delaware Office of State Planning Coordination**. Table 4 below outlines the types of flood hazard maps recommended for communities conducting a hazard mitigation and climate change adaptation plan.

Examples of GIS maps used to illustrate flood hazard zones and possible impacts on community infrastructure, neighborhoods and resources.

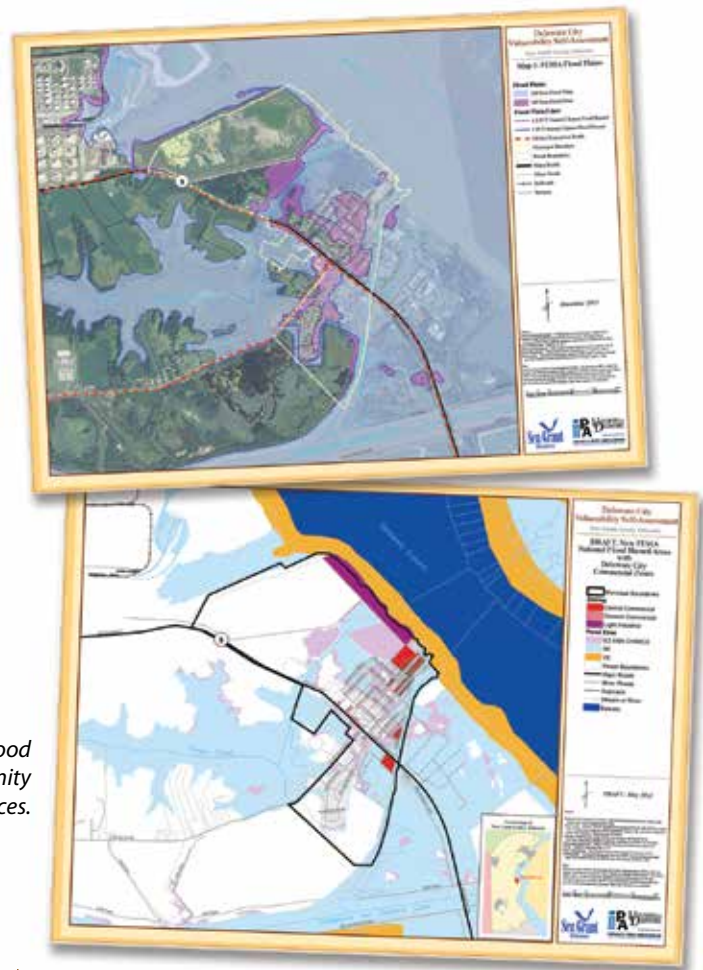


Table 4. Recommended Hazard and Climate Impact Maps

	Description	Resources
Stakeholder Group	<p>Coastal Inundation</p> <ul style="list-style-type: none"> One map showing the current shoreline A map showing the areas inundated with sea water according to each sea level rise scenario evaluated in the hazard mitigation and climate change adaptation plan 	<ul style="list-style-type: none"> NOAA's Mapping Coastal Inundation Primer explains how to create a coastal inundation map The Introduction and Methods sections of Preparing for Tomorrow's High Tide explains the sea level rise scenarios and GIS modeling approach used in Delaware's statewide sealevel rise vulnerability assessment The SLAMM tool creates GIS maps showing changes in marsh distribution due to sea level rise
	<p>Floodplains</p> <ul style="list-style-type: none"> Two maps showing the current 100- and 500-year floodplains. With climate change, communities can expect these types of flood events to occur more frequently More maps can be created showing how these floodplains could change with increased precipitation 	<ul style="list-style-type: none"> The Federal Emergency Management Agency (FEMA) publishes Flood Insurance Rate Maps (FIRMs) that contain floodplain information FEMA's flood information portal enables property owners to enter an address and compare effective and preliminary flood maps in all three Delaware counties Additional floodplain maps or more detailed flood information may be available locally Projections for increased precipitation totals are contained in the Delaware Statewide Climate Change Vulnerability Assessment
	<p>Storm Surge</p> <ul style="list-style-type: none"> A map for each category of hurricane (category 1–5) being evaluated in the hazard mitigation and climate change adaptation plan Maps to showing the change in area affected by storm surge for different sea level rise inundation scenarios 	<ul style="list-style-type: none"> The Sea, Lake and Overland Surges from Hurricanes (SLOSH) model can be used to identify areas likely to be affected by storm surge from hurricanes

Presenting Natural Hazards and Climate Change Information

Effective communication of natural hazard and climate impacts and vulnerabilities is an important component of the natural hazards and climate change adaptation planning process. Local officials or stakeholders leading the process will find the below resources and guides helpful. They will allow you to define your audience, create a message and approach the right forums for presenting your message.

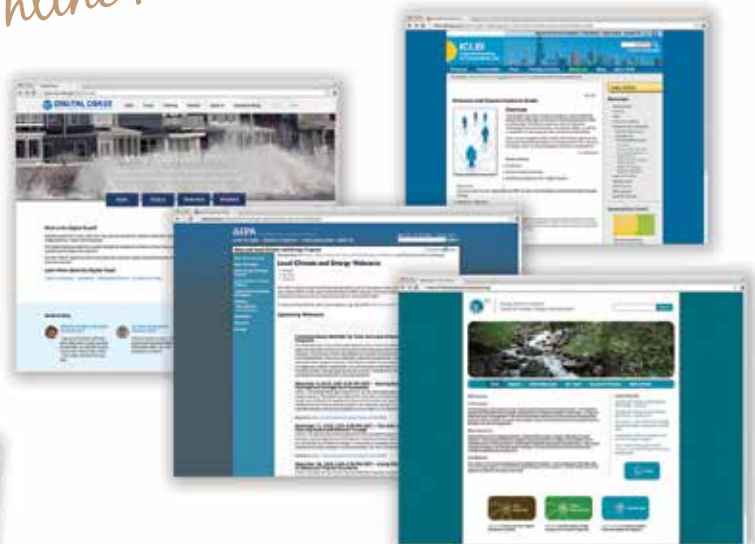
- **Columbia’s Center for Research on Environmental Decisions** has a guide for exploring the psychology of climate change communication and updates and tools from research focused on understanding helping decision makers advance climate change adaptation.
- **EPA** has had a number of webcasts related to climate change communication. *Risk Communication: A Vital Tool for Building Support for Climate Adaptation* can be found on their site.

- **Futerra** is a communications agency focused on sustainability issues and has produced a number of climate and sustainability communication guides including “Sell the Sizzle,” which is focused on positive ways to discuss climate change adaptation.
- **George Mason University’s Center for Climate Change Communication** has reports, academic journals and links to resources related to climate change communication.
- **ICLEI’s** Outreach and Communication Guide provides information for local officials on audience identification, messaging techniques and media relations.
- **NOAA’s** Coastal Climate Adaptation database has an entire section of reports relevant to climate change communication, where you can search for outreach materials and information on stakeholder engagement.
- **NOAA’s** Coastal Inundation Toolkit and Conserving Coastal Wetlands for Sea Level Rise Adaptation provide resources and information to help communities prepare for flooding. The Communicate section of the Toolkit and the Engage section of the wetlands resource provide information on communicating climate risk.

Guides



Online Resources



Next Steps

In this part of the tool kit, you learned how to identify natural hazards using past climate and hazard data as well as projections of how climate change could affect these hazards. Continue to Part V of the tool kit to learn about identifying and prioritizing vulnerabilities to the natural hazards and climate change impacts expected in your community.

Part V: Identifying and Prioritizing Vulnerabilities

Introduction

Part IV of this tool kit explains how to predict the types of natural hazards and climate change impacts communities will encounter using past natural hazard data as well as information on projected changes in climate. The next step in the hazard mitigation and climate change adaptation planning process is to identify the populations, infrastructure and natural resources vulnerable to these hazards.

In this part of the tool kit, you will learn:

- An approach for a preliminary vulnerability assessment
- Methods for identifying vulnerabilities
- Strategies for prioritizing vulnerabilities

Resources in this part of the tool kit include:

- Options for preliminary vulnerability assessments
- Outline and data sources for GIS mapping
- Instructions on public participation vulnerability assessments

Conducting a Preliminary Vulnerability Assessment

Gaining some initial information prior to a thorough and detailed vulnerability assessment can help to focus the fuller assessment and guide the process. There are two useful external self-assessment guides that can be used:

- ① Getting to Resilience—A Coastal Community Resilience Evaluation Tool developed by the New Jersey Office of Coastal Management.
- ② Coastal Community Resilience Index: A Community Self Assessment developed by MSALSG/Gulf of Mexico Alliance

Methods for Identifying Vulnerabilities

Communities undertaking a hazard mitigation and climate change adaptation planning process may find it useful to have two types of activities or exercises:

- **GIS mapping exercises**—Create a series of maps showing different natural hazard and climate change impacts overlaid with information about the community—for example, a set of maps showing the location of critical facilities, such as hospitals and police stations, in relation to floodplain boundaries.
- **Information gathering through public participation**—Draw on local knowledge to determine what areas, populations, infrastructure and natural resources are vulnerable to natural hazards and climate change impacts. For example, residents can identify areas that are currently susceptible to flooding during heavy precipitation events. They can also help identify the resources, infrastructure and populations most at risk from expected natural hazard events.

Identifying vulnerabilities through GIS mapping exercises produces results that are more comprehensive than those generated by asking the public. However, GIS mapping exercises are typically more time and resource intensive and may not be feasible for all communities. In addition, not all natural hazards and climate impacts can be shown in a map. For example, a mapping exercise cannot identify vulnerabilities resulting from a heat wave, although a map could be used to visually display the location of populations or infrastructure that are most vulnerable to extreme heat events.

Using public input to identify vulnerabilities, although less detailed than GIS mapping exercises, is a good option for communities with few resources and limited time to complete a planning process. In fact, many communities using GIS to identify vulnerabilities also hold public participation events to help verify the results of the mapping exercises and to engage the public in the hazard mitigation and climate change adaptation planning process. They also use public participation events to identify vulnerabilities that are unable to be displayed through mapping. Communities may also use the public participation sessions to prioritize and highlight vulnerabilities of greatest concern to the community. Communities that choose not to engage the public in the planning process can still draw on the knowledge of staff across government departments to help identify vulnerabilities.

GIS Mapping Exercises

GIS is a valuable tool for identifying vulnerabilities to natural hazards and climate change impacts. Part IV of this tool kit discussed how to create maps showing flooding and sea level rise inundation scenarios. The next step is to overlay those maps with information about the community to see who and what is likely to be impacted by those hazards. This section discusses the types of local data that should be overlaid with the hazard maps. Communities typically identify vulnerabilities in three categories:

- ① **Social**—populations, economic groups and culturally important areas or buildings
- ② **Infrastructural**—critical facilities (hospitals, police stations, wastewater treatment facilities, etc.), transportation infrastructure (roads, bridges, railroad tracks, public transit routes, etc.), communication infrastructure and energy production or distribution facilities
- ③ **Natural**—agricultural land, marshes and wetlands, open space, recreational areas, nature preserves

Tables 5, 6 and 7 list data items that should be considered for overlay on the hazard maps. Many municipalities and counties have a GIS specialist or office of GIS that manages this data. However, in some cases, different departments may house the data. For example, GIS files showing the community’s parks may be stored with the recreation department while GIS files for wastewater treatment facilities are maintained by the department of public works. Demographic information, such as income or ethnic group data, is contained in GIS data files from the U.S. Census Bureau. Access to these census files is included with most GIS software packages.

Identifying Vulnerabilities Through Public Participation

Identifying vulnerabilities through public participation draws on the knowledge of residents, business owners, government staff and elected officials, and others to determine how the community is affected by natural hazards and climatic events. Communities choosing not to engage the public in their planning process can still use this method by limiting participation to government employees. The “sticky note” method is a common way of soliciting information from the



Table 5. Social Data

Demographic	Economic	Cultural
<ul style="list-style-type: none"> • Age • Income level • Population density • Race/ethnicity/non-English speakers 	<ul style="list-style-type: none"> • Commercial, residential, industrial and mixed-use zoning boundaries • Major employers 	<ul style="list-style-type: none"> • Historic districts • Historic buildings or monuments

Table 6. Infrastructural Data

Transportation	Water and Wastewater	Other Critical Facilities
<ul style="list-style-type: none"> • Airports • Bridges • Bus routes • Ports and marinas • Railroads • Roads • Train and bus stations 	<ul style="list-style-type: none"> • Water and wastewater treatment facilities • Sewer lines • Pumping stations 	<ul style="list-style-type: none"> • Community centers • Communication towers • Energy production and distribution facilities • Government buildings • Hospitals • Landfills • Libraries • Police and fire stations • Government buildings • Schools

Table 7. Natural Resources Data

Natural Resources
<ul style="list-style-type: none"> • Agricultural land • Open space, nature preserves and conservation land • Parks and recreational areas • Wetlands and marshes

community. Participants begin by writing answers to the following on different colored sticky notes.

- ① **What do you value about the community?** What places, features, services, economic opportunities, natural places or cultural events make the community a good place to be?
- ② **What currently happens in the community when there is a flood event, storm or other hazard?** Who or what is affected and how? Encourage participants to be explicit in their answers. What neighborhoods, populations, services or infrastructure are currently most impacted during events? Where does flooding currently occur during storms or flood events? What

valued parts of the community, identified in step 1, are currently impacted by these hazards?

③ **What are the greatest threats to the community in the future?** Are these threats the same as in question 2? Does climate change exacerbate any concerns discussed in question 2? Are there new hazards that might occur due to climate change?

Provide participants with information on past and projected future natural hazards and climatic conditions to help formulate ideas. Participants should be as explicit as possible when writing their concerns on their sticky notes. When finished, place the sticky notes on a map of the community (if location specific) or the wall for all participants to see. The sticky notes can be grouped into categories, and notes with similar themes can be totaled to show areas of greatest interest or concern. Depending on the size of the group, the facilitator may want to limit the number of sticky notes per person.

Communities typically identify vulnerabilities in three categories: social, infrastructural and natural (as discussed in the GIS Mapping Exercise section). Communities may opt to have participants answer the three questions in relation to those categories. For example, one group of participants answers the questions as they pertain to the community’s natural areas while a second group answers the questions focusing on the built environment. A third group focuses on the social aspect of the community, identifying vulnerable populations, economic sectors and cultural features.

Prioritizing Vulnerabilities

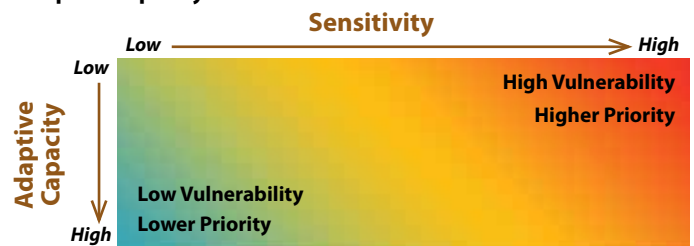
Once vulnerabilities have been identified, the next step is to prioritize them as “high,” “medium” or “low” vulnerability. This prioritization will help determine which vulnerabilities to focus on when selecting actions for the hazard mitigation and climate change adaptation plan (see Part VI for more information on choosing actions). For the purposes of this exercise, “vulnerability” is a function of two factors:

- **Sensitivity**—The degree to which a built, natural or human system¹ is directly or indirectly affected by natural hazards and climate change. If a system is likely to be affected as a result of projected natural hazards or climate change, it should be considered sensitive to climate change.

- **Adaptive Capacity**—The degree and ability of built, natural or human systems to accommodate or withstand changes in climate (including climate variability and climate extremes) or experience a natural disaster with minimal potential damage or cost.

Therefore, something that is “highly vulnerable” is highly sensitive to changes in natural hazards and/or climate and would have a low adaptive capacity (the ability to recover from, or easily modify itself to withstand, changes in natural hazards and climate). Figure 1 below demonstrates the relationship between vulnerability, sensitivity and adaptive capacity.

Figure 1. Vulnerability level based on sensitivity and adaptive capacity



Graphic courtesy of Daniella Hirschfeld, The Resiliency Place

For each vulnerability identified during the GIS mapping or public participation exercise, communities should rate both the sensitivity and the adaptive capacity (high, medium or low) to determine the overall vulnerability. Table 8 below shows the possible vulnerability levels based on sensitivity and adaptive capacity ratings:

Table 8. Matrix for Defining Vulnerability Level Based on Sensitivity and Adaptive Capacity

Shaded squares indicate vulnerability level		Sensitivity		
		Low	Medium	High
Adaptive Capacity	Low	Medium	Medium High	High
	Medium	Medium Low	Medium	Medium High
	High	Low	Medium Low	Medium

Next Steps

Now that you have learned how to identify and prioritize vulnerabilities, continue to Section 3 (Part VI) of this tool kit to learn how to select actions to address these vulnerabilities.

¹ Systems are defined as built, natural or human networks, organisms, populations, resources, services, assets and infrastructure that benefit a community or region and could potentially be affected by climate change and natural hazards.



SECTION 3

ACTION-ORIENTED MATERIALS

This two-part section covers key information needed to generate a list of prioritized local actions and develop basic implementation frameworks. A full read-through of this section and full use of the tools and resources included would enable a community leader to help a group of stakeholders identify and select the key next steps for their community.

In Part VI the tool kit covers basic introductory information on best practice actions and provides information and tools for selecting and prioritizing actions. Finally, Part VII can be used to develop an implementation strategy for the prioritized actions.

Part VI: Understanding, Selecting and Prioritizing Actions

Introduction

Section II of this tool kit explained how to identify current natural hazards, identify vulnerabilities and predict how these vulnerabilities could be altered by climate change. The next step in the hazard mitigation and climate change adaptation planning process is to select amongst these actions to address these vulnerabilities. There are many different types of actions communities can take to reduce their vulnerability to climate change and natural hazards. However, not all actions will be feasible to implement or will have the same level of priority for implementation. Therefore, it is important to have a system for prioritizing actions.

The resources in this part of the tool kit will be useful in preparing and hosting Workshops 3 and 4 (discussed in Part III of this tool kit).

In this part of the tool kit, you will learn about:

- Selecting from the wide array of possible actions and their associated types
- Determining the co-benefits of actions
- Prioritization of selected actions

Resources in this part include:

- A list of types of hazard mitigation and climate change adaptation actions
- PowerPoint slides with explanation of best practice actions
- A worksheet containing a list of actions for workshop participants to identify as locally relevant
- A list of actions that provide financial benefits in the Community Rating System
- A list of possible action selection criteria
- Worksheets for use in selecting and prioritizing actions

Selecting Actions for a Hazard Mitigation and Climate Change Adaptation Plan

There are many different types of actions a community can take to address a climate vulnerability or hazard. For example, a community vulnerable to flooding could make physical improvements to stormwater infrastructure, enhance wetlands or other natural features that manage stormwater or make changes in the zoning code to prevent future development in areas most susceptible to flooding. The community may also find it beneficial to engage the public in efforts to control stormwater or limit flood damage. The following sections

Table 9. Types of Actions for Climate Change Adaptation and Hazard Mitigation Plans

		Definition	Example Action
Action Type	Ecosystem	Enhancing, restoring or protecting natural areas to help protect a community from the impacts of climate change and natural hazards.	Restore the health of selected wetlands to provide additional natural flood control (for example, create buffer zones around wetlands or streams to allow for inland migration of natural resources).
	Economic	Providing incentives, rebates or other monetary incentives to encourage residents and businesses to implement strategies that increase resilience.	Offer financial incentives to building owners who retrofit structures to meet certain floodproofing or elevation standards.
	Spending	Direct spending by the government on projects that increase a community's resiliency.	Raise or elevate infrastructure, such as roads or buildings, to protect it from flooding. Structures not suitable for elevation should be floodproofed. Whenever cost-effective and feasible, consider acquisition and demolition of structures to permanently remove them from a flood zone.
	Planning	Incorporating the impacts of climate change into a new or existing planning process.	Create a comprehensive watershed management plan that accounts for projected increases in sea level and precipitation.
	Regulatory	Using zoning codes, building codes, ordinances, land use regulations and other local governance tools to increase the resilience of a community's built, social or natural infrastructure.	Create a floodplain setback: require that homes be built a minimum distance from floodplains, river channels or shorelines.
	Community Engagement	Implementing programs that educate or involve the public.	Promote on-site water retention and management on residential and commercial properties.
	Information Gathering	Addressing knowledge gaps—typically through studies or monitoring programs—that currently hinder hazard mitigation or climate change adaptation planning efforts.	Evaluate options for protecting historic structures and waterfront areas.

explain the different categories of actions communities should consider when developing a plan and provide resources for selecting actions.

Types of Actions

In general, there are seven different categories of climate change adaptation and hazard mitigation actions: ecosystems, economics, spending, planning, regulatory, community engagement and information gathering. Table 9 provides definitions and example actions for each category.

Resources for Identifying Further Actions

The topic of hazard mitigation and climate change adaptation may be new to many individuals involved in your planning process. To help stimulate discussion and ideas during Workshop 3, when participants will be tasked with identifying potential actions for a plan, this tool kit contains a PowerPoint presentation in Appendix



Visualization tools like the weTable can help participants use data and maps to define planning priorities and strategies.

II with best practice hazard mitigation and climate change adaptation strategies. In addition, Worksheet B contains a list of actions from which participants can select for potential inclusion in their community's plan. Worksheet B can also be distributed as a survey if your community decides not to host a workshop or if certain participants or committee members are unable to attend the workshop.

Worksheet B. List of Actions for Hazard Mitigation and Climate and Possible CRS Benefits

		Action or Activity	Applicability in Community	Possible CRS Benefits
Category	Planning Tool	Use an integrated planning approach; build adaptation and natural hazards into the town's normal planning procedures and documents (for example include coastal flooding and sea level rise in the city's Hazard Mitigation Plan).		X
		Create a comprehensive watershed management plan for debris, storm drains, tide gates and culverts in partnership with appropriate organizations and agencies.		
		Incorporate information on sea level rise into coastal planning and ecosystem restoration projects.		
		Increase the use of climate, weather and flood vulnerability information in managing stormwater/flood risk and individual events (for example work with FEMA to update flood maps in a way that reflects changing risks associated with climate change).		X
	Community Engagement Tool	Improve outreach and education particularly focused on successful behavior changes by community residents. Consider sessions and information on home building, retrofits, flood and climate change vulnerabilities.		X
		Promote on-site water retention and management on residential and commercial properties (for example rain gardens and bioswales).		
		Establish Mitigation Planning Team to establish an ongoing mitigation program for the community (reference City of Lewes program).		
		Develop signage along the water front to show citizens and tourist the flood threat.		X
	Information Gathering Tool	Evaluate community infrastructure's vulnerability to direct flood impacts, as well as vulnerabilities to indirect flood impacts (for example flooding of access routes).		X
		Include risks and vulnerabilities from coastal flooding and sea level rise in decisions involving land use along the waterfront/wetland areas.		
		Evaluate approvals of land use in areas that are prone to flooding when changes are proposed.		
		Continue to evaluate options for protecting historic structures and waterfront areas.		X
		Continue to evaluate need for public flood protection projects that could include barriers to coastal floodwaters (such as temporary flood walls) and improvements to the drainage system (such as installation of backflow preventers on storm drain outflows into the river/bay).		
		Increase monitoring and control of invasive species.		
	Ecosystem Based Tool	Incorporate low-impact development standards into new developments and community-wide improvements. For example, reducing paved areas, maintaining natural features, incorporating green infrastructure for stormwater management and constructing wetlands and detention ponds.		X
		Restore the health of some selected wetlands to provide additional natural flood control (for example, create buffer zones around wetlands or streams for inland migration of natural resources).		X
		Convert vulnerable land to natural systems to protect people, property and places.		X
	Regulatory Tool	Change zoning and land use regulations to discourage development in flood hazard areas and reduce investment in at-risk areas.		X
		Create a floodplain setback: Require that homes be built a minimum distance from the floodplain, river channels or shorelines		X
		Manage and regulate development to future risk level, not past. Update flood maps to include future flood risk.		X
Incorporate review of higher flood-risk impacts to new developments and new construction, especially related to street flooding and evacuation considerations.				
Update building codes to require more flood-resistant structures in floodplains. For example create a freeboard standard for homes in the floodplain.			X	
Economic Tool/Financial Incentives	Create incentives to encourage homeowners to design and build homes in safer locations and safer ways. For example, establish financial incentives to encourage homeowners to build new homes above the required base flood elevation.			
	Establish financial assistance or incentives and help encourage retrofitting of structures that do not meet flood-proofing or elevation standards.			
Spending Tool	Purchase land in vulnerable locations.		X	
	Identify and fund drainage improvement projects, specifically measures that reduce street flooding during rain events. For example, increase capacity of stormwater collection systems to accommodate increased risk and water levels. Also, where appropriate, install backflow preventers in storm drains.		X	
	Raise or elevate infrastructure to protect it from flooding.		X	
	Enhance shoreline protection where retreat and accommodation are not possible.			

The following websites also have information on hazard mitigation and climate change adaptation strategies and actions:

- The U.S. Environmental Protection Agency’s Climate Ready Estuaries Coastal Toolkit and Climate Ready Water Utilities online tool kits have case studies, action plans and other climate change adaptation resources for the built and natural environments.
- Georgetown’s Climate Center contains information on strategies for adapting to sea level rise and heat islands. The sea level rise tool kit focuses primarily on land use and regulatory actions that address climate change vulnerabilities.
- NOAA’s Coastal Climate Adaptation website contains case studies on climate change adaptation actions taken by local governments.
- The Climate Change Adaptation Knowledge Exchange (CAKE) is another good location to search for examples of climate change adaptation actions.

Co-Benefits of Actions

Many hazard mitigation and climate change adaptation actions can provide a community with additional benefits. For example, by purchasing vulnerable land a community can create a public park or preserve a meaningful vista thus benefiting the citizens. Actions that benefit a community in other ways are considered to be “win-win strategies” and often should be prioritized (See Part VII). Here are a number

of co-benefits that should be considered when identifying the best local actions to take:

- Relates to or builds on existing efforts in the city
- Connected to current state or federal priorities
- Creates a specific public benefit such as a park
- Reduces future spending or hazard costs
- Results in ecosystem benefits such as cleaner water in swimming areas

One major co-benefit of hazard mitigation and climate change adaptation actions relates to FEMA’s Community Rating System (CRS). The CRS is a voluntary program where local governments can help reduce flood insurance for community residents and businesses. These reductions are achieved through work in one of the following four areas:

- ① Public information activities
- ② Mapping and regulatory activities
- ③ Flood damage reduction activities
- ④ Flood preparedness activities

A column in Worksheet B indicates which activities or actions could provide financial benefits in the Community Rating System. To be sure if the action applies to the CRS, a community should check with their CRS contact.

Delaware CRS User Group Meeting



Worksheet C. Criteria for Prioritizing Hazard Mitigation and Climate Change Adaptation Actions

Use the questions below to help you rank each identified action with a score between 1 and 5:

- 1 = action has low value/support and/or won't be beneficial
- 5 = action has high value/support and will be beneficial

		Score
Actions to Include in the Plan	Social	
	• Will the citizens be behind this effort?	
	• Will this action lead to an increase in social resilience?	
	• Is the action equitable?	
	Technical	
	• Can the action be implemented from a technical point of view?	
	• Can the action handle a range of climate change impacts?	
	Administrative	
	• Does the city have the operational control to implement this action?	
	• Can this action be implemented in a timely manner?	
	Political	
	• Does this action have political support?	
	Economic	
	• Is it cost-effective? Does the benefit exceed the cost?	
	• Does funding exist or can it be acquired to finance the action?	
Environmental		
• Will the action increase the resilience of the natural environment?		
• Are there any positive side effects on the environment of the action?		

Prioritize Selected Actions

After selecting a list of possible hazard mitigation and climate change adaptation actions, the next step is to prioritize actions. Ideally, all relevant actions would be included in the plan. However, limitations in terms of budget, resources, social or political acceptance and other factors will make certain strategies more feasible than others. In addition to feasibility, many communities try to prioritize strategies that have benefits besides hazard mitigation and climate change adaptation. For example, in addition to managing stormwater, restoration of a degraded wetland also provides habitat for species to live in. This action might take priority over a different stormwater control measure that only addresses flooding and does not create habitat. Worksheet C contains criteria to help decide which actions to include in a plan. More information on prioritizing actions, including a detailed scoring system, can be found in the worksheet provided in Appendix III.

In Workshop 4 (see Part III of this tool kit), workshop participants will be responsible for using these criteria to prioritize actions identified in Workshop 3. There are different ways that communities can structure Workshop 4. Communities with a high turnout may choose to move participants into breakout groups with each group prioritizing actions in relation to a particular vulnerability, such as flooding or storm damage. Other communities may have each breakout group assign scores to all proposed actions and then compare results to see which actions scored highest among the breakout groups. If the workshop has a smaller number of individuals (fewer than 10), then the group can work as a whole to score and prioritize actions.

Communities that opt not to host a workshop for this process can distribute worksheets with instructions to relevant individuals to score and prioritize actions. See Appendix III for a rubric that participants can use to rate proposed actions using the criteria above.

Example of spending tool—land acquisition in Glenville, Del.



Next Steps

After finalizing the list of actions for the plan, the next step is to secure any final approval necessary and begin drafting the plan. To facilitate implementation of the overall hazard mitigation and climate change adaptation plan, it is recommended that brief implementation plans be drafted for each selected action. Continue to Part VII of this tool kit for more information on implementing the actions in your plan.

Part VII: Achieving Implementation

Introduction

Implementation plans are an important final step in the hazard mitigation and climate change adaptation planning process. Part VI of this tool kit discusses how to select and prioritize actions for reducing a community's vulnerability to natural hazards and climate change. However, communities can face barriers when trying to implement these actions. Barriers include: inadequate funding, no individual or department responsible for implementing the action and confusion about how to implement the action. Implementation plans help overcome these barriers by providing a clear strategy for implementing the action, including budgetary and staffing information.

In this part of the tool kit you will learn about:

- Components of an implementation plan
- Methods for overcoming hurdles, roadblocks and limitations
- Financial resources for hazard mitigation and climate adaptation

Resources in this tool kit include:

- Implementation plan template

Components of an Implementation Plan

Implementation plans are designed to help communities realize the actions listed in their hazard mitigation and climate change adaptation plans. Communities should write an implementation plan

for each action in their hazard mitigation and climate change adaptation plan. Implementation plans do not need to be long and can consist primarily of bullet points. However, all implementation plans should contain the sections described in Table 10, Worksheet D (on page 30) contains a sample implementation plan that can be modified for use as a template.

Table 10. Implementation Plan Components

Implementation Plan Section	Description
Administration and Staffing	Identify the primary person or department in charge of ensuring the project's continued progress Identify others who can dedicate time to the task Determine how the leader will work with the group
Implementation Steps	Provide a brief summary of the action Define the steps necessary to implement the action Designate lead departments or individuals responsible for each step
Proposed Timeline	State the target date for implementing the action Create a suggested timeline for the completion of key steps
Financing and Budget	Provide answers to the following questions: <ul style="list-style-type: none">• Is the project part of the basic expected work of current staff?• Will additional funds be needed?• Are there funds that can be accessed?• How much additional funding is needed (if known)?
Monitoring	Select indicators that can be used to gauge implementation success <i>For example, the number of participants in a program or acres of land conserved</i>
Alignment with Existing Priorities	Explain how the action meets or aligns with existing community priorities <i>For example, does the action help achieve goals or objectives in the community's comprehensive plan or other type of plan?</i> Explain what co-benefits, if any, can be achieved by implementing this measure <i>For example, does the action help save money, provide aesthetic value, habitat protection or other service?</i>

Title

Specific action: [Example: Incorporate natural hazard and climate change vulnerabilities into the zoning code during the regular review process.]

I. Alignment with Existing Priorities and Co-Benefits

- The [Enter City or Town]'s meaningful relationship with the sea, a core community value, would be greatly enhanced by recognizing in advance that the relationship will change as sea levels rise. Integrating natural hazards and climate change into planning efforts will help to maintain this meaningful relationship with the sea.
- Depending on the exact zoning code changes that are made, these actions could help to improve Community Rating System (CRS) scores.

II. Administration and Staffing

- Led by the Planning Commission with the chairperson as the primary point of contact.
- The Mitigation Planning Team would provide assistance as needed.

III. Implementation Steps—Zoning Code

Step 1: Create regular communications between the Planning Commission and the Mitigation Planning Team either in the form of post-meeting email updates or through attendance of key meetings by representative members.

Step 2: Review, and when appropriate, adopt the following specific suggestion for regulations that exceed the National Flood Insurance Program (NFIP) minimums.

- A. Create a freeboard standard for homes in the floodplain
 - This is an additional height requirement above the current base flood elevation (BFE) that provides a margin of safety and saves people money on their flood insurance.
- B. Create specific development prohibition in floodplain areas. Examples include:
 - The prohibition of new sheds in the floodplain
 - Prohibiting the expansion of the footprint of existing homes
- C. Updating flood maps to include future flood risks.

Step 3: Engage citizens and gain their support for the above changes.

Step 4: Finalize zoning code changes.

IV. Timeline Information

- Step 1, which would be an ongoing action with no specific end date, can also be started immediately as it could greatly benefit both the Mitigation Planning Team and the Planning Commission and does not require a significant amount of time to complete.
- Steps 2-4 could be considered ongoing, as they will be a part of a longer-term strategy for the future update.

X. Financing and Budget

- This work can vary greatly in cost; however, the initial review and changes to lay the groundwork for future updates could be done for limited costs.
- Costs are likely to increase if a contract with professional services or consulting firm are required, and/or if review by an attorney is required.

XI. Monitoring

- An indicator of complete success would be the inclusion of several standards that go beyond the NFIP minimums and improved CRS scores.

Methods for Overcoming Potential Hurdles, Roadblocks and Limitations

Although hazard mitigation and climate change adaptation actions are often advantageous to the collective community, they are not always easy to implement. In fact there are a large number of problems that can prevent communities from proper implementation of their identified actions. These limitations can be broken into two categories: 1) Local government resource conflicts and 2) Concerns with focusing on the future. Below, this tool kit provides greater details on each of these two categories and provides some guidance on ways to overcome these roadblocks.

Example of an ecosystem tool—installation of living shorelines can stabilize eroding wetlands and enhance habitat.



Local Government Resource Conflicts

Many local governments across the United States find it difficult to accomplish all of the things that their citizens expect. It can be hard to find the budget and staff time to maintain local roads, provide high quality education and protect the safety of residents. These difficulties can be exacerbated by the fact that agency staff work in silos and do not help each other but rather compete for resources. Given these existing local challenges including natural hazards and climate change actions in staff priorities can be very difficult. Some possible approaches for overcoming these difficulties include:

- Identifying actions that build on existing work loads and initiatives
- Recognizing and focusing on the co-benefits of a specific action

- Collaborating with a regional organization to bring in additional resources
- Identifying community members who can help lead the initiative
- Starting with smaller, easier actions to help gain support and momentum

Concerns with Focusing on the Future

Not only can hazard mitigation and climate change adaptation be challenging due to local limitations, but it can also be difficult due to the more far off and distant nature of the benefits. Specifically, some actions may not actually provide a community with tangible benefits today, but rather will help the community be better prepared for impacts 15 or 20 years from now. For example, when buying vulnerable property, the hazard reduction benefits may not kick in for another 15 years. Some possible approaches for overcoming these concerns include:

- Identifying actions that provide benefits today as well as to future generations
- Deepening the understanding of the benefits of the actions
- Working on actions that are stepping stones to the bigger, longer term actions
- Communicating the importance and current relevance of the actions
- Appealing to people with children and grandchildren

Financial and Technical Resources for Hazard Mitigation and Climate Adaptation

One of the biggest challenges communities face is finding adequate funding and technical expertise related to natural hazards and climate change adaptation. Fortunately, there are many programs designed to offer both financial and technical assistance to municipalities. Below is a list of federal funding sources and technical information sources:

Federal Funding Sources

The best way to stay on top of federal grants is through the grants portal, where you can search and sign up for regular updates. Below is a selection of some programs highlighted for their potential to be applied to hazard mitigation and climate change adaptation work.

- **Department of Transportation's Federal Highway Administration** has special federal aid funding

available that includes emergency relief and discretionary programs that can be relevant to local governments. Additionally, the environment planning and realty program has several funding opportunities, such as Transportation, Community and System Preservation (TCSP), that can be used for climate change adaptation related work.

- **The Environmental Protection Agency** has a number of programs that provide funding to local governments, including Community Action for a Renewed Environment (CARE), Environmental Justice and Water Grants.
- **The Federal Emergency Management Agency** has a number of programs that can help local governments and individuals be better prepared for future floods and disasters. These include, but are not limited to, **Flood Mitigation Assistance Program (FMA)**, **Hazard Mitigation Grant Program (HMGP)** and **Pre-Disaster Mitigation Program (PDM)**. The **Delaware Emergency Management Agency (DEMA)** and the **Delaware Department of Natural Resources and Environmental Control (DNREC)** have formed a partnership to administer the HMGP, PDM and FMA programs in Delaware.
- **Department of Agriculture** offers funding through several different branches including the Farm Services Agency, the Natural Resources Conservation Service and the Rural Development program.

Technical Information Sources

- **FEMA's** training division offers a variety of professional educational programs including ones focused on the Community Rating System.

- **Delaware Sea Grant** is part of the broader **National Sea Grant Program** and works with coastal communities to identify needs and fund research, outreach and educational activities.
- Delaware's **Department of Natural Resources and Environmental Control** offers resources and information related to Delaware-specific climate issues and impacts as well as sea level rise impacts and adaptation recommendations.
- The **Natural Resource Conservation Service**, part of **USDA** has experts that can assist communities and data that communities can use to better understand climate change impacts to soils, water and air.
- **Department of Transportation's Federal Highway Administration's** training and resource center has tools and trainings to help.

Additional listing of useful references, technical assistance, tools and funding opportunities can be found in the Appendix IV (on page 38) of this tool kit.

Next Steps

Implementation is the final stage of the hazard mitigation and climate change adaptation planning process. However, communities should continue to monitor the success of each action using the indicators selected in their implementation plans. Communities should also periodically repeat the planning process by reevaluating their vulnerabilities and identifying any additional actions necessary to address those vulnerabilities.



Appendix I: An example step-by-step timeline for developing an integrated hazard mitigation and climate change adaptation plan—Suggested time frame (1.5 Years)

	Months 1-2	Months 3-4	Months 5-6	Months 7-8	Months 9-10	Months 11-12	Months 13-14	Months 15-16	Months 17-18
Task 1: Provide background information									
Organize kickoff meeting	■	■							
Send stakeholder invitation and continue engagement		■	■						
Task 2: Convene meeting 1									
Scheduling and set-up			■	■					
Prepare presentations, agenda and needed items			■	■					
Hold meeting				■					
Notes and report-back				■					
Task 3: Climate and related impacts data									
Review existing plans				■	■				
Compile literature to review				■	■				
Review all key sources and draft synthesis report				■	■	■			
Finalize report with stakeholder feedback							■		
Task 4: Potential adaptation measures									
Review existing city initiatives				■	■				
Review models of climate adaptation				■	■				
Work with partners to identify additional measures					■	■			
Draft suggested adaptation actions					■	■			
Share list with stakeholders and revise based on their feedback							■		
Task 5: Convene meeting 2									
Scheduling and set-up						■	■		
Prepare presentations, agenda and needed items						■	■		
Hold meeting							■		
Notes and report-back							■		
Task 6: Create outreach documents									
Prepare draft fact sheet									■
Prepare draft sample presentation					■	■			
Prepare draft talking points							■	■	
Finalize with feedback						■	■		■
Task 7: Method of prioritizing preparedness actions									
Review potential prioritization criteria							■		
Suggest method and criteria for the meeting							■	■	
Finalize with feedback							■		
Task 8: Drafting implementation plans framework									
Draft framework for implementation plans							■	■	
Finalize framework with stakeholder feedback								■	
Task 9: Convene meeting 3									
Scheduling and set-up							■	■	
Prepare presentations, agenda and needed items							■	■	
Hold meeting								■	
Notes and report-back								■	
Task 10: Create implementation plans									
Review potential implementation strategies								■	■
Draft implementation plans								■	■
Finalize plans with stakeholder feedback									■
Task 11: Convene meeting 4									
Scheduling and set-up									■
Prepare presentations, agenda and needed items									■
Hold meeting									■
Notes and report-back									■
Task 12: Summarize lessons learned									
Draft case study							■		
Review and revise								■	■

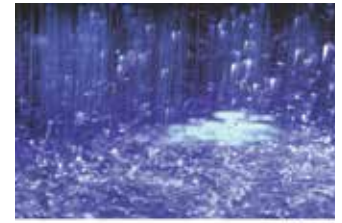
Useful Tools for Building Resilience

1. Planning Tools
2. Community Engagement Tools
3. Information Gathering Tools
4. Ecosystem Based Tools
5. Regulatory Tools
6. Economic Tools—Financial Incentives
7. Spending Tools

Community Rating System (CRS)

Communities are evaluated on the following four areas:

1. Public Information Activities
2. Mapping and Regulatory Activities
3. Flood Damage Reduction Activities
4. Flood Preparedness Activities



Scores result in flood insurance saving for community residents and businesses

* CRS Credits Possible



Planning Tools

- Use an integrated planning approach; build adaptation and natural hazards into the town's normal planning procedures and documents.*
- Create a comprehensive watershed management plan for debris, storm drains, tide gates and culverts, in partnership with appropriate organizations and agencies.
- Incorporate information on sea level rise into coastal planning and ecosystem restoration projects.
- Increase the use of climate and weather information in managing stormwater/flood risk and individual events.*

* CRS Credits Possible

Example: Integrated Planning Keene, NH & Lewes, DE



- Established a Committee of Department Heads to go through process (including Mayor, Chief of Police, etc.)
- Including adaptation and mitigation in Community Visioning and Comprehensive Planning
- Have created a standard review procedure for the Capital Improvement Program to ensure that decisions consider climate and hazards

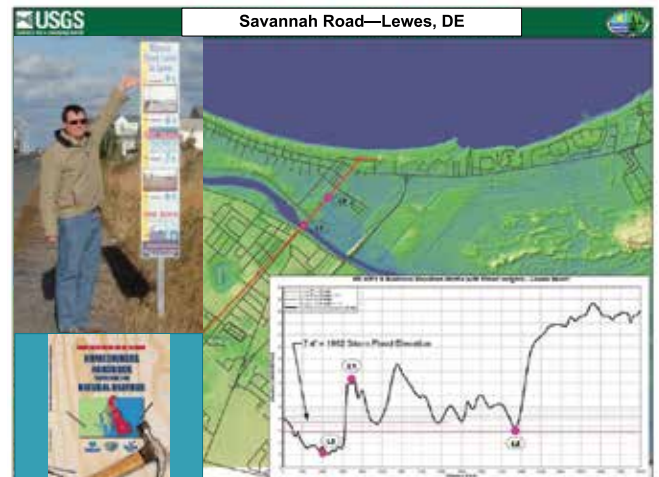
- Decided in 2011 to include climate adaptation and hazard mitigation in the comprehensive planning update.
- Working to further determine how exactly to articulate their goals in the document.
- Mitigation Planning Team meets quarterly.



Community Engagement Tools

- Improve outreach and education particularly focused on successful behavior changes by community residents.*
- Promote on-site water retention and management on residential and commercial properties.
- Establish a *Mitigation Planning Team* to establish an ongoing mitigation program for the community.
- Develop signage along the water front to show citizens and tourists the flood threat.*

* CRS Credits Possible



Information Gathering Tools

- Evaluate community infrastructure's vulnerability to direct flood impacts, as well as vulnerabilities to indirect flood impacts.*
- Include risks and vulnerabilities from coastal flooding and sea level rise in decisions involving land use along the waterfront/wetland areas.
- Evaluate approvals of land use in areas that are prone to flooding when changes are proposed.
- Continue to evaluate options for protecting historic structures and waterfront areas.*
- Continue to evaluate need for public flood protection projects that could include barriers to coastal floodwaters such as temporary flood walls, and improvements to the drainage system such as installation of backflow preventers on storm drain outflows into the river/bay.
- Increase monitoring and control of invasive species.

* CRS Credits Possible

Example: Improved Data Collection Annapolis, MD

In 2011 the city committed to:

- Evaluate risks and vulnerabilities from coastal flooding sea level rise in decisions involving land use along the waterfront.
- Evaluate the need and options for protecting historic structures and waterfront areas.
- Periodic review of current and projected sea levels. These should be reviewed on the same cycle as the city's comprehensive plan.



Ecosystem Tools

- Incorporate low-impact development standards into new developments and community-wide improvements.*
- Restore the health of some selected wetlands to provide additional natural flood control.*
- Convert vulnerable land to natural systems to protected people, property and places*

* CRS Credits Possible

Example: Delaware Estuary Living Shoreline Initiative (DELSI) in Maurice River Township, NJ



PDE and Rutgers Haskin Lab Living Shoreline Installation. At left: April 2010. Center: June 2010. At right: June 2011.

- PDE and Rutgers Haskin Shellfish Lab worked together to develop a living shoreline for the Delaware Estuary.
- Pilot project installed at an eroding wetland in front of a marina.
- Installation halted erosion, enhanced habitat at the site, and has held up through Hurricane Irene, Tropical Storm Lee and Hurricane Sandy.

Regulatory Tools

- Change zoning and land use regulations to discourage development in flood hazard areas and reduce investment in at risk areas.*
- Create a floodplain setback—require that homes be built a minimum distance from the floodplain, river channels or shorelines.*
- Manage and regulate development to future risk level, not past. Update flood maps to include future flood risk.*
- Incorporate review of higher flood-risk impacts to new developments and new construction, especially related to street flooding and evacuation considerations.
- Update building codes to require more flood resistant structures in floodplains.*

* CRS Credits Possible

Example: Regulatory Tool Norfolk, VA



- Keenly aware of the problem:
 - Regularly sees tidal flooding.
 - Some neighborhoods 8 + days a month.
- Considering zoning changes:
 - Areas vulnerable to flooding, parks and open space providing more water access.
 - Creating retreat zones—safer inland areas where people who will not be allowed to rebuild can move to.
- Elevating a road and rerouting all the areas storm drains:
 - Cost—\$1 million.

Economic Tools—Financial Incentives

- Create incentives to encourage homeowners to design and build homes in safer locations and safer ways. For example, establish financial incentives to encourage homeowners to build new homes above the required base flood elevation.
- Establish financial assistance or incentives and help encourage retrofitting of structures that do not meet flood-proofing or elevation standards.

Example: Incentive Program Hull, MA

- Building a case for adaptation with 3D photorealistic images of flooding impacts.
- The Board of Selectman unanimously passed a freeboard incentive—gives citizens up to \$500 in building permit fees if the builder elevates the home 2 feet above the current highest standard.



Homeowner Savings Available to any homeowner who builds above the floodplain

	V Zone		A Zone	
	Annual savings in NFIP premiums	Savings over 30-year mortgage	Annual savings in NFIP premiums	Savings over 30-year mortgage
1' freeboard	\$1,360 (25%)	\$40,800	\$502 (41%)	\$15,060
2' freeboard	\$2,730 (50%)	\$81,900	\$678 (55%)	\$20,340
3' freeboard	\$3,415 (62%)	\$102,450	\$743 (60%)	\$22,290

Spending Tools

- Purchase land in vulnerable locations.*
- Identify and fund drainage improvement projects. Specifically measures that reduce street flooding during rain events.*
- Raise or elevate infrastructure to protect it from flooding.*
- Enhance shoreline protection where retreat and accommodation are not possible.

* CRS Credits Possible

Example: Spending Tool—Land Acquisition Bowers Beach, DE



Picture and information retrieved from <http://delaware.newszap.com/centraldelaware/113935-70/new-bowers-beach-park>

- Private property flooded repeatedly from storms.
- Owner sought help from DNREC to lift the house, but it wasn't feasible.
- DNREC, FEMA and town worked together to purchase the land.
- The end result: Main Street Park.

Example: Spending Tool—Land Acquisition Glenville, DE



Glenville, DE home after the flood



Glenville, DE after buy-out

- Glenville, DE was destroyed by a flash flood in 2003.
- State and county governments purchased 171 homes.
- Area is now a flood plain that protects neighboring communities.

Appendix III: A rubric and example prioritization exercise for rating proposed actions.

Action Prioritization Exercise—Addressing Flooding to Homes

Rank each category between 1–5: 1=low value/support; 5=high value/support

Climate Change Adaptation / Hazard Mitigation Measure		Social	Technical	Administrative	Political	Economic	Environmental	Sum
1	Update mapping of flood zones to include sea level rise							
2	Conduct survey of vulnerable homes based upon home heights (elevation certificates) to get a better picture of the city’s vulnerability							
3	Improve outreach and education particularly focused on successful behavior changes related to home building and retrofits.							
4	Review and update the building and zoning codes							
5	Create additional financial incentives for building above the building code							
6	Create real estate disclosure statements and policies that cover current and future risks from floods and other possible hazards (erosion)							
7	Create a stormwater utility for improved management of the area and increased pervious pavement							
8	Improve the city’s level of participation in the community rating system (CRS)							
9	Review and understand options for stabilizing the shoreline including costs and potential loss of natural habitats							
10	Better understand sediment movement along beaches—equalize sediment distribution along coast (e.g. sharing sand resources)							
11	Creation of a tax district to cover beach nourishment efforts							
12	Improve dune and marsh health/quality							
13	Purchase vulnerable lands							
14	Enhance stormwater management practices and increase storage capacity							

Action Prioritization Exercise—Addressing Water Resource Concerns

Rank each category between 1–5: 1=low value/support; 5=high value/support

Climate Change Adaptation / Hazard Mitigation Measure		Social	Technical	Administrative	Political	Economic	Environmental	Sum
1	Acquire and maintain detailed information on the aquifer							
2	Ensure that aquifer information is integrated into all planning efforts							
3	Create/improve water resource monitoring program							
4	Engage in regional water management and create agreements with neighboring areas							
5	Study and potentially create water reuse programs							
6	Study mechanisms to decrease demand through water conservation efforts							
7	Study potential for water reuse—personal rain barrels and city wide gray water.							
8	Improve developer agreements so that on site water treatment/recharge systems are maintained							
9	Make sure that “as built” data (not just proposed project plans) is collected from all completed projects							
10	Create plans to address potential chemical contamination of the aquifer and its recharge areas							

Appendix IV: Resources at a glance—references, technical assistance, tools and funding opportunities (many of these resources are searchable and available online)

Delaware–Specific Resources

- Delaware Model Floodplain Management Ordinances (DNREC, Division of Watershed Stewardship)
- Delaware Drainage and Stormwater Information (DNREC, Division of Watershed Stewardship)
- Drainage of Lands & Management of Waters; Tax Ditches, Title 7, Chapter 41 Delaware Code (State of Delaware)
- Delaware Floodplain and Drainage Standards (DNREC, Division of Watershed Stewardship)
- Floodplain and Drainage Advisory Committee—Summary Report (DNREC, Division of Watershed Stewardship)
- Sea Level Rise Vulnerability Assessment for the State of Delaware (DNREC, Delaware Coastal Programs)
- Recommendations for Adapting to Sea Level Rise in Delaware (DNREC, Delaware Coastal Programs)
- Climate Change Projections and Indicators for Delaware (DNREC, Division of Energy & Climate)
- Delaware Climate Change Impact Assessment (DNREC, Division of Energy & Climate)
- Preparing Delaware for Emerging Climate Impacts and Seizing Economic Opportunities from Reducing Emissions (Delaware Executive Order 41)
- Delaware State Strategies for Policies and Spending, 2010 (Delaware Office of State Planning Coordination)
- Delaware Current Required and Optional Elements of a County Comprehensive Plan Title 9, Delaware Code (State of Delaware)
- Delaware Municipal Planning Checklists—for populations of more than or less than 2000 (Delaware Office of State Planning Coordination)
- Natural Hazard and Climate Change Adaptation Tool Kit for Delaware Communities (Delaware Sea Grant)

Floodplain Mapping Resources and the NFIP

- FEMA Coastal Study—Analysis and Mapping (FEMA Region III)
- FEMA Risk Mapping, Assessment, and Planning Program (FEMA Risk MAP Initiative—RAMPP)
- FEMA Flood Information Portal Access (FEMA Region III)
- FEMA Map Service Center (FEMA)
- National Flood Insurance Program (NFIP) Information (FEMA)
- Biggert-Waters 2012 / NFIP Reform (FEMA)

Coastal Land Use Planning Resources

- Adapting to Climate Change: A Planning Guide for State Coastal Managers (NOAA Ocean and Coastal Resources Management)
- Adaptation Tool Kit: Sea Level Rise and Coastal Land Use (Georgetown Climate Center)
- Managed Coastal Retreat: A Legal Handbook on Shifting Development Away from Vulnerable Areas (Columbia Law School—Center for Climate Change Law)

Natural Hazard Planning and Mitigation Resources

- Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards (FEMA)
- Integrating Hazard Mitigation Into Local Planning: Case Studies and Tools for Community Officials (FEMA)
- City of Lewes Hazard Mitigation and Climate Adaptation Action Plan (City of Lewes, DE)
- Delaware City Hazard Mitigation and Climate Adaptation Action Plan (Delaware City, DE)
- Delaware StormSmart Coast (StormSmart Coasts Network)
- Coastal Climate Adaptation Resources (NOAA Coastal Services Center)

- Adaptation Clearinghouse (Georgetown Climate Center)
- State and Local Adaptation Plans (Georgetown Climate Center)

Delaware–Specific Planning and Technical Assistance

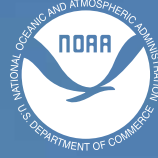
- Delaware Flood Mitigation Program (DNREC, Division of Watershed Stewardship)
- Delaware Drainage and Stormwater Management Program (DNREC, Division of Watershed Stewardship)
- Shoreline and Waterway Management Section (DNREC, Division of Watershed Stewardship)
- Delaware Climate and Sustainability Programs (DNREC, Division of Energy and Climate)
- Delaware Coastal Programs (DNREC, Delaware Coastal Programs)
- Land Use Planning and Preliminary Land Use Service (Delaware Office of State Planning Coordination)
- Private Lands Assistance Program (DNREC, Division of Fish & Wildlife)
- Regulatory Advisory Service (DNREC, Office of the Secretary)
- Hazard Mitigation Planning (Delaware Emergency Management Agency)

Data Sources and Visual Tools

- Delaware Environmental Observing System (DEOS) (University of Delaware)
- Delaware Coastal Flood Monitoring System (DGS) (DEOS) (University of Delaware)
- Digital Coast Tools (NOAA Coastal Services Center)
- Sea Level Rise and Coastal Flooding Impacts Viewer (NOAA Coastal Services Center)
- Delaware Sea Level Rise Viewer (DNREC, Delaware Coastal Programs)
- Coastal County Snapshots (NOAA Coastal Services Center)

Adaptation Planning Resources

- Lessons Learned on Local Climate Adaptation from the Urban Leaders Adaptation Initiative (Center for Clean Air Policy)
- Center for Climate Strategies Adaptation Guidebook: Comprehensive Climate Action (Center for Climate Strategies)
- Climate Adaptation & Resilience: A Resource Guide for Local Leaders—version 2.0 (Institute for Sustainable Communities)
- Getting to Resilience: A Coastal Community Resilience Evaluation Tool (New Jersey Office of Coastal Management)
- Implementing Climate Change Adaptation: Lessons Learned from Ten Examples (Headwaters Economics)
- Preparing for Climate Change: A Guidebook for Local, Regional and State Governments (King County, Washington)
- Cost-Efficient Climate Change Adaptation in the North Atlantic (case studies from 9 states including DE) (Connecticut Sea Grant)
- Climate Resilience Evaluation and Awareness Tool (CREAT) (U.S. Environmental Protection Agency)
- Climate Resilient Communities Program (ICLEI—Local Governments for Sustainability)
- Sustainable Communities Leadership Academy (Institute for Sustainable Communities)
- Climate Adaptation Knowledge Exchange Website (CAKE) (EcoAdapt)
- Getting to Resiliency Website and Questionnaire (New Jersey Department of Environmental Protection)



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