

HAZARD MITIGATION FOR NATURAL DISASTERS

A Starter Guide for Water and Wastewater Utilities

Select a menu option below. New users should start with Overview Hazard Mitigation.



**Overview
Hazard Mitigation**



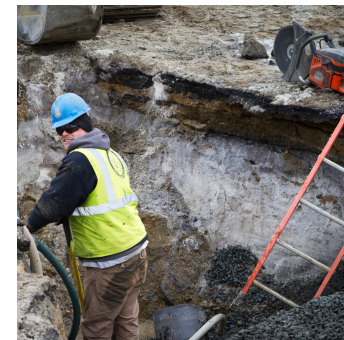
**Join Local Mitigation
Efforts**



**Develop Mitigation
Projects**



**Implement and
Fund Project**



Mitigation Case Study



Overview - Hazard Mitigation

Hazards Posed by Natural Disasters

Water and wastewater utilities are vulnerable to a variety of hazards including natural disasters such as earthquakes, flooding, tornados, and wildfires. For utilities, the impacts from these hazard events include damaged equipment, loss of power, disruptions to service, and revenue losses.

Why Mitigate the Hazards?

It is more cost-effective to mitigate the risks from natural disasters than it is to repair damage after the disaster. Hazard mitigation refers to any action or project that reduces the effects of future disasters. Utilities can implement mitigation projects to better withstand and rapidly recover from hazard events (e.g., flooding, earthquake), thereby increasing their overall resilience.

Mitigation projects could include:

- Elevation of electrical panels at a lift station to prevent flooding damage.
- Replacement of piping with flexible joints to prevent earthquake damage.
- Reinforcement of water towers to prevent tornado damage.

Mitigation measures require financial investment by the utility; however, mitigation could prevent more costly future damage and improve the reliability of service during a disaster.

Disclaimer: This Guide provides practical solutions to help water and wastewater utilities mitigate the effects of natural disasters. This Guide is not intended to serve as regulatory guidance. Mention of trade names, products or services does not convey official U.S. Environmental Protection Agency (EPA) approval, endorsement or recommendation for use.



Join Local Mitigation Efforts

Local Mitigation Efforts and Plans

Your local community is likely already involved in efforts to mitigate the effects of natural disasters. In fact, most state and local governments have existing hazard mitigation plans. A hazard mitigation plan summarizes the overall strategy for a community to reduce losses and break the cycle of recurring damage.

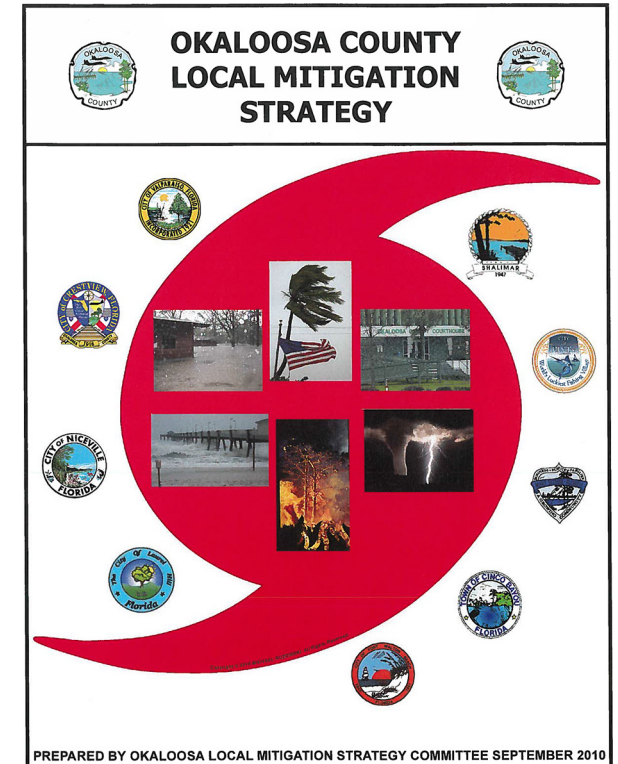
The mitigation plan typically summarizes each hazard (both risks and vulnerabilities), sets clear goals for being disaster resilient, and identifies a list of appropriate mitigation actions that the community wants to take. Having a plan is also a requirement for the local and state government to be eligible for certain types of federal funding for mitigation actions.

Value for Water and Wastewater Utilities

Becoming involved in local hazard mitigation planning has a two-fold benefit for water and wastewater utilities.

- First, utilities will be helping their communities become more resilient against identified natural disasters.
- Second, utility projects that are part of the hazard mitigation plan are eligible for external funding opportunities, such as federal grants and loans.

So how can utilities become involved?



Join Local Mitigation Efforts

Partner with your Local Mitigation Planner

Talk to your local mitigation planner because he or she is responsible for developing the hazard mitigation plan to decrease the risk to your community from various hazards. Since your utility is critical to the community, your local planner wants to help you mitigate hazards and list your proposed mitigation projects in the local plan.



[Click for Other Helpful Local Partners in Hazard Mitigation](#)

- **How do I contact my Local Mitigation Planner?**
 - o Contact your [State Hazard Mitigation Officer](#), who can then connect you to your county or local mitigation planner.
- **What should I say to the Local Mitigation Planner?**
 - o Introduce yourself and express interest in learning more about mitigation efforts.
 - o Ask about what hazards are of most concern and what local mitigation efforts are currently underway in your town, city, or county.
 - o Share your concerns about certain hazards and possible mitigation actions you are considering.
 - o Ask how your utility can be included in the next local mitigation plan update (5-year cycle for updates).
 - o Ask how your utility can become involved: how you can become a participating member in the local hazard mitigation process; are there upcoming meetings; can your utility participate in the update process and provide a mitigation project to list in the plan?

Other Local Partners in Hazard Mitigation

In addition to the local mitigation planner, you have the option of using other partners to also help you identify the hazards to your utility and how best to mitigate them.

- **Local Municipal Officials** - The town engineer and staff in the Community Development or Emergency Management Department can assist with researching historical disaster information and identifying grant funding for the hazard mitigation projects.
- **Experts with Knowledge of Specific Hazards** - This could include a Certified Floodplain Manager (CFM), state geologist, and state or local fire marshal. For example, a CFM knows how to reduce flood losses and locate Flood Insurance Rate Maps.
- **Professional Engineers (PEs)** - PEs can help identify hazards and assist with the design of hazard mitigation projects (e.g., scope of work, timeline and costs).
- **Building Inspectors** - Building inspectors ensure that your utility hazard mitigation project is within local and state building codes.
- **Chamber of Commerce or Economic Development Coordinator** - These officials can help justify your mitigation project by providing data on projected economic losses to the community from disruptions to drinking water and sewer services.
- **Neighboring Utilities** - Consult with neighboring utilities to determine if they experience similar hazards and if there are potential joint mitigation projects that can reduce impacts across multiple communities and the region.



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Coordinate on Mitigation Projects

With the help of your local mitigation planner, get involved in mitigation planning. Design equipment and processes with mitigation in mind. Also, identify utility-specific mitigation projects and see how the projects may fit into overall community efforts. For example, community mitigation efforts that affect stormwater (e.g., rain gardens, green infrastructure) may reduce the potential flooding at your wastewater utility.

Get Your Mitigation Projects Listed in the Local Mitigation Plan

Utility mitigation projects that are listed in the local mitigation plan become eligible for federal funding. Focus on projects that have significant impact for your utility and community. Work with your local mitigation planner to provide the needed information. See the example shown on this page of a proposed utility flood project listed in a local mitigation plan.

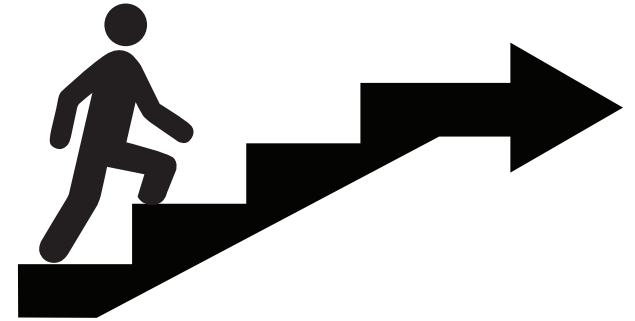
Okaloosa County Local Mitigation Strategy Project Summary Sheet																															
Project Name: Main Island Lift Station Replacement																															
Jurisdiction: <u>Okaloosa County</u> Contact Person/Information: <u>Mark Wise, P.E. – Engineering Manager</u>																															
1. General Description and Rationale New lift station to replace existing one. In previous hurricanes, this lift station has been submerged, causing a public safety problem. It is one of our largest (1 MGD ADF), oldest, and most critical lift stations. It also has structural & elevation problems. Timeframe for Completion: 2 years				2. LMS and Jurisdictional Comprehensive Plan Compliance/References: 2.a. LMS Goals and Strategies: Goal 5 – Reduce or eliminate hazards identified to at risk locations in the County and its municipalities by implementing the mitigation actions. 2.b. Comprehensive Plan: Goal 1 of Section 2.4: Provide environmentally safe and efficient wastewater treatment and disposal systems. This project is also in OCWS' 5-year C.I.P. 2.c. Is this project level of service or concurrency related: LOS <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Concurrency <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No																											
3. Budgetary Information: Is this project listed in the adopted 5-Year Capital Improvements Program? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No 3.a. Estimated Project Cost: \$3,400,000.00 Is this project fully funded? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No 3.b. Funding Plan (\$ in 000's) <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Source</th> <th>Allocated in Prior FYs</th> <th>FY11</th> <th>FY 12</th> <th>FY 13</th> <th>FY 14</th> <th>FY 15</th> <th>Total</th> </tr> </thead> <tbody> <tr> <td>OCWS Enterprise Fund (unfunded).</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td style="text-align: right;">0</td> </tr> </tbody> </table>								Source	Allocated in Prior FYs	FY11	FY 12	FY 13	FY 14	FY 15	Total	OCWS Enterprise Fund (unfunded).	0	0	0	0	0	0	0								0
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3.c. Expenditure Plan (\$ in 000's) <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Item</th> <th>Prior FY Expend.</th> <th>FY 11</th> <th>FY 12</th> <th>FY 13</th> <th>FY14</th> <th>FY 15</th> <th>Total</th> </tr> </thead> <tbody> <tr> <td>Main Island Lift Station – OCWS 5-year C.I.P.</td> <td>0</td> <td>400</td> <td>3000</td> <td>0</td> <td>0</td> <td>0</td> <td>3400</td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td style="text-align: right;">\$3,400,000</td> </tr> </tbody> </table>								Item	Prior FY Expend.	FY 11	FY 12	FY 13	FY14	FY 15	Total	Main Island Lift Station – OCWS 5-year C.I.P.	0	400	3000	0	0	0	3400								\$3,400,000
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							\$3,400,000																								
4. Statement of Operating Budget Impact. This project is in the C.I.P., but unfunded. To accomplish this, O.C.W.S. would need to borrow money, in which the debt service would be ultimately passed on to our customers, and possibly a rate increase would be needed.																															
				5. Location Map: On Okaloosa Island, west of the intersection of Santa Rosa Blvd. & Miracle Strip Parkway.																											

Example Wastewater Mitigation Project

Develop Mitigation Projects

Steps

Click the icon to the right to learn about the four steps to develop mitigation projects.



Mitigation Resources by Natural Disaster

Click below to explore specific resources and mitigation examples for each disaster or disaster impact.



Flood



Earthquake



Drought



Wildfire



Tornado



Power Outage

Steps to develop mitigation projects

Step 1. Understand the Threat Posed by the Hazard.

How serious is the natural hazard event that you face? For example, determine how high the floodwaters could be based on historical flood data (frequency and severity) of past events, or based on projected levels.

Step 2. Identify Vulnerable Assets and Determine Consequences.

How will the disaster affect your utility? For example, what pipes, treatment processes, storage tanks, and power supply could be damaged during an earthquake? Also, what are the consequences including damage, repair costs, service disruptions, public health advisories, and environmental impacts?

Step 3. Identify and Evaluate Mitigation Projects.

A mitigation action or project can reduce or eliminate the damage to equipment and disruption in service. Resources and examples to develop mitigation projects for various natural disasters are provided on the following pages.

Mitigation actions are generally evaluated against multiple criteria including effectiveness, practicality and cost. See the Federal Emergency Management Agency (FEMA) [STAPLEE Method](#) ^{EXHIBIT} for a benefit-cost review. Also, FEMA has identified [several mitigation methods](#) ^{EXHIBIT} that are pre-determined to be cost-effective for water and wastewater utilities (e.g., elevate instrument panels, buttress raw water intakes, replace inundated pumps with submersible or inline pumps, as appropriate).

Step 4. Develop a Plan to Implement the Mitigation Project.

The plan should identify who is responsible for taking actions, what are the costs and funding sources (e.g., grant funds, capital expenditures), and what is the timeframe of completion. Depending on the size and cost, some mitigation actions may be completed through internal routine work orders, capital improvement planning, or supplemental funding. Best practices have shown that using multiple funding avenues are most effective.

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Flood Mitigation Resources

Resource	Description
Flood Resilience: A Basic Guide for Water and Wastewater Utilities	User friendly guide with videos and interactive checklists to help utilities go through a 4-step process to assess floods and develop mitigation projects. Guide is targeted to small and medium utilities. (U.S. Environmental Protection Agency [EPA])
Storm Surge Inundation and Hurricane Strike Frequency Map	Maps of current worst-case coastal storm surge (abnormal rise of water generated by a storm), 100 and 500 year flood plains, and direct and indirect strikes from all hurricanes. (EPA)
Incident Action Checklist - Flooding	Checklist of activities that water and wastewater utilities can take to prepare for, respond to and recover from flooding. (EPA)

Flood Mitigation Examples

- Elevate or protect electrical service panels.
- Upsize culverts to better handle flood surges.
- Replace pumps with submersible or inline pumps.
- Protect facilities with flood proof doors, and barriers or sandbags.
- Buttress raw water intakes to prevent damage from erosion, scour and flood debris.
- Relocate equipment outside floodplain.



Elevate wellhead



Elevate electrical panel

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Earthquake Mitigation Resources

Resource	Description
Recent Earthquakes: Implications for U.S. Water Utilities <small>Exit</small>	Potential impacts of earthquakes on water utilities and the effectiveness of seismic upgrades of tanks, buildings, equipment and pipes. (Water Research Foundation)
Oregon Earthquake Resiliency Plan <small>Exit</small>	Mitigation measures for the anticipated Cascadia Earthquake. Chapter 8 addresses Water and Wastewater Systems. (Oregon Seismic Safety Policy Advisory Commission)
Seismic Guidelines for Water Pipelines <small>Exit</small>	Overview of how to design and install pipelines to mitigate damage from earthquakes. (FEMA and the National Institute of Building Sciences)
Seismic Vulnerability and Impact of Disruption of Lifelines in the Conterminous United States <small>Exit</small>	Overview of seismic vulnerability, impacts and mitigation measures for lifelines such as water systems. (FEMA)
Incident Action Checklist - Earthquake	Checklist of activities that water and wastewater utilities can take to prepare for, respond to and recover from earthquakes. (EPA)

Earthquake Mitigation Examples

- Seismic retrofit pipes with flexible joints.
- Reinforce settling tanks.
- Harden or replace transmission lines with earthquake resilient designs.
- Secure aboveground pipes.
- Install earthquake shutoff valves.



Secured pipes



Reinforced basin

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Drought Mitigation Resources

Resource	Description
Drought Response and Recovery Guide for Water and Wastewater Utilities	Guide for utilities preparing for, or facing, droughts. Includes worksheets and case studies to guide response and mitigation actions. (EPA)
M60 Drought Preparedness and Response <small>Exit</small>	Manual to help water managers facing water shortages by illustrating how to employ tried-and-true strategies and tactics of drought mitigation. (American Water Works Association)
Planning for Emergency Drinking Water Supply	Overview of how to deliver clean drinking water in the event of a disaster. Includes case studies and descriptions of alternate delivery methods. (EPA)
Drought Management Plan – A Template for Small Systems <small>Exit</small>	Guide for small systems to prepare for water shortages and implement drought mitigation procedures. Includes sample ordinances and utility policies. (Florida Rural Water Association)
Incident Action Checklist - Drought	Checklist of activities that water and wastewater utilities can take to prepare for, respond to and recover from drought. (EPA)

Drought Mitigation Examples

- Haul in water with tanker trucks permitted to carry potable water.
- Implement a leak detection and repair program to reduce lost water.
- Consider interconnections with other water sources and systems.
- Place restrictions designed to reduce or eliminate non-essential uses.



Emergency water



Utility interconnections



▶ Return to Develop Mitigation Projects



Wildfire Mitigation Resources

Resource	Description
Effects of Wildfire on Drinking Water Utilities and Best Practices for Wildfire Risk Reduction and Mitigation <small>EXIT</small>	Explanation of how wildfires affect water and wastewater services. Includes how to mitigate risk including forest management strategies and hydrologic effects of wildfires. (EPA and Water Research Foundation)
Fire Management Planning for Public Water Systems <small>EXIT</small>	Advice for developing a fire management plan. Includes links to other wildfire-related resources. (Colorado Department of Public Health and Environment)
Active Fire Mapping Program <small>EXIT</small>	Interactive map of active wildfires across the United States. (US Fire Service)
Incident Action Checklist - Wildfire	Checklist of activities that water and wastewater utilities can take to prepare for, respond to and recover from wildfires. (EPA)
Wildfire Hazard Mitigation Handbook for Public Facilities <small>EXIT</small>	Handbook of mitigation measures identified for pipes, pumping stations, treatment facilities, wells, chemical tanks and power supply. (FEMA)

Wildfire Mitigation Examples

- Remove debris, trees or other fire-hazard materials.
- Institute high fire danger procedures such as smoking bans and fire bans.
- Install fire resilient building materials.
- Modify treatment process for sediment in water.



Before and after removal of at risk structures and debris

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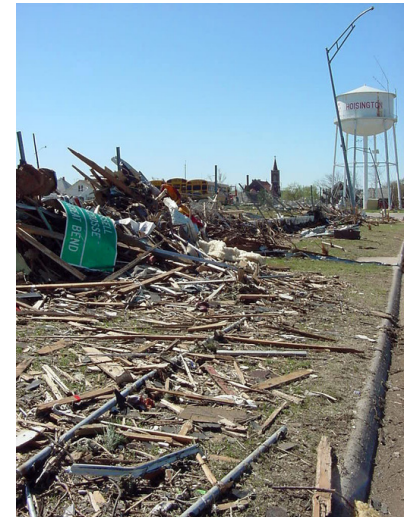


Tornado Mitigation Resources

Resource	Description
Reconstructing Non-Residential Buildings After a Tornado <small>EXIT</small>	Best practices for reconstructing buildings. Includes recommended mitigation measures for common damages. (FEMA)
Incident Action Checklist - Tornado	Checklist of activities that water and wastewater utilities can take to prepare for, respond to and recover from tornados. (EPA)

Tornado Mitigation Examples

- Reinforce water towers and welds.
- Remove sources of potential flying debris.
- Bolt down chemical tanks .
- Design new facilities, control rooms and offices to withstand high winds.
- Secure and anchor any trailers or temporary structures used by the facility and designate them as non-habitable during severe weather.



Reinforced water tower



Power Outage Mitigation Resources

Resource	Description
Power Resilience Guide	User-friendly guide to help utilities identify how to increase their resilience to power outages. (EPA)
Is your Water or Wastewater System Prepared? What you need to know about Generators	Explanation of how to integrate generators into a utility’s emergency response operation. Includes an explanation of different types of generators. (EPA)

Power Outage Mitigation Examples

- Purchase or rent a backup power generator.
- Maintain fuel on-site or have multiple ways to obtain fuel.
- Secure generators against wind, water and seismic activity.
- Talk to the power company and emergency management agency to get priority restoration.



Acquire generator



Elevate generator



Implement and Fund Projects

Below are tips for developing a mitigation strategy to implement and fund projects.

Tip #1 - Develop an implementation strategy that includes:

- ✓ Steps and approvals needed for implementing mitigation projects.
- ✓ Responsible parties for taking actions.
- ✓ Costs and funding sources (e.g., grant funds, capital budget).
- ✓ The timeframe of completion.

Tip #2 - Consider benefits of internally funding the mitigation projects:

- ✓ Gives control over carrying out a mitigation project (e.g., work order performed by utility personnel).
- ✓ Actions are not limited by grant requirements (e.g. FEMA requires building to certain flood elevation levels).
- ✓ May provide justification to the utility board of directors to raise rates for needed mitigation.

Implement and Fund Projects

Tip #3 - Incorporate the hazard mitigation projects into various documents to build technical and community support and budgeting:

- ✓ Utility's Capital Improvement Plan (CIP) or similar document.
- ✓ Local Hazard Mitigation Plan. Projects become eligible for certain FEMA funding.
- ✓ Community Comprehensive Plan.

Tip #4 - Find out about state or federal funding:

- ✓ Talk to your local mitigation planner and State Hazard Mitigation Officer (SHMO) about state or federal funding. State funding may be more accessible.
- ✓ Talk with other state officials (e.g., transportation, environmental protection) to see if your mitigation project can be linked to future projects.
 - For example, if your utility has a flood-prone lift station within a road right-of-way, complete your mitigation project at the same time as a proposed state or county roadway widening project.
- ✓ No project is too big or too small for state or federal funds. Consider proposing a range of mitigation projects from short-term (minimal planning and resources) to long-term (significant planning and resources).
- ✓ Consider grouping similar mitigation projects to get greater community-wide benefits, or take the opposite approach, separating a larger project into smaller, individual projects to improve the benefit-cost ratio and take advantage of smaller funding amounts that are available.

Implement and Fund Projects

Federal Funding for Mitigation Projects

There are several federal funding programs that can be used for mitigation projects. Receiving funding often requires diligence, good connections with local mitigation planners, and a strong project candidate and application.

Fed FUNDS. To help utilities understand and obtain federal disaster and mitigation funds, EPA developed Fed FUNDS. [Fed FUNDS](#) can help you quickly screen for applicable funding programs from U.S. Department of Housing and Urban Development (HUD), U.S. Department of Agriculture, Small Business Association, FEMA and EPA. It also provides examples of successful utility applications and tips to get funding.

FEMA’s Mitigation Funding Programs. FEMA has four individual programs to fund mitigation projects:

- [Public Assistance \(PA\) Grant Program*](#), [Exit](#)
- [Hazard Mitigation Grant Program \(HMGP\)](#), [Exit](#)
- [Pre-Disaster Mitigation Program \(PDM\)](#), and [Exit](#)
- [Flood Mitigation Assistance Program \(FMA\)](#). [Exit](#)

Each program has specific project eligibility and funding requirements. Publicly owned and operated utilities are eligible for all programs, while private non-profit utilities have limited program eligibility. Typically, the proposed

mitigation projects must go through a cost-benefit analysis and show clear benefits. Also, FEMA grants usually cover 75 percent of the costs and require a 25 percent state and local government match. The 25 percent match could consist of a utility’s personnel time and effort instead of actual funds. Also, other grants (e.g., HUD Community Development Block Grant) often can be used for the 25 percent state or local match.

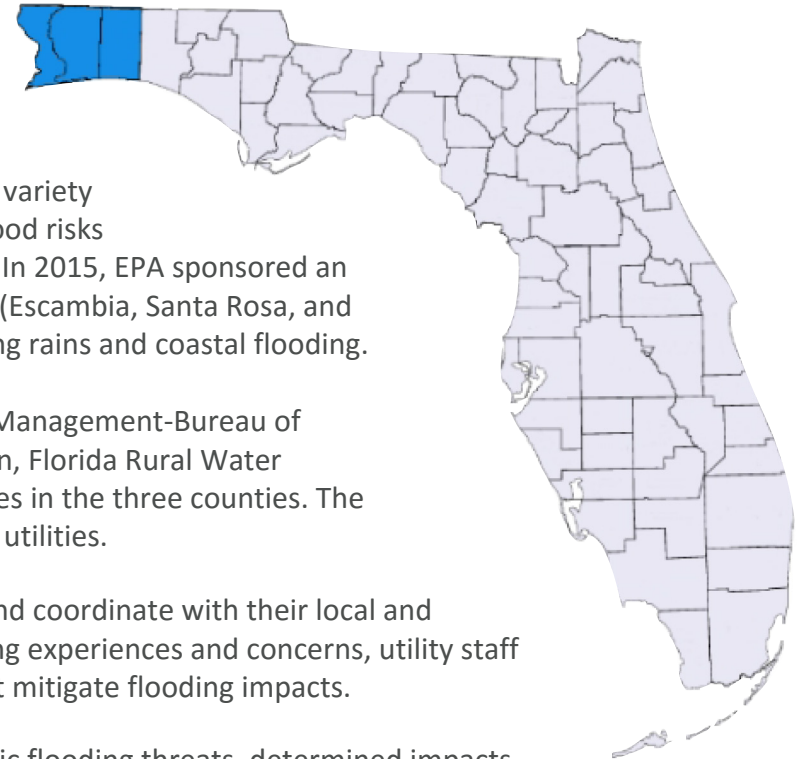
FEMA’s HMGP is the primary source of funds for communities to implement hazard mitigation projects following a Presidential Disaster Declaration. **To be eligible, utilities must be part of a locally adopted and FEMA-approved Local Mitigation Plan. Specific projects should be listed in the plan.**

See sixteen [examples](#) of FEMA-funded projects for water and wastewater utilities that participated in local mitigation planning.

** After a Presidential Disaster Declaration, damaged water and wastewater facilities may be eligible for these grants to repair and potentially mitigate the damaged portions of the facility.*

Use Pre-Disaster	Use During a Disaster	Use Pre- or Post-Disaster
 Which Funding Is Right for You?	 Currently in a Disaster? Here are forms to document the damage, costs, and repairs.	 Federal Disaster Funding Programs
 Be Prepared to Tap into Funding		 Utility Examples, Training, & Assistance

Mitigation Case Study



The approach used in this Guide, which can be applied to a variety of natural disasters, was used in a case study to mitigate flood risks to water and wastewater utilities in the Florida Panhandle. In 2015, EPA sponsored an effort to promote flood resilience in three Florida counties (Escambia, Santa Rosa, and Okaloosa Counties) that suffer from hurricanes, heavy spring rains and coastal flooding.

EPA’s partners included the Florida Division of Emergency Management-Bureau of Mitigation, Florida Department of Environmental Protection, Florida Rural Water Association, FEMA, and local mitigation planners and utilities in the three counties. The effort involved two workshops and several site visits to the utilities.

A key goal for the workshops was for utility staff to meet and coordinate with their local and state hazard mitigation planners. After sharing their flooding experiences and concerns, utility staff then brainstormed with mitigation planners on how to best mitigate flooding impacts.

During site visits to the three utilities, staff identified specific flooding threats, determined impacts to utility assets, and recommended practical mitigation options to protect those assets. With the help of the local mitigation planners, the utilities learned how to incorporate their proposed mitigation projects into the county’s local hazard mitigation plan and, consequently, be eligible for federal funding.

Sample mitigation projects for the three utilities included elevating instrument panels, creating a wall around influent headworks, reinforcing an embankment, and relocating a lift station. Utility staff also learned about implementing and funding mitigation projects, and received tips on building effective applications for federal funds.