Course Overview, Course Goal, and Objectives

The course will provide an overview of Public Assistance hazard mitigation project eligibility. By the end of the course, State, Local, Tribal, and Territorial Applicants and Recipients will be able to understand all aspects of Section 406 Mitigation of the Robert T. Stafford Act.

Upon successfully completing the course, you will be able to:

- Define Section 406 Mitigation
- Explain which types of projects are eligible for FEMA Public Assistance grant funding under Section 406 authority
- Identify the benefits and opportunities to reduce repetitive disaster losses by pursuing projects authorized under Section 406 Hazard Mitigation
- Discuss examples of potential mitigation work across damage categories C through G (Permanent Work)
- Explain the various methods to determine cost effectiveness of hazard mitigation proposal eligibility

Lesson 1 Overview and Objectives

This lesson introduces hazard mitigation. It provides an overview of the different hazard mitigation programs authorized under the Robert T. Stafford Act and discusses common Section 406 Hazard Mitigation projects for Permanent work.

At the end of this lesson, participants will be able to:

- Identify the administrative requirements of the course
- State the goals and objectives of the course
- Define hazard mitigation as it relates to Section 406 of the Stafford Act
- Discuss the types of mitigation measures eligible for Public Assistance funding under Section 406 of the Stafford Act

Hazard Mitigation

Hazard mitigation is defined as any sustained action taken to reduce or eliminate long-term risk to people and property from natural hazards and their effects. Merely repairing at-risk facilities to their pre-disaster condition does not protect the community from future disaster damages or reduce long-term costs.

Mitigation improvements should always be considered in the rebuilding process. FEMA has the authority to provide Public Assistance funding for cost-effective hazard mitigation measures for facilities damaged by an incident.*

*Robert T. Stafford Act 406(e), 42 U.S.C. 5172 (e), and 44 C.F.R. 206.226(e).

Why Mitigate?

As disasters have grown in frequency and severity, the costs of response and recovery have escalated to unsustainable levels. Nationwide natural disasters cost over $50 billion each year.

The most effective way to reduce potential losses is through disaster preparedness and mitigation. Mitigation can reduce excessive losses by:

- Breaking the disaster-rebuild-disaster cycle
- Strengthening existing infrastructure and facilities
- Addressing natural hazards

Hazard Mitigation Funding (1 of 2)

FEMA provides hazard mitigation funding under both the Public Assistance and Hazard Mitigation Assistance programs. These programs have different eligibility criteria, procedures, and timelines for implementation.

National Flood Insurance Act of 1968 NFIA **Hazard Mitigation Assistance** **Non-Disaster Related Programs**	**Stafford Act Section 203** **Hazard Mitigation Assistance** **Non-Disaster Related Programs**
Flood mitigation for insured properties	Pre-Disaster Mitigation: Multi-hazard project-specific

Hazard Mitigation Funding (2 of 2)

FEMA provides hazard mitigation funding under both the Public Assistance and Hazard Mitigation Assistance programs. These programs have different eligibility criteria, procedures, and timelines for implementation.

Stafford Act Section 406 **Public Assistance Disaster-Related Programs**	**Stafford Act Section 404** **Public Assistance Programs-Disaster-Related Programs**
Public Assistance: Mitigation of incident-caused damage	Hazard Mitigation Grant Program: Multi-hazard statewide mitigation
Funding: Available for disaster-damaged facilities only* *See exception for Alternative Projects in Chapter 2, Section VII.G.4(c) of the Public Assistance Program and Policy Guide	Funding: Available for damaged and non-damaged facilities based on a percentage of dollars obligated to the Public Assistance and Individual Assistance programs

Section 404 vs Section 406

The different hazard mitigation programs are authorized by separate sections of the Robert T. Stafford Act. The Hazard Mitigation Grant Program is authorized by Section 404. Hazard mitigation funded by the Public Assistance Program is authorized by Section 406.

Section 406 focuses on mitigation measures for facilities that have actually been damaged in a particular disaster. Section 404 has a broader scope and funds mitigation projects for both damaged and non-damaged facilities.

404 Mitigation

- Hazard Mitigation Branch/State Program
- May apply statewide
- Includes preventative measures
- Public and private properties
- Benefit-Cost Ratio > 1.0
- Limited funding

406 Mitigation

- Public Assistance Program
- Applies only to declared counties
- Includes only damaged elements of damaged facilities
- Public and Private Non-Profit facilities only
- 15% rule, 100% rule, or Benefit-Cost Analysis
- No program funding limits

Section 404: Hazard Mitigation Grant Program

Section 404 assists in implementing long-term hazard mitigation planning and projects following a Presidential major disaster declaration. It provides funds to States, Territories, Tribes, and local communities to protect public or private property through various mitigation measures.

Section 404 Recipients have the primary responsibility for prioritizing, selecting, and administering state and local hazard mitigation projects. Because Recipients have different approaches to executing the Hazard Mitigation Grant Program, you should consult with the local government in question to learn more about Section 404 procedures in a particular case.
For more details, read FEMA's Hazard Mitigation Assistance Guidance or visit the FEMA Hazard Mitigation Assistance page.

Combining Funding

Applicants may use both 406 and 404 mitigation funds to implement mitigation measures on the same facility, but not for the same work. Funds from one of these mitigation programs also cannot be used to meet the non-Federal cost share of work funded under the other mitigation program.

A combination of Sections 404 and 406 funding may be appropriate where:

- Section 406 hazard mitigation funding is used to provide protection to the parts of the facility that were damaged by the event
- Section 404 hazard mitigation funding is used to provide protection to the undamaged parts of the facility

Combined Funding Case Study (1 of 3)

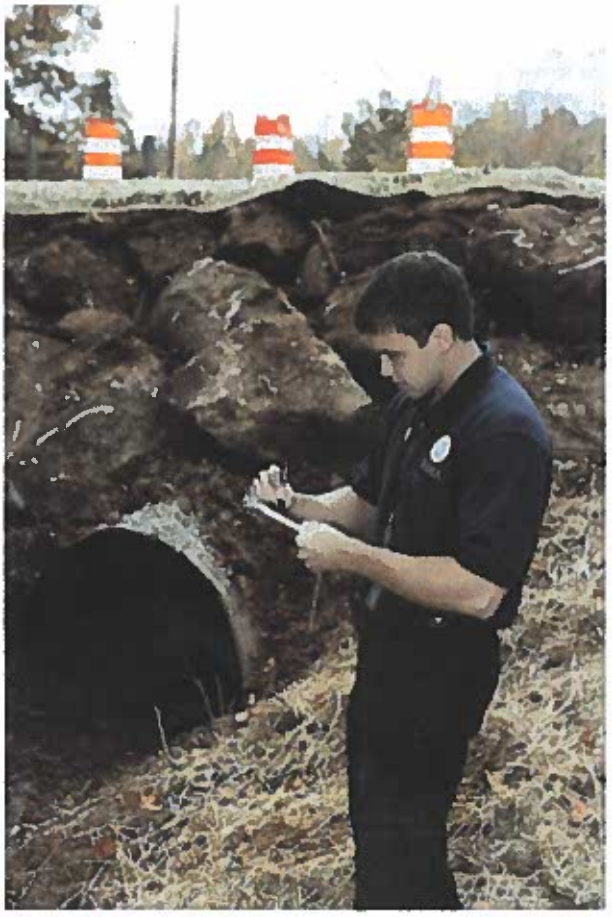
A FEMA Site Inspector determined that a 3-mile section of a 10-mile long storm water pipe was damaged during a Presidentially declared disaster.

Combined Funding Case Study (2 of 3)

Repair and mitigation of the 3 miles of damaged pipe would be eligible for Public Assistance funding and Section 406 Hazard Mitigation funding.

These damages and the mitigation proposal for the 3 miles of pipe would be documented in the Public Assistance Grants Portal. The Applicant can begin work on the repair and mitigation of the 3 miles of pipe once the project is approved.

Combined Funding Case Study (3 of 3)



The additional 7 miles of undamaged (or undamaged by the declared event) may be eligible for Section 404 Hazard Mitigation funding.

The Applicant would have to follow the State's application process for these funds and can only begin mitigation of the 7 miles of undamaged pipe once the application is approved.

Common Hazard Mitigation Measures

Hazard mitigation can only be applied to permanent work. Some examples of common hazard mitigation measures include:

- Increasing the number or size of drainage structures to prevent roadway destruction and washout
- Adding wing walls, riprap, stone, gabion baskets (wire mesh filled with stone), or bioengineering to control erosion
- Elevating facilities above the flood elevation
- Securing equipment with hurricane straps
- Elevating electrical transformers to avoid utility damage

Hazard Mitigation Example: Elevation of Standby Generators

Elevate or dry flood-proof components or systems vulnerable to flood damage, including:

- Equipment controls
- Electrical panels
- Heating, ventilation, and air conditioning/machinery rooms
- Emergency generators
- Fuel tanks

When wiring cannot be elevated, replace with equipment suitable for submerged applications.

Hazard Mitigation Example: Low Water Crossings

Bridges vulnerable to flood damage can sometimes be replaced with low-water crossings if traffic counts are low. As the term suggests, low-water crossings are dry when water levels are low but likely to submerge during floods, becoming unsafe for traffic.

Hazard Mitigation Example: Hurricane Winds

Hurricane winds and wind-blown debris can cause significant damage to structures. If windows are broken in high winds, the building's contents become vulnerable to damage.

Storm shutters are one of the most common methods of protection against damage from high winds. They are fastened over windows or other vulnerable openings to protect them and can be made from materials such as corrugated metal, plastic, wood or plywood, and polycarbonates.

Lesson 1 Summary

This lesson introduced hazard mitigation. It provided an overview of the different hazard mitigation programs authorized under the Stafford Act and discussed common Section 406 Hazard Mitigation projects for Permanent work.

In this lesson, participants learned how to:

- Identify the administrative requirements of the course
- State the goals and objectives of the course
- Define hazard mitigation as it relates to Section 406 of the Robert T. Stafford Act
- Discuss the types of mitigation measures eligible for Public Assistance funding under Section 406 of the Robert T. Stafford Act

Lesson 2 Overview and Objectives

This lesson addresses what measures can be taken to mitigate the risks and effects of different types of hazards. It also identifies resources available for Applicants and Recipients to learn more about developing mitigation proposals, including innovative ways to use Section 406 Hazard Mitigation funding.

In this lesson, you will learn how to:

- Identify and define the threats and hazards that cause damage to infrastructure
- Describe how to minimize future damage
- Identify resources available for applicants and recipients to learn more about developing mitigation proposals, including innovative ways for using 406 mitigation funding

Threats and Hazards

A wide range of threats and hazards can cause an incident and result in damage that needs to be repaired.

For an Emergency Declaration, an incident is defined as any instance that the President determines warrants supplemental emergency assistance to save lives and protect property and public health and safety, or to lessen or avert the threat of a catastrophe.

For a Major Disaster Declaration, an incident is defined as any natural catastrophe or, regardless of cause, any fire, flood, or explosion.

The Three Types of Threats and Hazards

FEMA organizes threats and hazards into three groups, so they can be better understood and addressed. They are:

- **Natural hazards**, which result from acts of nature
- **Human-caused incidents**, which result from the intentional actions of an adversary
- **Technological hazards**, which result from accidents or the failures of systems and structures

Types of Hazards

Below are some examples of types of hazards:

Natural

- Avalanche
- Disease outbreak
- Drought
- Earthquake

Human-caused

- Civil disturbance
- Cyber incident
- Sabotage
- School violence
- Terrorist act

Technological

- Airplane crash
- Dam/levee failure
- Hazardous materials release

- Epidemic
- Flood
- Hurricane
- Landslide
- Tornado
- Tsunami
- Volcanic eruption
- Wildfire
- Wind
- Winter storm
- Power failure
- Radiological release
- Train derailment
- Urban conflagration

Hazard Mitigation Measures: Category C - Roads and Bridges

- Repair of roads, bridges, and associated features, such as shoulders, ditches, culverts, lighting, and signs
- Mitigation examples:
  - Adding a headwall and wing walls to an existing culvert after a flooding event to prevent future damage to the road surface
  - Increasing the size of a culvert to prevent future overtopping/washout of the crossing

Hazard Mitigation Measures: Category D - Water Control Facilities

- Repair of drainage channels, pumping facilities, and some irrigation facilities
- Repair of levees, flood control dams, and flood control
  - The eligibility of these facilities is restricted as long as the Applicant provides

documentation to establish the pre-disaster capacity and maintains the facility on a regular schedule

- Mitigation examples:
  - Elevating equipment and controls of pumping facilities above flood elevations
  - Placing riprap at an irrigation canal to prevent a washout

Hazard Mitigation Measures: Category E - Buildings and Equipment

- Repair or replacement of buildings, including their contents and systems, heavy equipment, and vehicles
- Mitigation examples:
  - Building floodwalls around buildings to prevent flooding
  - Reinforcing buildings with shear walls to withstand seismic forces in an earthquake

Hazard Mitigation Measures: Category F - Utilities

- Repair of water treatment and delivery systems, power generation facilities and distribution facilities, sewage collection and treatment facilities, and communications
- Mitigation examples:

- Elevating sewer system access covers to the hydraulic grade line
- Replacing flooded pumps with submersible pumps

Hazard Mitigation Measures: Category G - Parks, Recreation, and Other

- Repair and restoration of parks, playgrounds, pools, cemeteries, mass transit facilities, beaches, and marinas
- This category is also used for any work or facility that cannot be adequately characterized by Categories C-F
- Mitigation examples:
  - Elevating filter and pump equipment for pools
  - Replacing wood piers or hardening with steel bumpers

All-Hazards Mitigation

It is good practice to implement mitigation measures that address several future hazards. Measures that are part of repairs to a damaged facility don't have to be limited to addressing the type of hazard that caused the damage.

Comprehensive all-hazards plans should acknowledge all hazards that pose a risk and define steps to avoid these hazards and/or reduce risk.

All-Hazards Mitigation - Example: Hurricane (1 of 3)

This building lost its windows and roof during a hurricane. The owner's first thought may be to replace the windows, because that is the most visible damage. However, they should also replace the roof and implement mitigation measures.

All-Hazards Mitigation - Example: Hurricane (2 of 3)

Think of what you know about hurricane damage:

- What other than the windows and roof could be damaged that isn't immediately apparent?
- What measures can be taken to prevent or reduce damage to the building's windows? Its roof? Other damage?
- What other hazards might these mitigation methods be effective against?

All-Hazards Mitigation - Example: Hurricane (3 of 3)

- Components that could be damaged but aren't immediately apparent:
    - Electrical systems, insulation, flooring
- Measures that can be taken to prevent or reduce damage:
    - Wet-proofing, dry-proofing, installation of backflow devices
    - Hurricane straps (roof-framing and walls), securing roof sheathing, anchoring ancillary structures to their foundations
    - Strengthening window glass, installing hurricane shutters
    - Replacing gable vents, reinforcing entry doors
- Other hazards the above mitigation methods are effective against:
    - Flooding, storm surge, hydrodynamic forces, debris impact forces, high winds

Bio-Engineering in Hazard Mitigation

Advantages of bioengineering solutions are:

- Low cost and lower long-term maintenance cost than traditional methods;
- Low maintenance of live plants after they are established
- Environmental benefits of wildlife habitat, water quality improvement and aesthetics
- Improved strength over time

Bio-engineering includes the use of vegetation in civil engineering construction. It

also extends to environmental modifications such as:

- Surface soil protection
- Slope stabilization
- Watercourse and shoreline protection
- Windbreaks
- Vegetation barriers (including noise barriers and visual screens)
- The ecological enhancement of an area

Applying Hazard Mitigation

Think about what types of damage your community could sustain during an incident. What measures can you take in advance to prepare for and mitigate future damage?

Now consider what kinds of repetitive losses you sustain. These are areas where mitigation could benefit your community.

It is also worth trying to mitigate hazards that have only happened once, since an incident that's happened before could recur in the future.

Hazard Mitigation Resources

To learn more about hazard mitigation program development, you can explore the following resources:

- FEMA Hazard Mitigation Assistance page
- FEMA Earthquake Mitigation Handbook
- FEMA Flood Mitigation Handbook
- FEMA Hurricane Mitigation Handbook
- FEMA Wildfire Mitigation Handbook
- E0871: Maximizing Mitigation
- E0239: 406 Hazard Mitigation

- Program Delivery Manager - 406 Specialist
- State or Local Floodplain Manager
- State Mitigation Officer
- Neighboring Communities
- State Historic Preservation Officer
- Academic Institutions
- Environmental nonprofits such as:
    - Leadership in Energy and Environmental Design
    - EDA Environmental

Lesson 2 Summary

This lesson addressed what measures can be taken to mitigate the risks and effects of different types of hazards. It also identified resources available for Applicants and Recipients to learn more about developing mitigation proposals, including innovative ways to use Section 406 Hazard Mitigation funding.

In this lesson, you learned how to:

- Identify and define the threats and hazards that cause damage to infrastructure
- Describe how to minimize future damage
- Identify resources available for applicants and recipients to learn more about developing mitigation proposals, including innovative ways for using 406 mitigation funding

Lesson 3 Overview and Objectives

This lesson will discuss the eligibility and documentation requirements for Section 406 Hazard Mitigation projects.

In this lesson, you will learn how to:

- Explain the eligibility requirements for Section 406 mitigation projects
- Describe the documentation requirements for Section 406 mitigation projects

Eligibility Considerations

FEMA considers a number of different factors when making determinations of eligibility.

These include:

- Disaster-related damage
- Cost-effectiveness
- Technical feasibility
- Environmental and historic preservation compliance
- Impact on operations and surrounding area
- Impact on vulnerability to another hazard

Disaster-Related Damage (1 of 2)

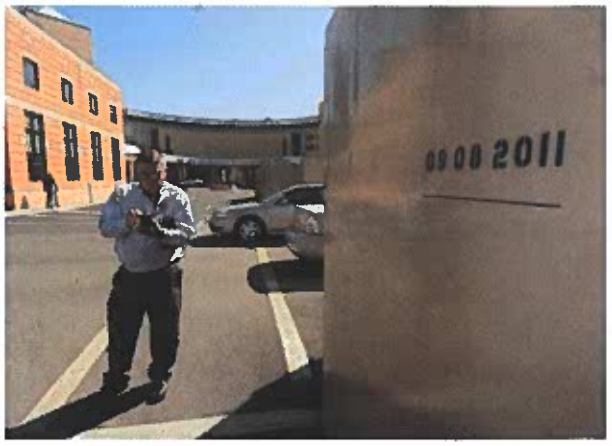
Mitigation measures must directly reduce the potential of future, similar damage to the facility. In general, hazard mitigation projects authorized under Section 406 focus on mitigation measures for the damaged parts of damaged facilities.

In some cases, Section 406 funds may be applied to mitigation measures on undamaged portions of a facility. These measures should provide protection for the damaged portions of the facility and be reasonable based on the extent of the damage.

Disaster-Related Damage (2 of 2)

Some examples of such measures include:

- Constructing floodwalls around damaged facilities
- Installing new drainage facilities (including culverts) along a damaged road
- Dry flood-proofing both damaged and undamaged buildings that contain components of a system that are functionally interdependent (i.e., cases where the entire system is jeopardized if any one component of the system fails)

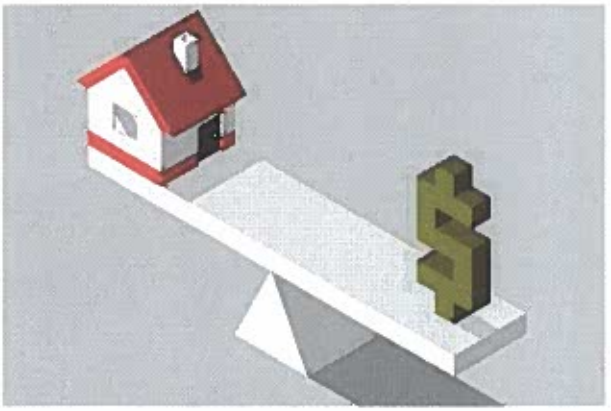


FEMA evaluates this type of proposal on a case-by-case basis. If FEMA determines mitigation measures to undamaged portions ineligible as 406 Hazard Mitigation, the Applicant may request Section 404 funding from the Recipient to provide protection to undamaged portions, while utilizing Section 406 mitigation funds to provide protection to damaged portions.

Cost-Effectiveness

Mitigation measures must be cost-effective. FEMA defines cost-effectiveness as:

- The benefits of a hazard mitigation project exceed the costs
- The Benefit-Cost Ratio is greater than one (BCR > 1)



Cost-effectiveness does *not* mean always selecting the least expensive alternative. The long-term costs and benefits need to be assessed.

Determining Cost-Effectiveness

Three different methods may be used to determine cost-effectiveness:

- 15-percent rule
- 100-percent rule (Appendix J in the Public Assistance Program and Policy Guide)
- Benefit-Cost Analysis

Determining cost-effectiveness will be discussed more in the next lesson.

Technical Feasibility

The goal of mitigation is to support Applicant implementation of good projects that will reduce the risk of damage during against future incidents without compromising a facility against other types of disasters. A mitigation measure should:

- Address the hazard that occurred
- Be realistic and feasible

Find out whether the Applicant has any requirements or preferences for mitigation. Understanding Applicant requirements and

preferences for mitigation is critical to the selection of suitable measures that will be technically feasible and cost-effective.

Example: The owner and occupants of a local government building may not wish to mitigate against earthquakes using exterior cross bracing for aesthetic reasons or because the bracing can block windows.

Environmental and Historic Preservation Compliance

Most mitigation measures alter the pre-disaster condition of a facility, which affects compliance with environmental and historic preservation laws, regulations, and Executive Orders.

Environmental and historic preservation compliance includes cultural considerations and public outreach, accounting for how the changes will affect the rest of the community.

As 406 Hazard Mitigation opportunities are identified, Public Assistance staff should initiate efforts to begin identifying environmental or historic preservation compliance issues associated with the proposed action.

Example: Environmental and Historic Preservation Compliance

A historic building in Missouri, owned by a city government, has flooded several times and is located in the floodplain. This building is on the National Historic Register and is visited by tourist, which generates additional income for the city.

Due to the historical significance and revenue generation of the building, the Applicant does not want to relocate the building out of the floodplain. As a mitigation

measure, they decided to elevate the structure at its current location.

Impact on Operations and Surrounding Area

Hazard mitigation measures often impact more than the facility that has been damaged. They can affect the hazard risk to other facilities, the function of services, and the local economy.

Applicants need to understand the impact that their projects will have on the surrounding area. Hazard mitigation for one facility can affect future protective measures for others, potential need for temporary facilities, and impact the function for utilities or basic infrastructure facilities during future disasters.

Example: Water control measures to prevent flooding in one area might divert water to another location, damaging a power plant or water supply utility. In this case, the benefits of the initial mitigation measure would be outweighed by the collateral damage.

Collateral Impact of Mitigation: Sewage Treatment Plant

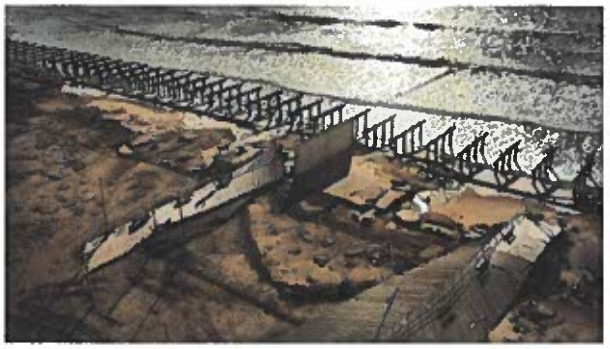
The 26th Ward Wastewater Treatment Plant in New York City during Hurricane Sandy, was flooded. Effluent from the plant contaminated the flood waters, and the plant was closed.

Consider:

- What is the impact on the economy?
- Will school need to be closed?
- Will traffic need to be diverted?

Collateral Impact of Mitigation: Rockaway Boardwalk (1 of 2)

Many times, mitigation measures will impact more than the facility that is damaged. The surrounding facilities can be part of the impact or become impacted, based on mitigation measures.

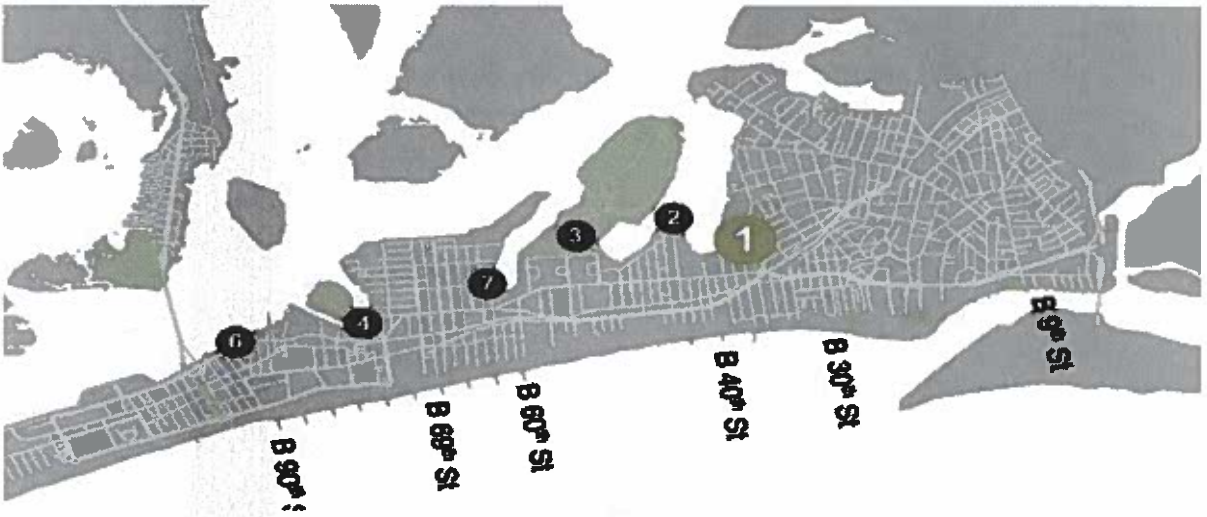


Rockaway Boardwalk in New York City was flooded in Hurricane Sandy. The city decided to elevate the boardwalk and construct sand barriers to mitigate the risks of future flood damage.

Collateral Impact of Mitigation: Rockaway Boardwalk (2 of 2)

These mitigation measures have the further effect of helping to protect buildings inland from the boardwalk debris, sea level rise, tidal flooding, and storm surge.

In addition, the Rockway Boardwalk repairs and mitigation funds were part of a larger plan set by FEMA that lead to growth in the economy and environment resilience.



Impact on Other Hazard Vulnerability

A mitigation measure designed to reduce the risk from one hazard can sometimes increase vulnerability to another. For

example, a proposed method of fireproofing a door or windows might have the unintended effect of trapping people inside if the building floods.

The failure of a mitigation measure can also have a cascading effect on hazards it was not designed to address. Levees are designed to hold back flood water, but when New Orleans levees were overwhelmed during Hurricane Katrina, flood damage was not the only result.

Flooded streets were impassable, hindering evacuation and limiting the mobility of emergency response personnel. Additionally, flood damage to utilities such as electricity, water, and sewage were interrupted and in some cases created more safety concerns.

Eligibility Considerations Example

Consider the following hazard mitigation measures. Which mitigation measures are likely to impact vulnerability to other hazards? Are any likely to affect the community in a negative way?

Examples:

- Constructing floodwalls around damaged facilities
- Installing new drainage facilities along a damaged road (e.g. culverts)
- Dry flood-proofing both damaged and undamaged buildings that contain components of a system that would be jeopardized if any one component of the system fails
- Slope stabilization to protect facilities:
    - Riprap
    - Retaining walls or gabion baskets
    - Geotextile fabric

- Use of disaster-resistant materials for power poles

Section 406 Documentation Requirements

In addition to the documentation needed to apply for a Section 406 grant, the following steps are also necessary:

- Demonstration of event-related damage
- Building a pre-disaster cost estimate; this is the basis for the project cost estimate, or what it will cost to restore the facility to its pre-disaster condition
- Approval of plans by a professional engineer
- Documentation of cost of historical damages for the Benefit-Cost Analysis
- Proof of consideration of environmental and historic preservation
- Documents submitted to FEMA's 406 mitigation specialist
- Posting all documents to Grants Portal

Depending on your project, certain documentation may be required outside of what is listed here, to include all special considerations such as Environmental and Historic Preservation and insurance.

Section 406 Mitigation Projects

When applying to use Public Assistance funds to repair a facility, you must inform FEMA if you wish to include changes or improvements. Failure to do so can negatively impact your funding.

By definition, Section 406 Hazard Mitigation measures generally involve making changes to the original facility.

Lesson 3 Summary

This lesson discussed the eligibility and documentation requirements for Section 406 Hazard Mitigation projects.

In this lesson, you learned how to:

- Explain the eligibility requirements for Section 406 mitigation projects
- Describe the documentation requirements for Section 406 mitigation projects

Lesson 4 Overview and Objectives

This lesson will discuss how to determine the cost-effectiveness of a hazard mitigation project.

At the end of this lesson, you will be able to:

- Describe FEMA's criteria for determining cost effective mitigation measures funded under Section 406 of the Robert T. Stafford Act
- Identify the components and methodology for calculating a benefit-cost analysis

Cost-Effectiveness

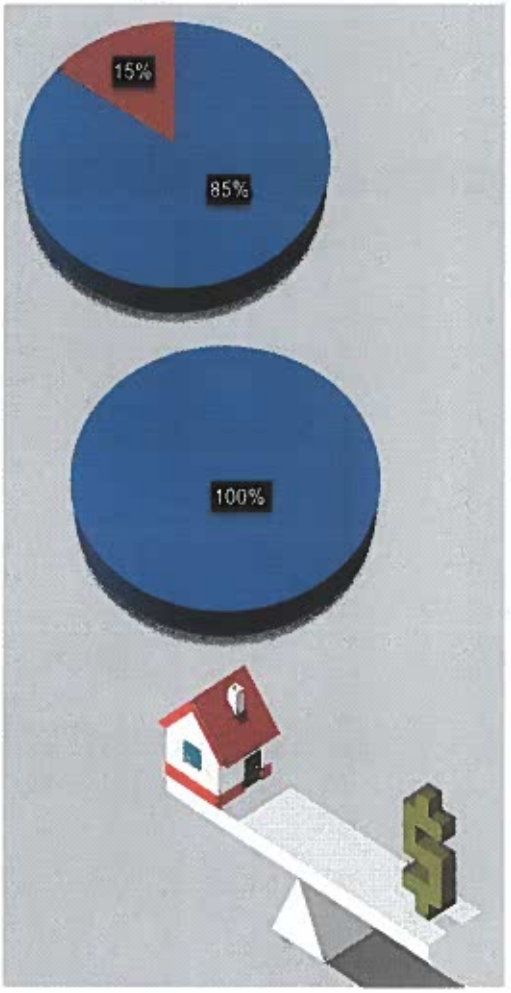
Cost effectiveness relates to the financial feasibility of technically feasible hazard mitigation measures. It is an assessment comparing pre-disaster repair cost to the increased costs associated with implementing various mitigation methods for a single project. FEMA determines whether a measure is financially feasible using its cost-effectiveness.

Example: Repairs to restore a facility to its pre-disaster condition will cost $10,000. Adding hazard mitigation measures that would prevent or reduce future damage costs will cost $1 million. Is hazard mitigation cost-effective?

Determining Cost-Effectiveness

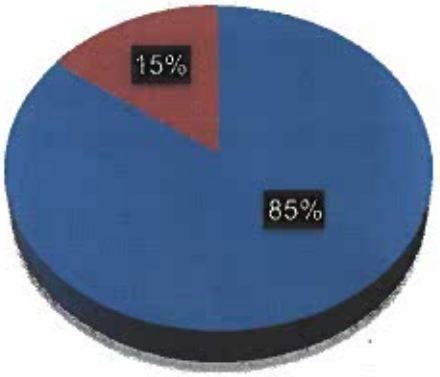
The *Public Assistance Program and Policy Guide* establishes three methods to determine whether a project is cost-effective. The cost-effectiveness of most 406 Hazard Mitigation projects is determined by either the 15% or 100% rule. However, these rules may exclude some otherwise cost-effective projects.

If the mitigation measure is not cost-effective based on the first two criteria, FEMA, Recipient, and Applicant will work together to develop a Benefit-Cost Analysis to determine whether it is cost-effective.



The 15 Percent Rule

FEMA considers mitigation measures to be cost-effective if the cost for the mitigation measure does not exceed 15% of the total eligible repair cost (prior to any insurance reductions) of the facility or facilities for which the mitigation measure applies.



If the costs exceed 15% of the total eligible repair cost, consider the 100% rule.

The 100 Percent Rule

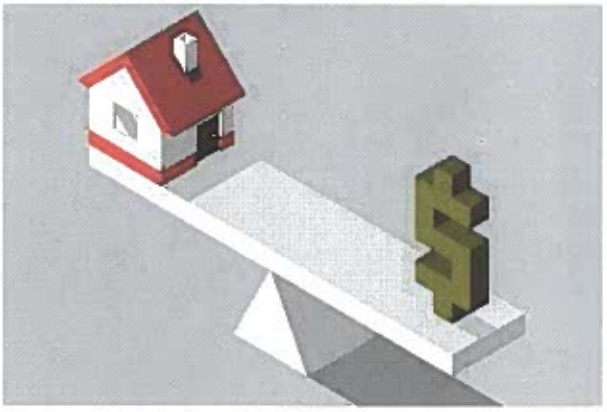
FEMA also considers mitigation measures to be cost-effective if:

- The mitigation measure is specifically listed in Appendix J: Cost-Effective Hazard Mitigation Measures of the *Public Assistance Program and Policy Guide*
- The cost of the mitigation measure does not exceed 100% of the eligible repair cost (prior to any insurance reductions) of the facility or facilities for which the mitigation measure applies

The items listed in Appendix J were derived from historical mitigation measures FEMA has determined to be cost effective.

If the project costs more than 15% of the total eligible repair cost or 100% of the damaged element repairs, then conduct a Benefit-Cost Analysis.

Benefit-Cost Analysis



Many mitigation measures that do not meet either the 15% or 100% rule prove to be cost-effective based on a Benefit-Cost Analysis. The Applicant must demonstrate through an acceptable benefit-cost analysis methodology that the benefits of the mitigation measure exceed the cost of implementing it.

A Benefit-Cost Analysis is based on a comparison of the total eligible cost for the mitigation measure to the total value of expected benefits.

Benefits include reductions in:

- Damage to the facility and its contents
- The need for Emergency Protective Measures
- The need for temporary facilities
- Loss of function

- Casualties (typically included only for earthquake, tornado, and wildfire mitigation)

Benefit-Cost Analysis Considerations

Some factors that a Benefit-Cost Analysis should also take into account include:

- The population affected
- Historical data
- Historical damage records
- Hydrology and hydraulics studies
- Damage frequency assessment
- Change in development of land

Benefit-Cost Analysis Specialist

Each disaster should have access to a Benefit-Cost Analysis specialist. This specialist makes the Benefit-Cost Analysis calculations. Most counties will have someone in engineering and planning who can do the same.

Applicants and Recipients can also hire a consultant to develop the Benefit-Cost Analysis for them before delivering it to FEMA for review.

Benefit-Cost Analysis Development Resources

There are a number of other tools and resources you can use to develop a Benefit-Cost Analysis:

- **Benefit-Cost Analysis software:** Make sure the version you are using is up to date and has the most current national guidelines for cost codes
- **Third-party professionals:** Individuals, such as the State Public

Assistance Representative, can provide further guidance
- **Recipient:** The Recipient can also provide useful guidance when developing a Benefit-Cost Analysis
- **FEMA courses:**
  - E0239: 406 Hazard Mitigation
  - E0276: Benefit-Cost Analysis: Entry Level

- FEMA has Benefit-Cost Analysis software* that provides appropriate Benefit-Cost Analysis methodologies. However, it is the Applicant or Recipient's responsibility to gather the necessary information and provide it to FEMA. FEMA Benefit Cost Analysis

Applicant Prepared Benefit-Cost Analysis

Once the Benefit-Cost Analysis has been calculated, it can be submitted to FEMA along with the other documentation for your hazard mitigation project.

Do not simply submit the Benefit-Cost Analysis number from the calculations. You must also record the documented sources, method used to calculate the final total, and enclose a signed copy of the Benefit-Cost Analysis.

FEMA Validation of Applicant Prepared Benefit-Cost Analysis

FEMA validates the Benefit-Cost Analysis by reviewing the methodology and the supporting documentation provided by the Applicant.

FEMA will perform a thorough review.

Lesson 4 Summary

This lesson discussed how to determine the cost-effectiveness of a hazard mitigation project.

In this lesson, you learned how to:

- Describe FEMA's criteria for determining cost effective mitigation measures funded under Section 406 of the Robert T. Stafford Act
- Identify the components and methodology for calculating a benefit-cost analysis

Lesson 5 Overview and Objectives

This lesson defines active and passive mitigation measures and provides several examples of successful Section 406 hazard mitigation projects.

At the end of this lesson, you will be able to:

- Describe elements of successful Section 406 active and passive hazard mitigation projects

Active vs. Passive Mitigation

There are two general types of mitigation: active and passive.

- **Active mitigation:** Mitigation measure that require human intervention (or power) to operate properly

- **Passive mitigation:** Mitigation measures that require no human intervention (or power) to operate properly

Passive measures are preferable and tend to be more sustainable; active mitigation measures should be avoided if possible, especially for natural hazards where there is little or no warning time, such as flash floods, tornadoes, or earthquakes.

Active Mitigation

Active hazard mitigation measures require some degree of human intervention to be fully effective. Active migration is considered 406 Hazard Mitigation if it is tied to a damaged element.

Examples of active mitigation:

- Flood - Flood-proofing techniques that require the installation of flood shields over doors and other openings prior to the event
- Wind - Installing or securing storm shutters

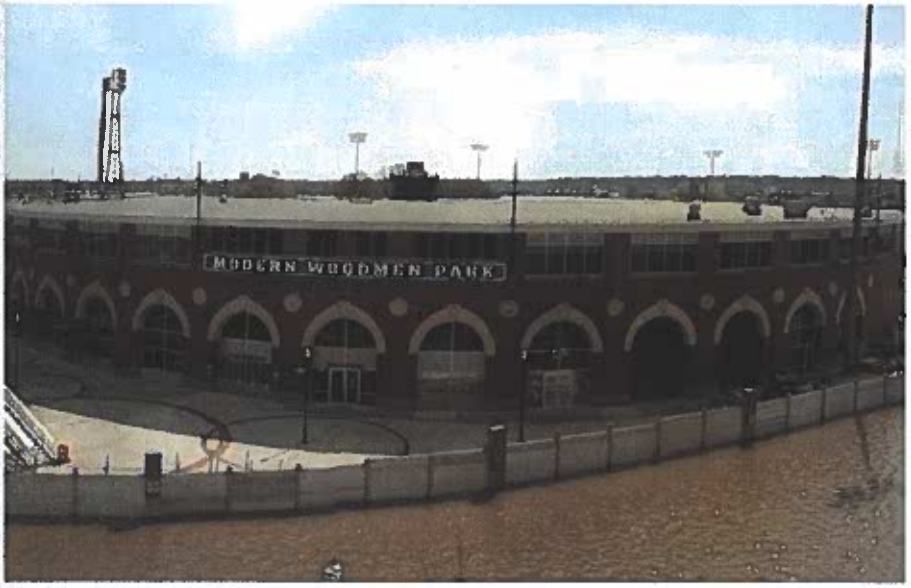
Passive Mitigation

Passive hazard mitigation measures do not require any human

intervention to be fully effective.

Examples of passive mitigation:

- Flood - Elevation and relocation of structures
- Wind - Improving roof sheathing and the connections between roof framing and walls
- Earthquake - Installing or securing shear walls or cross bracing



Case Study: Hurricane Zena (1 of 4)

As a result of Hurricane Zena, the windows of the Hazard County Courthouse were impacted and shattered by flying debris. During the recovery process, the Applicant has claimed this damage and is requesting funds to replace the windows. The Applicant wishes to request 406 Hazard Mitigation in order to prevent the failure of the courthouse windows during a future disaster event.

Case Study: Hurricane Zena (2 of 4)

The Applicant is considering the following two options for 406 Hazard Mitigation:

- **Active Mitigation:** Installation of accordion roll-down shutters to be

placed on the building and deployed prior to a hurricane
- **Passive Mitigation:** Glass upgrade to impact-resistant glass

Note: Mitigation options to protect windows from wind events include, but are not limited to, the Applicant's considerations.

Case Study: Hurricane Zena (3 of 4)

Direct and indirect benefits of the mitigation:

- **Direct benefit:** Limiting and/or preventing failure of the building windows and the need to replace them following an event
- **Indirect benefit:** Limiting and/or preventing the destruction of components and contents inside the building that would be exposed to storm winds and rains if the windows break

Case Study: Hurricane Zena (4 of 4)

The Applicant is making the following considerations in selecting active and passive hazard mitigation measures:

- **Active Mitigation**: The measure is effective as long as there is enough pre-event lead time and staff are available to deploy the measure
- **Passive Mitigation:** Impact resistant glass is robust, but still may break upon impact during extreme events

Applicants should propose the mitigation method that is most advantageous to their specific need and capability.

Case Study: Elevate Generator (1 of 2)

During Hurricane Sandy, both the New York University Langone Medical Center and LaGuardia Airport lost power. Each facility had generators to provide emergency power, but neither was adequately prepared for the flooding that occurred.

When the generators were flooded, the medical center and airport lost back-up power, interrupting service and endangering lives.

Case Study: Elevate Generator (2 of 2)

In response, the Langone Medical Center and LaGuardia Airport have used Section 406 Hazard Mitigation funding to

elevate their back-up generators and reduce the risk of power-loss during any future flooding.

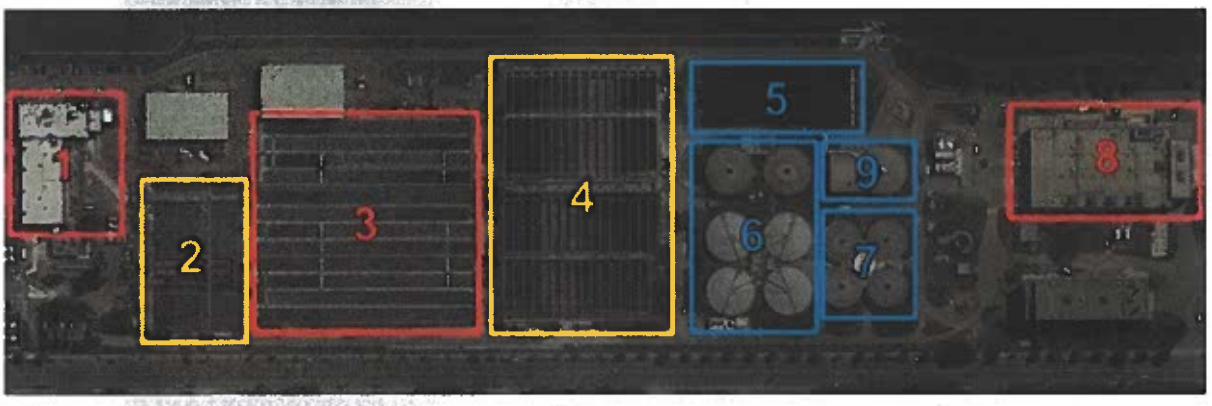
Case Study: Pipe Blow-Out

The town of Beaver Creek, Kansas is subject to flooding and runoff resulting in heavy water flow through buried pipes, exceeding their capacity.

The system of corrugated metal pipes experienced blow-outs three times in a five-year period. After studying the problem, the town used hazard mitigation funding to add vents to the surface where the system was vulnerable. These vents allow air to escape, preventing pressure from building up and reducing the risk of blow-outs.

Case Study: Sewage Treatment Plant Flood Wall (1 of 2)

The 26th Ward Wastewater Treatment Plant in New York City was damaged by flooding during Hurricane Sandy. Effluent from the plant entered the flood water and contaminated other nearby sites. A combination of 404 and 406 mitigation measures was provided to protect the plant but did not cover the entire cost of repairs.



Case Study: Sewage Treatment Plant Flood Wall (2 of 2)

However, wastewater treatment is considered an integrated and interdependent process. Damage to an ineligible component of the plant affects the function of the whole system, including eligible components.

After reviewing the case, the Recovery Branch approved dry floodproofing for the entire wastewater treatment plant as Section 406 Hazard Mitigation.

Lesson 5 Summary

This lesson defined active and passive mitigation measures and provided several examples of successful Section 406 hazard mitigation projects.

In this lesson, you learned how to:

- Describe elements of successful Section 406 active and passive hazard mitigation projects

Lesson 6 Overview and Objectives

This lesson will review the course objectives. Participants will take a Post-Course Assessment at its conclusion.

At the end of this lesson, participants will be able to summarize the content of the course.

Course Objectives

The course provided an overview of Public Assistance project eligibility. State, Local, Tribal, and Territorial Applicants and Recipients should now be able to understand all aspects of Section 406 Mitigation of the Robert T. Stafford Act.

In this course, you learned how to:

- Define Section 406 Mitigation
- Explain which types of projects are eligible for FEMA Public Assistance grant funding under Section 406 authority
- Identify the benefits and opportunities to reduce repetitive disaster losses by pursuing projects authorized under Section 406 Hazard Mitigation
- Discuss examples of potential mitigation work across damage categories C through G (Permanent Work)
- Explain the various methods to determine cost effectiveness of hazard mitigation proposal eligibility

Lesson 1 Objectives

This lesson introduced hazard mitigation. It provided an overview of the different hazard mitigation programs authorized under the Stafford Act and discussed common Section 406 Hazard Mitigation projects for Permanent work.

In this lesson, participants learned how to:

- Identify the administrative requirements of the course
- State the goals and objectives of the course
- Define hazard mitigation as it relates to Section 406 of the Robert T. Stafford Act
- Discuss the types of mitigation measures eligible for Public Assistance funding under Section 406 of the Stafford Act

Lesson 2 Objectives

This lesson addressed what measures can be taken to mitigate the risks and effects of different types of hazards. It also identified resources available for Applicants and Recipients to learn more about developing mitigation proposals, including innovative ways to use Section 406 Hazard Mitigation funding.

In this lesson, you learned how to:

- Identify and define the threats and hazards that cause damage to infrastructure
- Describe how to minimize future damage

- Identify resources available for applicants and recipients to learn more about developing mitigation proposals, including innovative ways for using 406 mitigation funding

Lesson 3 Objectives

This lesson discussed the eligibility and documentation requirements for Section 406 Hazard Mitigation projects.

In this lesson, you learned how to:

- Explain the eligibility requirements for Section 406 mitigation projects
- Describe the documentation requirements for Section 406 mitigation projects

Lesson 4 Objectives

This lesson discussed how to determine the cost-effectiveness of a hazard mitigation project.

In this lesson, you learned how to:

- Describe FEMA's criteria for determining cost effective mitigation measures funded under Section 406 of the Robert T. Stafford Act
- Identify the components and methodology for calculating a benefit-cost analysis

Lesson 5 Objectives

This lesson defined active and passive mitigation measures and provided several examples of successful Section 406 mitigation projects.

In this lesson, you learned how to:

- Describe elements of successful Section 406 active and passive hazard mitigation projects

Course Summary

Congratulations! This course is complete.

The course provided you with an overview of Section 406 Hazard Mitigation.