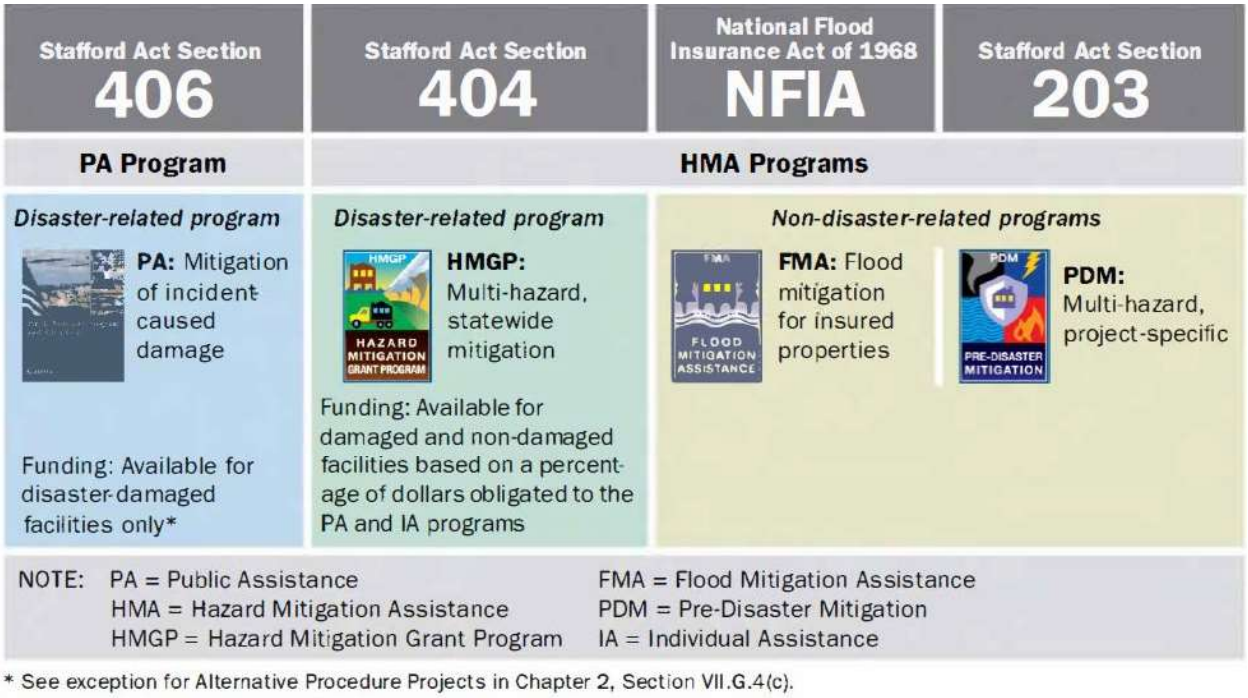

Figure 15. FEMA Hazard Mitigation Programs

FEMA refers to PA-funded hazard mitigation as PA mitigation and mitigation funded under HMGP as HMGP mitigation.

The Applicant may use both PA mitigation and HMGP mitigation funds to implement mitigation measures on the same facility, but not for the same work. The Applicant cannot use funds from one of these mitigation programs to meet the non-Federal cost share of work funded under the other mitigation program.

This document provides details regarding PA mitigation funding. FEMA's *Hazard Mitigation Assistance Guidance* provides further details on HMGP mitigation funding and the HMA programs.[295]

Hazard Mitigation Grant Program

The Recipient manages HMGP and is responsible for soliciting applications from STTL government agencies. Projects submitted to the Recipient must be in accordance with the Recipient's Hazard Mitigation Plan, address severe detrimental impacts, and have the greatest potential to reduce future losses. Eligible projects include acquisition of hazard-prone property, retrofitting existing buildings and facilities, elevation of flood-prone structures, infrastructure protection measures, and hazard mitigation planning. SLTT government agencies should direct questions regarding HMGP to the State, Territorial, or Tribal Hazard Mitigation Officer: www.fema.gov/state-hazard-mitigation-officers.

A. Public Assistance Hazard Mitigation

FEMA evaluates proposed PA mitigation measures for eligibility, cost-effectiveness, technical feasibility and effectiveness, and compliance with EHP laws, regulations, and EOs. In addition, FEMA ensures that the mitigation does not negatively impact the facility's operation or surrounding areas or create susceptibility to damage from another hazard.

[295] www.fema.gov/media-library/assets/documents/103279.

To be eligible for PA funding, the mitigation measures must directly reduce the potential of future damage to the damaged portion(s) of the facility. Generally, eligible PA mitigation measures are those the Applicant performs on the damaged portion(s) of the facility. If the Applicant proposes mitigation measures that are distinct and separate from the damaged portion(s) of the facility, FEMA evaluates the proposal and determines eligibility on a case-by-case basis considering how the mitigation measure protects the damaged portion(s) of the facility and whether the mitigation measure is reasonable based on the extent of damage. Some examples of such measures include:

- Constructing floodwalls around damaged facilities;
- Installing new drainage facilities (including culverts) along a damaged road;
- Adding fire suppression systems at facilities damaged by wildfire; and
- Dry floodproofing both damaged and undamaged buildings that contain components of a system that are functionally interdependent (i.e., when the entire system is jeopardized if any one component of the system fails).

If FEMA determines mitigation measures to undamaged portions ineligible as PA mitigation the Applicant may request HMGP funding from the State, Territorial, or Tribal government to provide protection to undamaged portions, while utilizing PA mitigation funds to provide protection to damaged portions.

PA mitigation opportunities usually present themselves during facility repair. However, in cases where the Applicant needs to repair a facility in an expedited manner, it may miss an opportunity to implement mitigation measures during repair. If the Applicant implements mitigation measures after the PA-funded repair is complete, the mitigation work may still be eligible for PA funding; however, FEMA will not provide PA funding for any duplicative work triggered by the subsequent mitigation.

Hazard Mitigation Best Practices

FEMA publishes documents describing best practices to reduce loss of life and property when repairing damaged facilities. These publications are listed in FEMA P-787, Catalog of FEMA Building Science Branch Publications and Training Courses at www.fema.gov/media-library/assets/documents/12909.

In some instances, the Applicant may implement mitigation measures after the incident occurs but before the incident is declared or before FEMA has the opportunity to evaluate the measure for eligibility. In these cases, the mitigation work may still be eligible for PA funding if it is cost-effective and FEMA confirms compliance with applicable EHP laws, regulations, and EOs.

If FEMA approves PA funding for mitigation and the Applicant does not complete the PA mitigation work, FEMA will deobligate the PA mitigation funds.

Cost-effective Evaluation

PA mitigation measures must be cost-effective.[296] FEMA considers PA mitigation measures to be cost-effective if any of the following criteria are met:

[296] 44 C.F.R. § 206.226(e).

- The cost for the mitigation measure does not exceed 15 percent of the total eligible repair cost (prior to any insurance reductions) of the facility or facilities for which the mitigation measure applies;
- The mitigation measure is specifically listed in Appendix J: *Cost-Effective Public Assistance Hazard Mitigation Measures*, AND the cost of the mitigation measure does not exceed 100 percent of the eligible repair cost (prior to any insurance reductions) of the facility or facilities for which the mitigation measure applies; and
- The Recipient or Applicant demonstrates through an acceptable benefit-cost analysis (BCA) methodology that the measure is cost-effective. FEMA's BCA software[297] provides appropriate BCA methodologies.

Many mitigation measures that do not meet the first two requirements above prove to be cost-effective based on a BCA. If the mitigation measure is not cost-effective based on the first two criteria, FEMA, the Recipient, and the Applicant work together to develop a BCA to determine whether it is cost-effective.

A BCA is based on a comparison of the total estimated cost for the PA mitigation measure to the total value of expected benefits to society. FEMA's BCA methodology considers common project benefits, which include reductions in the magnitude or frequency of:

- 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); and
- Previous impacts regardless of whether the impacts occurred in Federal declarations (only if documented).

B. Public Assistance Mitigation Funds for Capped Projects

1. Improved Project

If the capped amount for an Improved Project includes PA mitigation funds and the Applicant either does not complete the PA mitigation work, or replaces or relocates the original facility, FEMA deobligates the PA mitigation funds.

2. Alternate Project

If the SOW to restore a facility includes PA mitigation, and the Applicant elects to proceed with an Alternate Project, FEMA does not include costs related to the PA mitigation in the capped amount for the Alternate Project.

3. Alternative Procedures Project

When the Applicant is restoring the function, but changing the pre-disaster capacity of a facility, the proposed PA mitigation SOW is developed based on the actual SOW to be performed; however, the cost-effectiveness is evaluated based on the fixed-cost amount accepted for the pre-disaster restoration SOW. If the capacity is increased, the proposed hazard mitigation SOW and cost is limited to the SOW and cost necessary to mitigate to the pre-disaster capacity of the

[297] www.fema.gov/benefit-cost-analysis.

damaged facility. If the Applicant does not complete the approved PA mitigation, FEMA deobligates the portion of the fixed-cost amount related to hazard mitigation.

V. Repair vs. Replacement

When evaluating whether a damaged facility is eligible for replacement, FEMA compares the repair cost with the replacement cost and evaluates the feasibility of repairing the facility.[298]

A facility is considered repairable when:

- The cost to repair the disaster-related damage does not exceed 50 percent of the cost to replace the facility based on its pre-disaster size, capacity, and function; and
- It is feasible to repair the facility so that it can perform the pre-disaster function as well as it did prior to the incident.[299]

The comparison of the repair cost to the replacement cost results in a fraction that expresses repair as a percentage of replacement. The percentage is calculated with the repair cost as the numerator and the replacement costs as the denominator. FEMA refers to this as the "50% Rule."

The purpose of the 50% Rule is to make an early determination on whether it is more prudent to repair or replace a facility. It is not intended to be a full calculation of all eligible project costs.

A. Calculation

The repair cost (numerator) is the cost of repairing disaster-related damage only and includes costs related to compliance with codes and standards that apply to the repair of the damaged elements only.[300] The numerator does not include costs associated with:

- Upgrades of non-damaged elements even if required by codes or standards (e.g., elevation of an entire facility triggered by repair);
- Demolition beyond that which is essential to repair the damaged elements;
- Site work;
- Soft costs;
- Contents;
- Hazard mitigation measures; or
- Emergency Work.

The replacement cost (denominator) is the cost of replacing the facility based on its pre-disaster design (size and capacity) and function in accordance with applicable codes or standards. The denominator does not include costs associated with:

- Demolition;
- Site work;

Terminology

Soft costs are those not considered as direct construction costs, including:

- Architectural costs
- Engineering costs
- Project management costs
- Financing
- Legal fees
- Other pre-/post-construction expenses

Site Work is any exterior work at the site. Examples include:

- Excavation
- Backfill
- Erosion control
- Utility installation
- Paving

[298] 44 C.F.R. § 206.226(f).
[299] 44 C.F.R. § 206.226(f)(1).
[300] This includes consensus-based codes, specifications, and standards.

APPENDIX J: COST-EFFECTIVE PUBLIC ASSISTANCE HAZARD MITIGATION MEASURES

FEMA considers the following mitigation measures to be cost-effective Public Assistance (PA) mitigation if the measures do not exceed 100 percent of the eligible repair cost (prior to any insurance reductions). The mitigation measures must meet all eligibility requirements described in Chapter 8:IV. *Hazard Mitigation*. There may be instances where these measures are required by codes or standards. In such cases FEMA first evaluates whether the work is eligible as a code or standard (See Chapter 8:II. *Codes and Standards*).

I. Drainage Structures:

For Sections I.A. and I.C. (below), PA and environmental and historic preservation (EHP) staff coordinate to determine whether a hydrologic and hydraulic (H&H) study is needed. The Applicant must submit an H&H study to determine the appropriate culvert size with no adverse up or downstream impacts and National Flood Insurance Program regulations when:

- The facility is in a special flood hazard area;
- There is a potential adverse impact to the floodplain;[405]
- There is a potential adverse impact to a federally listed threatened or endangered species, critical habitat, or essential fish habitat;[406] or
- It is required to demonstrate compliance with the Clean Water Act.

A. Replace the structure with multiple structures or a larger structure. The Applicant may use existing SLTT drainage criteria for sizing replacement culverts. The Applicant must consider replacement structures with regard to the total drainage system.

B. For the purpose of erosion control, add properly designed entrance and exit structures, such as a headwall, wingwalls, flared aprons, or energy dissipation measures to increase efficiency and help to minimize scour and erosion. Depending on the severity of erosion, solutions for bank protection may include gabion baskets, rip rap,

Example

Adding a relief culvert located at the same crossing site as a damaged culvert and in the embankment above the flow line of the primary culvert or located upstream of the main culvert. A relief culvert provides an alternate route for the flow if the main culvert is over capacity or gets plugged and prevents sedimentation through the high-flow scouring action.

[405] 44 C.F.R. §§ 9.11(d)(4) and 60.3(b)(7), (c)(10), and (d)(3).

[406] Endangered Species Act 16 U.S.C. §§ 1531-1544 and Magnuson-Stevens Fishery Conservation and Management Act.

cast-in-place concrete, crushed stone or rock, grouted rip rap[407], sheet-piling, geotextile fabric, or similar measures to control erosion. Alternatively, the use of vegetation or a combination of vegetation and construction materials such as live fascines, vegetated geogrids, live crib walls, brush mattresses, root wads, or similar measures are eligible. The Applicant should consider using green infrastructure techniques such as bioswales, bioretention, rain gardens and similar techniques that may be used in public drainage systems.

C. Culverts:

1. Where the alignment of a culvert is inconsistent with existing water flow, realign the culvert vertically or horizontally or relocate the culvert to improve hydraulics and minimize erosion and scour. The Applicant must consider realignment of structures with regard to the total drainage system.
2. Extend the culvert discharge to mitigate erosion and scour by extending the discharge end beyond the toe of the embankment.
3. Install a debris barrier to prevent debris blockage or fins designed to orient floating debris for passage through the culvert.
4. Install a debris barrier riser to allow debris to float up with the rising floodwaters without blocking flow into the culvert.

II. Transportation Facilities:

A. Bridges:

1. Where traffic counts are low, replace with low-water crossings.
2. Install cables to restrain a bridge from being knocked off piers or abutments during floods or earthquakes.
3. Install girder and deck uplift tie-downs to prevent their displacement from the substructure.
4. Install Longitudinal Peaked Stone Toe Protection with nature planting, upstream of a failed abutment, to provide a stable floodplain bench for the protection of the abutment and the adjoining bridge approach. Consider other relevant Bio-engineering applications such as engineered logjams, log vanes or log bendway weir.

B. Marine Pier Ramps: If attached to decking, install open decking or floating decking with uplift-resistant tie-downs and fasteners.

C. Roadways and Railways: Where shoulders are susceptible to overflow from adjacent water courses, stabilize shoulders and embankments with geotextile fabric and revetments.

D. Roadways: Use geotextile drainage blankets between the pavement section and subbase to strengthen subgrade.

[407] Projects involving grouted rip rap may be subject to an environmental assessment and may not be allowable in all instances.

III. Mechanical, Electrical, Plumbing (MEP) Components:

A. Provide seismic bracing for electrical lines, conduit, piping, duct-work, water heaters, and other MEP equipment. Components can be wall mounted, floor mounted, or suspended.

B. Roof-Mounted Equipment: Secure to roof top via a continuous load path, using tie-downs, straps, or other anchoring systems that will resist expected wind forces.

C. Elevate or dry floodproof components or systems vulnerable to flood damage, including equipment controls, electrical panels; heating, ventilation, and air conditioning/machinery rooms; emergency generators; and fuel tanks. When wiring cannot be elevated, replace with equipment suitable for submerged applications.

D. Install switches, circuit isolation and/or quick connect capability to facilitate rapid connection of backup power for any damaged or susceptible mechanical and electrical components.

E. Install camlocks, transfer switches, and electrical panels to facilitate the connection of portable emergency generators.

IV. Pipes:

A. Install pipe joint restraints, flexible piping at pipe/conduit connections, or replace pipes with more ductile material.

B. Install continuous lining or encasement to prevent infiltration or structural collapse.

C. Underground Pipes: Install shut-off valves so that damaged sections of pipe can be isolated.

V. Water/Wastewater:

A. Pumps: If pumps and their attached motors are damaged by stormwater inundation, replace them with submersible or inline pumps as appropriate.

B. Sewer Access Covers: Elevate to the hydraulic grade line. When elevation is not feasible or practicable, install devices to prevent infiltration into access holes such as cast-iron watertight frames and covers.

C. Well Systems: Seal exposed portions of well casing or raise the elevation of the well head to prevent infiltration of flood waters.

D. Raw water intakes: Install buttressing to prevent damage from erosion, scour, and flood debris.

VI. Electric Power Systems:

A. Provide looped distribution service or other redundancies in the electrical service to critical facilities, such as hospitals and fire stations.

B. Install surge suppressors and lightning arrestors.

C. Transformers:

1. Elevate pad transformers above the Base Flood Elevation.

2. Support pole-mounted transformers with multiple poles.

D. Power Poles:

1. Replace damaged poles with higher-rated poles (preferably two classes stronger) of the same or different material. When replacing poles with higher-rated poles, install guys and anchors to provide lateral support for poles supporting pole-mounted transformers, regulators, capacitor banks, reclosers, air-break switches, or other electrical distribution equipment.
2. Remove large diameter lines.
3. Add cross-bracing to H-frame poles to provide additional strength.
4. Power Lines: Add guy-wires or additional support.

VII. Storage Tanks:

A. Anchor or otherwise protect from movement by strengthening or stiffening base connections.

B. Install self-initiating disconnects and shut-off values between tanks and distribution lines to minimize damage and leaks.

VIII. Buildings and Structures:

A. For small support buildings subject to uplift or rollover from high winds, securely anchor the buildings to foundations to prevent toppling or becoming missile hazards.

B. Elevate or dry or wet floodproof buildings.

C. Footings: Where spread footings have been undercut by scour, underpin footings.

D. Siding: Replace with a stronger siding with stronger attachments to the wall sheathing and structure.

E. Vents: Replace with water-resistant vents.

F. Non-structural Building Components: Brace interior walls, partitions, parapets, anchor veneer or cladding, suspended light features, drop ceilings, soffits, and other non-structural elements that could collapse and cause injury or block safe exit of a building during an earthquake or high-wind event.

G. Furnishings: Provide seismic ties, straps, or clips to secure replaced furniture, cabinets, computers, bookcases, and other furnishings.

H. Roofs

1. Install hurricane clips, fasteners, anchors, straps, and connectors that are compatible with the roof system and corrosion-resistant in coastal areas.
2. Strengthen the high-wind pressure areas (e.g., corner zones, roof soffits, overhangs).
3. Strengthen roof openings, such as hatches and skylights.
4. Low Slope Roofs: Replace entire roof covering with a fully adhered roof covering, such as a modified bitumen membrane roof. FEMA does not provide PA mitigation

funding for loose laid insulation or membranes as punctures can cause large amounts of water intrusion. Additionally, FEMA does not provide PA mitigation funding for loose laid roof membranes with loose ballast stones as the stones can become projectiles in high winds and cause damage.

5. Gable Roofs: Replace the gable-end framing with hipped roof framing to reduce wind forces (lower edge pressure; reduced projected wind area) and strengthen the roof framing.
6. Gutters and Downspouts: Upgrade to direct water away from the structure to prevent interior or basement water damage.

I. Doors and Windows:

1. Upgrade the weather stripping to prevent water infiltration.
2. Replace doors, door frames, hinges, and hardware with wind-resistant units.
3. Strengthen windows.
4. Replace glass with impact-resistant material.
5. Install shutters on windows:
   a. Of critical facilities, such as hospitals.
   b. On the lower floors of noncritical facilities most likely to be struck by debris.
   c. Of buildings with very high-value contents that can be damaged by water (such as libraries and document centers).
   d. Of buildings when failure of roofing materials or other portions of nearby structures could create impact hazards.

IX. Signage: Replace sign panels and their supports with a stronger type of system of supports and panels. Consider using multiple support posts and stronger panels and fasteners.