C.1 Categories of Mitigation Measures Considered

The following categories are based on the Community Rating System.

- Prevention
- Emergency Services
- Property Protection
- Natural Resource Protection
- Structural Projects
- Public Information

C.2 Alternative Mitigation Measures per Category

**Prevention**

Preventive measures are designed to keep the problem from occurring or getting worse. Their objective is to ensure that future development is not exposed to damage and does not increase damage to other properties.

- Planning
- Zoning
- Open space preservation
- Land development regulations
  - Subdivision regulations
  - Floodplain development regulations
- Stormwater management
- Fuels management, fire breaks
- Building codes
  - Firewise construction
- (also see Property Protection)

**Emergency Services**

Emergency services protect people during and after a disaster. A good emergency services program addresses all hazards. Measures include:

- Warning (floods, tornadoes, ice storms, hail storms, dam failures)
  - NOAA weather radio all hazards
  - Sirens
  - Reverse 911
• Evacuation and sheltering
• Communications
• Emergency planning
  – Activating the emergency operations room (emergency management)
  – Closing streets or bridges (police or public works)
  – Shutting off power to threatened areas (utility company)
  – Holding children at school/releasing children from school (school district)
  – Passing out sand and sandbags (public works)
  – Ordering an evacuation (mayor)
  – Opening evacuation shelters (red cross)
  – Monitoring water levels (engineering)
  – Security and other protection measures (police)
• Monitoring of conditions (dams)
• Critical facilities protection (buildings or locations vital to the response and recovery effort, such as police/fire stations, hospitals, sewage treatment plants/lift stations, power substations)
  – Buildings or locations that, if damaged, would create secondary disasters, such as hazardous materials facilities and nursing homes
  – Lifeline utilities protection
  – Health and safety maintenance

Property Protection

Property protection measures are used to modify buildings subject to damage rather than to keep the hazard away. A community may find these to be inexpensive measures because often they are implemented by or cost-shared with property owners. Many of the measures do not affect the appearance or use of a building, which makes them particularly appropriate for historical sites and landmarks.

• Retrofitting/disaster proofing
  – Floods
    ▪ Wet/dry floodproofing (barriers, shields, backflow valves)
    ▪ Relocation
    ▪ Acquisition
  – Tornadoes
    ▪ Safe rooms
    ▪ Securing roofs and foundations with fasteners and tie-downs
    ▪ Strengthening garage doors and other large openings
  – Drought
    ▪ Improve water supply (transport/storage/conservation)
    ▪ Remove moisture competitive plants (tamarisk/salt cedar)
    ▪ Water restrictions/water saver sprinklers/appliances
- Grazing on CRP lands (no overgrazing—see noxious weeds)
- Create incentives to consolidate/connect water services
- Recycled wastewater on golf courses
  - Earthquakes
    - Removing masonry overhangs, bracing, and other parts
    - Tying down appliances, water heaters, bookcases, and fragile furniture so they will not fall over during a quake.
    - Installing flexible utility connections that will not break during shaking (pipelines, too)
  - Wildland fire
    - Replacing building components with fireproof materials (roofing, screening)
    - Creating “defensible space”
    - Installing spark arrestors
    - Fuels modification
  - Noxious weeds/insects
    - Mowing
    - Spraying
    - Replacement planting
    - Stop overgrazing
    - Introduce natural predators
- Insurance

**Natural Resource Protection**

Natural resource protection activities are generally aimed at preserving (or in some cases restoring) natural areas. In so doing, these activities enable the naturally beneficial functions of floodplains and watersheds to be better realized. These natural and beneficial floodplain functions include the following:

- Storage of floodwaters
- Absorption of flood energy
- Reduction in flood scour
- Infiltration that absorbs overland flood flow
- Groundwater recharge
- Removal/filtering of excess nutrients, pollutants, and sediments from floodwaters
- Habitat for flora and fauna
- Recreational and aesthetic opportunities

Methods of protecting natural resources include:

- Erosion and sediment control
- Wetlands protection
• Riparian area/habitat protection
• Threatened and endangered species protection
• Fuels management
• Set-back regulations/buffers
• Best management practices—Best management practices ("BMPs") are measures that reduce nonpoint source pollutants that enter the waterways. Nonpoint source pollutants come from non-specific locations. Examples of nonpoint source pollutants are lawn fertilizers, pesticides, and other farm chemicals, animal wastes, oils from street surfaces and industrial areas and sediment from agriculture, construction, mining and forestry. These pollutants are washed off the ground’s surface by stormwater and flushed into receiving storm sewers, ditches and streams. BMPs can be implemented during construction and as part of a project’s design to permanently address nonpoint source pollutants. There are three general categories of BMPs:
  – Avoidance—Setting construction projects back from the stream.
  – Reduction—Preventing runoff that conveys sediment and other water-borne pollutants, such as planting proper vegetation and conservation tillage.
  – Cleanse—Stopping pollutants after they are en route to a stream, such as using grass drainageways that filter the water and retention and detention basins that let pollutants settle to the bottom before they are drained
• Dumping regulations
• Water use restrictions
• Weather modification
• Landscape management

**Structural Projects**

Structural projects have traditionally been used by communities to control flows and water surface elevations. Structural projects keep flood waters away from an area. They are usually designed by engineers and managed or maintained by public works staff. These measures are popular with many because they “stop” flooding problems. However, structural projects have several important shortcomings that need to be kept in mind when considering them for flood hazard mitigation:

• They are expensive, sometimes requiring capital bond issues and/or cost sharing with Federal agencies, such as the U.S. Army Corps of Engineers or the Natural Resources Conservation Service.
• They disturb the land and disrupt natural water flows, often destroying habitats.
• They are built to a certain flood protection level that can be exceeded by a larger flood, causing extensive damage.
• They can create a false sense of security when people protected by a structure believe that no flood can ever reach them.
• They require regular maintenance to ensure that they continue to provide their design protection level.

Structural measures include:

• Detention/retention structures
• Erosion and sediment control
• Basins/low-head weirs
• Channel modifications
• Culvert resizing/replacement/maintenance
• Levees and floodwalls
• Fencing (for snow, sand, wind)
• Drainage system maintenance
• Reservoirs (for flood control, water storage, recreation, agriculture)
• Diversions
• Storm sewers

Public Information

A successful hazard mitigation program involves both the public and private sectors. Public information activities advise property owners, renters, businesses, and local officials about hazards and ways to protect people and property from these hazards. These activities can motivate people to take protection

• Hazard maps and data
• Outreach projects (mailings, media, web, speaker’s bureau)
• Library resources
• Real estate disclosure
• Environmental education
• Technical assistance

Additional detail and discussion of the benefit of alternate mitigation measures are shown in the handouts that follow.
Preventive Measures
Preventive measures are designed to keep a problem such as flooding from occurring or from getting worse. The objective of preventive measures is to ensure that future development is not exposed to damage and does not cause an increase in damages to other properties. Building, zoning, planning and code enforcement offices usually administer preventive measures. Some examples of types of preventive measures include:

- Building codes
- Planning and zoning
- Open space preservation
- Floodplain regulations
- Stormwater management

Building Codes
Building codes provide one of the best methods of addressing flood hazards. When properly designed and constructed according to code, the average building can withstand many of the impacts of natural hazards. Hazard protection standards for all new and improved or repaired buildings can be incorporated into the local building code. Building codes can ensure that the first floors of new buildings are constructed to be higher than the elevation of the 100-year flood (the flood that is expected to have a one percent chance of occurring in any given year).

Just as important as having code standards is the enforcement of the code. Adequate inspections are needed during the course of construction to ensure the builder understands the requirements and is following them. Making sure a structure is properly anchored requires site inspections at each step.

Manufactured Homes
Manufactured or mobile homes are usually not regulated by local building codes. They are built in a factory and out of state, and they are shipped to a site. They do have to meet construction standards set by the U.S. Department of Housing and Urban Development. All mobile homes constructed after 1976 must comply with HUD’s National Manufactured Home Construction and Safety Standards. These standards apply uniformly across the country and it is illegal for a local unit of government to require additional construction requirements. Local jurisdictions may regulate the location of these structures and their on-site installation.

The NFIP allows communities to exempt mobile homes in existing mobile home parks from some of the flood protection requirements. The CRS provides up to 50 points if the community does not use this exemption.
Prevention

CRS Credit
The CRS encourages strong building codes. It provides credit in two ways: points are awarded based on the community’s BCEGS classification and points are awarded for adopting the International Code series. The CRS also has a prerequisite for a community to attain a CRS Class 8 or better: the community must have a BCEGS class of 6 or better. To attain a CRS Class 4 or better, the community must have a BCEGS class of 5 or better.

Planning and Zoning
Building codes provide guidance on how to build in hazardous areas. Planning and zoning activities direct development away from these areas, especially floodplains and wetlands. They do this by designating land uses that are compatible with the natural conditions of lands prone to flooding, such as open space or recreation. Planning and zoning activities can also provide benefits simply by allowing developers more flexibility in arranging improvements on a parcel of land through the planned development approach.

General and Comprehensive Plans
These plans are the primary tools used by communities to address future development. They can reduce future flood-related damages by indicating open space or low density development within floodplains and other hazardous areas. Unfortunately, natural hazards are not always emphasized or considered in the specific land use recommendations.

Generally, a plan has limited authority. It reflects what the community would like to see happen. Its utility is that it guides other local measures, such as capital improvement programs, zoning ordinances, and subdivision regulations.

Zoning Regulations
A zoning ordinance regulates development by dividing a community into zones and setting development criteria for each zone. Zoning codes are considered the primary tool to implement a general plan’s guidelines for how land should be developed. Zoning ordinances can limit development in hazardous areas, such as reserving floodplain zones for agricultural uses. Often, developers will produce a standard grid layout. The ordinance and the community can allow flexibility in lot sizes and location so developers can avoid hazardous areas.

One way to encourage such flexibility is to use a planned unit development (PUD) approach. This

Figure 2: Planned Unit Developments

PUD: In the standard zoning approach (left), the developer considers six equally-sized lots without regard for the flood hazard. Two properties are subject to flooding and the natural stream is disrupted. An alternative, flexible, PUD approach is shown on the right. The floodplain is dedicated as public open space. There are seven smaller lots, but those abutting the floodplain have the advantage of being adjacent to a larger open area. Four lots have identical lots instead of two. These alleviate compensation for the smaller lot sizes, so the parcels are valued the same. The developer makes the same or more income and the future residents are safer.
Prevention

approach allows developers to incorporate flood hazard mitigation measures into projects. Open space or floodplain preservation can be facilitated as site design standards and land use densities can be adjusted to fit the property’s specific characteristics, as shown in Figure 26.

Capital Improvement Plans
A capital improvement plan will guide a community’s major public expenditures for a five- to 20-year period. Capital expenditures may include acquisition of open space within the hazardous areas, extension of public services into hazardous areas, or retrofitting existing public structures to withstand a hazard.

CRS Credit
The CRS provides flood insurance discounts to those communities that implement various floodplain management activities that meet certain criteria. Comparing local activities to those national criteria helps determine if local activities should be improved.

Up to 100 points are provided for regulations that encourage developers to preserve floodplains or other hazardous areas from development. There is no credit for a plan, only for the enforceable regulations that are adopted pursuant to a plan. Up to 600 points are provided for setting aside floodplains for low density zoning, such as five acre lots or conservation.

Open Space Preservation
Keeping the floodplain and other hazardous areas open and free from development is the best approach to preventing damage to new developments. Open space can be maintained in agricultural use or can serve as parks, greenway corridors and golf courses.

General and capital improvement plans should identify areas to be preserved by acquisition and other means, such as purchasing an easement. With an easement, the owner is free to develop and use private property, but property taxes are reduced or a payment is made to the owner if the owner agrees to not build on the part set aside in the easement.

Although there are some federal programs that can help acquire or preserve open lands, open space lands and easements do not always have to be purchased. Developers can be encouraged to dedicate park land and required to dedicate easements for drainage and maintenance purposes. These are usually linear areas along property lines or channels. Maintenance easements also can be donated by streamside property owners in return for a community maintenance program.

CRS Credit
Preserving flood prone areas as open space is one of the highest priorities of the Community Rating System. Up to 700 points can be given, based on how much of the floodplain is in parks, wildlife refuges, golf courses, or other uses that can be depended on to stay open (Activity 420 – Open Space Preservation).
Prevention

Subdivision Regulations

Subdivision regulations govern how land will be subdivided and set construction standards. These standards generally address roads, sidewalks, utilities, storm sewers, and drainageways. They can include the following flood protection standards:

- Requiring that the final plat show all hazardous areas
- Requiring that each lot be provided with a building site above the flood level
- Requiring that all roadways be no more than one foot below the flood elevation

Floodplain Regulations

Most communities with a flood problem participate in the National Flood Insurance Program (NFIP). The NFIP sets minimum requirements for the participating communities’ standards for development, subdivision of land, construction of buildings, installation of mobile homes, and improvements and repairs to buildings. These are usually spelled out in a separate ordinance.

The NFIP minimum requirements are summarized in the box on the next page. It should be stressed that these are minimum requirements. To gain credit in the CRS, communities must adopt and implement floodplain regulations that go above and beyond the minimum requirements of the NFIP.

Enforcement

To ensure that communities are meeting the NFIP standards, FEMA periodically conducts a Community Assessment Visit. During this visit, the maps and ordinances are reviewed, permits are checked, and issues are discussed with staff. Failure to meet all of the requirements can result in one or more consequences:

- Reclassification under the Community Rating System to a higher class
- Probation, which entails a $50 surcharge on every flood insurance policy in the community, or
- Suspension from the NFIP.

In 2004, Lafourche Parish, Louisiana, was cited and reclassified from a CRS Class 9 to a Class 10, in effect kicking the Parish out of the CRS. Suspension is more serious. It means that the community is out of the NFIP and the following sanctions are imposed:

- Flood insurance will not be available. No resident will be able to purchase a flood insurance policy.
- Existing flood insurance policies will not be renewed.
- No direct federal grants or loans for development may be made in identified flood hazard areas under programs administered by federal agencies, such as HUD, EPA, and the Small Business Administration.
- Federal disaster assistance will not be provided to repair insurable buildings located in identified flood hazard areas for damage caused by a flood.
- No federal mortgage insurance or loan guarantees may be provided in identified flood
Prevention

hazard areas. This includes policies written by FHA, VA, and others.

- Federally insured or regulated lending institutions, such as banks and credit unions, must
  notify applicants seeking loans for insurable buildings in flood hazard areas that there is a
  flood hazard and the property is not eligible for federal disaster relief.

These sanctions can be severe for any community with a substantial number of buildings in the
floodplain. Most communities with a flood problem have joined the NFIP and are in full
compliance with their regulatory obligations.

One way to assure good administration and enforcement is to have Certified Floodplain
Managers on staff. The Association of State Floodplain Managers administers the national
Certified Floodplain Manager (CFM) program. Certification involves a three hour exam and a
requirement for continuing education each year. The exam covers the regulatory standards of the
National Flood Insurance Program as well as mapping, administration, enforcement and flood
hazard mitigation.

Minimum NFIP Regulatory Requirements
The NFIP is administered by FEMA. As a condition of making flood insurance available for
their residents, communities that participate in the NFIP agree to regulate new construction in the
area subject to inundation by the 100-year (base) flood. The floodplain subject to these
requirements is shown as an A or V Zone on the Flood Insurance Rate Map (FIRM).

There are five major floodplain regulatory requirements. Additional floodplain regulatory
requirements may be set by state and local laws.

Communities are encouraged to adopt local ordinances that are more comprehensive or provide
more protection than the federal criteria. The NFIP’s Community Rating System provides
insurance premium credits to recognize the additional flood protection benefit of higher
regulatory standards.

CRS Credit
There are many higher regulatory standards that warrant CRS credit. These standards include:

- Delineating a floodway, the area of higher hazard near the channel. This would allow
development outside the floodway (called the “floodplain fringe”) without engineering
studies to determine their impact on others.

- Requiring all new construction to be elevated one or two feet above the base flood
elevation to provide an extra level of protection from waves and higher floods. This extra
protection is reflected in a distinct reduction in flood insurance rates.

- Having all developers (not just the larger ones) provide flood data where none are
available.

- Specifications to protect foundations from erosion, scour and settling.

- Prohibiting critical facilities from all or parts of the floodplain.

- Prohibiting hazardous materials.

- Requiring buffers adjacent to streams or natural areas.
Prevention

- Restrictions on use of enclosures below elevated buildings.
- Flood storage lost due to filling and construction must be compensated for by removal of an equal volume of storage.
- The CRS also provides credit for having trained staff and a higher credit if the staff members are Certified Floodplain Managers.

It should be noted that one of the prerequisites for participation in the CRS is that the community be in full compliance with the minimum requirements of the NFIP. A community with a number of “potential violations” risks being removed from the CRS entirely.

Stormwater Management

Development in floodplains is development in harm’s way. New construction in the floodplain increases the amount of development exposed to damage and can aggravate flooding on neighboring properties.

Development outside a floodplain can also contribute to flooding problems. Stormwater runoff is increased when natural ground cover is replaced by urban development (see graphic). Development in the watershed that drains to a river can aggravate downstream flooding, overload the community’s drainage system, cause erosion, and impair water quality.

There are three ways to prevent flooding problems caused by stormwater runoff:

1. Regulating development in the floodplain to ensure that it will be protected from flooding and that it won’t divert floodwaters onto other properties, and
2. Regulating all development to ensure that the post-development peak runoff will not be greater than it was under pre-development conditions.
3. Set construction standards so buildings are protected from shallow water.

Most communities participate in the NFIP, which sets minimum requirements for regulating development in the floodplain. The State of Som states have more stringent requirements than the NFIP.

Stormwater runoff regulations require developers to build retention or detention basins to minimize the increases in the runoff rate caused by impervious surfaces and new drainage.
Prevention

systems. Generally, each development must not let stormwater leave at a rate higher than what existed under pre-development conditions.

Standards for drainage requirements are typical in subdivision regulations. Standards for storm sewers, ditches, culverts, etc., are best set when an area is laid out and developed. Traditionally, the national standard is to require that the local drainage system carry the 10-year storm. Recently, communities are finding that older estimates of the 10-year storm understated the true hazard, so they are addressing larger storms.

One problem with requiring the drainage system to carry water away is that runoff increases with urban development. The runoff equivalent of a 10-year storm occurs more frequently, and from smaller storms. The problem is just sent downstream onto someone else’s property.

Accordingly, modern subdivision regulations require new developments to ensure that the post-development peak runoff will not be greater than it was under pre-development conditions. This is usually done by constructing retention or detention basins to hold the runoff for a few hours or days, until flows in the system have subsided and the downstream channels can accept the water without flooding.

If the storm sewers or roadside ditches cannot handle a heavy rain, the standard subdivision design uses the streets to carry excess runoff. If the flows exceed the streets’ capacity, adjacent properties will flood. Therefore, the third approach to protecting from stormwater flooding is to make sure new buildings are elevated one or two feet above the street or above adjacent grade.

CRS Credit

CRS credit is provided for both higher regulatory standards in the floodplain and stormwater management standards for new developments. Credit is based on how those standards exceed the minimum NFIP requirements.

Conclusions and Recommendations

1. Installation of new mobile homes should be adequately administered to ensure proper tie downs and flood protection.
2. Ensure that general and land use plans address floodplains and the need to preserve these hazardous areas from intensive development.
3. Standards in subdivision regulations for public facilities should account for the hazards present at the site. New building sites, streets, and water systems should facilitate access and use by fire and emergency equipment.
4. Consider additional opportunities to preserve more open space, especially when new developments are proposed.
5. Maintain the County’s floodplain development and stormwater management regulations so that they meet or exceed minimum national and state standards to prevent flood problems from increasing.
6. The County should consider other higher standards to further protect the residents of Sacramento County.
References

Emergency Services Measures

Emergency Services Measures
Emergency services measures protect people during and after a disaster. A good emergency management program addresses all hazards, and it involves all local government departments. At the state level, emergency services programs are coordinated by the California Emergency Management Agency. Sacramento County emergency services are coordinated through the Sacramento County Office of Emergency Services.

This chapter reviews emergency services measures following a chronological order of responding to an emergency. It starts with identifying an impending problem (threat recognition) and continues through post-disaster activities.

Threat Recognition
The first step in responding to a flood, storm or other natural hazard is knowing when weather conditions are such that an event could occur. With a proper and timely threat recognition system, adequate warnings can be disseminated.

Floods. A flood recognition system predicts the time and height of the flood crest. This can be done by measuring rainfall, soil moisture, and stream flows upstream of the community and calculating the subsequent flood levels.

On larger rivers, this measuring and calculating is performed by the National Weather Service, a part of the U.S. Department of Commerce’s National Oceanic and Atmospheric Administration (NOAA). Support for NOAA’s efforts is provided by cooperating partners from state and local agencies.

Forecasts of expected river stages are made through the Advanced Hydrologic Prediction Service (AHPS) of the National Weather Service. Flood threat predictions are disseminated on the NOAA Weather Wire or NOAA Weather Radio. NOAA Weather Radio is considered by the federal government as the official source for weather information.

On smaller rivers, locally established rainfall and river gauges are needed to establish a flood threat recognition system. The National Weather Service may issue a “flash flood watch.” This is issued to indicate current or developing hydrologic conditions that are favorable for flash flooding in and close to the watch area, but the occurrence is neither certain nor imminent. These events are so localized and so rapid that a “flash flood warning” may not be issued, especially if no remote threat recognition equipment is available. In the absence of a gauging system on small streams, the best threat recognition system is to have local personnel monitor rainfall and stream conditions. While specific flood crests and times will not be predicted, this approach will provide advance notice of potential local or flash flooding.

Severe Weather. The National Weather Service is the primary agency for detecting meteorological threats, such as tornadoes, thunderstorms and winter storms. Severe weather warnings are transmitted through NOAA’s Weather Radio System. As with floods, federal agencies can only look at the large scale, e.g., whether conditions are appropriate for the formation of a thunderstorm. Local emergency managers can provide more site-specific and
Emergency Services Measures

timely recognition by sending out National Weather Service trained spotters to watch the skies when the Weather Service issues a watch or a warning.

Severe snow storms can often be forecast days in advance of the expected event, which allows time for warning and preparation. Though more difficult, the National Weather Service can also forecast ice storms.

Dam Failure. A key part of a dam safety program is for the emergency management office to be in touch with the operators of upstream dams. There should be periodic communication checks and clear criteria for when a dam appears threatened and when the community should notify downstream properties.

CRS Credit.
Credit can be received for using river flood stage predictions for the National Weather Service’s gages. The actual score is based on how much of the community’s floodplain is affected by these systems. A total of 40 points is possible under Activity 610 – Flood Warning Program.

Warning

After the threat recognition system tells the emergency management office that a flood, tornado, thunderstorm or other hazard is coming, the next step is to notify the public and staff of other agencies and critical facilities. The earlier and the more specific the warning, the greater the number of people that can implement protection measures.

The National Weather Service issues notices to the public using two levels of notification:

- **Watch**: conditions are right for flooding, thunderstorms, tornadoes or winter storms.
- **Warning**: a flood, tornado, etc., has started or been observed.

A more specific warning may be disseminated to the public by the community in a variety of ways. The following are the more common methods:

- Commercial or public radio or TV stations
- The Weather Channel
- Cable TV emergency news inserts
- Telephone trees/mass telephone notification
- NOAA Weather Radio
- Tone activated receivers in key facilities
- Outdoor warning sirens
- Sirens on public safety vehicles
- Door-to-door contact
- Mobile public address systems
- Email notifications
Emergency Services Measures

Multiple or redundant systems are most effective – if people do not hear one warning, they may still get the message from another part of the system. Each has advantages and disadvantages:

- Radio and television provide a lot of information, but people have to know when to turn them on. They are most appropriate for hazards that develop over more than a day, such as a tropical storm, hurricane, or winter storm.
- NOAA Weather Radio can provide short messages of any impending weather hazard or emergency and advise people to turn on their televisions for more information, but not everyone has a Weather Radio.
- Outdoor warning sirens can reach many people quickly as long as they are outdoors. They do not reach people in tightly-insulated buildings or those around loud noise, such as at a factory, during a thunderstorm, or in air conditioned homes. They do not explain what hazard is coming, but people should know to turn on a radio or television when they hear the siren.
- Automated telephone notification services are also fast, but can be expensive and do not work when phone lines are down. Nor do they work for unlisted numbers, call screening services, or cellular service, unless people sign up for notifications.
- Where a threat has a longer lead time, going door-to-door and manual telephone trees can be effective.

Just as important as issuing a warning is telling people what to do in case of an emergency. A warning program should have a public information aspect. Citizens should know the difference between a tornado warning (when they should seek shelter in a low spot), a flood warning (when they should stay out of low areas), and other appropriate warnings and responses.

StormReady

The National Weather Service established the StormReady program to help local governments improve the timeliness and effectiveness of hazardous weather related warnings for the public.

To be officially StormReady, a community must:

- Establish a 24-hour warning point and emergency operations center,
- Have more than one way to receive severe weather warnings and forecasts and to alert the public,
- Create a system that monitors weather conditions locally,
- Promote the importance of public readiness through community seminars, and
- Develop a formal hazardous weather plan, which includes training severe weather spotters and holding emergency exercises.
Emergency Services Measures

Being designated a StormReady community by the National Weather Service is a good measure of a community’s emergency warning program for weather hazards. It is also credited by the CRS.

CRS Credit
Community Rating System points are based on the number and types of warning media that can reach the community’s flood prone population. Depending on the location, communities can receive up to 25 points for the telephone calling system and more points if there are additional measures, like telephone trees. Being designated as a StormReady community can provide 25 additional points. These credits are in Activity 610 – Flood Warning Program.

Response

The protection of life and property is the most important task of emergency responders. Concurrent with threat recognition and issuing warnings, a community should respond with actions that can prevent or reduce damage and injuries. Typical actions and responding parties include the following:

- Activating the emergency operations center (emergency preparedness),
- Closing streets or bridges (sheriff or public works),
- Shutting off power to threatened areas (utility company),
- Passing out sand and sandbags (public works),
- Holding children at school/releasing children from school (school superintendent),
- Opening evacuation shelters (the American Red Cross),
- Monitoring water levels (engineering), and
- Establishing security and other protection measures (police/sheriff).

An emergency action plan ensures that all bases are covered and that the response activities are appropriate for the expected threat. These plans are developed in coordination with the agencies or offices that are given the various responsibilities.

Planning is best done with adequate data. One of the best tools is a map that shows which areas would be affected under different conditions. A flood stage forecast map shows areas that will be under water at various flood stages. Different flood levels are shown as color coded areas, so the emergency manager can quickly see what will be affected. Emergency management staff can identify the number of properties flooded, which roads will be under water, which critical facilities will be affected, who to warn, etc. With this information, an advance plan can be prepared that shows problem sites and determines what resources will be needed to respond to the predicted flood level.

Emergency response plans should be updated annually to keep contact names and telephone numbers current and to ensure that supplies and equipment that will be needed are still available. They should be critiqued and revised after disasters and exercises to take advantage of the
Emergency Services Measures

lessons learned and of changing conditions. The end result is a coordinated effort implemented by people who have experience working together so that available resources will be used in the most efficient manner possible.

CRS Credit
Up to 255 points of credit is available for a fully credited flood warning system. Credit is based on a variety of factors and is cumulative, which includes the previous credits mentioned.

Evacuation and Shelter
In an area subject to the tremendous forces that accompany hurricanes, evacuation is a prime life safety concern. Given the one to two days of lead time provided by the National Hurricane Center, evacuation on a large scale is a realistic lifesaving task. In other situations, such as a tornado, it is safer to keep people where they are rather than expose them to danger from an event that gives little warning.

According to Emergency Management: Principles and Practice, "The principle of evacuation is to move citizens from a place of relative danger to a place of relative safety, via a route that does not pose significant danger." There are six key ingredients to a successful evacuation:

- Adequate warning
- Adequate routes
- Proper timing to ensure the routes are clear
- Traffic control
- Knowledgeable travelers
- Care for special populations (e.g., handicapped, prisoners, hospital patients, and schoolchildren)

Those who cannot get out of harm’s way need shelter. Schools often serve as shelters during a storm as well as a place for those who have lost their homes after the storm.

Typically, the American Red Cross will staff a shelter and ensure that there is adequate food, bedding, and wash facilities. Shelter management is a specialized skill. Managers must deal with problems like scared children, families that want to bring their pets in, and the potential for an overcrowded facility.

CRS Credit
Because it is primarily concerned with protecting insurable buildings, the CRS does not provide any special credit for evacuation or sheltering of people. It is assumed that the emergency response plan would include all necessary actions in response to a flood.
Emergency Services Measures

Post-Disaster Recovery and Mitigation
After a disaster, communities should undertake activities to protect public health and safety and facilitate recovery. Appropriate measures include:

- Patrolling evacuated areas to prevent looting,
- Providing safe drinking water,
- Monitoring for diseases,
- Vaccinating residents for tetanus and other diseases,
- Clearing streets, and
- Cleaning up debris and garbage.

Throughout the recovery phase, everyone wants to get “back to normal.” The problem is that “normal” means the way they were before the disaster, exposed to repeated damage from future disasters. There should be an effort to help prepare people and property for the next disaster. Such an effort would include:

- Public information activities to advise residents about mitigation measures they can incorporate into their reconstruction work,
- Evaluating damaged public facilities to identify mitigation measures that can be included during repairs,
- Identifying other mitigation measures that can lessen the impact of the next disaster,
- Acquiring substantially or repeatedly damaged properties from willing sellers,
- Planning for long-term mitigation activities, and
- Applying for post-disaster mitigation funds.

Regulating Reconstruction
Requiring permits for building repairs and conducting inspections are vital activities to ensure that damaged structures are safe for people to reenter and repair. There is a special requirement to do this in floodplains, regardless of the type of disaster or the cause of damage. The NFIP requires that local officials enforce the substantial damage regulations. These rules require that if the cost to repair a building in the mapped floodplain equals or exceeds 50% of the building’s market value, the building must be retrofitted to meet the standards of a new building in the floodplain. In most cases, this means that a substantially damaged building must be elevated above the base flood elevation.
Emergency Services Measures

This requirement can be very difficult for understaffed and overworked offices following a disaster. However, if these activities are not carried out properly, not only does the community miss a tremendous opportunity to redevelop or clean up a hazardous area, it may be violating its obligations under the NFIP. The sanctions for failure to properly enforce the floodplain reconstruction regulations are spelled out in Chapter 5 – Preventive Measures. In some areas, mutual aid agreements have been established so building inspectors from a community not affected by the disaster can work in the communities that were hit the hardest.

CRS Credit
Sacramento County should formally establish post-disaster mitigation policies outlined in this Plan in the section above.

Conclusions and Recommendations

1. There are several threat recognition systems that can provide the County with advance notice of an impending emergency.
2. Stream and river gauges can help to protect residents in the County.
3. The Sacramento County Emergency Operations Plan contains general guidance on responding to many different kinds of hazards. There are additional documents, such as annexes and checklists that provide specific guidance for responding to individual natural hazards. Such guidance could be very helpful when things happen quickly and for hazards that have predictable impacts, such as tropical storms and flooding. The Sacramento County Emergency Operations Plan should be reviewed in detail to determine where improvements can be made and how to maximize credit under CRS.
4. The County’s plans and guidance documents on post-disaster inspections and capitalizing on post-disaster mitigation opportunities should be reviewed and updated. Current procedures should adequately ensure that the County’s obligations to the NFIP will be met.
5. The County should consider all possible local, state and federal funding options for installation of additional stream and river gauges to provide a higher level of protection to its residents.
6. The County should ensure that all steps are being taken to alleviate traffic jams during an evacuation of the county.
7. The County’s emergency preparedness, public information, and permits staffs should work together to develop post-disaster procedures for public information, reconstruction regulation and mitigation project identification.

References

2. CRS Credit for Flood Warning Programs, FEMA, 2006.
Emergency Services Measures


Property Protection Measures

Property Protection Measures
Property protection measures are used to modify buildings or property subject to damage. Property protection measures fall under three approaches:

- Modify the site to keep the hazard from reaching the building.
- Modify the building so it can withstand the impacts of the hazard, and
- Insure the property to provide financial relief after the damage occurs.

Property protection measures are normally implemented by the property owner, although in many cases technical and financial assistance can be provided by a government agency. These are discussed later in this chapter.

Keeping the Hazard Away

Generally, natural hazards do not damage vacant areas. As noted earlier, the major impact of hazards is to people and improved property. In some cases, properties can be modified so the hazard does not reach the damage-prone improvements. For example, a berm can be built to prevent floodwaters from reaching a house.

Flooding

There are five common methods to keep a flood from reaching and damaging a building:

1. Erect a barrier between the building and the source of the flooding.
2. Move the building out of the flood prone area.
3. Elevate the building above the flood level.
4. Demolish the building.
5. Replace the building with a new one that is elevated above the flood level.

Barriers

A flood protection barrier can be built of dirt or soil (a “berm”) or concrete or steel (a “floodwall”). Careful design is needed so as not to create flooding or drainage problems on neighboring properties. Depending on how porous the ground is, if floodwaters will stay up for more than an hour or two, the design needs to account for leaks, seepage of water underneath, and rainwater that will fall.
Property Protection Measures

inside the perimeter. This is usually done with a sump or drain to collect the internal groundwater and surface water and a pump and pipe to pump the internal drainage over the barrier.

Barriers can only be built so high. They can be overtopped by a flood higher than expected. Barriers made of earth are susceptible to erosion from rain and floodwaters if not properly sloped, covered with grass, and properly maintained. A berm can also settle over time, lowering its protection level. A floodwall can crack, weaken, and lose its watertight seal. Therefore, barriers need careful design and maintenance (and insurance on the building, in case of failure).

Relocation
Moving a building to higher ground is the surest and safest way to protect it from flooding. While almost any building can be moved, the cost increases for heavier structures, such as those with exterior brick and stone walls, and for large or irregularly shaped buildings. However, experienced building movers can handle any job.

In areas subject to flash flooding, deep waters, or other high hazard, relocation is often the only safe approach. Relocation is also preferred for large lots that include buildable areas outside the floodplain or where the owner has a new flood-free lot (or portion of the existing lot) available.

Building Elevation
Raising a building above the flood level can be almost as effective as moving it out of the floodplain. Water flows under the building, causing little or no damage to the structure or its contents.

Raising a building above the flood level is cheaper than moving it and can be less disruptive to a neighborhood. Elevation has proven to be an acceptable and reasonable means of complying with floodplain regulations that require new, substantially improved, and substantially damaged buildings to be elevated above the base flood elevation.

One concern with elevation is that it may expose the structure to greater impacts from other hazards. If not braced and anchored properly, an elevated building may have less resistance to the shaking of an earthquake and the pressures of high winds.
Property Protection Measures

Demolition
Some buildings, especially heavily damaged or repetitively flooded ones, are not worth the expense to protect them from future damages. It is cheaper to demolish them and either replace them with new, flood protected structures ("pilot reconstruction"), or relocate the occupants to a safer site. Demolition is also appropriate for buildings that are difficult to move – such as larger, slab foundation or masonry structures – and for dilapidated structures that are not worth protecting. Generally, demolition projects are undertaken by a government agency, so the cost is not borne by the property owner, and the land is converted to public open space use, like a park.

One problem that sometimes results from an acquisition and demolition project is a “checkerboard” pattern in which nonadjacent properties are acquired. This can occur when some owners, especially those who have and prefer a waterfront location, are reluctant to leave their homes. Creating such an acquisition pattern in a community simply adds to the maintenance costs that taxpayers must support.

Pilot Reconstruction
If a building is not in good shape, elevating it may not be worthwhile or it may even be dangerous. An alternative is to demolish the structure and build a new one on the site that meets or exceeds all flood and wind protection codes. This was formerly known as “demo/rebuild.” FEMA funding programs refer to this approach as “pilot reconstruction.” It is still a pilot program, and not a regularly funded option.

Certain rules must be followed to qualify for federal funds for pilot reconstruction:

- Pilot reconstruction is only possible after it has been shown that acquisition or elevation are not feasible, based on the program’s criteria.
- Funds are only available to people who owned the property at the time of the event for which funding is authorized.
- It must be demonstrated that the benefits exceed the costs.
- The new building must be elevated to the advisory base flood elevation.
- The new building must not exceed more than 10% of the old building’s square footage.
- The new building must meet all flood and wind protection codes.
- There must be a deed restriction that states the owner will buy and keep a flood insurance policy.
Property Protection Measures

- The maximum federal grant is 75% of the cost, up to $150,000. FEMA is developing a detailed list of eligible costs to ensure that disaster funds are not used to upgrade homes.

CRS Credit
The CRS provides the most credit points for acquisition and relocation, because this measure permanently removes insurable buildings from the floodplain. Under Activity 520 – Acquisition and relocation, Sacramento County could receive up to 100 points for Option 2.

The CRS credits barriers and elevating existing buildings (Activity 530 – Flood Protection). Elevating a building above the flood level will also reduce the flood insurance premiums on that individual building. A CRS score of up to 84 points is possible. Because barriers are less secure than elevation, not as many points are provided.

Higher scores are possible, but they are based on the number of buildings removed compared to the number remaining in the floodplain.

Retrofitting
An alternative to keeping the hazard away from a building is to modify or retrofit the site or building to minimize or prevent damage. There are a variety of techniques to do this, as described below.

Dry Floodproofing
Dry floodproofing entails making all areas below the flood protection level watertight. Walls are coated with waterproofing compounds or plastic sheeting. Openings, such as doors, windows and vents, are closed, either permanently, with removable shields, or with sandbags. Dry floodproofing of new and existing nonresidential buildings in the regulatory floodplain is permitted under state, FEMA and local regulations. Dry floodproofing of existing residential buildings in the floodplain is also permitted as long as the building is not substantially damaged or being substantially improved. Owners of buildings located outside the regulatory floodplain can always use dry floodproofing techniques.

Dry floodproofing is only effective for shallow flooding, such as repetitive drainage problems. It does not protect from the deep flooding along lakes and larger rivers caused by hurricanes or other storms.

Figure 2: Dry Floodproofing
Property Protection Measures

Wet Floodproofing
The alternative to dry floodproofing is wet floodproofing: water is let in and everything that could be damaged by a flood is removed or elevated above the flood level. Structural components below the flood level are replaced with materials that are not subject to water damage. This is the approach used for the first floor of the elevated homes described in the previous section.

For example, concrete block walls are used instead of wooden studs and gypsum wallboard. The furnace, water heater and laundry facilities are permanently relocated to a higher floor. Where the flooding is not deep, these appliances can be raised on blocks or platforms. This practice is not generally used where most structures are slab on grade.

CRS Credit
Credit for dry and wet floodproofing is provided under Activity 530 – Retrofitting. Because these property protection measures are less secure than barriers and elevation, not as many points are provided.

Insurance
Technically, insurance does not mitigate damage caused by a natural hazard. However, it does help the owner repair, rebuild, and hopefully afford to incorporate some of the other property protection measures in the process. Insurance offers the advantage of protecting the property, as long as the policy is in force, without human intervention for the measure to work.

Private Property
Although most homeowner’s insurance policies do not cover a property for flood damage, an owner can insure a building for damage by surface flooding through the NFIP. Flood insurance coverage is provided for buildings and their contents damaged by a “general condition of surface flooding” in the area.

Most people purchase flood insurance because it is required by the bank when they get a mortgage or home improvement loan. Usually these policies just cover the building’s structure and not the contents. Renters can buy contents coverage, even if the owner does not buy structural coverage on the building.

<table>
<thead>
<tr>
<th>Figure 3: Example Flood Insurance Premiums</th>
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<tbody>
<tr>
<td>Building Exposure</td>
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<tr>
<td>In the Special Flood Hazard Area (AE Zone)</td>
</tr>
<tr>
<td>Pre-FIRM (&quot;subsidized&quot;) rate</td>
</tr>
<tr>
<td>Post-FIRM (actuarial) rates</td>
</tr>
<tr>
<td>2 feet above the base flood elevation</td>
</tr>
<tr>
<td>1 foot above the base flood elevation</td>
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<tr>
<td>At the base flood elevation</td>
</tr>
<tr>
<td>1 foot below the base flood elevation</td>
</tr>
<tr>
<td>Outside the Special Flood Hazard Area</td>
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</tbody>
</table>

Premiums are for $150,000 in building coverage and $75,000 in contents coverage for a one-story house with no basement and a $500 deductible, using the October 2008 Flood Insurance Manual. Premiums include the 6% Community Rating System discount. Premiums are higher for local governments that do not participate in the CRS.
Property Protection Measures

Public Property
Governments can purchase commercial insurance policies. Larger local governments often self-insure and absorb the cost of damage to one facility, but if many properties are exposed to damage, self-insurance can drain the government’s budget. Communities cannot expect federal disaster assistance to make up the difference after a flood.

Under Section 406(d) of the Stafford Act:

“If an eligible insurable facility damaged by flooding is located in a [mapped floodplain] … and the facility is not covered (or is underinsured) by flood insurance on the date of such flooding, FEMA is required to reduce Federal disaster assistance by the maximum amount of insurance proceeds that would have been received had the buildings and contents been fully covered under a National Flood Insurance Program (NFIP) standard flood insurance policy. [Generally, the maximum amount of proceeds for a non-residential property is $500,000.]

[Communities] Need to:

- Identify all insurable facilities, and the type and amount of coverage (including deductibles and policy limits) for each. The anticipated insurance proceeds will be deducted from the total eligible damages to the facilities.
- Identify all facilities that have previously received Federal disaster assistance for which insurance was required. Determine if insurance has been maintained. A failure to maintain the required insurance for the hazard that caused the disaster will render ineligible for Public Assistance funding...
- [Communities] must obtain and maintain insurance to cover [their] facility — buildings, equipment, contents and vehicles — for the hazard that caused the damage in order to receive Public Assistance funding. Such coverage must, at a minimum, be in the amount of the eligible project costs. FEMA will not provide assistance for that facility in future disasters if the requirement to purchase insurance is not met. — FEMA Response and Recovery Directorate Policy No. 9580.3, August 23, 2000

In other words, the law expects public agencies to be fully insured as a condition of receiving federal disaster assistance.

CRS Credit
There is no credit for purchasing flood insurance, but the CRS does provide credit for local public information programs that explain flood insurance to property owners. The CRS also reduces the premiums for those people who do buy NFIP coverage.
Property Protection Measures

The Government’s Role

Property protection measures are usually considered the responsibility of the property owner. However, local governments should be involved in all strategies that can reduce flood losses, especially acquisition and conversion of a site to public open space. There are various roles the County or a municipality can play in encouraging and supporting implementation of these measures.

Government Facilities

One of the first duties of a local government is to protect its own facilities. Fire stations, water treatment plants and other critical facilities should be a high priority for retrofitting projects and insurance coverage. Often public agencies discover after the disaster that their “all-hazard” insurance policies do not cover the property for the type of damage incurred. Flood insurance is even more important as a mitigation measure because of the Stafford Act provisions discussed above.

Public Information

Providing basic information to property owners is the first step in supporting property protection measures. Owners need general information on what can be done. They need to see examples, preferably from nearby. Public information activities that can promote and support property protection are covered in Chapter 9.

Financial Assistance

Communities can help owners by helping to pay for a retrofitting project. Financial assistance can range from full funding of a project to helping residents find money from other programs. Some communities assume responsibility for sewer backups, street flooding, and other problems that arise from an inadequate public sewer or public drainage system. Less expensive community programs include low interest loans, forgivable low interest loans and rebates. A forgivable loan is one that does not need to be repaid if the owner does not sell the house for a specified period, such as five years. These approaches don’t fully fund the project, but they cost the community less and they increase the owner’s commitment to the flood protection project. Often, small amounts of money act as a catalyst to pique the owner’s interest to get a self-protection project moving.

The more common outside funding sources are listed below. Unfortunately, the last three are only available after a disaster, not before, when damage could be prevented. Following past disaster declarations, FEMA and the California Emergency Management Agency have provided advice on how to qualify and apply for these funds.

Pre-disaster funding sources:

- FEMA’s Pre-Disaster Mitigation (PDM) grants
Property Protection Measures

- FEMA’s Flood Mitigation Assistance (FMA) grants
- Community Development Block Grants
- Conservation organizations, although generally these organizations prefer to purchase vacant land in natural areas, not properties with buildings on them.

Post-disaster funding sources:
- Insurance claims
- The NFIP’s Increased Cost of Compliance (ICC). This provision increases a flood insurance claim payment to help pay for a flood protection project required by code as a condition to rebuild the flooded building. It can also be used to help pay the non-federal cost-share of an elevation project.

Post-disaster funding sources, federal disaster declaration needed:
- FEMA’s disaster assistance (for public properties). However, the amount of assistance will be reduced by the amount of flood insurance that the public agency should be carrying on the property.
- Small Business Administration disaster loans (for non-governmental properties)
- FEMA’s Hazard Mitigation Grant Program

Acquisition Agent

The community can be the focal point in an acquisition project. Most funding programs require a local public agency to sponsor the project. The local government could process the funding application, work with the owners, and provide some, or all, of the local share. In some cases, the local government would be the ultimate owner of the property, but in other cases another public agency could assume ownership and the attendant maintenance responsibilities.

Mandates

Mandates are considered a last resort if information and incentives are insufficient to convince a property owner to take protective actions. An example of a retrofitting mandate is the requirement that communities have to disconnect downspouts from the sanitary sewer line.

There is a mandate for improvements or repairs made to a building in the mapped floodplain. If the project equals or exceeds 50% of the value of the original building, it is considered a “substantial improvement.” The building must then be elevated or otherwise brought up to current flood protection codes.

Another possible mandate is to require less expensive hazard protection steps as a condition of a building permit. For example, many communities require upgraded electrical service as a
Property Protection Measures

condition of a home improvement project. If a person were to apply for a permit for electrical work, the community could require that the service box be moved above the base flood elevation or the installation of a separate ground fault interrupter circuits in the basement.

CRS Credit
Except for public information programs, the CRS does not provide credit for efforts to fund, provide incentives, or mandate property protection measures. CRS credits are provided for the actual projects after they are completed. However, to participate in CRS, a community must certify that it has adequate flood insurance on all properties that have been required to be insured. The minimum requirement is to insure those properties in the mapped floodplain that have received federal aid.

Repetitive Loss Properties
Chapter 4 explains the criteria for designation of the County’s repetitive loss areas. These properties deserve special attention because they are more prone to damage by natural hazards than any other properties in the County. Further, protecting repetitive loss buildings is a priority with FEMA and California Emergency Management Agency mitigation funding programs.

Conclusions and Recommendations
1. There are several ways to protect individual properties from damage by natural hazards. The advantages and disadvantages of each should be examined for each situation.
2. Property owners can implement some property protection measures at little cost, especially for sites in areas of low hazards (e.g., shallow flooding, sewer backup, and thunderstorms). For other measures, such as relocation and elevation, the owners may need financial assistance.
3. Local government agencies can promote and support property protection measures through several activities, ranging from public information, insurance and financial incentives to full funding.
4. Government properties, including critical facilities, should be evaluated to determine whether they have any special measures to protect them from flooding.
5. Property protection measures can protect the most damage-prone buildings in the County repetitive loss properties.
6. Because properties in floodplains will be damaged at some point, a special effort should be made to provide information and advice to floodplain property owners. Special attention should be given to repetitive loss and high hazard areas.
7. All property protection projects should be voluntary. Other than state and federally mandated regulations, local incentives should be positive as much as possible, such as providing financial assistance.
8. A standard checklist should be developed to evaluate a property’s exposure to damage from floods. It should include a review of insurance coverage and identify where more information
Property Protection Measures

can be found on appropriate property protection measures. The checklist should be provided to each agency participating in this planning process and made available to the public. Sacramento County should evaluate its own properties using the standard checklist. A priority should be placed on determining critical facilities’ vulnerability to damage and whether public properties are adequately insured.

9. Sacramento County should protect its own publicly owned facilities with appropriate mitigation measures.

10. The County should seek state and federal funding support for higher cost measures, such as elevation, relocation and acquisition of high priority properties. High priority properties are:

   - Those properties in repetitive loss areas.
   - Critical facilities in the floodway or subject to flood depths of more than two feet.

References


Natural Resource Protection

Natural Resource Protection
Resource protection activities are generally aimed at preserving (or in some cases restoring) natural areas. These activities enable the naturally beneficial functions of fields, floodplains, wetlands, and other natural lands to operate more effectively. Natural and beneficial functions of watersheds, floodplains and wetlands include:

- Reduction in runoff from rainwater and snow melt in pervious areas
- Infiltration that absorbs overland flood flow
- Removal and filtering of excess nutrients, pollutants and sediments
- Storage of floodwaters
- Absorption of flood energy and reduction in flood scour
- Water quality improvement
- Groundwater recharge
- Habitat for flora and fauna
- Recreational and aesthetic opportunities

As development occurs, many of the above benefits can be achieved through regulatory steps for protecting natural areas or natural functions. The regulatory programs are discussed in Chapter 5 – Preventive Measures. This chapter covers the resource protection programs and standards that can help mitigate the impact of natural hazards, while they improve the overall environment. Seven areas are reviewed:

- Wetland protection
- Erosion and sedimentation control
- River restoration
- Best management practices
- Dumpying regulations
- Urban forestry
- Farmland protection

Wetland Protection

Wetlands are often found in floodplains and depressional areas of a watershed. Many wetlands receive and store floodwaters, thus slowing and reducing downstream flows. They also serve as a natural filter, which helps to improve water quality, and they provide habitat for many species of fish, wildlife and plants.

Wetlands that are determined to be part of the waters of the United States are regulated by the U.S. Army Corps of Engineers and the U.S. Environmental Protection Agency (US EPA) under
Natural Resource Protection

Section 404 of the Clean Water Act. Before a “404” permit is issued, the plans are reviewed by several agencies, including the Corps and the U.S. Fish and Wildlife Service. Each of these agencies must sign off on individual permits.

There are also nationwide permits that allow small projects that meet certain criteria to proceed without individual permits. Wetlands not included in the Corps’ jurisdiction or that are addressed by a nationwide permit may be regulated against by local authorities.

If a permit is issued by the Corps or the County, the impact of the development is typically required to be mitigated. Wetland mitigation can include creation, restoration, enhancement or preservation of wetlands elsewhere. Wetland mitigation is often accomplished within the development site, however, mitigation is allowed off-site and sometimes in another watershed. The appropriate type of mitigation is addressed in each permit.

Some developers and government agencies have accomplished the required mitigation by buying into a wetland bank. Wetland banks are large wetlands created for the purpose of mitigation. The banks accept money to reimburse the owner for setting the land aside from development.

When a wetland is mitigated at a separate site there are drawbacks to consider. First, it takes many years for a new wetland to approach the same quality as an existing one. Second, a new wetland in a different location (especially if it is in a different watershed) will not have the same flood damage reduction benefits as the original one did.

CRS Credit

CRS focuses on activities that directly affect flood damage to insurable buildings. While there is no credit for relying on the Corps of Engineers’ 404 regulations, there is credit for preserving open space in its natural condition or restored to a state approximating its natural condition. The credit is based on the percentage of the floodplain that can be documented as wetlands protected from development by ownership or local regulations.

Erosion and Sedimentation Control

Farmlands and construction sites typically contain large areas of bare exposed soil. Surface water runoff can erode soil from these sites, sending sediment into downstream waterways. Erosion also occurs along streambanks and shorelines as the volume and velocity of flow or wave action destabilize and wash away the soil.

Sediment suspended in the water tends to settle out where flowing water slows down. This can clog storm drains, drain tiles, culverts and ditches and reduce the water transport and storage capacity of river and stream channels, lakes and wetlands. When channels are constricted and flooding cannot deposit sediment in the bottomlands, even more sediment is left in the channels. The result is either clogged streams or increased dredging costs.

Not only are the drainage channels less able to perform their job, but the sediment in the water reduces light,
Natural Resource Protection

oxygen and water quality, and often carries chemicals, heavy metals and other pollutants. Sediment has been identified by the US EPA as the nation’s number one nonpoint source pollutant for aquatic life.

There are two principal strategies to address these problems: minimize erosion and control sedimentation. Techniques to minimize erosion include phased construction, minimal land clearing, and stabilizing bare ground as soon as possible with vegetation and other soil stabilizing practices.

If erosion occurs, other measures are used to capture sediment before it leaves the site. Silt fences, sediment traps and vegetated filter strips are commonly used to control sediment transport. Runoff from the site can be slowed down by terraces, contour strip farming, no-till farm practices, hay or straw bales, constructed wetlands, and impoundments (e.g., sediment basins and farm ponds). Slowing surface water runoff on the way to a drainage channel increases infiltration into the soil and reduces the volume of topsoil eroded from the site.

Erosion and sedimentation control regulations mandate that these types of practices be incorporated into construction plans. They are usually oriented toward construction sites rather than farms. The most common approach is to require applicants for permits to submit an erosion and sediment control plan for the construction project. This allows the applicant to determine the best practices for the site.

CRS Credit

Implementation of erosion and sedimentation control provisions qualify for CRS points.

River Restoration

There is a growing movement that has several names, such as “stream conservation,” “bioengineering,” or “riparian corridor restoration.” The objective of these approaches is to return streams, streambanks and adjacent land to a more natural condition, including the natural meanders. Another term is “ecological restoration,” which restores native indigenous plants and animals to an area.

A key component of these efforts is to use appropriate native plantings along the banks that resist erosion. This may involve retrofitting the shoreline with willow cuttings, wetland plants, or rolls of landscape material covered with a natural fabric that decomposes after the banks are stabilized with plant roots.

In all, restoring the right vegetation to a stream has the following advantages:

- Reduces the amount of sediment and pollutants entering the water
- Enhances aquatic habitat by cooling water temperature
- Provides food and shelter for both aquatic and terrestrial wildlife
- Can reduce flood damage by slowing the velocity of water
- Increases the beauty of the land and its property value
- Prevents property loss due to erosion
Natural Resource Protection

- Provides recreational opportunities, such as hunting, fishing and bird watching
- Reduces long-term maintenance costs

The last bullet deserves special attention. Studies have shown that after establishing the right vegetation, long-term maintenance costs are lower than if the banks were concrete. The Natural Resources Conservation Service estimates that over a ten-year period, the combined costs of installation and maintenance of a natural landscape may be one-fifth of the cost for conventional landscape maintenance, e.g., mowing turf grass.

Figure 2: Aquatic and Riparian Buffer Plant Zones

Different types of plants are used in different buffer zones along a channel. Zone 1 plants are normally submerged while zone 2 plants are inundated during much of the growing season. Zone 3 plants are water tolerant, but are flooded only during high water. By using the proper plants in each zone, they stabilize streambanks, filter polluted runoff, and provide habitat. Source: Banks and Buffers – A Guide to Selecting Native Plants for Streambanks and Shorelines, Tennessee Valley Authority.

CRS Credit

The Community Rating System focuses on activities that directly affect flood damage to insurable buildings. However, there are credits for preserving open space in its natural condition or restored to a state approximating its natural condition. There are also credits for channel setbacks, buffers and protecting shorelines.
Natural Resource Protection

Best Management Practices

Point source pollutants come from pipes such as the outfall of a municipal wastewater treatment plant. They are regulated by the US EPA and the California Environmental Protection Agency. Nonpoint source pollutants come from non-specific locations and are harder to regulate. Examples of nonpoint source pollutants are lawn fertilizers, pesticides, other chemicals, animal wastes, oils from street surfaces and industrial areas, and sediment from agriculture, construction, mining and forestry. These pollutants are washed off the ground's surface by stormwater and flushed into receiving storm sewers, ditches and streams.

The term “best management practices” (BMPs) refers to design, construction and maintenance practices and criteria that minimize the impact of stormwater runoff rates and volumes, prevent erosion, protect natural resources and capture nonpoint source pollutants (including sediment). They can prevent increases in downstream flooding by attenuating runoff and enhancing infiltration of stormwater. They also minimize water quality degradation, preserve beneficial natural features onsite, maintain natural base flows, minimize habitat loss, and provide multiple usages of drainage and storage facilities.

CRS Credit

Under Activity 450 – Stormwater Management, credit is given for both water quality and water quantity. Water quality credit under activity is given to a community who implements best management practices.
Natural Resource Protection

Figure 3: BMPs and Stormwater

Dumping Regulations

BMPs usually address pollutants that are liquids or are suspended in water that are washed into a lake or stream. Dumping regulations address solid matter, such as shopping carts, appliances and landscape waste that can be accidentally or intentionally thrown into channels or wetlands. Such materials may not pollute the water, but they can obstruct even low flows and reduce the channels’ and wetlands’ abilities to convey or clean stormwater.

Many cities have nuisance ordinances that prohibit dumping garbage or other “objectionable waste” on public or private property. Waterway dumping regulations need to also apply to “nonobjectionable” materials, such as grass clippings or tree branches, which can kill ground cover or cause obstructions in channels. Regular inspections to catch violations should be scheduled.

Many people do not realize the consequences of their actions. They may, for example, fill in the ditch in their front yard without realizing that is needed to drain street runoff. They may not understand how regards their yard, filling a wetland, or discarding leaves or branches in a watercourse can cause a problem to themselves and others. Therefore, a dumping enforcement program should include public information materials that explain the reasons for the rules as well as the penalties.
Natural Resource Protection

CRS Credit
The CRS provides up to 30 points for enforcing and publicizing a regulation that prohibits dumping in the drainage system.

Farmland Protection
Farmland protection is quickly becoming an important piece of comprehensive planning and zoning throughout the United States. The purpose of farmland protection is to provide mechanisms for prime, unique, or important agricultural land to remain as such, and to be protected from conversion to nonagricultural uses.

Frequently, farm owners sell their land to residential or commercial developers and the property is converted to non-agricultural land uses. With development comes more buildings, roads and other infrastructure. Urban sprawl occurs, which can create additional stormwater runoff and emergency management difficulties.

Farms on the edge of cities are often appraised based on the price they could be sold for to urban developers. This may drive farmers to sell to developers because their marginal farm operations cannot afford to be taxed as urban land. The Farmland Protection Program in the United States Department of Agriculture’s 2002 Farm Bill (Part 519) allows for funds to go to state, tribal, and local governments as well as nonprofit organizations to help purchase easements on agricultural land to protect against the development of the land. Eligible land includes cropland, rangeland, grassland, pastureland, or forest land that is part of an agricultural operation. Certain lands within historical or archaeological resources are also included.

The hazard mitigation benefits of farmland protection are similar to those of open space preservation, as discussed in Chapter 5 – Preventive Measures:

- Farmland is preserved for future generations,
- Farmland in the floodplain keeps damageable structures out of harm’s way,
- Farmland keeps more stormwater on site and lets less stormwater runoff downstream,
- Rural economic stability and development is sustained,
- Ecosystems are maintain, restored or enhanced, and
- The rural character and scenic beauty of the area is maintained.

CRS Credit
Credit is given for preserving open space in the floodplain, regardless of why it is being preserved. Credit is also provided for density zoning of flood prone areas. Agricultural zones that require minimum 10- or 20-acre lots would qualify.
Natural Resource Protection

Conclusions and Recommendations

1. A hazard mitigation program can use resource protection programs to support protecting areas and natural features that can mitigate the impacts of natural hazards.
2. Preserving farmland in the floodplain will prevent damage to homes, businesses, and other development.
3. Sacramento County should continue to enforce wetland protection, erosion and sediment control and BMP standards.
4. The public and decision makers should be informed about the hazard mitigation benefits of restoring rivers, wetlands and other natural areas. Restoration and protection techniques should be explained.
5. County should widely publicize its illicit discharge rules.
6. The public should be informed about the need to protect streams and wetlands from dumping and inappropriate development along with the relevant codes and regulations.

References

**Structural Project Measures**

**Structural Project Measures**
Flood control projects have traditionally been used by communities to control or manage floodwaters. They are also known as “structural” projects that keep flood waters away from an area as opposed to “non-structural” projects, like retrofitting, that do not rely on structures to control flows.

**Flood Control Measures**

Four general types of flood control projects are reviewed here: levees, reservoirs, diversions, and dredging. These projects have three advantages not provided by other mitigation measures:

- They can stop most flooding, protecting streets and landscaping in addition to buildings,
- Many projects can be built without disrupting citizens’ homes and businesses, and
- They are constructed and maintained by a government agency, a more dependable long-term management arrangement than depending on many individual private property owners.

However, as shown below, structural measures also have shortcomings. The appropriateness of using flood control depends on individual project area circumstances.

<table>
<thead>
<tr>
<th>Pros and Cons of Structural Flood Control Projects</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Advantages</strong></td>
<td><strong>Disadvantages</strong></td>
</tr>
<tr>
<td>They may provide the greatest amount of protection for land area used.</td>
<td>They can disturb the land and disrupt the natural water flows, often destroying wildlife habitat.</td>
</tr>
<tr>
<td>Because of land limitations, they may be the only practical solution in some circumstances.</td>
<td>They require regular maintenance, which if neglected can have disastrous consequences.</td>
</tr>
<tr>
<td>They can incorporate other benefits into structural project design, such as water supply and recreational uses.</td>
<td>They are built to a certain flood protection level that can be exceeded by larger floods, causing extensive damage.</td>
</tr>
<tr>
<td>Regional detention may be more cost-efficient and effective than requiring numerous small detention basins.</td>
<td>They can create a false sense of security, as people protected by a project often believe no flood can ever reach them.</td>
</tr>
<tr>
<td></td>
<td>Although it may be unintended, in many circumstances they promote more intensive land use and development in the floodplain.</td>
</tr>
</tbody>
</table>
Structural Project Measures

Levees and Floodwalls

Probably the best known flood control measure is a barrier of earth (levee) or concrete (floodwall) erected between the watercourse and the property to be protected. Levees and floodwalls confine water to the stream channel by raising its banks. They must be well designed to account for large floods, underground seepage, pumping of internal drainage, and erosion and scour. Key considerations when evaluating the use of a levee include:

- Design and permitting costs,
- Right of way acquisition,
- Removal of fill to compensate for the floodwater storage that will be displaced by the levee,
- Internal drainage of surface flows from the area inside the levee,
- Cost of construction,
- Cost of maintenance,
- Mitigation of adverse impacts to wetlands and other habitats,
- Loss of river access and views; and
- Creating a false sense of security, because while levees may reduce flood damage for smaller more frequent rain events, they may also overtop or breach in extreme flood events and subsequently create more flood damage than would have occurred without the levee.

Levees placed along the river or stream edge degrade the aquatic habitat and water quality of the stream. They also are more likely to push floodwater onto other properties upstream or downstream. To reduce environmental impacts and provide multiple use benefits, a setback levee is the best project design. The area inside a setback levee can provide open space for recreational purposes and provide access sites to the river or stream.

Floodwalls perform like levees except they are vertical-sided structures that require less surface area for construction. Floodwalls are constructed of steel sheet pile or reinforced concrete, which makes the expense of installation cost prohibitive in many circumstances. Floodwalls also degrade adjacent habitat and can displace erosive energy to unprotected areas of shoreline downstream.

Sea walls are barriers or retaining walls that are built facing a large lake, ocean or the Gulf of Mexico. They are intended to protect the land from erosion by wave action. However, they often have an adverse impact on the shore and on neighboring properties and the movement of sand. The natural forces that transport sand and replenish beaches are disrupted by the wall, often
Structural Project Measures

increasing shoreline erosion on adjacent properties. Therefore, they are not encouraged and are even prohibited in many areas.

Reservoirs and Detention
Reservoirs reduce flooding by temporarily storing flood waters behind dams or in storage or detention basins. Reservoirs lower flood heights by holding back, or detaining, runoff before it can flow downstream. Flood waters are detained until the flood has subsided, then the water in the reservoir or detention basin is released or pumped out slowly at a rate that the river can accommodate downstream.

Reservoirs can be dry and remain idle until a large rain event occurs. Or they may be designed so that a lake or pond is created. The lake may provide recreational benefits or water supply (which could also help mitigate a drought).

Flood control reservoirs are most commonly built for one of two purposes. Large reservoirs are constructed to protect property from existing flood problems. Smaller reservoirs, or detention basins, are built to protect property from the stormwater runoff impacts of new development.

Regardless of size, reservoirs protect the development that is downstream from the reservoir site. Unlike levees and channel modifications, they do not have to be built close to or disrupt the area to be protected. Reservoirs are most efficient in deeper valleys where there is more room to store water, or on smaller rivers where there is less water to be stored.

In urban areas, some reservoirs are simply manmade holes, excavated to store floodwaters. Reservoirs in urban areas are typically constructed adjacent to streams (though usually outside of the floodplain). When built in the ground, there is no dam for these retention and detention basins and no dam failure hazard. Wet or dry basins can also serve multiple uses by doubling as parks or other open space uses.

There are several considerations when evaluating use of reservoirs and detention:

- There is the threat of flooding the protected area should the reservoir’s dam fail,
- There is a constant expense for management and maintenance of the facility,
- They may fail to prevent floods that exceed their design levels,
- Sediment deposition may occur and reduce the storage capacity over time,
- They can impact water quality as they are known to affect temperature, dissolved oxygen and nitrogen, and nutrient levels, and
- If not designed correctly, in-stream reservoirs may cause backwater flooding problems upstream.
Structural Project Measures

Diversion
A diversion is a new channel that sends floodwaters to a different location, thereby reducing flooding along an existing watercourse. Diversions can be surface channels, overflow weirs, or tunnels. During normal flows, the water stays in the old channel. During floods, the floodwaters spill over to the diversion channel or tunnel, which carries the excess water to a receiving lake or river.

Diversions are limited by topography; they will not work in some areas. Unless the receiving water body is relatively close to the flood prone stream and the land in between is low and vacant, the cost of creating a diversion can be prohibitive.

Dredging
Dredging is often viewed as a form of conveyance improvement. However, it has the following problems:

- Given the large volume of water that comes downstream during a flood, removing a foot or two from the bottom of the channel will have little effect on flood heights.
- Dredging is often cost prohibitive because the dredged material must be disposed of somewhere.
- Unless in-stream or tributary erosion are corrected upstream, the dredged areas usually fill back in within a few years, and the process and the expense have to be repeated.
- If the channel has not been disturbed for many years, dredging will destroy the habitat that has developed.

To protect the natural values of the stream, federal law requires a U.S. Army Corps of Engineers permit before dredging can proceed. This can be a lengthy process that requires a lot of advance planning and many safeguards to protect habitats, which adds to the cost of the project.

Channelization
Channelization has traditionally been the common method for dealing with local drainage or flooding problems. Channelization involves straightening, deepening and/or widening a stream or river channel. With this approach, there are several concerns to keep in mind:

- Channelized streams can create or worsen flood problems downstream as larger amounts of water are transported at a faster rate.
Structural Project Measures

- Channelized streams rise and fall faster. During dry periods the water level in the channel is lower than it should be which creates water quality problems and degrades habitat.
- Channelized waterways tend to be unstable and experience more erosion. The need for periodic reconstruction and silt removal becomes cyclic, which makes channel maintenance very expensive.

On the other hand, properly sloped and planted channels are more aesthetically and environmentally appealing and can be cheaper to maintain.

CRS Credit

Structural flood control projects that provide 100-year flood protection and that result in revisions to the Flood Insurance Rate Map are not credited by the CRS in order to avoid duplicating the larger premium reduction provided by removing properties from the mapped floodplain.

The CRS credits smaller flood control projects that meet the following criteria:

- They must provide protection to at least the 25-year flood,
- They must meet certain environmental protection criteria,
- They must meet federal, state and local regulations, such as the Corps of Engineers’ 404 permit and Florida dam safety rules, and
- They must meet certain maintenance requirements.

These criteria ensure that credited projects are well-planned and permitted. Any of the measures reviewed in this section would be recognized under Activity 530 – Flood Protection, although it would be very hard to qualify a dredging project. Credit points are based on the type of project, how many buildings are protected, and the level of flood protection provided.

Conclusions and Recommendations

1. Continue to require onsite retention and detention facilities to manage runoff from sites to avoid overloading drainage systems. There is a benefit to ensuring that post-development runoff does not exceed pre-development conditions.
2. Consider the benefits of regional upper watershed retention and detention to help mitigate the amount of conveyance of downstream flows. This approach could be combined with the preservation of open space of sensitive lands.
3. Levees and floodwalls should continue to be maintained and enhanced to the extent practical.
4. Improvement to channels should be considered in terms of the immediate benefit for increased conveyance and the long-term cost of maintaining them.
Structural Project Measures

References

2. CRS Credit for Drainage System Maintenance, FEMA, 2006.
Public Information Measures

A successful hazard mitigation program involves both the public and private sectors. Public information activities advise property owners, renters, and businesses about hazards and ways to protect people and property from these hazards. These activities can motivate people to take the steps necessary to protect themselves and others.

Information can bring about voluntary mitigation activities at little or no cost to the government. Property owners mitigated their flooding problems long before government funding programs existed. The typical approach to delivering information involves two levels of activity. The first is to broadcast a short and simple version of the message to everyone potentially affected. The second level provides more detailed information to those who respond and want to learn more.

This chapter starts with activities that reach out to people and tell them to be advised of the hazards and some of the things they can do. It then covers additional sources of information for those who want to learn more. It ends with an overall public information strategy.

Outreach Projects

Outreach projects are the first step in the process of orienting property owners to the hazards they face and the concept of property protection. They are designed to encourage people to see out more information in order to take steps to protect themselves and their properties.

Research has shown that outreach projects work. However, awareness of the hazard is not enough; people need to be told what they can do about the hazard, so projects should include information on safety, health and property protection measures. Research has also shown that a property run local information program is more effective than national advertising or publicity campaigns. Therefore, outreach projects should be locally designed and tailored to meet local conditions.

Community newsletters/direct mailings: The most effective types of outreach projects are mailed or distributed to everyone in the community. In the case of floods, they can be sent only to floodplain property owners.

News media: Local newspapers can be strong allies in efforts to inform the public. Press releases and story ideas may be all that’s needed to whet their interest. After a flood in another community, people and the media become interested in their flood hazard and how to protect themselves and their property. Local radio stations and cable TV channels can also help. These media offer interview formats and cable TV may be willing to broadcast videos on the hazards.

Other approaches: Examples of other outreach projects include:

- Presentations at meetings of neighborhood, civic or business groups,
- Displays in public buildings or shopping malls,
- Signs in parks, along trails and on waterfronts that explain the natural features (such as the river) and their relation to the hazards (such as floods),
- Brochures available in municipal buildings and libraries, and
- Special meetings, workshops and seminars.
Local Implementation

There are several types of outreach projects implemented in Seminole County. The County’s website features a page describing flood facts and flood safety measures. The County also distributes a brochure titled “Flood Safety and Awareness” to all property owners in the County. There is also a hurricane and storm information page on the County’s website, which contains emergency information when a storm is threatening the area. In addition, news releases are posted to the County’s website, which contain safety information related to natural hazards when appropriate. The County holds a Hurricane Expo to disseminate information about hurricane safety and give residents hurricane safety kits, including a guide to hurricane safety, a flashlight, and a DVD about hurricane safety. The County also advertises safety information on local billboards.

Finally, various brochures are available in the community at various departments such as in the Building Division to provide residents with flood safety and property protection advice.

CRS Credit

The Community Rating System provides up to 380 points for projects on flood topics. One hundred of these points are for having a public information program strategy. This plan qualifies for the strategy credit.

Real Estate Disclosure

Many times after a flood or other natural disaster, people say they would have taken steps to protect themselves if they had known they had purchased a property exposed to a hazard. There are some federal and state requirements about such disclosures, but they have their limits.

Federal law: Federally regulated lending institutions must advise applicants for a mortgage or other loan that is to be secured by an insurable building whether the property is in a floodplain as shown on the Flood Insurance Rate Map. If so, flood insurance is required for buildings located within the floodplain if the mortgage or loan is federally insured. However, because this requirement has to be met only 10 days before closing, the applicant is often already committed to purchasing the property when he or she first learns of the flood hazard.

State law: State laws set standards for real estate sales and licensing of agents and brokers. In addition, Florida has a natural hazards disclosure law, which requires the seller of real estate to give the buyer a document outlining whether the property is in an area prone to flooding, hurricanes or tornadoes. The shortcoming of such a law is that because of the sporadic nature of flooding, a property owner may legitimately not be aware of past or potential flooding problems.
Local Implementation

The County has one additional law related to natural hazard disclosure. The final plat for development plans must include the limits of the floodplain, indicating the flood elevation for the 100-year flood. This only provides information for developments that have been platted since the requirement went into effect and then only if the title search sees it and advises the buyer. The multiple listing service does not include a listing of whether a property is in a flood zone or wetland. Disclosure practices are left up to the individual broker or agent.

CRS Credit

Communities in Florida should be eligible for five points under the “Other disclosure requirements” for the state law requiring sellers to notify the buyer of natural hazards. Seminole County is eligible for 5 points for including the limits of the floodplain on all final plans.

Libraries and Websites

The two previous activities tell people that they are exposed to a hazard. The next step is to provide information to those who want to know more. The community library and local websites are obvious places for residents to seek information on hazards, hazard protection, and protecting natural resources.

Books and pamphlets on hazard mitigation can be given to libraries, and many of these can be obtained for free from state and federal agencies. Libraries also have their own public information campaigns with displays, lectures and other projects, which can augment the activities of the local government. Today, websites are commonly used as research tools. They provide fast access to a wealth of public and private sites for information. Through links to other websites, there is almost no limit to the amount of up to date information that can be accessed on the internet.

In addition to online floodplain maps, websites can link to information for homeowners on how to retrofit for tornadoes and floods or a website about floods for children. The “FEMA for Kids” website teaches children how to protect their home and what to have in a family disaster kit.

Local Implementation

A search of the Seminole County Library catalog on December 14, 2010 showed that the library has 38 publications about floods and 64 publications about hurricanes. The documents about floods represent a broad range of topics, from flood proofing, construction guidance to a review of flood policies to a guide to reading flood maps.

The County’s website, www.seminolecountyfl.gov, is kept updated with information on the County’s activities, including the mitigation planning process. FEMA’s floodplain maps for the County are available at http://www.seminolecountyfl.gov/gm/building/flood_firm.asp.

CRS Credit

The Community Rating System provides up to 30 points for having a variety of flood references in the local public library and up to 36 more for similar material on municipal websites (Activity 350 – Flood Protection Information).
Technical Assistance

Hazard Information
Many benefits stem from providing map information to inquirers. Residents and business owners that are aware of the potential hazards can take steps to avoid problems or reduce their exposure to flooding. Real estate agents and house hunters can find out if a property is flood prone and whether flood insurance may be required.

Communities can easily provide map information from FEMA’s Flood Insurance Rate Maps (FIRMs) and Flood Insurance Studies. They may also assist residents in submitting requests for map amendments and revisions when they are needed to show that a building is located outside the mapped floodplain.

Some communities supplement what is shown on the FIRM with information on additional hazards, flooding outside mapped areas and zoning. When the map information is provided, community staff can explain insurance, property protection measures and mitigation options that are available to property owners. They should also remind inquirers that being outside the mapped floodplain is no guarantee that a property will never get wet.

Property Protection Assistance
While general information provided by outreach projects or the library is beneficial, most property owners do not feel ready to retrofit their buildings without more specific guidance. Local building department staffs are experts in construction. They can provide free advice, not necessarily to design a protection measure, but to steer the owner onto the right track.

Building or public works department staffs can provide the following types of assistance:
- Visit properties and offer protection suggestions,
- Recommend or identify qualified or licensed contractors,
- Inspect homes for anchoring of roofing and the home to the foundation,
- Provide advice on protecting windows and garage doors from high winds, and
- Explain when building permits are needed for home improvements.

There is a concern that a local official might provide the wrong information and the community would be sued if a project failed. To counter this, there are guidelines for local programs and training on how to identify the right measures. FEMA conducts a free week-long course at its Emergency Management Institute on property protection measures for flooding. FEMA and the Corps of Engineers periodically conduct one- or two-day retrofitting workshops.

Local Implementation
FEMA floodplain maps are available on the County’s website, as described above. The Building Division will also provide maps to anyone who requests them.

CRS Credit
The Community Rating System provides 140 points for providing map information to inquirers. Up to 71 points are available for providing one-on-one flood protection assistance to residents.
and businesses and for making site visits. Both services must be publicized.

**Public Information Program Strategy**

A public information program strategy is a document that receives CRS credit. It is a review of local conditions, local public information needs, and a recommended plan of activities. A strategy consists of the following parts, which are incorporated into this plan:

- The local flood hazard (discussed in Chapter 3 of this plan)
- The property protection measures appropriate for the flood hazard (discussed in Chapter 6)
- Flood safety measures appropriate for the local situation (flood safety measures are discussed on page 110 and hurricane safety is discussed in the phonebook and other publications)
- The public information activities currently being implemented within the community, including those being carried out by non-government agencies (discussed above in sections 10.1 and 10.4)
- Goals for the community’s public information program (discussed in Chapter 4)
- The outreach projects that will be done each year to reach the goals (discussed in the Recommendations section of this chapter and in Chapter 11)
- The process that will be followed to monitor and evaluate the projects (discussed in Chapter 11)

**Public Information Topics**

At its November 4th, 2010, meeting, the FMPC reviewed the various public information activities currently underway with the goals of this Floodplain Management Plan in mind. The members of the FMPC discussed improving the current County website to make it easier for residents to find the information they need, using social media such as Facebook and Twitter to convey information, and using faith-based organizations and homeowners’ associations to help spread information to as many residents as possible.
Flood Safety

Pay attention to evacuation orders. Listen to local radio or TV stations for forecasts and emergency warnings. Know about evacuation routes and nearby shelters and have plans for all family members on how to evacuate and where to meet if you’re split up during an emergency.

Do not drive through a flooded area. During a flood, more people drown in their cars than anywhere else. Don’t drive around road barriers; the road or bridge may be washed out.

Do not walk through flowing water. Flash flooding is the leading cause of weather-related deaths in the U.S. Currents can be deceptive; 6 inches of moving water can knock you off your feet in a strong current. If you walk in standing water, use a stick to help you locate the ground.

Stay away from power lines and electrical wires. Electrical currents can travel through water. Report downed power lines to the police or sheriff by calling 911.

Have the power company turn off your electricity. Some appliances, like TV sets, keep electrical charges even after they’ve been unplugged. Don’t use appliances or motors that have gotten wet unless they have been taken apart, cleaned and dried.

Look before you step. After a flood, the ground and floors are covered with debris like broken bottles and nails. Floors and stairs that are covered with mud can also be slippery.

Be alert for gas leaks. Use a flashlight to inspect damage. Don’t smoke or use candles, lanterns, or open flames unless you know the gas has been shut off and the area has been ventilated.

Look out for animals that may have been flooded out of their homes and who may seek shelter in yours. Use a pole or stick to turn things over and scare away small animals.

Carbon monoxide exhaust kills. Use a generator or other gasoline-powered machine outdoors. The same gases for camping stoves. Charcoal furnaces are especially deadly – cook with charcoal outdoors.

Clean everything that got wet in the flood. Floodwaters have picked up sewage and chemicals from roads, farms, factories, and storage buildings. Spoiled food, and flooded cosmetics and medicines can be health hazards. When in doubt, throw it out.

Take care of yourself. Recovering from a flood is a big job. It is tough on both the body and the spirit and the effects a disaster has on you and your family may last a long time.

CRS Credit

The CRS provides 100 points for a public information program strategy. A mass mailing to all properties can earn up to 60 more points and can meet the publicity requirements to receive credit for several other activities.

Conclusions

1. There are many ways that public information can be used so that people and businesses will be more aware of the hazards they face and how they can protect themselves.

2. Many of the public information activities can be implemented by community staff. By formalizing its activities, a community can earn nearly 500 points under the Community Rating System.

3. Outreach projects, libraries, websites and the Hurricane Expo are currently being used as public information tools in Seminole County.

4. The most important topics to cover in public information activities are:
   - Safety precautions for all types of hazards, but especially storms, floods and fog. Evacuation is recognized as the most important safety precaution for tropical storms and hurricanes.
   - Flood protection measures, including rules for new construction and insurance.
• Keeping drainageways clear and protection from local drainage problems.
• Family and emergency preparedness measures.
• What the County is doing and sources of assistance.
• Protecting water quality and wetlands and the benefits of open space.

The most appropriate ways to spread this information are:
• Websites and social media
• Mailings to everyone, in utility bills or otherwise
• News releases or newspaper articles
• Newsletters
• Displays, particularly at special events such as the Hurricane Expo
• Handouts, flyers and other materials, which can distributed at special events and presentations

Recommendations

1. The County’s website should be improved to make navigation to flood hazard and safety information more intuitive.
2. The County should increase its presence on social media, such as Facebook and Twitter, to maximize the number of people reached with flood hazard and safety information.
3. The County should continue to distribute brochures about hurricanes to those living in the mapped floodplain.
4. The County should continue to hold Hurricane Expo and give away preparedness kits at the event.
5. Staff should reach out to homeowners’ associations and faith-based organizations to help spread the word about flood hazards and safety measures.
6. The County’s website should have a mitigation page.
7. The County should consider implementation of an outreach program strategy for credit under the CRS.

References

3. CRS Credit for Outreach Projects, FEMA, 2006.
C.3 Mitigation Alternative Selection Criteria

The following criteria were used to select and prioritize proposed mitigation measures:

**STAPLE/E**

- Social—Does the measure treat people fairly? (different groups, different generations)
- Technical—Will it work? (Does it solve the problem? Is it feasible?)
- Administrative—Do you have the capacity to implement and manage project?
- Political—Who are the stakeholders? Did they get to participate? Is there public support? Is political leadership willing to support?
- Legal—Does your organization have the authority to implement? Is it legal? Are there liability implications?
- Economic—Is it cost-beneficial? Is there funding? Does it contribute to the local economy or economic development?
- Environmental—Does it comply with environmental regulations?

**Sustainable Disaster Recovery**

- Quality of life
- Social equity
- Hazard mitigation
- Economic development
- Environmental protection/enhancement
- Community participation

**Smart Growth Principles**

- Infill versus sprawl
- Efficient use of land resources
- Full use of urban resources
- Mixed uses of land
- Transportation options
- Detailed, human-scale design

**Other**

- Does measure address area with highest risk?
- Does measure protect…
  - The largest # of people exposed to risk?
  - The largest # of buildings?
  - The largest # of jobs?
– The largest tax income?
– The largest average annual loss potential?
– The area impacted most frequently?
– Critical infrastructure (access, power, water, gas, telecommunications)?

● What is timing of available funding?
● What is visibility of project?
● Community credibility
MITIGATION IDEAS:

POSSIBLE MITIGATION MEASURES BY HAZARD TYPE

A Mitigation Planning Tool For Communities

Hazard mitigation refers to any sustained action taken to reduce or eliminate the long-term risk to human life and property from hazardous conditions. The following list of possible hazard mitigation measures for communities is compiled from experience and discussion within the states of FEMA Region 5: Illinois, Indiana, Michigan, Minnesota, Ohio and Wisconsin. The list of hazard types and ideas starts generally with coverage of natural hazards, such as flood or earthquake. These are followed by types of man-made and technological hazards. As extensive as this list is, it does not preclude other ideas for activities to save lives and prevent or reduce damages in the future. Many of the ideas are developed in other FEMA publications, including www.fema.gov, as well as in publications of other federal and state agencies.

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A WORD ABOUT PLANNING

Mitigation planning is best accomplished from a multi-hazard perspective. Reducing the level of risk involving one natural or technological hazard may increase the risk of damage from another hazard. Consequently, it is important to consider that some mitigation alternatives may not be viable given a particular set of hazard conditions. For example, elevating a home on stilts to allow for water flow in a floodplain can be a good thing, but it becomes a problem if the home is in an earthquake zone and the ground starts shaking.

PREPAREDNESS FOR ALL TYPES OF HAZARDS

Some mitigation ideas fit easily into many or all hazard types. These also tend to fall under a type of planning generally referred to as "preparedness." A selection of mitigation/preparedness ideas is included here at the beginning; these ideas can be considered relevant to all sections of the mitigation ideas list.

Public Education and Awareness

State and local governments can provide information describing all types of hazards, methods for preventing damages resulting from hazardous conditions, and how to respond when a hazard threatens. Either directly or by lobbying elected officials, citizens can also get involved in comprehensive planning activities that identify and alleviate their communities’ hazards.

Mutual Aid/Interagency Agreements

Local governments should establish mutual aid agreements for utility and communications systems, including 9-1-1. Mutual aid or interagency agreements have value for preventing or responding to other hazard or emergency situations, as fire and police departments often do.

9-1-1 and 3-1-1

Some communities have expanded their basic 9-1-1 location identification telephone service to include features such as "enhanced 9-1-1" that registers name, address, and a description of the building/site. It has become more common to use a "reverse 9-1-1" system with which a community can send out a mass telephone announcement to every number in the 9-1-1 system. Additionally, non-emergency 3-1-1 service can be used to have people call to get information, such as locations of cooling shelters during a heat wave.

NOAA Weather Radio

Communities can encourage the use of National Oceanic and Atmospheric Administration (NOAA) weather radios among their residents. At least one set of counties surrounding a chemical stockpile has provided NOAA weather radios to all homes and businesses within the area.

NOAA Weather Radio continuously broadcasts National Weather Service forecasts, warnings and other crucial weather information. NOAA Weather Radio also provides direct warnings to the public for natural, man-made, or technological hazards, and it is the primary trigger for activating our country’s Emergency Alert System (EAS) on commercial radio, television, and cable systems.

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Emergency Alert System
Using digital technology to distribute messages to radio, television and cable systems, the EAS provides state and local officials with the ability to send out emergency information targeted to a specific area. The information can be sent electronically through broadcast stations and cable systems even if those facilities are unattended.

Continuity of Operations Planning
The goal of Continuity of Operations (COOP) planning is to ensure that the essential functions of an organization, including government, can continue to operate during and after an emergency incident which may prevent access to normally operating systems, such as physical plant, data or communication networks, or transportation.

Communities can encourage businesses, other organizations, and families to prepare themselves by regularly backing up computer drives, copying essential files and/or important family information, and storing these items in a separate location. A larger organization may coordinate with another office from the organization in a different part of the country to take over operations when necessary.

Land Use Planning
Once a community is familiar with the location of its hazardous areas; it may adopt a land use plan, or modify an existing land use plan to:
- Guide development away from hazardous areas;
- Reduce density in the hazardous areas; or
- Encourage greater development restrictions on the property.

Site Emergency Plans
Communities can encourage development and testing of internal emergency plans and procedures, including COOP planning, by businesses and other organizations.

Communities should develop and test site emergency plans for schools, factories, office buildings, shopping malls, hospitals, correctional facilities, stadiums, recreation areas, and other similar facilities.

Emergency Response Personnel
Emergency response personnel need to be trained and plan for various contingencies and response activities, such as evacuation, traffic control, search, and rescue.

Community Emergency Response Teams
A community may consider sponsoring a Community Emergency Response Team (CERT). A CERT is a volunteer group of citizens who are trained and equipped to respond if emergency services are unable to meet all of the immediate needs of the community following a major disaster, especially if there is no warning as in an earthquake.

Insurance
Insurance should not be considered an alternative to reducing damages for any type of hazard, but it does have the value of protecting oneself from financial devastation if damage were to occur.
Real Estate Disclosure

Real estate disclosure laws are important because they force a seller to advise a potential buyer about pre-existing conditions. This allows buyers to make more informed decisions about the potential risks involved in owning property, such as whether a property is located in a floodplain or if it had been previously damaged from flood water or any other type of hazard condition.

Family Disaster Plans and Supply Kits

Communities can encourage residents to prepare themselves by stocking up with necessary items and planning for how family members should respond if any of a number of possible emergency or disaster events strike.

FLOOD

Ninety percent of federal disaster declarations are for flood events. Response and recovery costs can be extremely high, so where risks are apparent it makes sense to take actions that prevent damage from occurring. If flood damage cannot be fully prevented, there may be mitigation techniques that lessen the damage. Flooding addressed in this section can be from high ground water, overland flooding from rivers or streams, or from a dam failure.

Acquisition

Land with structures may be purchased by and titled in the name of a local governing body that can remove structures and enforce permanent restrictions on development.

Relocation

A structure may be moved to a less hazardous location.

Elevation

A structure may be mechanically lifted so that the lowest floor, including the basement, is raised above the base flood elevation. Utilities or other mechanical devices should also be raised above expected flood levels.

Dry-Floodproofing

It may be possible to keep water out by strengthening walls, sealing openings, or using waterproof compounds or plastic sheeting on walls. Dry-floodproofing is not recommended for residential construction but may be a reasonable alternative for non-residential structures—either in new construction, while making a substantial improvement, or while repairing a substantially damaged structure.

Wet-Floodproofing

Using water resistant paints or other materials can allow for easy cleanup after floodwater exposure in accessory structures or in a garage area below an elevated residential structure. In a basement, wet-floodproofing may be preferable to attempting to keep water out completely, because it allows for controlled flooding to balance exterior and interior water forces and discourage structural collapse. Wet-floodproofing may not be used for basements in cases of new construction, substantial improvement, or substantial damage.
<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Floodplain/Coastal Zone Management</td>
<td>Determining and enforcing acceptable land uses through planning and regulation may not prevent inevitable flooding in flood-prone areas, but planning and regulation can alleviate the risk of damage by limiting exposure in such hazard areas. Floodplain and coastal zone management can be included in comprehensive planning.</td>
</tr>
<tr>
<td>Capital Improvement Plans</td>
<td>Infrastructure planning decisions can affect flood hazard mitigation. For example, decisions to extend roads or utilities to an area may increase exposure. Some communities may consider structural flood protection such as levees or floodwalls.</td>
</tr>
<tr>
<td>Zoning Ordinance Adoption or Amendments</td>
<td>Examples of zoning methods that affect flood hazard mitigation include: 1) adopting ordinances that limit development in the floodplain; 2) limiting the density of developments in the floodplain; and 3) requiring that floodplains be kept as open space.</td>
</tr>
<tr>
<td>Subdivision Ordinances or Amendments</td>
<td>Subdivision design standards can require elevation data collection during the platting process. Lots may be required to have buildable space above the base flood elevation.</td>
</tr>
<tr>
<td>Building Code Adoption or Amendments</td>
<td>Requirements for building design standards and enforcement include the following possibilities: 1) that a residential structure be elevated; and 2) that a non-residential structure be elevated or floodproofed.</td>
</tr>
<tr>
<td>Conservation Easements</td>
<td>Conservation easements may be used to protect environmentally significant portions of parcels from development. They do not restrict all use of the land. Rather, they direct development to areas of land that are not environmentally significant.</td>
</tr>
<tr>
<td>Transfer of Development Rights</td>
<td>In return for keeping floodplain areas in open space, a community may agree to allow a developer to increase densities on another parcel that is not at risk. This allows a developer to recoup potential losses from non-use of a floodplain site with gains from development of a non-floodplain site.</td>
</tr>
<tr>
<td>Purchase of Easement/Development Rights</td>
<td>Compensating an owner for partial rights, such as easement or development rights, can prevent a property from being developed contrary to a community’s plan to maintain open space. This may apply to undeveloped land generally or to farmland in particular.</td>
</tr>
<tr>
<td>Stormwater Management Ordinances or Amendments</td>
<td>Stormwater ordinances may regulate development in upland areas in order to reduce stormwater run-off. Examples of erosion control techniques that may be employed within a watershed area include proper bank stabilization with sloping or grading techniques, planting vegetation on slopes, terracing hillsides, or installing riprap boulders or geotextile fabric.</td>
</tr>
<tr>
<td>Multi-Jurisdiction Cooperation Within Watershed</td>
<td>Forming a regional watershed council helps bring together resources for comprehensive analysis, planning, decision-making, and cooperation.</td>
</tr>
<tr>
<td>Comprehensive Watershed Tax</td>
<td>A tax can be used as a mitigation action in several ways: 1) tax funds may be used to finance maintenance of drainage systems or to construct reservoirs; 2) tax assessments may discourage builders from constructing in a given area; or 3) taxes may be used to support a regulatory system.</td>
</tr>
<tr>
<td>Post-Disaster Recovery Ordinance</td>
<td>A post-disaster recovery ordinance regulates repair activity, generally depending on property location. It prepares a community to respond to a disaster event in an orderly fashion by requiring citizens to: 1) obtain permits for repairs, 2) refrain from making repairs, or 3) make repairs using standard methods.</td>
</tr>
<tr>
<td>Flood Insurance</td>
<td>Purchasing flood insurance does not prevent a flood from occurring, but it does mitigate a property owner’s financial exposure to loss from flood damage. National Flood Insurance Program (NFIP) policies are only available in communities that participate in the program, which is administered by FEMA.</td>
</tr>
<tr>
<td>Floodplain Ordinances or Amendments</td>
<td>Communities that choose to participate in the NFIP must adopt ordinances that meet minimum federal and state requirements. Communities may pass more stringent ordinances to reduce risk even further.</td>
</tr>
<tr>
<td>Community Rating System</td>
<td>Also administered by FEMA, the Community Rating System (CRS) is a companion program to the NFIP. It rewards a community for taking actions over and above minimum NFIP requirements with the goal of further reducing flood damages in the community. The more actions a community takes, the lower the premiums for flood insurance within that community.</td>
</tr>
<tr>
<td>Updated Floodplain Mapping</td>
<td>By taking the initiative locally to more accurately map problem areas with information not already on FEMA maps, a community can warn residents about potential risks that may not have been anticipated. Upgrading maps provides a truer measure of risks to a community.</td>
</tr>
<tr>
<td>Storm Drainage Systems</td>
<td>Flood mitigation can involve installing, re-routing, or increasing the capacity of a storm drainage system that may involve detention and retention ponds, drainage easements, or creeks and streams. It can include separation of storm and sanitary sewerage systems as well as higher engineering standards for drain and sewer capacity.</td>
</tr>
<tr>
<td>Drainage System Maintenance</td>
<td>At most times, a drainage system will do its job and move water to intended areas. However, if a system is not maintained, erosion, material dumping, or deterioration of man-made reinforcement materials may reduce the carrying capacity of a stream. Therefore, regular maintenance, such</td>
</tr>
</tbody>
</table>
as sediment and debris clearance, is needed so that the stream may carry out its design function. Also important is detection and prevention/discouragement of discharges into storm-water/sewer systems from home footing drains, downspouts or sump pumps.

**Drainage Easements**

Communities may consider obtaining easements for planned and regulated public use of privately owned land for temporary water retention and drainage.

**Wetland Protection**

With special soils and hydrology, wetlands serve as natural collection basins for floodwaters. Acting like sponges, wetlands collect water, filter it, and release it slowly into rivers and streams. Protecting and preserving wetlands can go a long way toward preventing flooding in other areas.

**Roads**

Roads are needed to get people and goods from place to place. In addition to planning for traffic control during floods, there are various construction and placement factors to consider when building roads. To maintain dry access, roads should be elevated above the base flood elevation. However, if a road creates a barrier it can cause water to pond. Where ponding is problematic, drainage and flow may be addressed by making changes to culvert size and placement. In situations where flood waters tend to wash roads out, construction, reconstruction, or repair can include not only attention to drainage but also stabilization or armoring of vulnerable shoulders or embankments.

**Structural Flood Control Measures**

Structural flood control measures (e.g., levees, dams, or floodwalls) channel water away from people and property. Structural measures may also increase drainage or absorption capacities (e.g., detention and retention basins, relief drains, spillways, drain widening/dredging or rerouting, logjam and debris removal, extra culverts, bridge modification, dike setbacks, flood gates and pumps, or channel redirection). However, structural measures may cause an increase in the base flood elevation. History has shown that structures that channel water may create a false sense of security and result in greater damage to nearby properties if the structures fail.

**Minor Structural Projects**

A minor structural project is similar but smaller and more localized than a structural project, in that the measures used to reduce flooding may include levees, floodwalls, dams or other activities that channel water away from people or property. However, a minor structural project should only be constructed in areas that cannot be mitigated through non-structural activities, or where structural activities are not feasible due to low densities.

**Dam and Levee Maintenance**

Although dams and levees may have been constructed properly, failure to maintain them can lead to significant loss of life and property if they are stressed and broken or
breached during a flood event. An inspection, maintenance and enforcement program helps to ensure continued structural integrity. Dams or levees need to be kept in good repair. Unnecessary or old and structurally unsound dams should be removed. Planning for dam breaks can include constructing emergency access roads as well as automating pump and flood gate operation. And it never hurts to regulate development in a dam’s hydraulic shadow, where flooding would occur if there were a severe dam failure.

Community Outreach and Education

Communities may use outreach programs to: 1) advise homeowners of risks to life, health and safety; 2) facilitate technical assistance programs that address measures that citizens can take; or 3) facilitate funding for mitigation measures. Driver safety strategies for flooded areas can be addressed through driver safety/education classes and by the media. Local officials can be trained on flood fighting, floodplain management, flood proofing, traffic control during flooding, and other measures.

Debris Control

Community members can participate in debris control by securing debris, yard items, or stored objects that may otherwise be swept away, damaged, or pose a hazard if floodwaters would pick them up and carry them away. Additionally, a community can pass and enforce an ordinance that regulates dumping.

Hazardous and Buoyant Material Protection

Containers of hazardous materials such as petroleum or chemicals should not be located in a flood hazard area. If such a location is necessary, hazardous material containers need to be anchored, because the contents can contaminate water and multiply the damaging effects of flooding by causing fires or explosions, or by otherwise making structures unusable. Also, buoyant materials should be anchored, because if they float downstream, they may cause additional damage to buildings or bridges or may plug a stream resulting in higher flood heights.

Manufactured Homes

Manufactured or mobile homes should be elevated above the base flood elevation and anchored, or more preferably, kept out of the floodplain.

Flood Warning

In addition to a communication strategy, a flood warning system may consist of people or machines monitoring water level with stream gauges. Although a flood warning system generally does not provide long-term damage reduction, it can alleviate health and safety risk by providing citizens time to escape and possibly remove belongings that could be damaged. NOAA weather radio and EAS broadcasts can be incorporated into a community's flood warning system.
Back-up Generators  A community may consider back-up generators for pumping and lift stations in sanitary sewer systems, along with other measures (e.g., alarms, meters, remote controls, and switchgear upgrades).

Basement Backflow Prevention  Depending on its infrastructure capabilities, a community may encourage the use of check valves, sump pumps, and backflow prevention devices in homes and buildings.

LANDSLIDE AND DEBRIS FLOW

Landslides or debris flow can be caused by the same high water levels or rain that result in flooding. Landslides can also be caused by earthquakes. Although many mitigation measures resemble those for flooding, landslides pose unique considerations.

Mapping  Local governments, developers, and residents can make better decisions using maps. Soil types, slope percentage, drainage, or other critical factors are used to identify landslide prone areas.

Building Codes  Building codes can set construction standards, including minimum foundation requirements, in landslide-prone areas.

Zoning Ordinances  Zoning ordinances may be used to create buffers between structures and high-risk areas.

Slide-Prone Area Ordinance  A special purpose ordinance for slide-prone areas may be used to limit fill or dumping, as well as address drainage and other landslide related problems.

Code Enforcement  A strong community commitment to code enforcement is necessary to ensure compliance with building codes and zoning ordinances.

Drainage Control Regulations  Drainage regulations are similar to storm water management regulations. By controlling drainage, a community can reduce the risk of landslides resulting from saturated soils.

Grading Ordinances  Grading ordinances require developers and landowners to obtain permits prior to filling or regrading. Such ordinances may also provide specific design standards.

Hillside Development Ordinances  Hillside development ordinances are special purpose ordinances that set specific standards for construction on hillsides.

Subdivision Ordinances  Subdivision ordinances set guidelines on how land will be divided, the placement and size of roads, and the location of infrastructure. Such ordinances can also be used to regulate open space and buildable areas.

Sanitary System Codes  Sanitary system codes can reduce the effect of drainage on landslides by limiting the type and location of sanitary systems.
Geological Hazard Overlay Zones  A geological hazard overlay zone requires a detailed geological analysis prior to any construction activity. Used in association with building codes, this may reduce damage potential by providing clear information about risk.

Open Space Designations  Open space designations keep landslide prone areas undeveloped.

Relocation  Structures may be moved to less hazardous locations.

Acquisition  Land and structures may be purchased by and titled in the name of a local governing body that can remove structures and enforce permanent restrictions on development.

Restraining Structures  Restraining structures may be designed and used to hold soil in place.

Debris-Flow Measures  Debris-flow measures may include stabilization, energy dissipation, and flow control measures, all of which may reduce damage in sloping areas.

Grading  Grading can be used to increase slope stability, depending on types of soils, height of fill or cut, and compaction.

Vegetation Placement and Management Plans  Various types of vegetation increase soil stability through root length and strength and by absorbing precipitation. Management plans are aimed at ensuring long-term maintenance of vegetation appropriate for an area.

Utility Location  Placing utilities outside of landslide areas decreases the risk of service disruption.

Abatement Districts  A special taxing district, such as an abatement district, can be used to pool resources to mitigate common hazards.

Restrictive Covenants  A legally binding agreement in a private development can be used to impose restrictions on land use.

THUNDERSTORMS / LIGHTNING
Damage from thunderstorms and lightning is often underestimated. Everyone should have an appreciation for the dangers of lightning. Although not entirely preventable, damage and life safety risk from these events can be minimized.

Community Outreach and Education  Communities may use outreach programs to promote awareness of thunderstorm dangers. Driver safety strategies for severe weather events can be addressed by driver safety/education classes and by the media.

Early Warning Systems  Local and state governments can invest in public early warning systems/networks, as well as train people to serve as weather spotters.

Building Construction  Public and private buildings can be designed with structural bracing, shutters, laminated glass in window panes, and hail-resistant roof shingles or flashing to minimize damage.
Surge Protectors and Lightning Protection
Surge protection can be installed on critical electronic equipment. Lightning protection devices and methods, such as lightning rods and grounding, can be installed on a community’s communications infrastructure and other critical facilities.

Burying Power Lines
Buried power lines offer the security of uninterrupted power during and after storms. However, consideration needs to be made for maintenance and repair, particularly in cold climates where soil freezes more readily.

TORNADO
Tornadoes can strike anywhere and cause extensive damage. Damage and life safety risk may not be entirely preventable, but it can be minimized.

Construction Standards and Techniques
To strengthen public and private structures against severe wind damage, communities can require or encourage wind engineering measures and construction techniques that may include structural bracing, straps and clips, anchor bolts, laminated or impact-resistant glass, reinforced pedestrian and garage doors, window shutters, waterproof adhesive sealing strips, or interlocking roof shingles. Also, architectural design can make roofs less susceptible to uplift.

Safe Rooms
Risk to lives can be improved through construction and use of concrete safe rooms in homes and shelter areas of mobile home parks, fairgrounds, shopping malls, or other vulnerable public areas.

Manufactured Homes
Damage and injury can be prevented by anchoring manufactured homes and exterior attachments such as carports and porches.

Loose Items
Loose items like yard and patio furniture should be secured.

Temporary Debris Disposal
Temporary debris disposal sites can be protected by fencing and/or located away from populated areas.

SEVERE WIND
Severe wind can be as destructive as tornadoes. Damage and life safety risk may not be entirely preventable, but it can be minimized.

Roofing Shingles
Requiring the use of special roofing shingles designed to interlock and resist uplift forces in extreme wind conditions can reduce damage to a roof or to other structures.

Building Construction
Engineered construction can accommodate foundation design, braced elevated platforms, and the ability of a structure to withstand the lateral forces of winds and waves.
Manufactured Home Tie-Downs: The risk of manufactured home damage can be reduced by using tie-downs with anchors and ground anchors appropriate for the soil type.

Burying Power Lines: Buried power lines offer the security of uninterrupted power after severe winds, but consideration needs to be made for maintenance and repair.

Designed-Failure Mode: Designed-failure mode refers to power line design that allows for lines to fail or fail in small sections rather than as a complete system, so restoration can be done more quickly.

Backup Power: Backup power resources can enable critical facilities to continue basic services and can be used by businesses to ensure security and protect refrigerated goods.

Tree Management: Tree pruning near power lines can reduce the potential for trees falling on and breaking power lines.

**EXTREME TEMPERATURE**

When temperatures reach levels that are extremely high or extremely low, they pose dangers that can be alleviated by planning for how to handle such situations.

Outreach/Public Awareness: A local government can organize outreach to vulnerable populations during periods of extreme temperature, including establishing and promoting accessible heating or cooling centers in the community.

Heating Requirements: Housing/landlord codes can require minimum temperatures.

Heating Bills: If not already required by state law, communities can encourage utility companies to offer special arrangements for paying heating bills.

Heating and Cooling Centers: A community can establish heating and/or cooling centers for vulnerable populations. Center operations should be linked to outreach projects that encourage at-risk populations to use the centers.

**WINTER WEATHER/SNOWSTORMS**

Proper preparation can decrease the risks of injury that can occur during cold weather, and snowstorms in particular.

Family and Traveler Emergency Preparedness: A local or state government can produce and distribute family and traveler emergency preparedness information relating to severe winter weather hazards.

Driver Safety: Safety strategies for severe weather events can be included in driver education classes and materials.

Power Lines: Burying or otherwise protecting electric and other utility lines can prevent utility disruption by protecting lines from ice.
wind or snow damage. Nevertheless, lines buried in frozen soil may be difficult to reach if repair is necessary.

**Code Enforcement and Building Maintenance**

Local governments can impact building/site design through building code enforcement of snow-related ordinances such as snow loads, roof slope, snow removal, and storage. Communities can also monitor snow amounts to provide site-specific snow load data.

Home and public building maintenance should be encouraged in order to prevent roof and wall damage from “ice dams,” particularly resulting from ice and sleet storms.

**Shelters**

A community can establish heating centers or shelters for vulnerable populations, not only for residents, but also for stranded motorists/travelers.

**Outreach**

A community can plan to systematically contact isolated, vulnerable, or special-needs populations.

**Animal Protection**

Farmers and other animal custodians should plan for addressing livestock or other animal needs.

**Roads**

Local governments need to always plan for and maintain adequate road and debris clearing capabilities.

**Snow Fences**

Using snow fences or “living snow fences” (rows of trees or other vegetation) can limit blowing and drifting of snow over critical roadway segments.

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**SNOW LOAD**

Buildings can only hold so much snow before they collapse. Paying attention to snow load weight capacities can prevent damage and injury.

**Snow Load Design Standards**

A single snow load weight capacity standard may not be adequate for all areas within a community. Local building departments should determine the snow load limits for their communities based on local data. A community’s building code can include snow load limits or weight capacity standards in an appendix.

**Snow Weight Data Collection**

Establishing a program of systematic snow weight data collection will enable a community’s building department to better establish realistic snow load design standards.

**Maintenance**

Building owners should be educated and encouraged to inspect older buildings for deterioration and make subsequent repairs.

**Modifications**

As buildings are modified, new technology may be used to create or increase structural stability.
Analysis and Repair or Replacement of Structural Systems  Existing support systems may be vulnerable to load stress. A community may wish to set up an inspection system and recommend repairs to building owners.

**SUBSIDENCE**

Some areas of land are susceptible to collapse. Risks of collapse can be determined and managed.

- **Community Awareness**  Local and state governments can promote community awareness of subsidence risks and effects.
- **Mapping**  Old mining areas or geologically unstable terrain should be identified and mapped so that development can be prevented or limited.
- **Open Space**  Areas susceptible to collapse can be maintained as public open space.
- **Acquisition**  Land or structures may be purchased by and titled in the name of a local governing body that can enforce permanent restrictions on development.
- **Filling or Buttressing**  Filling or buttressing subterranean open spaces, as with abandoned mines, can prevent or alleviate collapse.
- **Relocation**  A structure may be moved to a less hazardous location.
- **Hydrological Monitoring**  Groundwater levels can be monitored in subsidence-prone areas.

**EARTHQUAKE**

Some regions are particularly susceptible to earthquake damage. Risks of injury and damage from earthquake events can be determined and managed.

- **Seismic Hazard Mapping**  Information gained from seismic hazard mapping can be used to assess risk. The first step is collection of geologic information on seismic sources, soil conditions, and related potential hazards. The second step is to prepare a map showing the approximate locations of various hazards.
- **Related Hazard Mapping**  Other earthquake related hazards include liquefaction and land slides. Maps of these related hazards may be used for vulnerability analysis and risk assessment.
- **Map Education**  Map users should be educated in the appropriate uses and limitations of maps.
- **Rapid Visual Screening**  Rapid visual screening is a technique used to quickly inspect a building and identify disaster damage or potential seismic structural and non-structural weaknesses. This method may be used to screen and prioritize retrofitting efforts, or inventory high-risk structures and critical facilities. In a post-
disaster setting, rapid visual screening can be used to assess risk during response and recovery efforts and determine if buildings are safe to re-occupy.

Loss Estimation Studies
After seismic hazards have been identified, planners can create an earthquake scenario to estimate potential loss of life and injuries, the types of potential damage, and existing vulnerabilities within a community. Scenarios can be particularly useful in predicting lifeline performance, i.e., the sustainability of critical public services or systems such as electricity, water, or roadways. This knowledge can be used to develop earthquake mitigation priorities.

HAZUS
FEMA’s HAZUS is a computer-based tool that can be used to quantitatively estimate losses from an earthquake.

Seismic Safety Committees
Duties of a local or state seismic safety committee can include providing policy recommendations, evaluating and recommending changes in state and local seismic safety standards, and an annual assessment of local and statewide implementation of seismic safety improvements.

School Survey Procedures
Schools are critical facilities not only because of the special population they accommodate, but also because they are often identified as shelter sites for a community. Due to this sheltering role, it is essential that these buildings function after a seismic event. A community can develop a survey procedure and guidance document to inventory structural and non-structural hazards in and near school buildings. Survey results can be used to determine mitigation priorities that can be incorporated into capital improvement plans.

Capital Improvement Planning
School districts, local governments, corporations, and others have developed capital improvement plans to ensure that facilities remain operational for years down the road. It is more efficient and cost effective to incorporate structural and non-structural seismic strengthening actions into ongoing building plans and activities, rather than to rehab later.

Guidelines and Model Ordinances
Earthquake hazards can be mitigated through land use planning. Communities can develop and distribute guidelines or pass ordinances that require developers/building owners to locate lifelines, buildings, critical facilities, and hazardous materials out of areas subject to significant seismic hazards. Particular consideration should be given to enforcing such ordinances in areas with steep slopes or subject to ground displacement, severe ground shaking, or liquefaction.

Building Codes
Although land use management that avoids building on hazardous sites is an effective way to reduce earthquake risk, there may be times when it is necessary to build on such sites. Engineers and architects have designed buildings in ways that reduce the impact of ground shaking. Encouraging all local governments to adopt and enforce
updated building code provisions is one effective way to reduce earthquake damage risk.

**Seismic Code Training**
Legislators often enact seismic building provisions that do not get enforced because architects, engineers, and building departments are unaware of the provisions. Conducting information sessions or other forms of outreach on seismic code provisions for new and existing buildings can enhance code use and enforcement by local architects, engineers, contractors and code enforcement personnel.

**Buildings as Structural Hazards**
Homeowners and businesses can take simple measures to strengthen their buildings before the next earthquake. Bracing walls and bolting sill plates to the foundation are examples. Non-reinforced masonry buildings and non-ductile concrete facilities are particularly vulnerable to ground shaking. These buildings should be strengthened and retrofitted against future seismic events.

**Non-Structural Hazards**
Many injuries in earthquakes are caused by nonstructural hazards, such as attachments to buildings. These include lighting fixtures, windows (glass), pictures, tall bookcases, computers, ornamental decorations on the outside of the buildings (like parapets), gas lines, etc. Activities that can reduce the risk of injury and damage include: anchoring tall bookcases and file cabinets, installing latches on drawers and cabinet doors, restraining desktop computers and appliances, using flexible connections on gas and water lines, mounting framed pictures and mirrors securely, and anchoring and bracing propane tanks and gas cylinders.

**Technical Assistance for Homeowners**
Developing a technical assistance information program for homeowners and teaching them how to seismically strengthen their houses can be an effective mitigation activity. The program could include providing local government building departments with copies of existing strengthening and repair information for distribution to homeowners. Other potential distribution sources include insurance companies, realtors and libraries.

**Infrastructure Hardening**
Identification and hardening of critical lifeline systems, i.e., critical public services such as utilities and roads, to meet “Seismic Design Guidelines and Standards for Lifelines,” or equivalent standards, may distinguish a manageable earthquake from a social and economic catastrophe.

**Bridge Strengthening**
State and local highway departments should review construction plans for all bridges to determine their susceptibility to collapse. Problem bridges should be retrofitted.

**Hazard Mitigation Awareness**
Local or state governments can use community outreach activities to foster an awareness of earthquake mitigation activities in homes, schools and businesses.
Financial Incentives
Local or state governments can support financial incentives like low interest loans or tax breaks for home and business owners who seismically retrofit their structures.

Insurance
Local or state governments can work with insurance industry representatives to increase public awareness of the importance of earthquake insurance. Home structural improvements can be factored into the process of obtaining insurance coverage or reduced deductibles.

Reference Library
A local or state government can establish a library consisting of technical documents on structural and nonstructural mitigation options, as well as model ordinances and procedures that have been used by other jurisdictions to reduce earthquake risk.

**DROUGHT**

Periods of time with little or no precipitation can pose risks that can be managed with conservation and preparation.

Water-Saving
Citizens can be encouraged to take water-saving measures, especially when extra water is needed for irrigation and farming. Possibilities include installing low-flow water saving showerheads and toilets, and turning water flow off while brushing teeth or during other cleaning activities.

Water Storage
Human consumption is the primary reason to maintain a storage of water. People cannot live without consuming water regularly.

Water Use Ordinances
Communities can pass ordinances to prioritize or control water use, particularly for emergency situations like firefighting.

Contingency Plans
Drought contingency plans can help anticipate needs and actions to take during a drought.

Water Delivery Systems
Designs or plans for water delivery systems can include consideration of drought events.

Crop Insurance
Crop insurance can preserve economic stability for farmers during a drought.
WILDFIRE

Wildfires typically start in woodland or prairie areas. They can occur naturally though they are often exacerbated by human activities. Wildfires can be hard to control as they threaten homes and communities located nearby. Although preventing or controlling wildfires is preferable, there are many mitigation efforts we can take to prevent or alleviate damage to our homes and communities when fires inevitably occur.

Public Education
Outreach efforts can promote such items as non-combustible roof covering, fire safe construction, and the importance of clearing brush and grass away from buildings. It is important to promote public education on smoking hazards and the risks of recreational fires.

Neighborhood Groups
Citizens may organize neighborhood wildfire safety coalitions to plan how their neighborhoods can work together to prevent a wildfire.

Zoning
Zoning can be used to cluster development into defensible areas and keep development away from fire hazards such as steep slopes, where fires are difficult to contain.

Defensible Space
Damage potential can be reduced by ensuring that structures are surrounded by defensible space or buffer zones. Buffer zones are manageable areas, generally 30 to 100 feet and cleared of combustible materials.

GIS Mapping
GIS mapping of vegetative coverage can facilitate analysis and planning decisions through comparison with topography, zoning, developments, infrastructure, or other markers.

Power Line Maintenance
Local power companies can help prevent or alleviate wildfires by proper maintenance and separation of power lines, as well as efficient response to fallen power lines.

Insurance Company Promotions
Insurance companies can include wildfire safety information in materials provided to area residents.

Property Maintenance
Maintenance of property in or near wildfire prone areas can go a long way toward preventing or reducing the spread of fire. Maintenance includes fuel management techniques such as pruning and clearing dead vegetation, selective logging, keeping grass short, planting fire-resistant vegetation, and creating fuel/fire breaks, i.e., areas where the spread of wildfires will be slowed or stopped by the removal of fuels. Other helpful techniques include use of fire resistant roofing and building materials; use of functional shutters on windows; keeping flammables such as curtains secured away from windows, or using heavy fire-resistant drapes; taking advantage of the fire department’s home safety inspections; sweeping/cleaning dead or dry leaves, needles, twigs, and combustibles from roofs, decks, eaves, porches and yards; keeping woodpiles and other combustibles away from structures; use of boxed or enclosed eaves on a house; thorough clean-up of spilled...
Fireplace and Chimney Maintenance
Residents should be encouraged to inspect chimneys at least twice a year and clean them at least once a year. Safe fireplace/chimney use and maintenance includes spark arrestors and emphasis on proper storage of flammable items.

Building Codes
Building codes can be used to require upgrades to existing as well as new structures.

Waste Disposal
Wildfire risk can be reduced by safe disposal of yard and household waste rather than through open burning.

Arson Prevention
Wildfires can be prevented by arson prevention clean up activities in areas of abandoned or collapsed structures, accumulated junk or debris, and in areas with a history of storing flammable materials where spills or dumping may have occurred.

Burning Restriction
Local ordinances can require burn permits and restrict campfires and outdoor burning.

Road and Driveway Clearance
Roads and driveways should be kept accessible to emergency vehicles and fire equipment. Driveways should be relatively straight and flat, with at least some open spaces to turn. Bridges should be strong enough to support emergency vehicles, with clearance wide and high enough for two-way traffic and emergency vehicle access. Addresses should be visible from the road, and keys to gates around property should be provided to the local fire department.

Hillside Construction
It is important to note that hillsides facing south or west are more vulnerable to increased dryness and heat from sun exposure. Structures should be set back from slopes outside of the “convection cone” of intense heat that is projected up the slope of a hill as a wildfire “climbs” it.

Building Foundations
In wildfire prone areas, risk may be decreased by enclosing the foundations of homes and other buildings, rather than leaving them open where undersides can be exposed to blown embers or other materials.

Motorized Equipment
Proper maintenance and storage of motorized equipment can decrease wildfire risk.

Flammable Materials
Wildfire risk can be alleviated by safely using and storing necessary flammable materials, including machine fuels. Approved safety cans should be used for storing gasoline, oily rags and other flammable materials. Firewood should be stacked at least 100 feet away and uphill from homes.

Smoke/Fire Detectors and Sprinklers
Citizens can install and maintain smoke detectors and fire extinguishers on each floor of their homes or other buildings.
Spotters

Early detection of wildfires, while fires are smaller, can help make fire fighting more successful. Detection can be accomplished by fire spotters who work from either towers or planes.

Media

Media can broadcast information about fire watches and fire warnings.

Response Personnel

Response personnel should have regular training and exercise experience.

Water Supplies

Water supplies for emergency fire fighting should be maintained in accordance with National Fire Protection Association (NFPA) standards. Residents should identify and maintain any number of outside water sources such as small ponds, cisterns, wells, swimming pools or hydrants. It is a good idea to have a garden hose that is long enough to reach any area of a home or other structures on a property. Freeze-proof exterior water outlets are recommended for at least two sides of a home or other structures. Additional outlets can be installed at least 50 feet from a home. It may be a good idea to obtain a portable gasoline powered pump in case electrical power is cut off.

Evacuation

Residents should be instructed on proper evacuation procedures, such as wearing protective clothing (e.g., sturdy shoes, cotton or woolen clothing, long pants, a long-sleeved shirt, gloves and a handkerchief to protect the face); taking a Disaster Supplies Kit; and choosing a route away from fire hazards.

Individual Response

Fire emergency telephone numbers should be posted at every telephone. Residents should plan several escape routes away from their homes, by car and foot.

It is a good idea to keep a set of hand tools that can be used as fire tools, such as a rake, axe, hand/chainsaw, bucket and shovel.

When wildfire threatens, residents should be instructed to carry and listen to battery-operated radios for reports and evacuation information, and follow instructions from local officials. Cars should be backed into garages or parked in open space facing the direction of escape, with doors and windows closed and the key in the ignition. Garage windows and doors should be closed but left unlocked. If residents have time, they can take steps to protect their homes by closing windows, vent doors, venetian blinds and heavy drapes; removing lightweight curtains; shutting off natural
gas at the meter; turning off pilot lights; closing fireplace screens; and moving flammable furniture into the center of the home away from windows and sliding-glass doors. Outside, residents can seal attic and ground vents with pre-cut plywood or commercial seals; turn off propane tanks; place combustible patio furniture inside; connect garden hose to outside taps; set up a portable gasoline-powered pump; place lawn sprinklers on the roof and near above-ground fuel tanks; wet the roof, wet or remove shrubs within 15 feet of the home; and gather fire tools.

**STRUCTURE FIRES**

The risk of structure fires varies by location and demographics. Studies commissioned by the U.S. Fire Administration find that certain populations are more at risk of death or injury from structure fires. These groups include people who are economically disadvantaged, very young or very old.

<table>
<thead>
<tr>
<th>Codes and Enforcement</th>
<th>Building codes and enforcement are the first measure for preventing structure fires.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Building Design</td>
<td>Building designs can include firewalls and fire doors, as well as alarm and sprinkler systems, especially in tall buildings, dormitories, and attached structures.</td>
</tr>
<tr>
<td>Public Education and School Programs</td>
<td>Communities can encourage public education and school programs, especially regarding stoves, heaters, fireworks, matches/lighters, smoke detectors, and evacuation. Public education can particularly focus on safe handling and disposal of cigarettes, cigars, pipes, and matches, as careless smoking and children playing with matches and lighters are significant hazards in some neighborhoods. Alcohol and other drug use can exacerbate the risks.</td>
</tr>
<tr>
<td>Personal Preparation</td>
<td>Citizens can install and maintain fire extinguishers and smoke detectors. Everyone in a household or workplace can be taught how to use a fire extinguisher. Residential standards established by the National Fire Protection Association (NFPA) require a smoke detector in each bedroom, or adjacent to all sleeping areas. All equipment should be tested and/or inspected regularly, and smoke detector batteries should be changed twice a year. Installing a sprinkler system is another valuable mitigation measure. Also, fire emergency telephone numbers should be posted at every telephone, and residents or building occupants should plan escape routes and assembly points away from their homes or workplaces.</td>
</tr>
<tr>
<td>Heating Systems</td>
<td>Fire risk can be controlled through proper installation and maintenance of heating systems.</td>
</tr>
</tbody>
</table>
Space Heaters
If electric space heaters are necessary, they should be placed at least 3 feet from objects, particularly combustible objects. Kerosene heaters pose additional risks relating to flammable liquids and carbon monoxide.

Fireplace and Chimney Maintenance
Residents should be encouraged to inspect chimneys at least twice a year and clean them at least once a year. Safe fireplace/chimney use and maintenance includes installation of spark arrestors and emphasis on proper storage of flammable items.

Electrical Outlets
Fire risk can be controlled through safe installation, maintenance and use of electrical wiring, outlets and fault interrupters.

Arson Prevention
Structure fires can be prevented by clean up activities in areas of abandoned or collapsed structures, accumulated junk or debris, and in areas that have a history of storing flammable materials where spills or dumping may have occurred. Older communities in particular should consider establishing a quick process to secure and/or demolish abandoned structures.

Flammable Materials
Fire risk can be controlled by using proper procedures, from training and exercising to safe handling of explosive and flammable materials.

Power Line Maintenance
Local power companies can help prevent or alleviate fires by proper maintenance and separation of power lines, as well as efficient response to fallen power lines.

Fire Departments
Fire departments should be deployed, equipped and trained per NFPA standards and ISO recommendations.

Transportation Planning
Transportation planning is important for assessing roads, overpasses, etc., in order to maximize access and improve emergency response times to all inhabited or developed areas of a community. Subdivisions should include more than one entrance to allow access if one of the entrances becomes blocked.

Civil Disturbances
It is important to gain control of civil disturbances and criminal activities that could lead to arson.

Fireworks
It is important to enforce fireworks regulations.

Illegal Drug Laboratories
Fire risk can be improved by elimination of clandestine methamphetamine, or other illegal drug, laboratories through law enforcement and public education.

**SCRAP TIRE FIRES**
Burning tires emit toxins into the surrounding air. Scrap tire fires not only are difficult and dangerous for fire fighters, they also pose health hazards for the surrounding community.
Tire Disposal Policies

A sample of policies for regulating safe disposal and management of scrap tires includes the following: separation of stored scrap tires from other materials; limits on the size of each pile; minimum distances between piles and property lines; covering, chemically treating, or shredding tires to limit mosquito breeding; providing for fire vehicle access to scrap tire piles; training employees in emergency response operations; installation of earthen berms around storage areas; prevention of pools of standing water in the area; control of nearby vegetation; an emergency plan posted on the property; and storing only the permitted volume of tires authorized for a particular site.

Facility Siting

Land use planning should recognize that scrap tire storage and processing facilities can pose a real environmental and health threat to a community.

Law Enforcement

Law enforcement agencies can be alerted to watch for illegal tire dumping.

Alternate Use/Recycling

Promoting technologies that recycle tires can be an asset. Examples include using whole tires in roadbeds, for culvert wingwalls, or as slope protection, or using shredded tires for a playground surface.

Pest Control

Pest-control measures for mosquitoes and other nuisances around scrap tire yards will not prevent fires, but controlling pests can decrease the risk of disease to people in the vicinity.

HAZARDOUS MATERIALS

Various government agencies regulate the use, storage, release, and disposal of hazardous substances, because exposure to these substances can result in imminent injury, illness, or damage to property. Mitigation begins with regulatory compliance.

Safety Procedures and Policies

Regulations require training in and compliance with all safety procedures and systems related to the manufacture, storage, transport, use, and disposal of hazardous materials.

Public Awareness and Worker Education

The Emergency Planning and Community Right-to-Know Act (EPCRA), also known as SARA Title III, provides an infrastructure at the state and local levels to plan for chemical emergencies. Facilities that store, use, or release certain chemicals may be subject to reporting requirements. Reported information is publicly available so that interested parties may become informed about potentially dangerous chemicals in their community. Employers must also communicate the hazards of workplace chemicals and ensure that workers receive education and training.

Local Emergency Planning Committee

To address the possibility of hazardous material incidents, communities are required under Federal law (SARA Title III).
to maintain an active and viable Local Emergency Planning Committee (LEPC) to develop an emergency plan for preparing for and responding to chemical emergencies, such as spills, leaks, explosions, or other releases. The LEPC is required to review, test, and update the plan each year.

**Emergency Plans**

The community’s emergency plan must include the following: identification of local facilities and transportation routes where hazardous materials are present; procedures for immediate response in case of an accident, including a community-wide evacuation plan; a plan for notifying the public that an incident has occurred; names of response coordinators at local facilities; and a plan for conducting simulation exercises that test the plan.

**Risk Management Plans**

U.S. Environmental Protection Agency (EPA) regulations require development of Risk Management Plans for sites that manufacture, store, or handle hazardous materials. The details of Chemical Accident Prevention and Risk Management Programs are managed by EPA’s Chemical Emergency Preparedness and Prevention Office (CEPPO).

**Transportation**

The U.S. Department of Transportation (USDOT) administers a labeling and placarding system for identifying the types of hazardous materials that are transported along the nation’s highways, railways, and waterways. This system enables local emergency officials to identify the nature and potential health threat of chemicals being transported. If an accident were to occur, local emergency officials would be able to determine the proper emergency response procedures for the situation. Local law enforcement and other emergency officials should be well-versed in compliance with and enforcement of USDOT and state regulations regarding hazardous material and hazardous waste transportation.

**Disposal**

The U.S. EPA’s Office of Solid Waste regulates disposal of hazardous waste, as required by the Federal Resource Conservation and Recovery Act (RCRA). RCRA’s goals are to: 1) protect us from the hazards of waste disposal; 2) conserve energy and natural resources by recycling and recovery; 3) reduce or eliminate waste; and 4) clean up waste that may have spilled, leaked, or been disposed of improperly.

**Emergency Response Teams**

Regulations require trained, equipped, and prepared emergency response teams, for hazardous material sites and for the community in general.

**Search and Rescue**

Search and rescue teams need to be trained, equipped, and prepared to work among hazardous materials.

**Industrial Site Buffering**

Hazardous material exposure can be prevented or reduced by separation and buffering between industrial areas and
other land uses. Industrial areas should be located away from schools, nursing homes, hospitals, and other facilities with large or vulnerable populations.

Radioactivity and Radon
Radioactive soils and high-radon areas can pose risks that should not be ignored. Mitigation actions may include avoiding development, removing soils, and capping openings in basements.

Cleanup of Brownfields
A brownfield site is real property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant. Cleanup activities are expensive, but they are recommended for preventing exposure to harmful substances. Grants, low interest loans, or tax relief may be available to assist in the cost of mitigating these sites. Cleaned sites may then be redeveloped and added back to a community’s tax roles.

Security
Security considerations should include preparedness for terrorism, sabotage, or civil disturbance.

TRANSPORTATION ACCIDENTS
Ground, air, and water transportation issues can pose risks to transportation users and to the general public.

Driver Education
The risk of transportation accidents can be reduced through improvements in driver education, traffic law enforcement, and transportation planning that balances needs of public transportation conveyers with safety of the general public. Commercial operators also need training and skill enhancement programs.

Road Design
Improved design, routing, and traffic control at problem roadway areas can reduce risk of transportation accidents. Designated truck routes, as well as enforcement of weight and truck travel restrictions, can help. In long-term planning, communities can consider establishing more connector roads to reduce congestion on arterial roads.

Railroads
Accidents can be reduced through railroad inspections and improved designs at problem railway/roadway intersections.

Airports
Airport maintenance, security, and safety programs are essential for reducing accident risk.

Marine Safety
Accident risk can be reduced through programs that address marine safety and general boater awareness.

Mass Casualty Preparation
It is important to consider training, planning, and preparedness for mass-casualty incidents involving all modes of transportation.
Traffic Control  
Road closures and traffic control in accident areas becomes especially critical during a hazardous material incident response.

**UTILITY FAILURE**  
Public utilities are critical infrastructure for any community. The potential for failure needs to be reviewed, and inadequacies need to be addressed.

**Water and Sewer**  
Consideration is needed for proper location, design, and maintenance of water and sewer systems, including insulation of critical components to prevent damage from ground freeze. Sewer and storm water systems should be separated or expanded to handle anticipated storm water volumes.

**Electrical Lines**  
A community may consider burying electric and telephone lines, where possible, to resist damage from severe winds, lightning, ice, and other hazards.

**System Redundancies**  
One place where redundancies are recommended is in utility and communications systems, especially lifeline systems, e.g., essential public utilities. The intention is that if one system fails, the other shadow system can take over.

**Backup Power**  
Generators can be used for backup power at critical facilities.

**Maintenance**  
Regular maintenance and equipment checks are important, along with replacement or renovation of aging structures and equipment, which should be made as hazard-resistant as economically possible.

**Rolling Blackouts and Brownouts**  
Sometimes it is a good idea to implement “rolling blackouts” in electrical systems that will otherwise fail completely due to overloading.

**Lightning Protection**  
Electrical and communications systems should be protected from lightning strikes.

**Tree Trimming**  
Tree trimming and maintenance is important for preventing limb breakage and for safeguarding nearby utility lines. A model measure would be to establish a community forestry program with a main goal of creating and maintaining a disaster-resistant landscape in public right-of-ways.

**Digging Hotlines**  
Most, if not all, states have a utility damage prevention hotline that people can call before digging.

**Vulnerable Populations**  
Communities can develop programs/networks for contacting and assisting elderly or homebound persons during periods of infrastructure failure.
OIL AND NATURAL GAS WELLS; PETROLEUM AND NATURAL GAS PIPELINES

Regions with oil and natural gas wells and/or petroleum and natural gas pipelines need to consider the risks of release.

Safety Regulations
The first step in oil and natural gas well accident prevention is community and operator compliance with industry safety regulations and standards.

Contingency Plans
Companies and surrounding communities need to address contingency planning for worker and public protection, including rescue and evacuation procedures.

Well Segregation
Accidents can be prevented by using buffer strips of land to segregate wells, storage tanks, and other production facilities from transportation routes and adjacent land uses, in accordance with state regulations, and consistent with the level of risk.

Pipeline Location and Design
Pipelines should be well-marked and located away from dense development, critical facilities, special needs populations, and environmentally vulnerable areas whenever possible. Proper pipeline design, construction, maintenance and inspection are essential, especially in high hazard seismic zones.

Digging Hotlines
Most, if not all, states have a utility damage prevention hotline that people can call before digging.

RADIOLOGICAL EMERGENCIES

People receive radiation exposure each day from the sun, radioactive elements in soil and rocks, household appliances like television sets and microwave ovens, and medical and dental x-rays. These exposures may prompt controversy, but they do not pose the risk of imminent danger from radiation release that might occur if a nuclear power plant had a meltdown. Serious radiological accidents can occur anywhere radioactive materials are used, stored, or transported. A nuclear power plant, hospital, university, research laboratory, industrial plant, major highway, railroad line, or shipping yard could be the site of a radiological emergency.

Users of Radiological Materials
Users, transporters, and disposers of radiological materials are required to follow strict procedures that prevent or minimize radiation release.

Emergency Planning For Transportation Routes
Communities located along major transportation routes should develop and practice an emergency plan for handling transportation accidents involving radiological materials.

Radiological Emergency Preparedness for Nuclear Plants
Radiological Emergency Preparedness (REP) for communities surrounding nuclear power plants requires proper awareness of, training on, and implementation of radiological emergency procedures. Specific planning requirements for communities within primary and secondary Emergency Planning Zones are found in the Code of Federal
Three Ways To Minimize Exposure

A community can promote the following three ways to minimize radiation exposure: 1) distance; 2) shielding; and 3) time. The more distance between a person and the source of the radiation, the less radiation received. Like distance, the more heavy, dense materials between a person and the source of the radiation, the better. Finally, most radioactivity loses its strength fairly quickly. Limiting the time spent near the source of radiation reduces the amount of radiation received.

Shelters and Warning Systems

Communities can promote awareness of designated fallout shelters and accident warning systems. They also may develop and promote workable population protection plans, i.e., evacuation and in-place sheltering plans.

Safe Rooms

Concrete safe rooms or shelters can be constructed in houses, trailer parks, community facilities, and business districts.

Building Materials

Public buildings and critical facilities can be constructed using laminated glass, metal shutters, structural bracing, and other hazard-resistant, durable construction techniques.

SABOTAGE / TERRORISM / WEAPONS OF MASS DESTRUCTION

Sabotage, terrorism, and the potential for exposure to weapons of mass destruction (WMD) have become part of our social conscious and should be considered in mitigation planning.

Assessment

Local governments can start with development of a thorough community risk and threat assessment that identifies potential vulnerabilities and targets for a sabotage/terrorism/WMD attack.

Critical Infrastructure Protection

Critical Infrastructure Protection (CIP) is extremely important. The federal government has begun a systematic effort to define, prioritize, and develop effective strategies for protecting the Nation’s critical infrastructure. Local governments are an integral part of the effort with regard to critical local services, such as water, electricity, telephones, roads and bridges. CIP should be a prominent part of community risk and threat assessment.

Computers

Every person and institution with computers that interface with other computers should consistently use computer data back-up systems and anti-virus software.

Building Materials

Public buildings and critical facilities can be constructed or retrofitted using laminated glass, metal shutters, structural bracing, and other hazard-resistant, durable construction techniques.
Monitoring and Reporting
Prevention can be addressed through alertness, awareness, and monitoring of organizations and activities that may threaten a community. A community can establish a system for reporting information that can be used to prevent terrorist incidents or sabotage. One model may be the U.S. Department of Justice’s Operation TIPS, the Terrorism Information and Prevention System, piloted in select cities beginning in August 2002.

Emergency Responder Preparedness
Communities can establish programs for law enforcement/emergency responder training, planning, and preparedness for terrorist/sabotage/WMD attacks.

School Violence
School safety and violence prevention programs are valuable, particularly since school violence is unfortunately becoming more common.

Public Gatherings
Communities may consider heightening security at public gatherings, special events, and critical community facilities and industries.

Mental Health Services
Communities can develop a greater awareness of, and provision for, mental health services in schools, workplaces, and other institutional settings.

Private Emergency Plans
Communities can encourage private sector development and testing of internal emergency plans and procedures, including Continuity of Operations (COOP) planning.

CIVIL DISTURBANCE
The potential for civil disturbance and resulting problems should be addressed in mitigation planning. Civil disturbances can include prison or institutional rebellions, disruptive political gatherings, violent labor disputes, urban protests or riots, or problems at large-scale events.

Law Enforcement
Local and state governments can provide law enforcement agencies with training, staffing, and resources.

Planning and Documentation
Local governments or other organizations can anticipate and plan for incidents. When a civil disturbance occurs, it may be a good idea to record the event on videotape for later study and use in prosecutions.

Facility Design
Emergency and security provisions can be included in design requirements for schools, factories, office buildings, shopping malls, hospitals, correctional facilities, stadiums, recreation areas, and other similar facilities.

Environmental Design
Crime Prevention Through Environmental Design (CPTED) is a field of planning that examines design, management, integration, and lowered density of poor or blighted areas with the goal of reducing vandalism, crime, and some types of riot events.
PUBLIC HEALTH EMERGENCIES

If left unchecked, various diseases or environmental conditions can result in widespread illness and threats to life.

Immunization  
Immunization against communicable diseases can be encouraged among residents of a community.

Ventilation  
The spread of communicable diseases can be thwarted by compartmentalizing ventilation systems in areas/facilities prone to crowding, or areas that may involve exposure to contagions or noxious atmospheres.

Radon  
Communities can increase public awareness of radon dangers and the prevention efforts that can be taken to reduce concentrations of radon in homes and buildings.

Water and Sewer  
Communities need to maintain water and sewer infrastructure at acceptable operating standards. Back-up generators for water and wastewater treatment facilities can help maintain acceptable operating levels during power failures. Separation of storm and sanitary sewer systems can also prevent release of untreated sanitary waste when stormwater might otherwise overfill a sewer system.

Vacant Structures  
Demolition and clearance of vacant condemned structures can prevent rodent infestations.

Public Health Systems and Public Awareness  
Communities can maintain public health systems with sufficient disease monitoring and surveillance capabilities to protect the population from large-scale outbreaks; they can also support free or reduced-cost clinics and school health services. Public awareness campaigns can emphasize the causes, symptoms, and protective actions for disease outbreaks or other potential public health emergencies.

Contamination Containment  
Public contact with contaminated sites or waters, including floodwaters, should be prevented as much as possible.

Waste Disposal  
Communities need to address pollution control, enforcement, and cleanup. Particular procedures need to be followed for disposing of chemicals, including hazardous waste and scrap materials.

Septic Tanks  
Septic tanks need to be properly located, installed, cleaned, monitored, and maintained.
### Sacramento County

#### Mitigation Action Projects & Priorities

**Mitigation Strategy Meeting**  
**May 24, 2011**

<table>
<thead>
<tr>
<th>Responsible Jurisdiction/Department</th>
<th>Mitigation Action Title</th>
<th>Hazards Addressed</th>
<th>Prioritization Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public outreach: All Hazards</td>
<td>Multi-hazard</td>
<td>36</td>
<td></td>
</tr>
<tr>
<td>Emergency Services: CERT training</td>
<td>Multi-hazard</td>
<td>13</td>
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<tr>
<td>Noxious Weeds Abatement: Aquatic, Land</td>
<td>Agricultural</td>
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<tr>
<td>Mosquito Vector Control: vector control/vegetation mgt.</td>
<td>Agricultural</td>
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<tr>
<td>Hawks</td>
<td>Bird Strike</td>
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<tr>
<td>Noise makers</td>
<td>Bird Strike</td>
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<tr>
<td>Eliminate habitats</td>
<td>Bird Strike</td>
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<tr>
<td>Inundation mapping</td>
<td>Dam Failure</td>
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<tr>
<td>EAPs</td>
<td>Dam Failure</td>
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<tr>
<td>Establish better communication between dam owners and local communities</td>
<td>Dam Failure</td>
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<td>Develop realistic dam breach scenarios based on current conditions</td>
<td>Dam Failure</td>
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<tr>
<td>Folsom Dam – increase storage capacity combined with early release</td>
<td>Drought</td>
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<td>Central Valley Water Supply Project</td>
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<td>Water Supply Master Planning (including groundwater management planning and multi-jurisdictional task force)</td>
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<td>Conservation Programs</td>
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<td>Low Impact Development</td>
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<td>Water Metering: State Mandate by 2025</td>
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<td>California Adopted Green Building Code: 20 by 2020</td>
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<td>Hydromodification Plan</td>
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<td>Seismic Retrofitting</td>
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<td>Interior Levees</td>
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<td>Cooling Centers</td>
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<td>Burn Restrictions on Ag. Industry</td>
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<td>County-wide Watershed Management Plan</td>
<td>Flood</td>
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<td>Drainage Capital Improvements</td>
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<td>Pump Station Upgrades</td>
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<td>Beaver Control</td>
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<td>Seepage &amp; Erosion Control</td>
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<td>Overtopping: splash cap</td>
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<td>Future Development Areas: Implement multi-functional flood control and drainage (widen creeks and soften slope banks; wetland habitat enhancement; off-line detention basins with weirs, etc)</td>
<td>Flood</td>
<td>32</td>
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<td>Future Development Areas: Assessment Districts to finance plans, studies, etc.</td>
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<td>Elevation projects: new and existing development</td>
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<td>Mitigate Repetitive Loss areas</td>
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<td>Acquisition</td>
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<td>Floodproof wells along creek</td>
<td>Flood</td>
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<td>Evacuation planning: vertical areas, high ground, etc</td>
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<td>Livestock evacuation planning</td>
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<td>Enhance ALERT systems</td>
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<td>Convert benchmarks to NAVD88/ use for all new development</td>
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<td>Update floodplain ordinances/General Plan: DFIRMS, SB5, other?</td>
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<td>Evaluate participation in CRS</td>
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<td>Enhance floodplain management program</td>
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<td>Implement CIP projects</td>
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<td>Detention basins for all new development</td>
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<td>New 100-year studies: Magpie Creek, Arcade Creek &amp; Cripple Creek, others?</td>
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<td>Create New Development Standards</td>
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<td>Vegetation management plan for creek systems</td>
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<td>Fans/Crop watering for Ag industry</td>
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<td>Warming Centers</td>
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<td>Small Electronic Signage for local jurisdictions</td>
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<td>Solar Signage (multi-purpose)</td>
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<td>Natomas Levee Improvements: 200 yr protection</td>
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<td>Sacramento Levee Improvements: 200 yr protection</td>
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<td>Ring Levees: Delta area</td>
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<td>Levee Certifications</td>
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<td>Levee O &amp; M: vegetation issues</td>
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<td>Levee break scenarios: Delta area</td>
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<td>Add soil to address levee subsidence</td>
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<td>Create and maintain access roads: American River Parkway</td>
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<td>Fuels Modification: American River Parkway</td>
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<td>Ignition Resistant Construction Upgrades</td>
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<td>County-wide WUI Fuels Modification Program</td>
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<td>Reopen/staff Fire station # 33</td>
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