

# Warning and Emergency Services



*If people know that flood conditions are likely to occur, they can take steps to ensure their own safety and minimize damage to their homes, businesses, and personal property. A flood warning system that does the following things can go a long way toward reducing losses from localized flooding:*

- *Identifies flooding threats;*
- *Disseminates information to residents as a warning or advisory;*
- *Signals the need for emergency services; and*
- *Promotes public understanding of flood risks.*

A flood warning and emergency response program focuses on knowing when and where it will flood and doing something about it before the flood causes any damage. In areas subject to localized flooding, the first component of the system—flood threat recognition—would be different from that on larger rivers, but the provisions for spreading the warning, educating people, and developing community response would be essentially the same as for other flood situations.

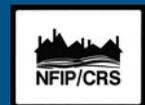
## Recognizing the Threat

### *Types of Systems*

Before a flood warning program can be developed, the community must have a system that provides advance notice of potential flooding conditions. This is known as flood threat recognition. Nationally, flood threat recognition is managed by the National Weather Service (NWS) and its regional River Forecasting Centers.

#### **Communities can obtain CRS**

**credit** for their flood warning system. *CRS Credit for Flood Warning Programs* describes the elements of a flood warning system that are eligible for credit under Activity 610 of the CRS:



- Flood threat recognition systems;
- Emergency warning dissemination;
- Other response efforts;
- Critical facilities planning; and
- Being a StormReady community.

*When information from radar, remote gauges, or the NWS indicate that conditions are ripe for local flooding, the emergency operations staff can monitor developments and decide if a watch or warning is appropriate.*



French &amp; Associates

The NWS focuses on larger rivers and major threats, such as hurricanes. It cannot track every little stream and ditch. It does monitor conditions and issue flood watches and warnings, but often only for low-lying areas, not crest predictions on individual streams. Therefore, more specific recognition of localized flooding potential is left to local authorities. The NWS can, however, provide technical advice and assistance.

### **A Local System**

There are two major types of local flood warning systems: manual and automated. Deciding which to choose depends on the characteristics of the watershed, the flood loss potential, and the warning time that will be needed for the community to take action.

Manual systems involve a network of residents who collect data by reading rain and river gauges or using other observation techniques. When a predesignated condition occurs (perhaps the gauge measurement reaches a certain level), the gauge watchers contact a community flood coordinator, usually in the emergency management office. The flood coordinator may use paper graphs or a computer model to calculate the impact of the rain and water levels and obtain a simple flood forecast.

Automated systems can be faster, more accurate, and more reliable, but are more expensive than manual systems. As rain gauges fill with water, they tip over, sending a signal to a central monitoring station. Computers record and react to the data provided by the automatic rain and river gauges and calculate a flood prediction.

The amount of damage incurred by localized flooding may not justify the significantly greater expense of an automated system. Further, an automated system may not be

effective for localized flooding because there is often no identifiable flooding source on which to install a stream gauge.

A community and its local NWS office can work together to determine what can be done to develop advance notice of localized flooding. The collective experience of community officials and residents with historic flooding and drainage problems can help inform hydrologists about the conditions under which localized flooding is likely to occur and help them advise the community on the most effective type of flood warning system and what conditions will warrant issuing a warning.

It may be that the NWS general watches or warnings will provide all the advance notice that can be expected. If so, rather than invest a lot of effort in gauges, radios, and computers, the community could use storm spotters, police patrols, and other volunteer weather watchers to advise of potential flooding. It should focus on preparing an appropriate program for disseminating the warnings it does get, teaching people what to do, and developing effective community responses.

However, it may be possible and very useful to have a system that predicts that low lying areas will flood in the next few hours. Even this general advance notice could help residents move cars or close openings. Such a warning system would be meteorologically focused, with warnings based on precipitation rates, radar displays, the rate of snowmelt known historically to cause flooding, and other factors, rather than on gauges of the precipitation and stream flow.

## Issuing the Warning

Even though the community's system for recognizing a threat of localized flooding would be different from the system for larger rivers, the procedures for issuing the flood warning would be much the same as for other hazards. Once NWS flood watches and warnings are received or local information suggests an imminent threat, that information needs to be spread among residents, businesses, critical facilities, and local government personnel.

A community should determine whether, and when, any areas subject to flooding should receive special warnings. For example, some neighborhoods may always be the first to be flooded, even if the flood threat to the rest of the community never rises to the level of a general warning. Or, if the general NWS warning for the community is the best information that is going to be available, perhaps areas subject to localized flooding should receive special instructions beforehand.



French & Associates

*Before this gauge was installed in Matteson, Illinois, two people had died at this underpass. They thought the water was shallow enough that they could drive through, their cars stalled, and they drowned. The gauge is a localized flood threat recognition system that enables motorists to see how deep the water is and avoid risking their cars and lives.*



*Some roads will be blocked because of flooding.*

FEMA News Photo

A flood warning should advise people what areas are likely to be flooded, what actions they should take, what actions they should avoid (using closed streets or dangerous intersections, etc.), and what they can expect officials and emergency personnel to do. It should also encourage people to pass the word to others, especially those least likely to hear the warning and those who might need special help.

## Responding to the Threat

### *The Community's Response*

After a flood warning is issued, the community sets in motion a previously agreed-upon flood response effort. The actions to be implemented should be part of the emergency response or emergency preparedness plan administered by the emergency manager. Often these plans have a flood annex or separate procedures for flood-specific activities.

The plan should include:

- Instructions for emergency services personnel;
- Identification of roads that should be closed before flooding begins;
- Identification of routes to be kept clear for flood response and access to buildings;
- Procedures for residents to exit the flooded (or blocked) areas; and
- Identification of critical facilities (hospitals, water treatment plants, etc.) that need attention.

## Raindrops to Response

**Tulsa, Oklahoma**, is subject to flooding and flash flooding, often resulting from severe thunderstorms. Tulsa's system for recognizing flood threats and issuing warning information is a cooperative effort among the National Weather Service, the news media, the Tulsa Area Emergency Management Agency (TAEMA), amateur radio operators, and the City of Tulsa.

Tulsa's computerized ALERT (Automated Local Evaluation in Real Time) system includes 39 rain gauges, 19 stream gauges, and seven detention gauges that report changes as they happen. A hydrologic program develops stream and flood forecasts, which are analyzed by the city's Department of Public Works staff in consultation with TAEMA, the Fire Department, and the Police Department, to determine appropriate action.

When warranted, flood watches and flood warnings are issued by the Tulsa NWS office. They are distributed through the National Oceanic and Atmospheric Administration (NOAA) Weather Wire or NOAA Weather Radio, and then via other media.

If the amount of rain expected will cause ponding and other flooding of small streams and depressions, the NWS may issue a "flash flood warning." But sometimes these events are so localized and rapid that a flash flood warning never gets issued. On the smaller flooding sources, local rainfall and

river gauges are needed. When street flooding is reported, Public Works staff are sent to the field as spotters, who confirm what is occurring and what action needs to be taken.

In addition to the NWS data, TAEMA also maintains a weather sensor system consisting of two types of radar, which are used to monitor stream water levels and changes in the atmosphere. The system is equipped with its own database that compiles and analyzes data received from the two sensors. A technician analyzes both reports.

When a flood threat is recognized, the next step is to notify the public and staff of other agencies and critical facilities. Residents receive information through the media. Manual and automated telephone systems are used by TAEMA to contact city departments and critical facilities such as area nursing homes, childcare facilities, and hospitals.

TAEMA may decide to activate the emergency warning sirens. Tulsa has 82 warning sirens, each of which can be heard for up to a 1-mile radius. A three-minute alternating "high-low" tone on the siren tells people of impending flooding. Citizens have been instructed that, upon hearing the flood siren, they should avoid low-lying areas or any place where flooding is likely to occur, drive only with caution, and access local media for further information.

The community should conduct practice drills of its response program at least once each year when there is no flood. In addition, an ongoing training program will ensure that local staff are always aware of what to do. The staff should also be trained to test and maintain warning equipment; response equipment, machinery, and supplies; computers, and communications systems.

### Site-Specific Responses

The community's plan should specify the personnel responsible for securing critical facilities and providing flood protection for those facilities. Each critical facility should have its own flood response plan that its staff implements. Often, these are prepared and administered by the facility's security office, the counterpart to the community's emergency management office.

The facility flood response plan should cover the following topics:

- Identifying what flood warning message will trigger implementation of the plan;
- Identifying which people need to be called when the warning is issued, their telephone numbers, and where they should report;



St. Tammany Parish, Louisiana

*Cars can be damaged in a small amount of water. Moving vehicles to higher elevations before local flooding can significantly reduce the cost of flood damage.*

- Operating or closing a gate valve, including how to do it, when to do it, and where it is located;
  - Closing door or window shutters on a building or gates in a floodwall, including where they are stored, how they should be installed, and how they should be fastened or locked in place;
  - Operating a sump pump system;
  - Operating a generator if the power is disrupted, including how to connect or disconnect it, how to start it, how to refuel it, and what circuits should be charged;
  - Maintaining the valves, pumps, and other mechanical components;
  - Reporting to and communicating with the community's emergency manager; and
- Listing safety measures, such as:
    - ▶ Evacuating the building when the flood threatens;
    - ▶ Making sure that generators do not injure power company personnel by back-feeding into the power lines; and
    - ▶ Ensuring that there is adequate ventilation for generator exhaust.

## Informing the Public

Public information before the flood should equip residents with an understanding of:

- The procedure for the warnings, signals used, what radio or television station to listen to, how much time there will be, and the reliability of the warnings;
- What to do during a flood warning to minimize risks to health and safety;
- What to do during a flood warning to reduce property damage;

- How to get help from the Red Cross, local emergency services, and other organizations;
- How to find out which shelters are open; and
- How to obtain supplies, if needed.

It is important to ensure that homeowners are also aware of their options for responding to potential flood threats. The community should provide information about where homeowners can obtain materials for sandbags and other mitigation activities.

Where floodwaters rise quickly, people should be advised that sandbagging may be too little too late. Instead, they should be advised about other measures that can be taken to protect the building. The most effective ones (see Chapter 10) are permanent and need to be prepared in advance, well before a flood warning is given. However, it may be possible on short notice to put protective shields on buildings as illustrated on page 10-5, or to put a few sandbags in crucial places.

People also need to know the location of some nearby, safe parking so they can quickly move their vehicles out of danger. This alone can significantly reduce the cost of damage.

Residents should be advised how to develop a family response plan. Generally, people are more interested in such preparations when they understand that they are useful for fires, storms, and other family emergencies as well.

## StormReady Program

Becoming a designated StormReady community is one way to ensure that the community is prepared for localized flooding. The StormReady program is administered by the NWS to help communities become better prepared for storms and other natural disasters. Because it is not limited to the problems of riverine or coastal flooding, the StormReady program guidance and materials are particularly well-suited to localized flooding problems. The Web site, <http://www.stormready.noaa.gov>, provides guidance for warning dissemination and describes proven methods for educating citizens and preparing the community to handle a storm.



The Turn Around Don't Drown™ program is a public education program developed by the NWS to help communities educate residents about the dangers of walking or driving in flood waters.

<http://weather.gov/os/water/tadd/index.shtml>

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.

Being designated as a StormReady community by the NWS is a good measure of a community's emergency warning program for weather hazards. It is also credited by the CRS.



*The Red Cross has a great deal of information on family preparedness.*

## After the Flood

### Recovery



FEMA News Photo

*The recovery phase of a flood is a good time for public information programs because people are more aware of the issues and problems caused by flooding.*

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

- Ensuring that the basic needs of citizens are met, including shelter, food, and safe drinking water;
- Monitoring for diseases;
- Vaccinating residents for tetanus;
- Patrolling evacuated areas to prevent looting;
- Clearing streets; and
- Cleaning up debris and garbage.

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

- Inspecting damaged buildings and public facilities to identify mitigation measures that can be included during permitted repairs;
- Conducting public information activities to advise residents about mitigation measures they can incorporate into their reconstruction work; and

- Updating the community's mitigation plan and applying for assistance made available through the disaster programs.

### Inspections

Requiring permits for building repairs and conducting inspections are vital activities to ensure that damaged structures are safe for people to re-enter and repair. Even in shallow flooding, the foundation may have shifted or been undermined; electrical hazards are always a potential danger; and building components that are saturated lose their strength and can collapse, injuring people. There is a special requirement to do an inspection in the Special Flood Hazard Area and other regulated floodplains, regardless of the type of disaster or cause of damage.

The National Flood Insurance Program (NFIP) requires that local officials enforce the substantial damage regulations in their floodplain management ordinances. These rules require that if the cost to repair a building in the floodplain equals or exceeds 50 percent of the building's market value, the building must be retrofitted to comply with the community's floodplain ordinance. In many cases, this means that a substantially damaged building must be elevated to or above the base flood elevation.

There may be pressure from the public and elected officials to waive this regulation in order to help people return to normal as fast as possible, even though that means exposing people and buildings to the type of flooding that caused the disaster in the first place. Further, waiving the requirement is a violation of the community's adopted regulations and its obligations to the NFIP, and can be cause for placement on probation or suspension from the program. However, a community can facilitate post-disaster reconstruction and make the permit requirements more palatable through such techniques as:

- Publicizing the need for permits and explaining how to apply for them;
- Keeping the permit office open later;
- Setting up a permit office in the affected area;
- Having permit officials walk through the flooded area and issue permits to repair minor damage without all the application paperwork; and
- Waiving the permit fee.

The substantial damage requirement can be very difficult for understaffed and overworked offices after a disaster. If these activities are not carried out properly, not only does the community miss a tremendous opportunity to redevelop or clear out a hazardous area, but it also may be violating its obligations under the NFIP. 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.

The Federal Emergency Management Agency (FEMA) has developed software to help local officials make substantial damage determinations. The software comes with a manual, *Guide on Estimating Substantial Damage Using the NFIP Residential Substantial Damage*

Estimator, FEMA 311. Copies can be obtained from the FEMA Regional Office. Training sessions and technical assistance may be available after a disaster declaration.

### Public Information Activities

People need to recognize that returning to normal may mean returning to a building that will be damaged by another flood. The community should inform its residents and businesses about the regulatory requirements and the need to clean and rebuild carefully. This can be done through news releases and handouts.

#### Repairing Your Flooded Home

This classic handbook from the American Red Cross and FEMA guides flooded property owners through the steps they need to take to re-enter and re-occupy their homes after the flood waters retreat. Lots of illustrations, lists, and references to further sources of information combine to describe how to clean up, repair, and stay safe. Each chapter, listed below, describes one step.

- Step 1. Take Care of Yourself First
- Step 2. Give Your Home First Aid
- Step 3. Get Organized
- Step 4. Dry Out Your Home
- Step 5. Restore the Utilities
- Step 6. Clean Up
- Step 7. Check on Financial Assistance
- Step 8. Rebuild and Floodproof
- Step 9. Prepare for the Next Flood

Hard copies of the book are available from local Red Cross chapters or by writing to FEMA, P.O. Box 2012, Jessup, MD 20794-2012.

[http://www.redcross.org/services/disaster/0,1082,0\\_570\\_,00.html](http://www.redcross.org/services/disaster/0,1082,0_570_,00.html)

Sometimes, FEMA or the Red Cross will make copies of *Repairing Your Flooded Home* available in bulk quantities, or the community can copy and distribute appropriate pages.

The messages that should be disseminated should cover:

- Safety precautions when returning to a damaged building;
- Which activities require a permit;
- How to apply for a permit;
- Which activities do not require a permit (e.g., cleanup and emergency repairs to prevent further damage);
- The substantial damage rule;
- The benefits of Increased Cost of Compliance flood insurance coverage (see Chapter 11);
- How to determine the need for licensed contractors, if licensing is required by the community;
- How to implement steps 2, 3, and 4 in *Repairing Your Flooded Home*, such as taking pictures for insurance and disaster assistance claims before throwing things away, and health and safety precautions; and
- How to include retrofitting measures as part of repairing homes or businesses.

### Mitigation Activities

During the recovery phase of a flood, everyone is more sensitive to flooding and interested in doing something about it. It is a good time to build awareness, educate residents, and get the public involved in mitigation and other community activities.

The community should evaluate how the warning and response systems worked during the flood. Information should be collected about where flooding occurred and which properties were affected. Documenting high water marks can help a community make decisions about potential regulatory changes. It may be useful to use this information to redraw flood hazard maps, as Conway, South Carolina did (see Chapter 4).

Community staff should go with the disaster assistance staff as they inspect public facilities and identify opportunities for mitigation during reconstruction of the facilities. Certain public and private nonprofit facilities are eligible for additional funding for approved mitigation measures.

The staff should review and update the community's mitigation plan to reflect what is learned about the flooding hazard, the lessons learned from the community's flood response, information collected during the building inspections, and available mitigation funding.

## Where to Get Help

- The county office of emergency services or emergency management is a good source of information, and can describe how other communities are addressing flood warning systems, response, and public education.
- The National Weather Service is an essential contact on flood threat recognition and warning. Each Weather Service Office has a hydrologist who can help set up a local flood warning program. They can be found at <http://www.nws.noaa.gov/organization.html>.
- The National Weather Service StormReady Program can be accessed at <http://www.stormready.noaa.gov>.
- The local chapter of the American Red Cross can provide recovery assistance and should be included in a community's response and recovery planning. It can also provide valuable information on family preparedness. <http://www.redcross.org>.
- The State Office of Emergency Management can provide guidance on warning systems, emergency response planning, and mitigation resources.

During post-flood rebuilding, it also can be possible to incorporate sustainability principles into individual buildings or into neighborhoods. In **Grand Forks, North Dakota**, for example, people who had to replace their furnaces or hot water heaters because their basements got wet during the 1997 flood were offered rebates by the community and the local utility to encourage them to replace the old models with more energy-efficient systems.

More information on redevelopment is given in Chapter 9, and the U.S. Department of Energy has a large compilation of suggestions for similar measures at its "Smart Communities Network" at <http://www.sustainable.doe.gov/disaster/disintro.shtml>.

After a flood in 1995, **Jefferson Parish, Louisiana**, examined the causes of flooding problems in the Dumonde Subdivision. The area had been flooded four times in the previous 10 years. The investigation found two homes and a wooden fence that obstructed drainage from the subdivision. The Parish applied for and received a Hazard Mitigation Grant from FEMA. It acquired the properties, cleared the buildings and the fence, and restored the drainage system.

- FEMA has many resources for helping to prepare residents for flooding at <http://www.fema.gov/hazards/floods/floodf.shtm>.
- CRS Credit for Flood Warning Programs provides guidance on flood threat recognition, warning dissemination, and flood response planning.
- Technical assistance and financial help for post-flood mitigation projects are available from a variety of sources. The first place to contact is the FEMA Disaster Field Office, if a Presidential disaster declaration has been made. The next place is the State emergency management agency.
- Examples of flood warning and public safety publicity can be found in CRS Credit for Outreach Projects.

Additional resources are listed in Appendixes A and B.